Exploring the Determinants of Organisational E-Commerce Adoption : An Analysis of E-Readiness and Technological and Behavioural Control Factors using PLS-SEM and Multinomial Regression

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Declaration of Authenticity and Author's Rights

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Previously Published Work

I would like to acknowledge that some of the research results in this thesis come from work that has already been submitted for publication or is in the process of submission. This thesis is related to the following papers, which are either being reviewed by peers or will be published soon.

1. **Exploring E-commerce in Pakistan: A Review of Literature**
   Muhammad Malik and Martin Halvey (current status: under review).
2. **E-Readiness factors as predictors of organisational E-commerce adoption: Evidence from Pakistan**
   Muhammad Malik and Martin Halvey (current status: under review)
3. **Technological Factors and Perceived Behavioural Control as predictors of organisational E-Commerce adoption: Evidence from Pakistan.**
   Muhammad Malik and Martin Halvey (will be under review)

Please note that the status of these papers may change during the publication process, and I will provide updates as they become available.

Muhammad Saqib Malik

DEDICATION

To my father, Dr. Muhammad Afzal Malik, whose unwavering support and encouragement have been the driving force behind my PhD journey, who did not live long enough to witness this thesis.

To my uncle, Muhammad Anwar Malik, the driving force behind my father's PhD which served as catalyst, inspiring my own doctoral study.

To my mother, whose countless prayers and unwavering faith have helped me succeed in all my endeavours.

To Aliya, my beloved wife, whose constant love and support have been a source of strength and inspiration throughout this journey.

To Mariam, my dear daughter, who has brought immense joy and laughter to my life and has been a reminder of what truly matters.

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Nomenclature

Sr No	Abbreviation	Definition
1	AW	Awareness
2	BR	Business Resources
3	CA	Perceived Cost Acceptability
4	CT	Commitment
5	GR	Government E-Readiness
6	GV	Governance
7	HR	Human Resources
8	ICT	Information and Communication Technology
9	IN	Intention to adopt E-Commerce
10	IT	Information Technology
11	MF	Market Forces
12	PB	Perceived Behavioural Control
13	PC	Perceived Compatibility
14	PE	Perceived Ease of Use
15	PS	Perceived Security
16	RA	Perceived Relative Advantage
17	SI	Support Industries E-Readiness
18	TR	Technology Resources

Abstract

E-Commerce technologies are widely adopted by organisations for increased efficiency and competitive edge in both public and private sectors. Statistical evidence shows that E-Commerce adoption in developing economies is low and firms in these regions face adoption challenges distinct from those in developed countries. However, despite some shared challenges generalisation of results from one developing country to the other requires great caution. The term "Developing Countries" is not distinctive and a significant variance in socio-economic factors exists in this block. Given the sensitivity of E-Commerce adoption to such factors, country-specific research is required for better understanding. E-commerce is a driver of economic growth and e-commerce adoption by developing countries is not only essential for their prosperity but is also pivotal for sustainable global economic development in an interconnected world. Pakistan holds significant potential to boost the global economy, yet its E-Commerce adoption trails behind several regional players. The literature survey reveals a scarcity of high-quality Pakistan-based studies, with many failing to adhere to statistical and general research principles. Most of these studies focus on "usual suspects" and terminate at the initial adoption of organisational E-Commerce. This quantitative study utilised correlational and classification techniques to investigate the influence of more pertinent factors on firm-level E-Commerce adoption within the unique context of Pakistan. By empirically testing four models developed using constructs from the Perceived E-Commerce Readiness Model (PERM), Theory of Reasoned Action (TRA), and Technology, Organisation, Environment (TOE), the study addressed four research questions. A distinct feature of this study is the comparison of E-Commerce adoption decisions in public and private sectors, providing insights into potential disparities and unique challenges faced by each sector. A range of univariate and multivariate techniques were used in the study including Partial Least Square Structural Equation Modelling (PLS-SEM) and Multinominal Logistic Regression. Using the stratified sampling technique questionnaires were sent to potential respondents in two phases. The impact of E-readiness factors was examined using 448 valid responses received in phase 1. In the second phase, 347 valid responses were received, which were then used to examine the effects of technological and behavioural factors on an organisation's E-Commerce adoption decision. The study found that the E-Readiness of "Business Resources", "Technical Resources", "Government", "Governance", and "Support Industry", along with "Awareness" about E-Commerce and "Commitment" impact E-Commerce adoption. Among Technological and Behavioural Control Factors, Perceived Behavioural Control, "Perceived Compatibility", "Relative Advantage" and "Perceived Security" were found positively related to E-Commerce adoption in Pakistan. The study also identified the relevance of factors at different stages of organisational E-Commerce adoption. While some factors remained relevant in all stages, their impact varied in magnitude at different levels of E-Commerce adoption in organisations. The study also highlighted some interesting differences between the public and private sectors. Private sector organisations scored higher in terms of perceived E-Readiness, Technological and Behavioural Control Factors. E-Commerce adoption cost was found relevant only in the private sector as in the public sector its effect was statistically insignificant. In terms of magnitude, relative advantage and cost acceptability were found more strongly and statistically significantly related to organisational E-Commerce adoption in the private sector compared to the public sector. This study contributed to existing knowledge by explaining the variance in organisational E-commerce adoption decisions, incorporating E-readiness alongside various technological and behavioural factors. A systematic survey was essential to address the research questions effectively, resulting in a comprehensive literature review specifically focused on the context of Pakistan. The findings of this study offer valuable insights for decision-makers at both the national and organisational levels for the promotion of E-Commerce in Pakistan. This study highlighted the importance of E-Readiness, Technological, and Behavioural control factors, paving the way for future research to develop concise scales for auditing these factors and potentially integrating them into a unified model.

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CHAPTER 1 INTRODUCTION TO THE RESEARCH

1.0 INTRODUCTION

The first chapter of this thesis provides a comprehensive foundation for the research undertaken. It begins with the 'Research Background', offering a detailed context and setting the stage for the study. This is followed by the 'Research Objectives' and “Research Questions”, which clearly outline the aims and goals of the investigation. The 'Significance of the Study' section elucidates the potential impact and value of the research, highlighting its relevance in the field. The 'Rationale of the Study' explains the reasoning behind the chosen research topic and approach, providing justification for the study. Finally, the 'Thesis Structure' offers an overview of the organisation and layout of the thesis, guiding readers through the subsequent chapters. This introductory chapter serves as a roadmap, providing clarity and direction for the journey that the thesis embarks upon.

1.1 BACKGROUND OF STUDY

Increased usage of information and communication technologies in our daily lives has led to the creation of a virtual world that affects and permeates almost every part of our lives. The new millennium started with increased internet use for commercial purposes. Businesses realised the hidden potential of the internet and web technologies, and thus began an era of a new type of commerce called E-Commerce (Kraemer et al., 2006). There have been tremendous developments in Information and Communication Technologies (ICT) in the past few decades. Internet is now faster, wireless, and readily available at an affordable price. Software developments have led to the birth of interactive web2 technology capable of two-way communication (Corral et al., 2012). A variety of portable handheld devices and smartphones with web browsing features are available at a price range that suits most people (Janowski and Bednarczyk, 2016). These advancements in the ICT have further catalysed e-trade (Vărzaru et al., 2021, Sardjono et al., 2021).

E-Commerce is the heart of the new “knowledge economy”(Qin, 2009) and as a result of globalisation and increased economic connectivity, it has made significant inroads into the world's financial system (Awiagah et al., 2016). Resultantly, while many brick-and-mortar businesses migrated online, "pureplay" dot-com businesses such as Amazon and eBay emerged and defined new business models that no one had ever known before (Kraemer et al., 2006). Today, the internet and its associated technologies are necessary to survive and progress in the modern economy. Countries are eager to adopt ICT-based solutions to enhance the competitiveness of a country (Oliveira and Martins 2011). New business models and the inclusion of ICT technologies gave birth to a new type of economy that is different from the traditional economy and requires a reassessment of how traditional businesses used to do business. So, several new models of tax collection, legal matters related to trade and consumer protection, cybersecurity, and cross-border trade have been suggested, tried and implemented (Kraemer et al., 2006).

E-Commerce can be defined in several ways (discussed in section 2.1) however, it is basically application of ICT in the business settings aimed at achieving efficiency, productivity and service delivery (Scholl et al., 2009). E-Commerce is believed to benefit both buyers and sellers. E-Commerce enables customers to make purchases online and gives them more options by enabling them to shop a wide range of products and services from distant vendors across the world. Buyers also gain from increasing sellers competition, symmetric information, low “search costs” , improved budgeting, and more product comparison (Valarezo et al., 2018). Similarly, E-Commerce benefits merchants by increasing their market access and decreasing their start-up costs. Particularly advantageous to businesses in emerging

economies are lower transaction costs, the elimination of intermediaries, and networking with global supply networks (Robey et al., 1990, UNCTAD, 2017a, Molla and Licker, 2005b). The elimination of political borders due to inherent E-Commerce characteristic enables organisations from developing nations to expand internationally which has resulted into a substantial increase in cross-border trade via electronic channels (ADP and ESCAP, 2018).

Like, businesses and their customers, E-Commerce technologies have the potential to benefit governments as well. While private firms drive efficiency and maximise profits through ICT applications, governments use similar technologies to provide citizens and businesses an improved access to public services in an efficient manner (WTO, 2013). Many governments have adopted E-Commerce technologies in the last few decades to deliver public services through E-Government (ACCA, 2014). There is no single definition of E-Government that everyone agrees on. While some academics consider public sector E-Commerce to be a subset of E-Government or digital government (Stowers, 2001), others call E-Government an application of E-Commerce technologies in the public sector (Chaffey, 2009). According to McClure (2000), E-Government is the usage of web-based internet applications to provide better access to government services and information to the public. E-Government can be called public sector E-Commerce as it has been defined as "any process or transaction conducted by the government sector organisation over a computer-mediated network that transfers the ownership of, or rights to use goods, services, or information (US Department of Commerce, 2000). E-Commerce in public and private sectors share same technological foundations, with both sectors striving to use these technologies for improved processes, enhanced service quality and standardisation. However, in terms of business model both sectors differ, as public sector E- Commerce or E-Government is based on laws, regulations ,and statues aimed at providing greater and efficient reach of public services contrary to their private counterpart that mainly aim profit maximisation (Scholl et al., 2009). This thesis understands E-Government as an application of E-Commerce technologies in the public sector in line with Chaffey (2009). Also, terms E-Government and public sector E-Commerce are used interchangeably in this work.

While at the global level, E-Commerce sales are surging (Kraemer et al., 2006), the growth is not uniform and developing economies are still struggling to adopt E-Commerce at a comparable level (UNCTAD, 2017b). Low E-Commerce adoption in developing economies have indirect implications on the overall global economy (Starnini et al., 2019) as economies of countries are interlinked now, and a sustainable global economy requires all-inclusive development (Johnson and Turner, 2010, Avgerou, 2002) .

Introduction of E-Commerce in developing economies brought forth distinct challenges promoting researchers to study E-Commerce in developing economies' context. So from 2010 onwards , we find several E-Commerce adoption studies at individual (Martínez-Domínguez and Mora-Rivera, 2020, Hallikainen and Laukkanen, 2018, Alzahrani et al., 2017) and organisational (Rahayu and Day, 2017, Alsaad et al., 2017, Choshin and Ghaffari, 2017) levels in developing economies context. Researchers have used several conceptual models involving combination of wide variety of variables to study possible relationships among technological, internal, external factors and E-Commerce adoption (Rodríguez-Ardura and Meseguer-Artola, 2010, Rowe et al., 2012, Abed, 2020). E-Commerce technology exists in a certain environment which heavily impacts its adoption rate (Straub et al., 1997). A significant e commerce literature thus focuses on influence of variables like culture, economics, and demographics on E-Commerce adoption/acceptance and online consumer behaviour(Craig and Douglas, 2006, Hallikainen and Laukkanen, 2018).

Organisations in developing economies are often hit by peculiar resource poverty and lack of knowledge that negatively impacts their ability to adopt ICT based solutions (Brown and Thompson, 2011, Ejiaku, 2014, Ndou, 2004a). Capacity to utilise electronic technologies has been termed as E-Readiness and

organisations require adequate E-Readiness both at organisational and environmental levels not only for initial E-Commerce adoption but also for their continued use (Molla and Licker, 2005b). Importance of E-Readiness has been highlighted by several other studies as well (Rahayu and Day, 2015, Hoque and Boateng, 2017, Kabanda and Brown, 2015, Quimba and Calizo, 2019). Similarly perceptions about the intrinsic characteristics of E-Commerce (Awa et al., 2016, Rahayu and Day, 2015) and decision makers' behavioural control have also been identified as key factors affecting E-Commerce adoption in developing economies (Grandón et al., 2011).

While organisations in the developing economies share some challenges, there is a significant variability in socio-economic factors among the developing countries (Vaithianathan, 2010, Khokhar and Serajuddin, 2015b) .Given importance of socio-economic factors on E-Commerce adoption(Hendricks and Mwapwele, 2023, Kabanda and Brown, 2017), it is important to study E-Commerce in peculiar country specific context.

Pakistan is a developing economy and has a great potential to contribute into the global economy due to its natural resources and diverse workforce (Atif et al., 2017, Hussain et al., 2015, Arrfat, 2019, Ahmed et al., 2018, Mustafa et al., 2018). Several business in Pakistan shifted their trade partially or completely online as a part of global phenomenon but despite substantial investments and efforts by successive governments, many organisations in Pakistan are still hesitant to adopt E-Commerce (Khan, 2016). Pakistan's significant untapped potential to contribute to global economy, disproportionate e-trade growth compared to the similar regional players (Javed, 2020a, GOP, 2019b) and peculiar socio-economic context make it an excellent case for academic investigations.

Literature survey is a first step to understand a phenomenon as it identifies current research trends and highlights the areas that require attention (Vom Brocke et al., 2015). A systematic literature search indicates a general dearth of E-Commerce adoption studies in Pakistan. While author was able to find a small body of E-Commerce adoption research in Pakistani context, most of the studies lacked clearly defined theoretical foundation and research design thereby lacking reliability and validity. Scholars predominantly employed first generation statistical techniques in quantitative research often neglecting statistical principals. Moreover, existing research lacks innovation as well with authors focusing on the usual "suspects" borrowed from studies done in developed countries. Organisations adopt E-Commerce in varying degrees of sophistication in a linear manner, but organisations can adopt a specific level of sophistication by passing any previous lower level (Lip-Sam and Hock-Eam, 2011, Al-Hudhaif and Alkubeyyer, 2011). The influencing variables differ in terms of the nature and strength of association with different levels of E-Commerce adoption in organisations (Molla and Licker, 2005a, Rahayu and Day, 2017). The author observed that despite the significance of studying E-Commerce adoption at different levels within organisations, all existing Pakistani studies terminate at the first level of adoption.

As mentioned earlier in this section, governments are also using E-Commerce technologies for public service delivery. However, most of the Pakistan based studies have treated E-Government in isolation of E-Commerce adoption. Like E-Commerce studies, there are very few organisational E-Government adoption studies. While E-Government can be called public E-Commerce, the decision-making process, and priorities in public and private sectors are different (Valle-Cruz, 2019, Ward and Mitchell, 2004). Despite, a possible difference in E-Commerce adoption in the two sectors, the author, could not find a single comparative study of E-Commerce adoption in both sectors.

This study investigates and compares the relationship of E-Readiness, technological and behavioural factors with E-Commerce adoption in both private and public sector organisation in a peculiar Pakistani

context. Relationship and effect of selected factors is studied different stages of organisational E-Commerce adoption.

1.2 RESEARCH OBJECTIVES

This study examines organisational E-Commerce adoption in Pakistan, with a focus on E-Readiness, technology, and perceived behavioural control variables. Project objectives are:

1. To explore impact of E-Readiness factors on E-Commerce adoption in Pakistan's public and private sector organisations.
2. To explore the impact of Technological and Perceived Behavioural Control factors on E-Commerce adoption in Pakistan's public and private sector organisations.
3. To compare impact of E-Readiness, Technological and Perceived Behavioural Control factors, in Pakistan's public and private sector organisations.
4. To identify the discriminating E-Readiness, Technological, and Perceived Behavioural Control factors at different levels of organisational E-Commerce adoption in Pakistan.

1.3 RESEARCH QUESTIONS

Based on the research objectives mentioned above, the following are the research questions.

1. How do E-Readiness factors relate to organisational E-Commerce adoption in Pakistan's public and private sectors?
2. How do Technological and Perceived Behavioural Control factors relate to organisational E-Commerce adoption in Pakistan's public and private sectors?
3. Do E-Readiness, Technological and Perceived Behavioural Control factors have significantly different relationships with E-Commerce adoption in public and private sectors of Pakistan?
4. How do E-Readiness, Technological and Perceived Behavioural Control factors relate to different levels of organisational E-Commerce adoption in Pakistan as discriminating factors?

1.4 SIGNIFICANCE OF THE STUDY

Increased E-Commerce adoption in developing economies can benefit firms in developed countries by providing them competitive advantage. Major exports of the developing economies are raw materials and semifinished products. Similarly, in global services imports, more than 70% comprises intermediate services (Seric and Tong, 2019). Given that global business is becoming increasingly competitive, the ability of firms to access and procure differentiated good quality inputs at cheaper rates contributes significantly to providing a competitive edge in the global market (OECD, 2013). Increased E-Commerce adoption by developing economies means the availability of a large variety of services, raw materials, semi-finished and finished products to both developed and developing economies through cross-border E-Commerce (Tu and Shangguan, 2018).

Developing countries have more growth potential and an ideal investment opportunity for investors from developed economies. Fast economic growth in developing economies rescued the world economy by contributing more than 50% of the world economic growth after the financial crises of 2008-2009 (Chen et al., 2019b). Several multinational companies from developed economies are attracted to start their operations in developing economies because of the strong economic growth potential (contrary to the already matured economy of developed countries), affordable labour, and untapped resources. In fact, rapid economic growth in some developing economies has given birth to new multinational companies from developing economies as well, for example, Samsung, Lenovo,

Standard bank, and Petronas, etc. (W.F., 2010). Managers of global companies from both developed and developing countries need to customise their business policies according to the peculiar environment of a specific country.

As today's economy is fragmented and interconnected, a prosperous developing country is in the interest of developed countries (Starnini et al., 2019). E-Commerce can play an important role in providing some very desirable objectives in developing countries as it can significantly benefit not only individuals, organisations but societies as well. E-Commerce has potential to reduce poverty in developing economies by empowering skilled entrepreneurs. The skilled workforce of the developing economies, especially those living in the rural areas, can benefit from the greater reach and access provided by E-Commerce technologies. Empowerment of rural workers (particularly women) and boosting their living conditions can aid in breaking the vicious "poverty cycle" in developing nations. Moreover, public sector E-Commerce can enhance overall governance and give individuals with convenient access to public services (UNCTAD, 2017a). The adoption of E-commerce in developing nations holds substantial implications for the global economy, particularly in the context of the growing prominence of Global Value Chains (GVCs). These chains, which are pivotal to international trade, investment, and production, encompass multinational enterprises that operate across borders. Through the strategic utilisation of backward linkages, which involve importing inputs from other countries, and forward linkages, which entail exporting inputs for production elsewhere, nations can enhance their production efficiency and service delivery. This interconnectedness of economies underscores the criticality of E-commerce adoption in developing contexts, as it fosters increased economic interdependence. Thus, the significance of E-commerce adoption extends beyond national borders, influencing the dynamics of the global economy (Llanes, 2020, Adejoh, 2018).

This study is expected to provide valuable insights into E-Commerce adoption in Pakistan. While findings of this research can guide Pakistan's leadership to make informed decisions about E-Commerce related matters, global welfare and funding organisations can also adopt strategies and direct funds towards areas that need attention guided by the results of this research project. Leadership of multinational firms can also benefit from this research as results of this study may potentially help decision makers of multinational firms to make customised country specific business plans.

1.5 THE RATIONALE OF THE STUDY

E-Commerce research can be divided into research streams that emerged in line with the E-Commerce penetration in the society. So, in developed countries, soon after firms started thinking possible inclusion of information technology in business as a commerce medium, E-Commerce attracted the attention of research scholars. The first stream of research in E-Commerce was thus centred around the potential benefits and constraints of E-Commerce (Zhuang and Lederer, 2003, Daniel and Wilson, 2002, Stockdale and Standing, 2004, Goldstein and O'Connor, 2000, Kuzic et al., 2002). Later, when E-Commerce adoption gained momentum, a new research stream emerged that focused on the determinants of the E-Commerce adoption at organisational and individual levels (Wymer and Regan, 2005, Gefen and Straub, 2000b, Al-Qirim, 2005). The researchers were keen to know why some organisations and individuals choose to adopt E-Commerce while others do not. Lastly, the third research stream is about E-Commerce "downstream" issues like customer services and E-Commerce success (Molla and Licker, 2001, Wang, 2008, Chaffey, 2007, Quayle, 2002). As E-Commerce arrived in developed countries late ,most of the earlier E-Commerce research was done within the context of developed economies (Worzala et al., 2002, Spindler and Börner, 2013, Park et al., 2004, Simpson and Docherty, 2004, Dwivedi et al., 2009b, Wymer and Regan, 2005, Al-Qirim, 2006). In developing economies, E-Commerce research started gaining popularity after 2000 which resulted in an increasing

trend of E-Commerce research in developing countries context (Pavlou and Fygenson, 2006, Molla and Licker, 2005b, Li and Xie, 2012, Rahayu and Day, 2015, Rowe et al., 2012).

Cross-cultural and comparative studies reveal that E-Commerce adoption is sensitive to the cultural, social, and economic environment (Dai and Palvi, 2009, Lightner et al., 2002, Chai and Pavlou, 2004). Several influencing variables greatly vary not only between developing and developed economies but also within developed countries and developing countries (Molla and Licker, 2005b, Vaithianathan, 2010, Khokhar and Serajuddin, 2015a, O'sullivan and Sheffrin, 2003). This means that E-Commerce adoption determinants relate differently not only between developed and developing economies but also, we cannot generalise the findings of a study done in developing economies to all developing countries. A country specific study is thus important to understand E-Commerce adoption phenomenon.

While we find some Pakistan-based E-Commerce adoption studies in private (Abid and Noreen, 2006, Baig et al., 2011, Idrees et al., 2020, Imtiaz et al., 2020, Khan et al., 2010, Khaskheli and Jun, 2016, Shafique and Mahmood, 2008) and public sector (Rehman et al., 2012, Chandio et al., 2018, Qaisar and Khan, 2010, Arfeen and Khan, 2009, Chohan et al., 2020). To the best of the author's knowledge, there is no comprehensive empirical study based on solid conceptual and theoretical understanding in the Pakistani context. As discussed in detail later in section 3.2.2.2, there seems to be no innovation in terms of the variables studied, models used, and data analysis techniques applied. E-Commerce adoption typically matures in phases and moves linearly from a lower level towards a higher level in order of sophistication (Rao et al., 2003) and the influencing variables and/or their relationship with each development stage may be different (Molla and Licker, 2005b). However, all existing Pakistan based E-Commerce adoption studies terminate at the very first stage of adoption.

This study was done in two phases, each involving different sets of predictor variables, more relevant to countries like Pakistan. The study is based on a more representative sample of Pakistani firms both from public and private sectors. A total of four models with two sets of predictors have been proposed and tested to study not just the initial adoption but more advanced stages of adoption. In terms of data analysis some robust algorithms have been used to make sure that our proposed measurement models are valid, reliable, and thus measure what they are supposed to measure. The study used second generation SMART PLS SEM and Multinominal Regression techniques to find the relationships between predictors and outcome variables.

The study is likely to contribute and fill in the knowledge gap by

1. Validating measurement scales for E-Readiness, Technological and Behavioural Control Factors in the peculiar context of Pakistan.
2. Investigating relationships of E-Readiness factors (more relevant in Pakistani context), Technological and Behavioural Control Factors with organisational E-Commerce adoption using second generation PLS-SEM.
3. Comparing relationship of E-Readiness, technological and behavioural factors with organisational E-Commerce adoption in private and public sector s.
4. Studying discriminant factors relevant to each level of organisational E-Commerce adoption in public and private sector organisations of Pakistan.

To fulfil the objectives, this study inadvertently contributed to the existing body of knowledge in several other ways as well as. The necessary steps taken to accomplish the objectives and answer research questions such as systematic survey of existing literature in Pakistani context, usage of second

generation PLS SEM to explain organisational E-Commerce adoption, collection of responses from more representative sample from public and private sector organisations also proved to be a valuable augmentation in the existing literature.

1.6 SCOPE OF THE STUDY

This research project understands E-Commerce as " the exchange of information across electronic networks, at any stage in the supply chain, whether within an organisation, between business and consumer or between the public and private sector, whether paid or non-paid" (UK Cabinet Office, 1999) and E-Government or E-Commerce in the public sector as "application of E-Commerce technologies in the public sector "(Chaffey, 2009). Our chosen definition is comprehensive and takes into account evolving commerce trends by accounting for transaction activities (including several presales interactions), extending the scope of E-commerce beyond only cash transactions, and encompassing both public and private sectors. A stagged model of E-Commerce adoption adopted from the model proposed by Rao et al. (2003) and Symonds (2000) has been used to study the relationship of influencing variables at different stages of E-Commerce adoption. The study is based on the responses collected from different public and private sector organisations of Pakistan chosen randomly using "Stratified" sampling technique from a database created by appending data taken from FBR and Chamber of Commerce.

1.7 STRUCTURE OF THE THESIS

This thesis is divided into nine chapters. Chapters one through four describe research settings. Chapter one introduces the project and chapter two through four are review of literature about E-Commerce, underlying technologies of E-Commerce, E-Commerce adoption, and theoretical frameworks used in previous research. Chapter five explains the theoretical foundation of this study by forming hypotheses and modelling variables. Chapter six explains and justifies the research design to achieve the project objectives. Chapter seven is about data analysis and describes the research results by presenting descriptive and inferential analysis results. Chapters five, six and seven thus collectively make research frame. Research outcomes are discussed in chapters eight and nine. Chapter eight discusses the results of the research with possible explanations. Finally, chapter nine concludes the thesis by summarising the research findings, discussing the contribution of the research, recommendations, limitations, and future directions of research. Please refer to Figure 1-1 for chapter details and thesis structure.

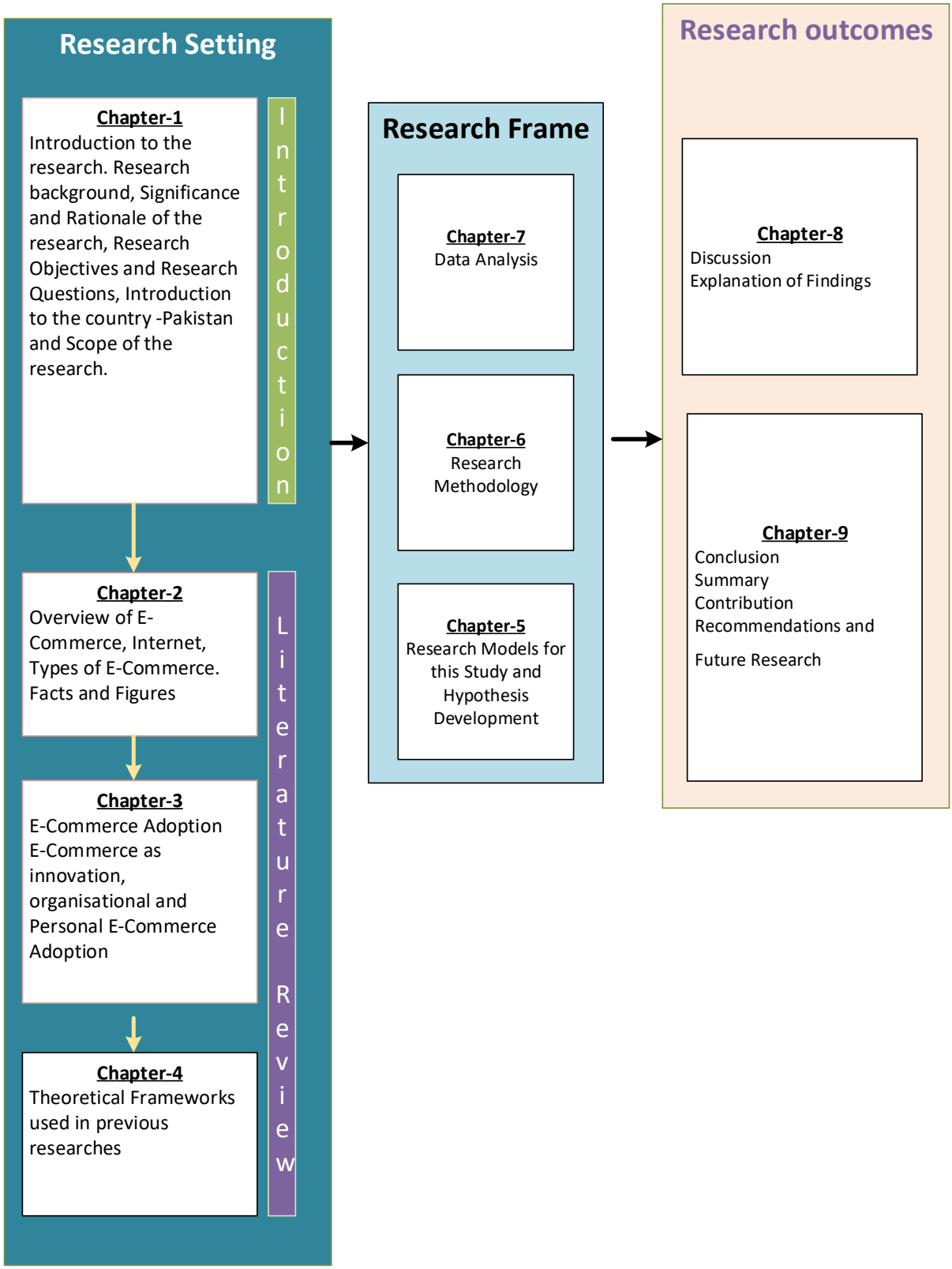


Figure 1-1: Thesis structure.

1.8 SUMMARY

The chapter introduced the research project by describing the study's background, significance, and rationale. E-Commerce emerged when businesses started using Information and Communication Technology (ICT)-based business applications. E-Commerce is a collection of different ICT applications to conduct business and is now a mainstream business activity. Several studies have established a positive relationship between organisational E-Commerce adoption and economic growth. E-Commerce technologies can benefit firms in both the private and public sectors. While private organisations strive for efficiency, expanded market reach, and increased profits, public sector organisations strive for improved, effective, and efficient public service delivery. Even though E-Commerce is growing everywhere, some countries, especially developing countries, are having a harder time catching up. Research into E-Commerce adoption started when businesses realised, they could use ICT to improve their operations. Some early studies looked at the potential benefits and the challenges of using E-Commerce. Subsequent studies looked at barriers and drivers of E-Commerce adoption and post adoption issues. Several researchers noted that E-Commerce technology is highly contextual, and generalising research findings from developed countries to any country was problematic. This is because developed and developing countries have different socio-cultural and economic environments. Most of the research so far has focused on developed countries. It wasn't until after the year 2000 that scholars really started paying attention to E-Commerce in developing countries and found that these countries had challenges different from those in developed economies. Despite common challenges, there exists considerable variation in socio-economic indicators among developing nations. This diversity suggests that research findings from one developing economy cannot be simply extrapolated to another, primarily due to the sensitivity of E-Commerce to socio-economic and cultural factors. Therefore, it's essential to conduct country-specific research to comprehensively understand the dynamics of E-Commerce adoption within each unique socio-economic and cultural context. This study is expected to fill existing knowledge gaps (highlighted in chapter 3) by investigating additional patient factors using some robust and cutting-edge statistical techniques and four models for a better understanding of organisational E-Commerce adoption in Pakistan.

CHAPTER 2 OVERVIEW OF E-COMMERCE

2.0 INTRODUCTION

This chapter starts with defining E-Commerce and discussion on the various interpretations found in existing literature. It then explores the applications of E-Commerce in both public and private sectors, its extensions, and its evolution within organisations. A dedicated section compares the term E-Commerce and E-Business. Given that this study is contextualised within Pakistan, a concise introduction to the country is provided, along with an overview of the state of E-Commerce and Internet usage in Pakistan, supported by relevant statistics and comparisons. The chapter presents valuable data at regional, national, and global levels, facilitating meaningful comparisons. Furthermore, it delineates the various definitions that shape the scope and conceptual framework of this research, thereby providing a comprehensive understanding of the study's context.

2.1 ELECTRONIC COMMERCE

Increasing number of organisations in the public and private sectors, use internet and web based technologies for their all communication needs and as a platform for trade (Lee et al., 2018). Innovative characteristics of internet not only allow greater collaboration, optimise operations, gain competitive advantage but also give global reach for trade (UNCTAD, 2017a). Increased integration of internet in everyday life resulted in emergence of terms prefixed with “e” (like e-trading, e-marketing etc). Commercial use of internet also resulted in new versions of business models and especially customised strategies. At global level, terms “digital economy” and “ data driven economy” is also used to refer to “e- version” of the conventional economy (Mougayar, 1998, Sukhodolov, 2018).

Electronic commerce is a special type of business model that enables trading online (Bloomenthal, 2020) and is based on the combination of Internet and web technologies in which the internet acts as an infrastructure to carry packets of data across the globe much like postal system thorough standard communication protocols (Brynjolfsson et al., 1998, Kahn and Dennis, 2020) and World Wide Web (or simply Web) provides interaction interface for information retrieval and sharing (Britannica, 2020).

Literature defines E-Commerce in several ways that differ in scope and perspective. While some scholars are of the view that only online transactions with the element of “trade” or “payment” are E-Commerce transactions (Lawrence et al., 1998, McKay and Marshall, 2004, Turban et al., 1999), others define E-Commerce as “any digitally mediated” transaction regardless of having financial element in it (ENACHE, 2018, Ngai and Wat, 2005). Today several pre-sales and post-sales activities also happen online. Sale in a brick-and-mortar setup may result from several online presales interactions. So, some scholars even include online pre and post-sales activities in E-Commerce (Chaffey, 2009). Table 2-1 lists some of the E-Commerce definitions found in the literature.

Table 2-1: E-Commerce definitions source (literature survey)

Name(s) of Scholor(s)	Definition
Kalakota (1997)	E-Commerce can be defined from (1) communication perspective as the delivery of information or payment digitally, (2) as business process perspective because E-Commerce is essentially an application of ICT in business (3) as service perspective because E-Commerce leads to cost reductions and increased quality and speed of service delivery, (4) and finally, the online perspective looks E-Commerce as buying and selling online.
Lawrence, et al (1998)	Trade of information, products and services using any computer connected by the internet

Turban, et al. (1999)	Process of trade and exchange goods, services, or information through an electronic medium, primarily the internet
UK Cabinet Office (1999)	"E-Commerce is the exchange of information across electronic networks, at any stage in the supply chain, whether within an organisation, between business and consumer or between the public and private sector, whether paid or non-paid"
McKay and Marshall (2004)	Doing business including selling, buying, exchanging products, services and information exchange using a computer system and internet.
Ngai & Wat (2005)	A modern business methodology that addresses the needs of organisations, merchants, and consumers to cut costs while improving the quality of goods and services and increasing the speed of service delivery
Khan, et al. (2014a)	Doing business electronically
ENACHE (2018)	E-Commerce is doing business using technology. It is an electronic business application that involves electronic fund transfer, supply chain management, online transaction processing, e-marketing, corporate purchasing, value chain integrations etc
ADP and ESCAP (2018)	E-Commerce is the sale and purchase of products (physical, digital, services) transacted utilising internet and electronic data exchange technologies over devices such as personal computers, tablets, and mobile phones
Zwass (2019)	E-Commerce is maintaining relationships and doing business including the trade of products, services, and information over the internet. It also includes information exchange and internal transactions within functional departments of an organisation.

From the above discussion, while there are divergent views on the scope of E-Commerce, there is consensus on the role of web technologies, the internet, and devices like computers, handheld wireless digital devices.

Modern mobile phones and mobile internet provide an excellent platform for web browsing on the go. Today, a large proportion of the population uses mobile devices connected through the mobile internet to access websites and retrieve or share information. In addition to information retrieval or sharing, users can also perform E-Commerce activities on E-Commerce-enabled websites and mobile applications (Kourouthanassis and Giaglis, 2012). In fact, larger proportion of internet users connect to the internet wirelessly through handheld mobile devices. Today, modern mobile phones are affordable and packed with excellent features, including web browsing capability (Liang and Wei, 2004). Modern web technologies have introduced a new breed of websites with more interactivity and features that allow users to create their content on websites. The revolutionary web 2 technologies led to the emergence of online social networking platforms that allowed information-sharing collaboration on websites and portals (Afrasiabi Rad and Benyoucef, 2011). Today a significant volume of E-Commerce transactions take place on mobile devices (often connected through mobile internet) and social networking websites. The former is termed Mobile Commerce, while the latter is called Social Commerce (Pelet and Papadopoulou, 2015, Siau et al., 2001).

2.1.1 MOBILE COMMERCE

Most of the scholars define mobile commerce (M-Commerce) as E-Commerce conducted on mobile networks using mobile devices and while acknowledging few differences, call it a subset of E-Commerce (Coursaris and Hassanein, 2002, Yap and Hii, 2009, Yang, 2005, Abdelkarim and Nasereddin, 2010,

Deshmukh et al., 2013, Chakrabarty, 2019, Veeranjaneyulu, 2016, Chaudhary and Sharma, 2014). On the other hand, few scholars call M-Commerce a different commerce model due to some differences arising from nature and characteristics of the fixed and mobile commerce platform (Swilley, 2016, Zhang and Yuan, 2002, Chong et al., 2012). There are two most cited differences in M-Commerce and E-Commerce. The first one is difference in hardware, most of the modern mobile devices have built in global positioning system (GPS) which enable software developers render customised and geographically specific services/data to users (Huang et al., 2018). The second difference is software related because of difference in networking technology and development language of mobile web (Swilley, 2016, Coursaris and Hassanein, 2002, Tiwari et al., 2006, Siau et al., 2001) .

Despite the differences some differences, both E-Commerce and M-Commerce aim at the exchange of information and buying/selling online using the internet. M-Commerce can best be described as a subset or special type of E-Commerce with some additional advantages over traditional E-Commerce that result from the portability of devices and the wireless nature of the networking technology (Coursaris and Hassanein, 2002, Yap and Hii, 2009, Yang, 2005, Abdelkarim and Nasereddin, 2010, Deshmukh et al., 2013, Chakrabarty, 2019, Veeranjaneyulu, 2016, Chaudhary and Sharma, 2014) . Today E-Commerce transactions held on mobile devices connected through wireless internet make a large proportion of total E-Commerce. In 2018, 31.6 million UK shoppers used mobile devices to shop online, making roughly 48.3 percent of the UK population and 66.7% of all internet shopping (CRR, n.d.) . The graph in Figure 2-1 shows the mobile shopping trend in western Europe.

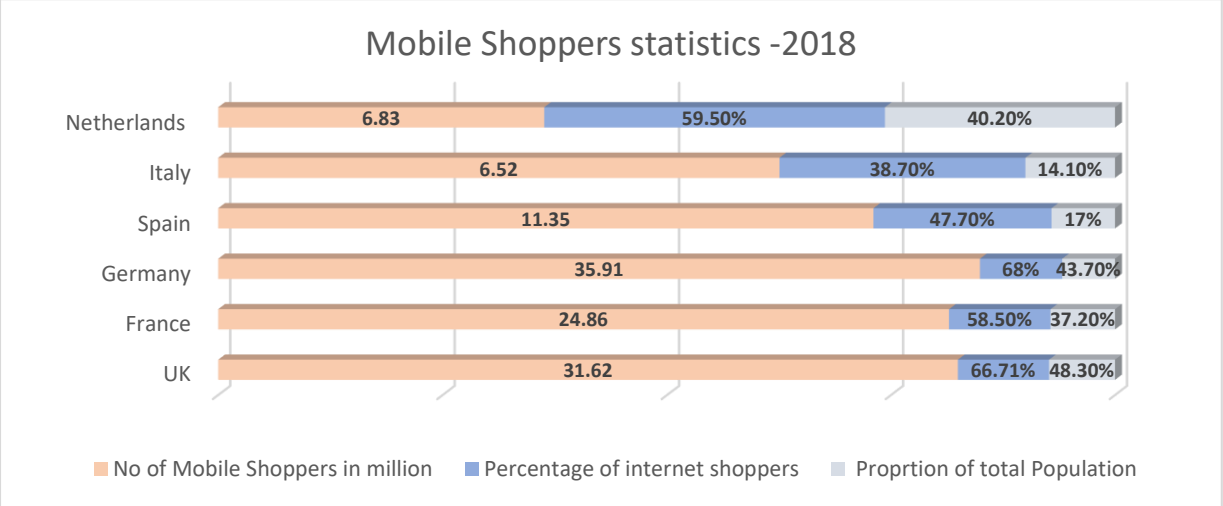


Figure 2-1: Mobile Shoppers in Western Europe source (CRR, n.d)

2.1.2 SOCIAL COMMERCE

Social Commerce is an extension of E-Commerce that aims to provide a customised and personalised shopping experience by exploiting the benefits of "large social capitals" and "interaction data" available on social networking sites (Liang and Turban, 2011). Laudon and Traver (2016) defined Social Commerce as E-Commerce enabled by online social networks. So Social Commerce is also just a version of E-Commerce that exploits the potential and benefits of online social networking platforms. The successful integration of "Hyper Text" technology to the internet by Tim Berners resulted in the invention of web technologies that act as an interface for digital communication. Web technologies were initially one-directional. Online communities still existed, but due to the lack of two-way communication features in web technologies, E-mails, web logs and list servers were used for interactivity. The next breed of interactive web technology called web 2 technology allowed users to connect to the network automatically through the system itself. These two-way communication

vehicles are now the technology behind modern interactive social media platforms(Manovich, 2009). All modern social platforms like Facebook, YouTube, Instagram, and Pinterest are based on the same web2 technology. Although some of the most popular social platforms were created for virtual socialising only, some businesses started using them for interaction with their customers. Most recently, organisations are using social media for buying and selling and providing customer services through it (Chaffey, 2009). The foundation of Social Commerce (S-Commerce) is the ancient concepts of human collaboration. For their survival and prosperity, humans have always had a fundamental need to trade goods and services. In those days, social groups influenced both the trade principles and the relationship principles. The propensity for humans to form groups has made a substantial contribution to human growth and wealth. Social Commerce is also based on the same principles of collaborations obtained through modern online social networking (Gibreel et al., 2018). Traditional commerce heavily relied on "trust agents" to assist sellers and buyers in making confident trade decisions, but E-Commerce lacks these intermediaries making the buying and selling online a risky endeavour. Social networking websites can act as trust agent in the online trading. Online communities and groups of buyers and sellers act as mediators of trust in online transactions. Social sites provide an excellent platform for consumers to contact social communities and seek advice. A buyer provides feedback about what they like and dislike about the products. Buyers and sellers both benefit from the feedback system; while a seller gets an insight into the market by analysing the reviews, the buyer also makes an informed choice after going through what other users say about a particular product. The distinction between E-Commerce and Social Commerce is becoming increasingly blurred, as most pure E-Commerce websites now include social networking and feedback systems, and social network working sites have added trading features in addition to networking and collaboration facilities online (Lipsman et al., 2012, Liang and Turban, 2011).

2.2 E-COMMERCE IN THE PUBLIC SECTOR

Inspired by the success of E-Commerce in the private sector, there were strong movements in the public sector to utilise E-Commerce applications for better public service delivery. However, the process of E-Commerce adoption in the public and government sectors was slow and complex because of the inherent differences in organisational structure, the complexity of the decision-making process, and the scarcity of resources. In most cases, the adoption of E-Commerce services in the public sector required reengineering of the whole business processes. However, today, several governments across the globe are utilising ICT for better public service delivery, achieving administrative efficiency, and providing access to different government layers at a single web portal. E-Commerce is helping several public sector organisations achieve the much-desired objective of "public value" through "Digital Government" or "E-Government."(Stowers, 2002, Liu and Yuan, 2015, Gil-Garcia et al., 2018).

E-Government or Digital Government is the usage of E-Commerce technologies in the public sector that often involves digital interactions between governments and (1) citizens(2) other government organisations (3) government employees, and (4) commercial businesses (Ibrahim, 2007). The most widely used ICT application is the website or portal that gives public services. Its functionality varies from a basic static website to an interactive transactive website. Several developed countries widely use transactive and informative websites to offer public products and services (like online buying/ renewal of licenses, permits, and passports) (Brabham and Guth, 2017, Stowers, 2002).

Much like private sector E-Commerce, E-Government (or digital Government) involves the usage of ICT technologies, especially web technologies, computers/other digital devices, and the internet, to offer products and services to businesses and citizens. There is a divergent view on definition of E-Government .While some argue that public sector E-Commerce is a subset of E-Government(Stowers, 2001), others argue that E-Government is a Public sector version of E-Commerce (Chaffey, 2009).

Stowers (2001) defined “public sector E-Commerce” as a transaction conducted by public sector organisation using computer-mediated networks that transfer the rights to use goods, services, or information. Since rights to use goods, services and information are transferred through web technologies, the internet, and digital devices, we can safely call E-Government or Digital Government as “Application of E-Commerce technology in the public sector ”(Chaffey, 2009). Since E-Commerce is a set of ICT based business applications that can be used both in private and public sector. This study will use the terms E-Government, digital government, and public sector E-Commerce interchangeably.

2.3 CATEGORIES OF E-COMMERCE - PRIVATE SECTOR

In the private sector, E-Commerce has been categorised as Business-to-Customer (B2C), Business-to-Business (B2B), Business-in-Business (B1B), and Consumer-to-Consumer (C2C). B2C, also called “Supply-Side”. E-Commerce is concerned with the transactions between a business and its customers for personal or non-commercial use. A substantial proportion of the world’s E-Commerce is related to the transactions between two businesses called Business to Business B2B E-Commerce. Business in Business (BIB) E-Commerce is a relatively less-mentioned E-Commerce category that involves transactions or information exchange between different functional departments or employees of the same organisation. The consumer to consumer (C2C) E-Commerce model is based on the business interactions between two consumers. Normally, this business model requires a third party managed online platform where sellers and buyers interact. Examples of this type of E-Commerce include buying and selling products on platforms like “Gumtree”, online non-business e-Bay auctions, and buying and selling on other online classified platforms between non-business entities. Another E-Commerce model called Customer to Business (C2B) allows individuals/ customers to supply products and services to the businesses. Examples of the C2B model include affiliate marketing, where a customer of Amazon or E-Bay, for instance provides marketing services to the businesses (Jentzsch and Miniotas, 1999, Nemat, 2011).

2.4 CATEGORIES OF E-COMMERCE -PUBLIC SECTOR

The literature survey reveals that while some authors have listed public sector E-Commerce categories along with private sector E-Commerce categories without any sectoral distinction (John, 2018, Nemat, 2011, Mueller, 2000, Manzoor, 2010) others list the same categories and business models as categories the E-Government/ digital government or Internet Government (Belanger and Hiller, 2006, Yildiz, 2007, Joseph, 2013). Government to Citizen or G2C E-Commerce model is about the online transactions and interactions between Government (provincial/federal/local) and its citizens. Examples include the renewal of a driving license, payment of council tax or fines. The Government to Business (G2B) business model is like the G2C except that businesses replace the role of citizens. Examples include buying business permits, payment of business taxes etc. Depending upon the level of sophistication and information system architecture, different layers of government (i.e. Federal, Provincial or Local) and units within the same layer of government or between different layers may interact online for the exchange of information and buying/selling of goods and services from each other. This E-Commerce model is referred to as Government to Government (G2G) E-Commerce. The government often choose to interact with its employees online to exchange information (for example, for communication of standard operating systems or job manuals). This model in E-Commerce is called Government to Employee (G2E) E-Commerce (Nemat, 2011).

2.5 E-COMMERCE AND E-BUSINESS

Although the terms E-Business and E-Commerce are often used interchangeably, literature survey reveals that there is a divergent view on their definitions. The term E-Business is sometimes used as a concept that can be applied to operations and strategy of an organisation i.e., acquiring “E-Business

Technologies" or formulation of "E-Business Strategy". E-Business as an "adjective" is used to describe a business that has no physical presence or its core operations are only done in virtual environment i.e. "Pure-Play" businesses like Amazon, eBay, Uber, Just Eat etc (Chaffey, 2009). Historically, the term E-Business was first coined by the International Business Machines (IBM) back in 1997. They defined E-Business as a "business act". According to their definition, an E-Business is a business that uses networking technologies (internet, intranet, and extranet) and communication technologies like the world wide web to gain business benefits. Most frequently used technologies include networking and world wide web technologies in key business processes that often enable businesses to operate from anywhere at any time (Smith et al., 2001). In summary, both terms E-Commerce and E-Business are loosely defined and differ in scope. Chaffey (2009) calls E-Business just a new name for ICT management within the organisation and supports the view that E-Commerce is a subset of E-Business. However, he also agrees that E-Business and E-Commerce can be interpreted as same thing. He argues that the difference of opinion on the definition of E-Business is not that important if the scope of E-Business or E-Commerce is clear at the organisational level and managers can drive the benefits from the ICT investment.

2.6 E-COMMERCE STAGES OF DEVELOPMENT

Over the past several years, researchers and practitioners have suggested different maturity models of information systems within organisations. The purpose was to measure and map the state of information systems maturity level within organisations, as means for benchmarking, self-assessment, and continuous improvement (Ahern et al., 2004, Fraser et al., 2002, Mettler et al., 2010, Paulk et al., 1993). The models are stagged linear sequences of different stages that can act as a guide to map the level of E-Commerce maturity within organisations as well. While E-Commerce maturity models typically follow a linear progression , It is not necessary for organisations to pass through all stages one by one, instead, many firms now bypass several stages and directly reach an advanced stage (Rao et al., 2003). Following sections describe different E-Commerce maturity models in both public and private sectors.

2.6.1 PRIVATE SECTOR E-COMMERCE DEVELOPMENT STAGES

O'Connor and O'Keefe (1997) presented a model to explain the position of small organisations based on features and sophistication of organisational websites as a marketplace. The model is based on "Online Marketing Paradigms" characterised by the website's level of information content and transaction functionality. In terms of information content, the simplest and most basic paradigm is "Billboard" followed by "Virtual Catalogues" and "Inverted Catalogue" in order of increasing information.

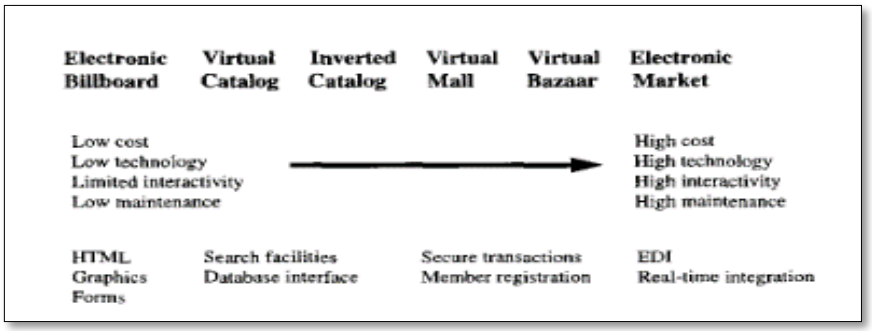


Figure 2-2: E-Commerce development model (O'Connor and O'Keefe, 1997)

content. As shown in Figure 2-2 each progressive stage comes with more interactivity and terminates at fully integrated transactional online platform stage.

McKay et al. (2000) suggested a 6 stage "Stages of Growth" model called the SOG-e Model. The model was later validated and used in studies by many researchers, including Prananto et al. (2003). The proposed model includes "No Presence", "Static Website" "Interactive Online", "Electronic Commerce", "Internal Integration", "and "External Integration" stages. Each successive stage is more advanced than the previous stage in terms of the sophistication and functionality offered. Figure 2-3 shows the model that maps different level levels of E-Commerce in order of sophistication (from low to high) on the horizontal axis and level of investment along the vertical axis. The "No Presence stage" is characterised by having no web presence at all, and later a business may go online through a static website which is the second stage towards growth. In the third stage, the business adds two-way communication functionality. The fourth stage features cart functionality and thus allows consumers to do financial transactions online. An organisation can integrate its E-Commerce enabled website with internal functional areas and value chain at a more advanced fifth stage and finally with the suppliers to gain the highest growth level of the model.

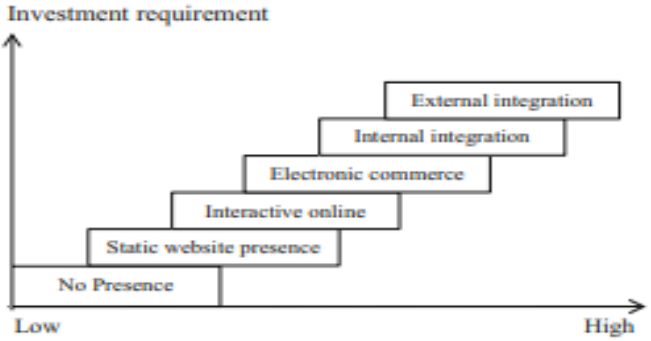


Figure 2-3: E-Commerce growth model in organisations (McKay et al., 2000)

Rao et al. (2003) suggested a four-stage linear model of E-Commerce growth within organisations. They named the stages "Presence, "Portals", "Transactions Integration", and "Enterprises Integrations". Table 2-2 lists each stage of E-Commerce growth with relevant characteristics.

Table 2-2 Four stagged linear model of E-Commerce growth (Rao et al., 2003)

S.No	Stage	Characteristics
1	Presence	Web site presence with simple content/ brochure, one-way communication, contact information. No external/internal functional integration.
2	Portals	In addition to the previous stage, this stage offers 2-way communication with customers and suppliers, non-cart-based order placing, searchable databases. Information displayed is dynamically linked with the inventory.
3	Transactions Integration	In addition to the portal stage features, this stage also offers financial or cart-based transactions facility.
4	Enterprises Integration	This stage is characterised by the full integration of all the organisational business processes. Thus, all business-to-business and business to consumer processes are integrated with the value chain.

Molla and Licker (2004) surveyed 150 South African businesses and mapped the E-Commerce diffusion on a six-stagged E-Commerce maturity model (Table 2-3).

Table 2-3: E-Commerce maturity model (Molla and Licker, 2004)

Stage	Name
1	Not connected to the internet, no e-mail
2	Connected to the internet with email but no website
3	Static website
4	Interactive website, customers can fill in and submit online forms
5	Transactive website that allows online selling and purchasing, online customer services
6	Integrated web. Suppliers, customers, back-office systems integrated with the web. Most of the transactions done electronically

Above mentioned models help conceptually understand the stages that organisations pass through while E-Commerce progress and map the status of E-Commerce development within organisations. Although the above models differ for the number of stages and their names, there seems to be consensus on the fact that E-Commerce maturity can be mapped on a linear development path that organisations follow in their journey towards achieving full functionality of E-Commerce. However, organisations can jump one or several stages of maturity and start from any advanced stage.

2.6.2 PUBLIC SECTOR E-COMMERCE (E-GOVERNMENT) DEVELOPMENT STAGES

Much like private sector organisations, public sector E-Commerce maturity can also be represented linearly in order of sophistication. Since both private and public sectors have different objectives and businesses, the features/ characteristics corresponding to development stages are different. Some public sector E-Commerce models are described as follows.

Layne and Lee (2001) presented a four-stage model that starts with the development of a static website without any interactive functionality followed by "Transaction Phase", "Vertical Integration Phase" and "Horizontal Integration Phase". According to Layne and Lee (2001), public sector E-Commerce comes into life only in the second phase where citizens and businesses can do transactions online (e.g. renewing driving licenses, paying taxes, etc.). The vertical integration phase involves linking the lower government authorities with the higher ones in the same domain. The link and information sharing between taxation authorities at the local and federal levels is an example of this phase. The fourth stage is characterised by the integration of several different government departments. This most developed phase of the model provides citizens and businesses to access the government from a single portal.

Watson and Mundy (2001) proposed a three-stage E-Government model comprising of "Initiation", "Infusion", and "Customisation". Table 2-4 lists the three stages of the proposed strategic framework and their relevant features.

Table 2-4: E-Government development model (Watson and Mundy, 2001)

S. No	Stage	Brief Features
1	Initiation	Single point access for several government bodies through portals. Options to make payments online, Information about the political representation, citizens can have access to the political scene.
2	Infusion	Most of the governments become electronic, online review and payment applications, electronic bills presentations.
3	Customisation	One to one relationship between citizens and government. Maintenance of personal profiles of citizens with records of their payments, interactions etc.

Symonds (2000) presented a four-stage E-Government development model with E-Government evolving through a continuum of one-way communications, two-way communications, exchanges, and portals. Table 2-5 lists the four stages along with the summary of relevant characteristics.

Table 2-5: Four stage E-Government maturity model (Symonds, 2000)

S. No	Stage	Brief Features
1	One-way communication	Static website with one-way communication
2	Two-way Communication	Websites having the functionality of two-way communication. Citizens can provide their information to the government mostly through forms and emails.
3	Exchanges	Quantifiable exchanges between government and citizens. Examples include license renewal, payment of fines and penalties, etc.
4	Portals	Complete integration of governments. The portals are not based on a particular public body rather, citizens are guided to the right public organisation based on their needs.

In 2001 United Nations Division for Public Economics and Public Administration (UNDPEPA), in association with the American Society for Public Administration (ASPA) (UNPAN, 2002), did a research project to benchmark the E-Government progress on a staged approach. Table 2-6 list the benchmarks used in the study.

Table 2-6: E-Government progress model (UNPAN, 2002)

Sr. No.	Stage	Brief Characteristics
1	Emerging	Basic and limited information. Few independent government websites
2	Enhanced	Website content is updated regularly
3	Interactive	Two-way communication, downloadable forms, appointment booking applications
4	Transactional	Citizens can pay their bills and make financial transactions online.
5	Seamless	Integration of all public bodies, greater collaboration,

The United Nations also used a similar model for their worldwide E-Government survey in 2012 based on a new four-stage model of online service development. In order of the maturity, four stages were “Emerging”. “Enhanced”. “Transactional”. and “Connected.” Apparently, the model is same as the previous model except the “Interactive stage” was merged into the second stage (Enhanced) of the previous model (UN, 2012).

After consolations with several governments, the world bank developed an E-Government development model based on three phases: Publish, Interact and Transact (WB, 2002). Table 2-7 lists the three phases along with their respective characteristics.

Table 2-7: World Bank's model of E-Government maturity (WB, 2002)

Sr. No.	Stage	Brief Characteristics
1	Publish	Government information, laws, and policies with basic contact information on the websites, downloadable forms, and documents present online.
2	Interact	Websites with the functionality of providing feedback, contact with the government bodies and officials through online forms.
3	Transact	Websites with link to government services online. Citizens can do online financial transactions.

The UK Government also developed a transformational map for its more than 100 E-Government websites (The National Audit Office, 2002). This is a three-phase model. Table 2-8 lists the phases and their brief characteristics.

Table 2-8: National Audit Office- E-Government maturity model (The National Audit Office, 2002)

Phase	Brief Characteristics
Phase:1	Provision of basic information
Phase:2	Interactive, personal account management, basic transactional facility, e-publishing
Phase:3	Complex transactional facility

In addition to the above several consultancies and hardware/software vendors like IBM(IBM, 2003), Cisco(CISCO, 2002), and Accenture(Accenture, 2014) have also presented their versions of E-Government maturity models. While the models differ in number, scope, and name of stages, they help develop a conceptual understanding of how E-Governments evolve.

2.7 E-COMMERCE GROWTH

Online shopping is becoming increasingly popular in many regions of the world. In April 2020, the United Nations' trade body (UNCTAD) released figures related to E-Commerce in 2018. With an estimated increase of 8% from 2017, global e-trade was $25.6 trillion in 2018, which was equivalent to

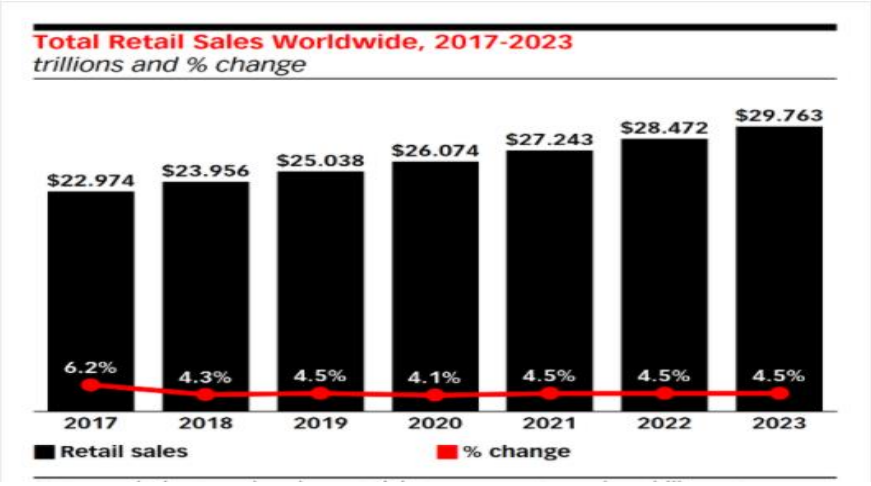


Figure 2-4: Total Retail Sales Worldwide, 2017-2023- (e-marketer, 2019)

30% of the total global GDP of that year (UNCTAD, 2020). Retail E-Commerce makes a larger proportion of total E-Commerce growth. According to an estimate, retail E-Commerce is likely to grow at an average rate of 4.5% in 2022 and 2023. The graph in Figure 2-4 shows the trend of retail E-Commerce growth, according to which the retail E-Commerce volume is likely to be $ 29.763 in 2023. However, the projections were made before the start of the COVID pandemic and do not account for any possible surge in E-Commerce due to increased online shopping in a health emergency.

Overall, E-Commerce volume is also on a constant rise. The global sales volume of E-Commerce is projected to be $3,453.3 billion by the end of 2025 (Figure 2-5).

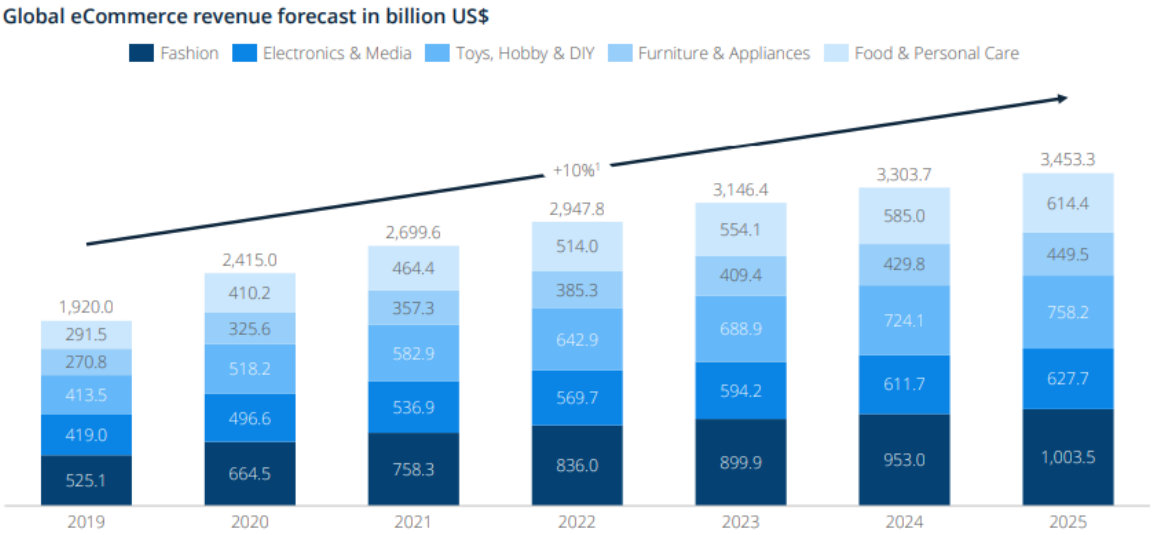


Figure 2-5: Global E-Commerce volume projections - (Statista, 2020a)

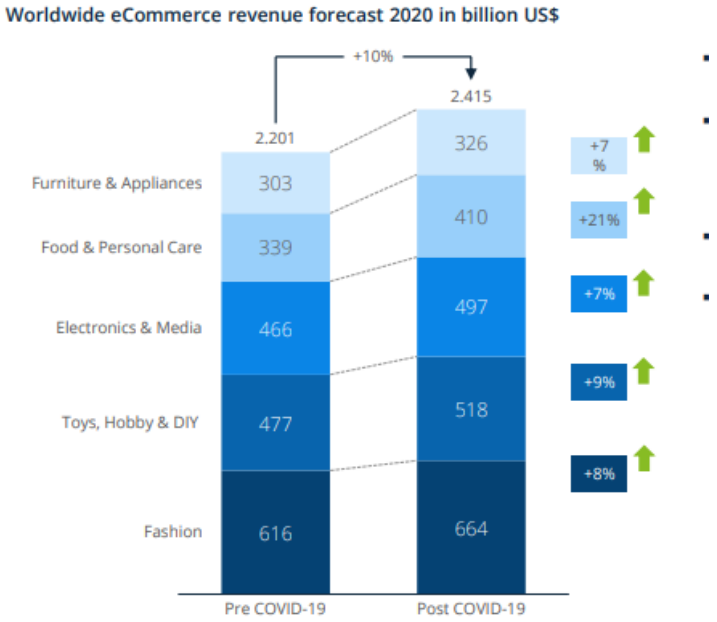


Figure 2-6: E-Commerce sales surge 2020 (Statista, 2020a)

The Global pandemic and lockdowns resulted in a surge in online shopping. Resultantly forecasters have adjusted their figures (Figure 2-6). We can see that Food and personal care is expected to increase by 21% followed by Toys, Hobby and DIY (7%), Fashion (8%) and both Electronics &Media and Furniture & Appliances are expected to grow by 7% as compared to previously projected figures(Statista, 2020a). While E-Commerce sales are booming worldwide, the major proportion of E-Commerce sales is contributed by advanced economies or relatively advanced developing economies like China and the Republic of Korea. According to UNCTAD's press release in 2018, sales value-wise USA led the world with $8,640 billion (42% of its GDP) followed by Japan $ 3,280 billion (66% of GDP), China $2304 Billion (17% of GDP), Korea $1,364 billion (84% of its GDP) and UK $918 billion (32% of its GDP)(UNCTAD, 2020).

2.8 PAKISTAN-AN INTRODUCTION

Pakistan, officially known as the Islamic Republic of Pakistan, is situated in South Asia. It gained its independence on 14th August 1947 from the then British India. It borders with Arabian sea, India, Iran, Afghanistan, and China (Figure 2-7). Pakistan has a total area of 796.095 sq. Kms out of which 35.2% is agriculture land, 27.6% arable land, 1.1% permanent crops land, permanent pasture 6.5 and forest 2.1. The rest of the land, 62.7%, comes into the "others" category. Pakistan has a population of 238,181,0334 (estimated for July 2021), most of which is settled around the Indus River and its side streams. Most of the Pakistani population comprises youth (0-14 year – 36.01%, 15-24 years - 19.3% and 25-54 34.7%). With a median age of 22 years, the current estimated population growth rate is 1.99%. Pakistani population is distributed in both rural and urban areas. Notable urban areas include Karachi, Lahore, Faisalabad, Rawalpindi, and Islamabad (Capital). Pakistan is administratively divided into 5 provinces, Punjab, Sindh, Baluchistan, Khyber Pakhtoon Khaw (KPK), and Gligat Baltistan.

Pakistan has a reasonably good communication infrastructure. Pakistan's telecommunication network is composed of diversified technologies, including Microwave Radio Relay, Coaxial Cables, Cellular and Satellite networks. Telecommunication (especially wireless) has recently attracted substantial investments. While fixed telephony is declining (only 1.14 out of 100 inhabitants), mobile and wireless

Figure 2-7:Pakistan Map adopted from Encyclopaedia Britannica

connectivity are surging (76.38 out of 100 inhabitants). A large proportion of Pakistan is covered by fourth generation (4 G) networking technology, and a small fraction is still connected through 3rd Generation (3G) or GPRS technology. Experiments for Fifth generation (5G) connectivity are in progress, and it is likely to be available to the masses in a couple of years. There are 151 airports in the country, cities and villages are connected through a network of railway tracks (11,881 km) and roads (11,881 km)(CIA.GOV, 2021). Pakistan has three main sea ports Bin Qasim, Karachi, and Gwadar(SEARATES, 2020). Pakistan's GDP was $340.64 billion in 2023 and is currently growing at a rate of 2.5% (IMF, 2024)

Services contribute to a significant proportion of GDP (56.5%), followed by agriculture (24.4%) and industrial (19.5%). According to the estimates of 2017, Pakistan had 61.71 million labour force. Pakistan's notable manufacturing heads include textile and apparel, food processing, Pharmaceuticals, sugar, surgical instruments, construction materials, paper products and fisheries. Not all its produce is consumed within the country; Pakistan exported worth $31.517 billion in 2019. Major export goods include Textile, Rice, Leather, Sporting Items, Chemicals, Surgical instruments, and carpets. Major export destinations are the USA, UK, China, Germany, UAE, and Africa. Pakistani import exceeds its exports ($42.27 billion in 2019). Pakistan imports petroleum, transport-related items, crude oil, iron/steel, tea, chemicals, and edible oil from China, UAE, Saudi Arabia, UK, and USA. Besides, it exports labour mainly in the Gulf countries (CIA.GOV, 2021).

Pakistan has a federal parliamentary system of governance. Most public service is delivered by organisations managed by federal, provincial, or local governments. Like several developing economies Pakistan's economy is facing different challenges. Political rivalry, internal disputes, security issues,

energy crises, and several managerial issues have led to underdevelopment. Although several corrective measures have been taken to improve the security, energy availability, and consistency in the policies in the recent past, burdensome investment climate deters the investment. Pakistan is hoping for a breakthrough in the economy in the next few years because of a $60 billion worth "China-Pakistan Economic Corridor" (CPEC) project targeted towards energy and other manufacturing projects (CIA.GOV, 2021).

2.9 INTERNET IN PAKISTAN

Since the internet serves as the backbone of e-commerce technologies, it is pertinent to briefly discuss the status of the internet in Pakistan. In Pakistan, internet was first introduced in 1992-93 when a company called "Imran -Net" started its first dial-up email services from Lahore. Later, SDNPK launched dial-up services from three cities (Karachi, Lahore, Islamabad) in 1993. Later, Digicom launched its services in Karachi by using a satellite based SCPC link of 64 kbps. Later state-owned Pakistan Telecommunication Limited started providing dial-up connections via its nationwide phone lines network in 1995 through its subsidiary company Pak Net (ISPAK, 2020). In 1996 three significant developments took place: the launch of Pakistan Telecommunication Authority (as a regulatory body for telecommunications), provision of improved graphics-based 28.8kbs service in selected cities of Pakistan by Pak Net, and the launch of Comsats- a private internet service provider. Inclusion of several private internet service providers and technological developments resulted in improved speed, bandwidth, and technology (from dial-up to fibre) (ISPAK, 2020). Today fixed broadband internet service providers include PTCL, Nayatel, wi-tribe, Comsats, Linkdotnet, Qubee, Wateen Telecom etc. (Saleem, 2015). Pakistan recorded a significant surge in digital connectivity after the deregulation of the telecom sector in 2003 and following the launch of 3G mobile internet services in 2014 (Hanif et al., 2017). The masses readily accepted mobile services. According to the Pakistan Telecommunication Authority's 2015 statistics a record growth of 345% in mobile broad band subscribers was recorded in

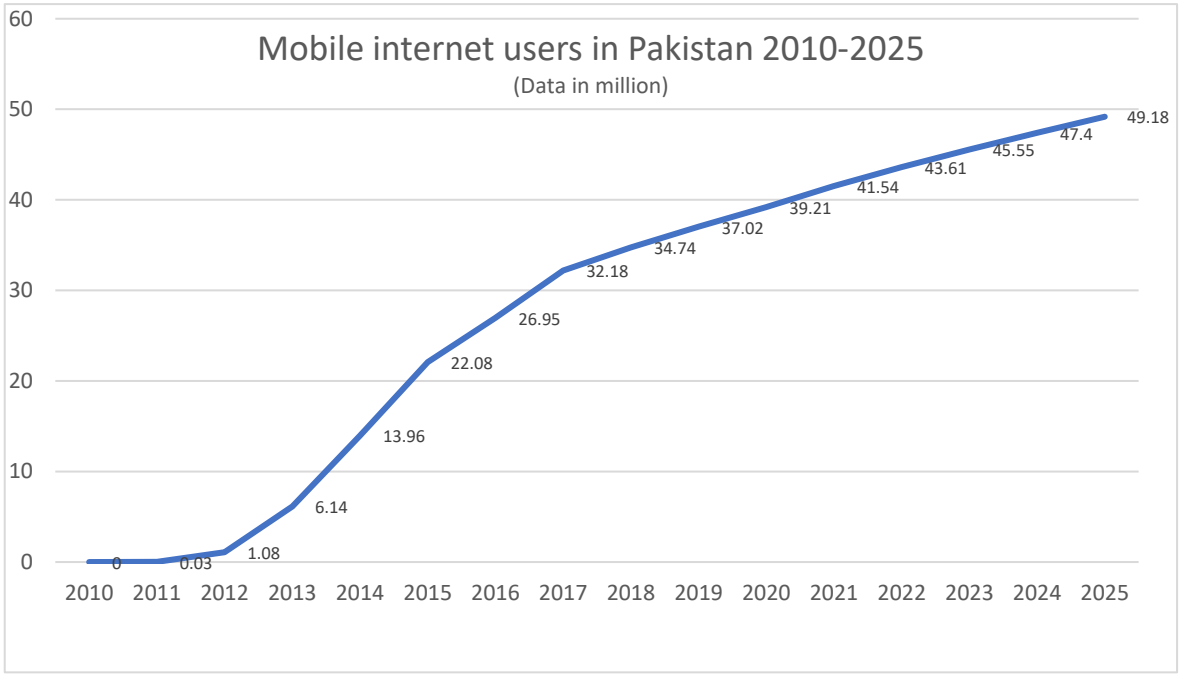


Figure 2-8:Projected mobile internet users in Pakistan - (Statista, 2021b)

the first year. Today a wide area of Pakistan is covered by the 4rth Generation (4G) mobile internet, and trials of Fifth Generation (5 G) have started. Major mobile broadband service providers in Pakistan include Mobilink, Warid, Telenor, Ufone, and Zong (Arifeen, 2017). In 2019 only 17.2% of the population

was connected to the internet, lower than the regional internet which was lower than the penetration rate of 37.9% (Statista, 2020d). Fixed broadband does not seem popular, and only 0.9% of the population was using fixed broadband for digital connectivity while the regional average of the same for south Asia is 3.5% (Internet World Stats, 2020). There seems to a quite heterogeneous internet penetration rate in Asia. The penetration rate varies from a low of 0.1% for North Korea to 96% for South Korea (Internet World Stats, 2020). In 2019, there were 37.02 million internet users in Pakistan and are projected to reach 49.23 million in 2025 (Figure 2-8) (Statista, 2021), out of which 49.18 are projected to be mobile broad band users (Figure 2-9) .

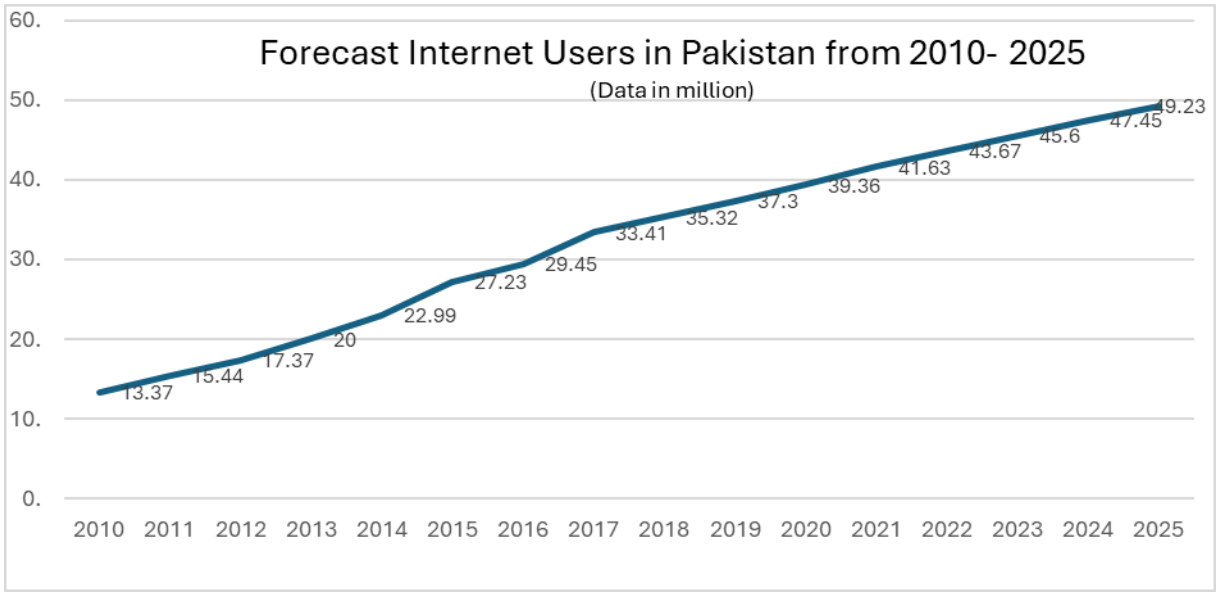


Figure 2-9: Projected Internet users in Pakistan- (Statista, 2021b)

The average internet speed in Pakistan is above 10 Mbps which compared to the other countries in the region is relatively better. Pakistan's National Telecommunication Company (PTCL) offers broadband speeds in the range of 6Mbps to 100 Mbps depending upon the area (PTCL, 2020). Other notable companies like Jazz, Telenor and Zong, in addition to their cellular services and mobile internet services also claim to provide a speed of up to 150Mbps through portable devices based on fourth-generation (4G) technology (Jazz, 2020b, Telenor, 2020, Zong, 2020).

2.10 E-COMMERCE IN PAKISTAN

Pakistan is a developing economy, and like several other developing countries, it is facing common challenges like high birth rate, low human resource development, and inadequate infrastructure (Yip and Ramakrishnan, 2002, Ernst and Lundvall, 1997a, Gurara et al., 2017). However, despite several challenges, Pakistan has excellent potential for E-Commerce. Pakistani shoppers did $ 2bn worth of online shopping in 2019. Online shopping is expected to increase the E-Commerce sales volume in

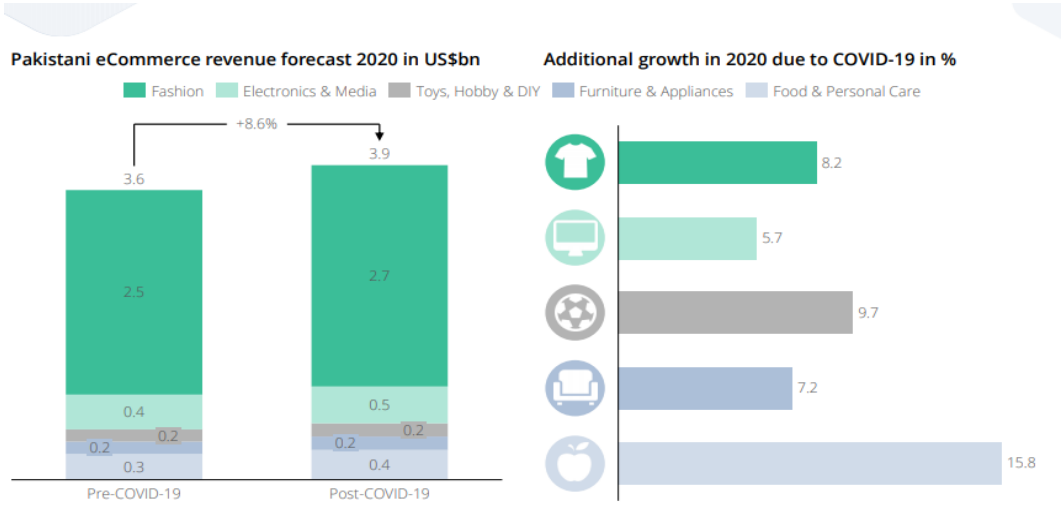


Figure 2-10: COVID-19 19 impact on E-Commerce sales: (Eden et al., 2020)

Pakistan in the wake of the COVID 19 health emergency (Figure 2-10). Total Pakistani E-Commerce sales are projected to be $ 7.1 bn in 2024, with an annual average growth rate of 27% between 2019-2024 (Figure 2-11)

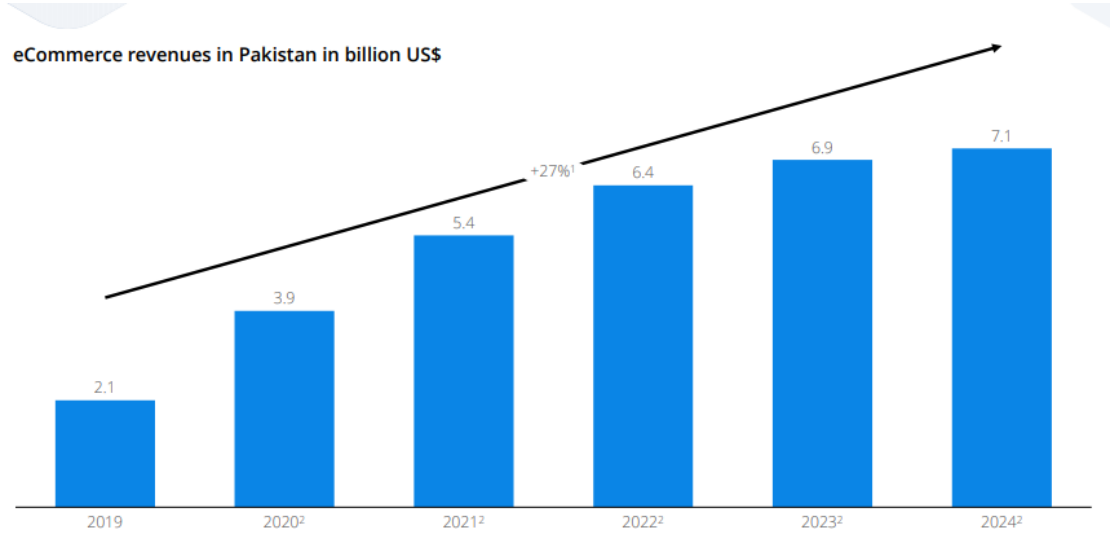


Figure 2-11: E-Commerce in Pakistan projection (Eden et al., 2020)

Pakistan is a populous country with a total population of just over 216 million. More than 64% of the population is below the age of 29 and the proportion is expected to remain roughly the same for the

next 30 years. In addition, the number of small and medium enterprises (known as the economy drivers) is growing; there are more than 3.2 million small and medium enterprises (SMEs) (RLTSquare, 2020). Although Pakistan's infrastructure is relatively poor compared to many global and regional countries, several infrastructure enhancements projects and schemes have been initiated in Pakistan. The projects and schemes aim to address power/ energy shortage, increase rail and road network and enhance telecommunication infrastructure with the help of increased private investment and public-private partnership(SBP, n.d). The telecommunication sector is the fastest-growing sector of Pakistan and has attracted substantial foreign direct investment (FDI). The tele density is constantly rising, and more than 70% of the Pakistani population lives in the cellular coverage area (Siddiqui, n.d.).

Pakistan remained a victim of terrorism in the past; however, the situation is much improved in recent years because of several military-led operations in troubled areas. The improved security and success of military operations are acknowledged by the world as well (The News, 2020, Nawaz, 2016, Khan, 2011). With a great young workforce, several infrastructure improvements projects and improved security Pakistan seems to have the potential of a good E-Commerce market on both supply and demand side.

2.10.1 E-COMMERCE PLAYERS OF PAKISTAN

In the Pakistani E-Commerce landscape, organisations are operating with both "Pure Play" and "Omnichannel" business models. E-Commerce players in Pakistan use their own online websites, marketplaces, social media, or a combination of both (RLTSquare, 2020).

2.10.1.1 MAJOR E-COMMERCE VERTICALS OF PAKISTAN

Pakistani E-Commerce niche can be categorised as (1) Retail including online brand stores (Junaid Jamshed, Alkaram, Metro etc) and virtual market places (Daraz, Symbios etc), (2) E-ticketing platforms including those working as a virtual marketplace for ticketing (book me and easy tickets etc) and those managed by brands themselves (like PIA), (3) Ride-hailing platforms (Uber, Creem) (4) food delivery platforms including virtual marketplaces (food panda, cheety) , brands like Mc Delivery or KFC and (5) classified (OLX, Pakwheels). Online retail has received substantial investment as compared to the other verticals but has not grown in proportionate with the level of investment, and much of the retail market remains uncaptured (Dawood, 2019). In addition to the niche as mentioned earlier, video blogging and freelancing have also gained popularity (Khalid and Siddiqui, 2019, Ninjaoutreach, 2020).

Daraz Pakistan (https://www.daraz.pk/) is a prominent name among Pakistani E-Commerce players. The company was founded by "Rocket Internet" of Germany in 2012 but later acquired by internet giant Alibaba. The company is still operating with the same name (i.e., Daraz) in Pakistan and a few other Asian countries, including Siri Lanka, Nepal, and Bangladesh(Rogers, 2019, Jajja, 2018). Other online marketplaces include Wbminternational.pk, Symbios.pk, Shophive.com, Homeshopping.pk, IShopping.pk and Yayvo.com(Rogers, 2019). Some domain-specific "pure-play" organisations like Pak wheels (https://www.pakwheels.com/) (deals with car sales), Zameen (https://www.zameen.com/) (Real estate-related web portal) OLX (https://www.olx.com.pk/) (classifieds) also attract heavy traffic.

There has been a significant increase in the number of freelancers in Pakistan in the last few years. In fact, according to a recent survey of "Payoneer" (an online payment platform), Pakistan outperformed the whole continent in freelancing (Figure 2-12). Pakistan was at number 4 globally with an annual increase in revenue of 47 percent, while India with 29% was at number 7 and Bangladesh with 27% growth was at number 8. Pakistan has more than 70% of the population below the age of thirty, and this segment of the population forms the major chunk of the gig economy globally.

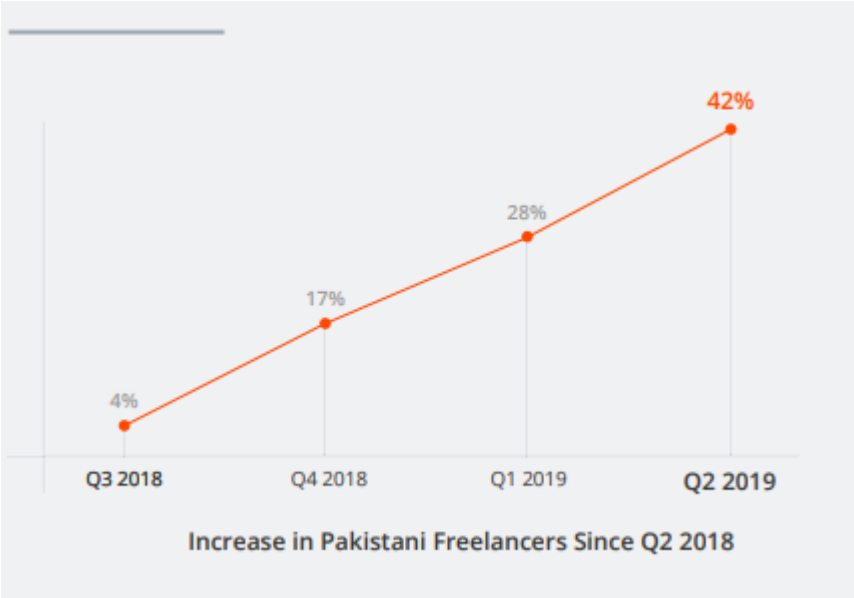


Figure 2-12: Increase in Pakistani free lancers source:(Payoneer, 2019)

Moreover, there is an increasing trend in youth acquiring technical education. The survey data reveals that Pakistani freelancer females are earning $22 an hour, which is 10% more than their male counterparts. The sharp surge in freelancers and the fact that Pakistani freelancers work an average of 34 hours per week suggest that youth in Pakistan can make freelancing a full-fledged career (Payoneer, 2019).

In the past couple of years, Pakistan seems to have been obsessed with Vlogging, especially in fashion, traveling, and videos as simple as related to the daily routine. The fashion industry seems to have changed its advertisement campaign strategy. In addition to the well-known and famous fashion icons, several other youngsters who made their reputation by regular vlogging are followed by millions of followers and are being paid heavily by the manufacturers and social media platforms. YouTube, Instagram, and Twitter are the most popular and extensively used social platforms both by manufacturing organisations and influencers (Khalid and Siddiqui, 2019, Ninjaoutreach, 2020).

In public sector, many organisations have websites that offer information and policy guidance but usually lack financial transactions facilities. The Government websites are single independent websites and thus provide no single platform for the citizens to access government services from a single platform. Apart from ministry websites, other notable public sector organisations with informational websites include utility service providers like SNGPL, SSGCL, LESCO, PESCO and Karachi Electric Company, etc.

2.10.2 PAKISTAN- E-COMMERCE INFRASTRUCTURE

Even though there have been constant efforts by successive Pakistani governments to improve the country's overall infrastructure, Pakistan's general infrastructure still lags behind several regional countries (Ahmed et al., 2013). While telecommunication infrastructure is essential for E-Commerce

growth, overall infrastructure of country also indirectly affects E-Commerce development by influencing the overall economic growth (Raburu and Onditi, 2017).

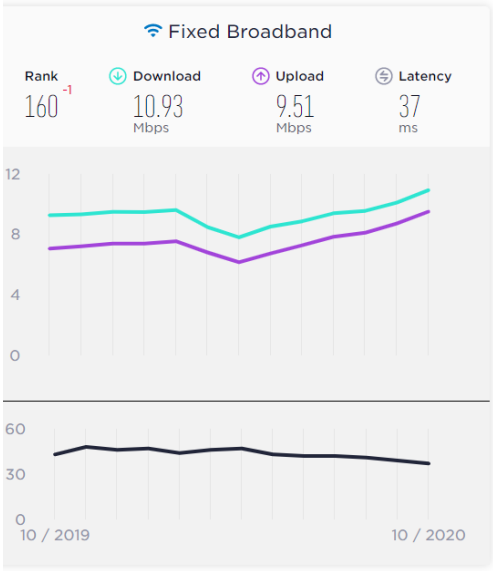


Figure 2-13: Pakistan: month wise average Internet speed -Pakistan (SpeedTest, 2020)

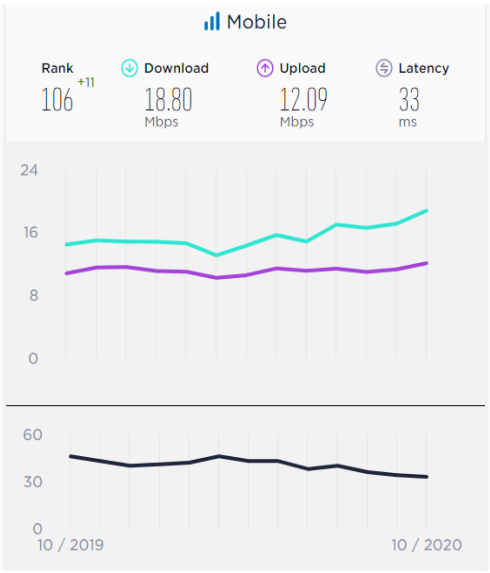


Figure 2-14: Month wise average mobile broadband speed- Pakistan (SpeedTest, 2020)

Energy drives the industry wheel; however, Pakistan still faces severe energy shortage issues (CIA.GOV, 2021). The road and rail network also needs attention. The world bank identified poor communication infrastructure as a bigger constraint for economic growth in Pakistan. The condition of roads is not very satisfactory, several rural parts of the country still need to be connected through roads or rail tracks. The railways also need to improve its speed. Presently, Railway takes somewhere between 20-28 days to deliver from port to upcountry which is up to 7 times slower than the US and Canada (Kiani, 2013).

2.10.2.1 TELECOMMUNICATION COMPANIES

There has been a sharp surge in the consumer base of telecommunication companies in Pakistan following the deregulation of the sector back in 2003. The start of 3G and 4G cellular services paved the way for exponential growth in mobile telephony and mobile broadband subscription. Consequently, broadband subscriptions in Pakistan increased from 2% to 30% in just a short period of 5 years (MOC, 2019). The telecommunication sector comes in the domain of the Ministry of Information Technology (https://moitt.gov.pk/). An organisation found in 1996 through PTA ordinance called the “Pakistan Telecommunication Authority” (PTA) regulates the infrastructure, operations, and maintenance of telecommunication services. The backbone of Pakistan's telecommunications infrastructure is the "Pakistan Telecommunication Company Limited" (PTCL). Initially state-owned, PTCL underwent privatization in 2006 when approximately 26% of its shares and control were acquired by the private sector entity "Etisalat Telecommunications". Presently, the government retains a 62% stake, while the public holds 12% of shares. PTCL, operating as a national telecommunications company, continues to play a significant role in advancing the country's telecommunications services (Shahid, 2019).

Pakistan received extensive private investment in telecommunication, mostly in mobile telephony. Mobile telephony service providers include Mobilink, Ufone, Zong, Telenor, Warid, WorldCall, Wateen, Nayatel etc (Arifeen, 2017). Figure 2-15 shows the market share of major cellular service providers in Pakistan.

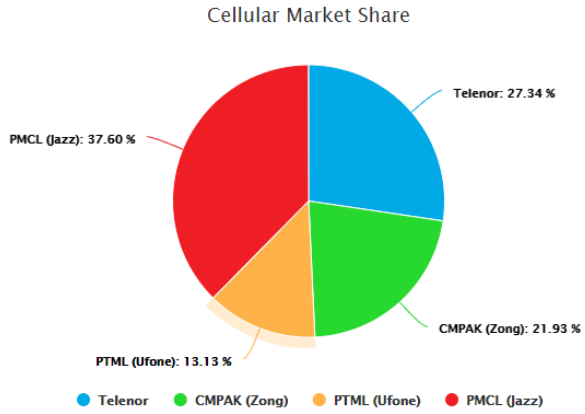


Figure 2-15:Cellular Market Share August 2020 (PTA, 2020)

2.10.2.2 QUALITY, PENETRATION, AND AFFORDABILITY OF INTERNET IN PAKISTAN

The average download speed of mobile broadband between 2019-2020 was 18.80 Mbps, while the fixed broadband download speed for the same period was 10.93 Mbps (Figure 2-14, Figure 2-13). National telecommunication company offers internet speed ranging from 6Mbps to 100 Mbps (SpeedTest, 2020). Some mobile telephony service providers also offer fixed broadband devices that also offer more or less the same speed range (Jazz, 2020a, witribe, 2020). Pakistan seems to have good download and upload speeds compared to some immediate neighbouring economies. However, it still lags globally. Table 2-9 lists the average broadband speeds of some other regional and global economies for the same period. According to Pakistan Telecom Authority (PTA), Pakistan has a total broadband subscription of 87 million which means a penetration rate of 40.95%. There are 85 million 3G/4G subscribers with a penetration rate of 39.98% (PTA, 2020). Mobile broadband and telephony seem to be at the heart of telecommunication services, with more than 97% of internet connections based on mobile networks. However, a significant majority of mobile internet subscribers actually do not use the internet (GSMA, 2019, GSMA, 2020).

Table 2-9:Average speed in Mbps for the period of October 2019 to October 2020 (SpeedTest, 2020)

Country	Mobile		Fixed	
	Download	Upload	Download	Upload
India	12.34	4.52	48.99	45.65
Bangladesh	10.28	6.84	31	32
Singapore	64.06	19.15	229.42	226.22
USA	53.44	11.80	165.88	62.11
UAE	129.61	24.25	117.84	54.57
China	124.39	26.96	140.74	40.09
UK	41.72	10.44	76.59	22.88
Pakistan	18.80	12.09	10.93	9.51

Affordability, low literacy rate, and low Perceived Security concerns remain top reasons for Pakistan's low usage of the internet. Most Pakistanis attribute non-usage to high mobile set costs and expensive mobile services. Figure 2-16 graphically represents the percentage contribution of different barriers towards non usage of the mobile internet (GSMA, 2016).

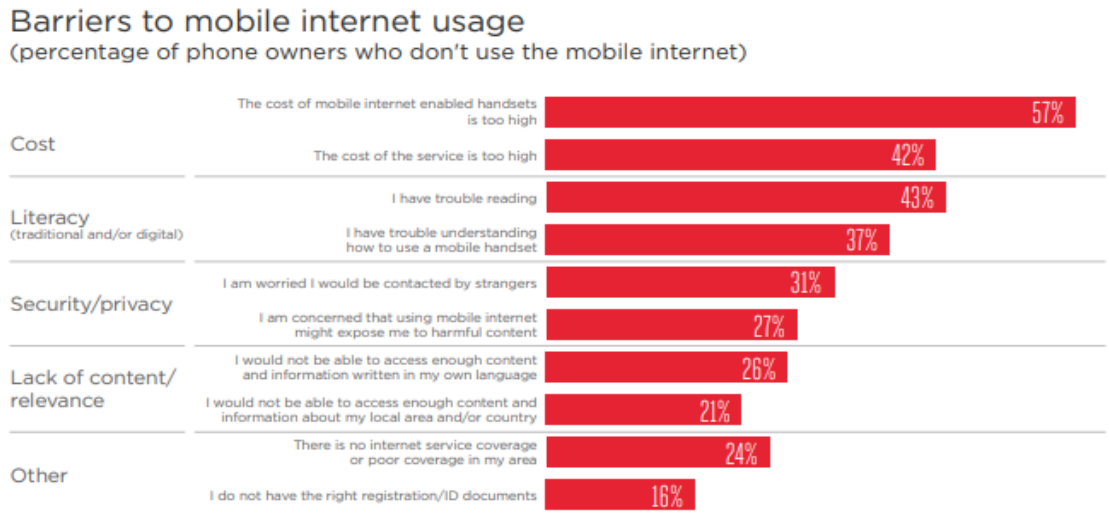


Figure 2-16: Mobile internet barriers (GSMA, 2016)

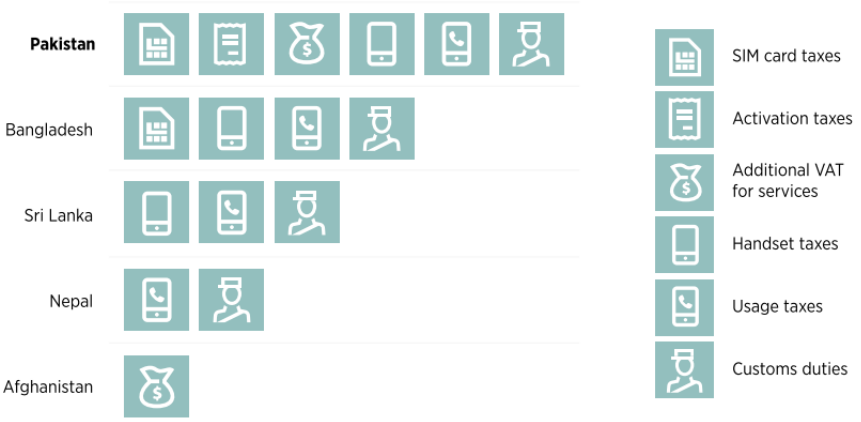


Figure 2-17: Mobile telephony tax comparison with neighbouring countries (GSMA, 2020)

Pakistani mobile services are heavily taxed (Figure 2-17). Apart from the direct taxes and spectrum license fee, mobile service operators also pay other regulatory fees, including universal fund fee, Research & development fund, and annual numbering and license fee. In addition, the telecommunication companies pay a substantial amount for networking equipment import, including customs duty (10%-25%), 17% provincial sales tax, and 5.5% income tax. These taxes and fees contribute to the lowest regional Average Revenue Per User (ARPU). Mobile users also pay SIM card tax, provincial tax, withholding tax. On the usage of services like voice, data, and SMS, additional Provisional Sales Tax (PST) and Federal Excise Duty (FED) is charged from the subscriber (GSMA, 2015).

In addition to what consumers pay directly, all business taxes and regulatory fees also ultimately transfer to the consumers. Resultantly, Pakistani consumers pay much more for mobile internet access

than several regional comparable economies. Table 2-10 compares the average per Gigabyte price in USD frozen on the 27/04/2020 exchange rate.

Table 2-10: Broadband cost per GB in USD (Cable.co.uk, 2020)

S. No.	Name	Average price of 1GB (USD)	Cheapest 1GB for 30 days (USD)	Sample date
1	India	0.09	0.02	14/02/2020
2	Sri Lanka	0.51	0.14	18/02/2020
3	Vietnam	0.57	0.04	25/02/2020
4	China	0.61	0.14	07/02/2020
5	Indonesia	0.64	0.13	13/02/2020
6	Pakistan	0.69	0.07	20/02/2020
7	Bangladesh	0.70	0.13	05/02/2020
8	Mongolia	0.74	0.37	18/02/2020
9	Iran	0.75	0.12	14/02/2020
10	Myanmar	0.78	0.72	18/02/2020
11	Nepal	0.86	0.26	20/02/2020
12	Malaysia	1.12	0.35	19/02/2020
13	Bhutan	1.16	0.39	06/02/2020
14	Thailand	1.23	0.18	24/02/2020
15	Philippines	1.42	0.95	20/02/2020
16	Cambodia	1.50	0.25	17/02/2020
17	Afghanistan	1.55	0.01	25/02/2020
18	Timor-Leste	2.08	0.83	24/02/2020
19	Singapore	2.47	0.47	21/02/2020
20	Hong Kong	2.55	0.62	14/02/2020
21	Brunei Darussalam	2.64	1.76	05/02/2020
22	Macau	2.89	1.21	18/02/2020
23	Maldives	3.88	1.85	19/02/2020
24	Japan	3.91	1.07	14/02/2020
25	Lao People's Democratic Republic	4.16	0.37	17/02/2020
26	Taiwan	5.91	0.64	24/02/2020
27	British Indian Ocean Territory	7.50	6.67	14/02/2020
28	South Korea	10.94	0.43	17/02/2020

2.10.2.3 PAYMENT METHODS

A robust and efficient digital payment structure is essential for online financial transactions. There are a total of 38 banks in Pakistan that issue bank cards, five banks offer point of sales (POS) services, and four banks offer international payment gateway services. Also, two microfinance banks offer E-Commerce gateway to their consumers (GOP, 2019b).

Pakistani buyers and sellers traditionally like to make transactions through cash. A large proportion of the population does not possess a bank card and those who possess also hesitate to do online transactions due to security reasons; thus, cashless transactions are relatively small. However, in the recent past, especially during COVID 19 outbreak, there has been a surge in digital payments (Sarfraz,

2020). Neighbouring country India, which is considered to be the world's largest unbanked population (DA, 2020) seems to be better than Pakistan in terms of credit card penetration rate (Figure 2-18). The credit card penetration rate in Pakistan by the end of 2025 is projected to 1.3% (Figure 2-19). Although

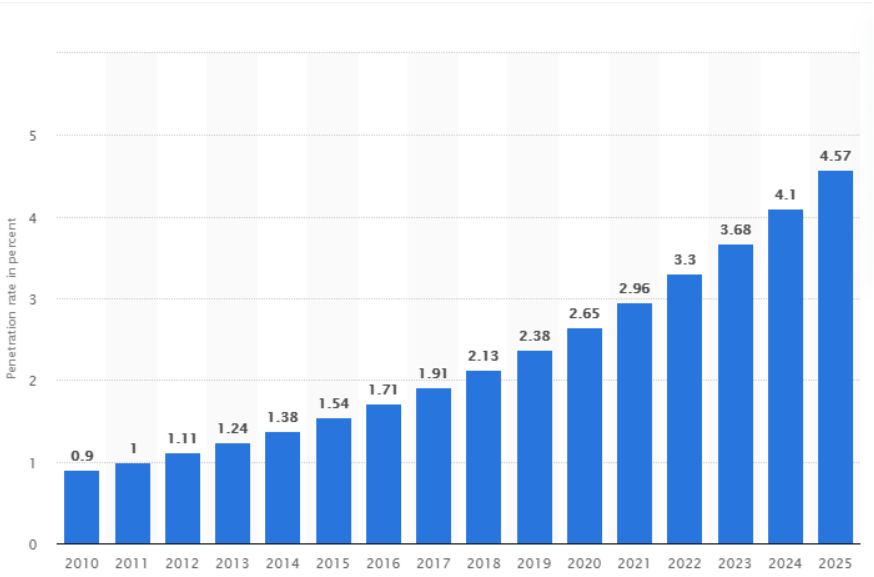


Figure 2-18: India credit card penetration rate 2010-2025 (Statista, 2020b)

there has been a surge in electronic fund transfer at point of sales in recent years. A large proportion of the Pakistani population is still unbanked. More than five percent of the whole world's unbanked population lives in Pakistan (Yasir, 2018). Pakistani financial service providers are aware of the gap, and they seem to be responding accordingly. Recently, cellular services providers have introduced some electronic card alternates in association with other financial institutions. Easy Paisa (the world's third-largest mobile payment platform) started its services in Pakistan in 2009. The service was launched by Telenor (cellular service providers) and Tameer Microfinance Bank. This payment method is a pretty popular mode of payment in Pakistan, and several merchants /buyers do financial transactions using this service. Another similar popular service is Jazz Cash, launched by Mobilink Pakistan – a mobile service provider (Khan, 2018).

In 2015, Habib Bank Limited and Monet collaborated to launch Pakistan's first mobile point of sales system based on GPRS technology. In 2016 an organisation called Keenu introduced a digital payment solution that enables the buyers to pay directly through their bank accounts. Another organisation Payfast ((https://apps.net.pk/about-our-company/) acts as a bridge between financial institutions, customers, and merchants. In 2017 another similar digital wallet SIMSIM was launched. The traditional banks also responded to the gap by introducing services like OTP (one-time pin) to allow buyers to pay digitally through their credit or debit cards (Indrastra, 2018). Unfortunately, the world's market leader PayPal is not present in Pakistan. For international payments, merchants and freelancers use platforms like Payoneer (https://www.payoneer.com/uk/), safe pay(https://www.safetypay.com/en/), and Skrill (https://www.skrill.com/en/). However, not all merchants accept payments through these platforms.

Former Finance Minister of Pakistan, Mr. Asad Umar realised the importance of having a payment solution like PayPal in Pakistan and formed a committee for this purpose. However, PayPal refused to

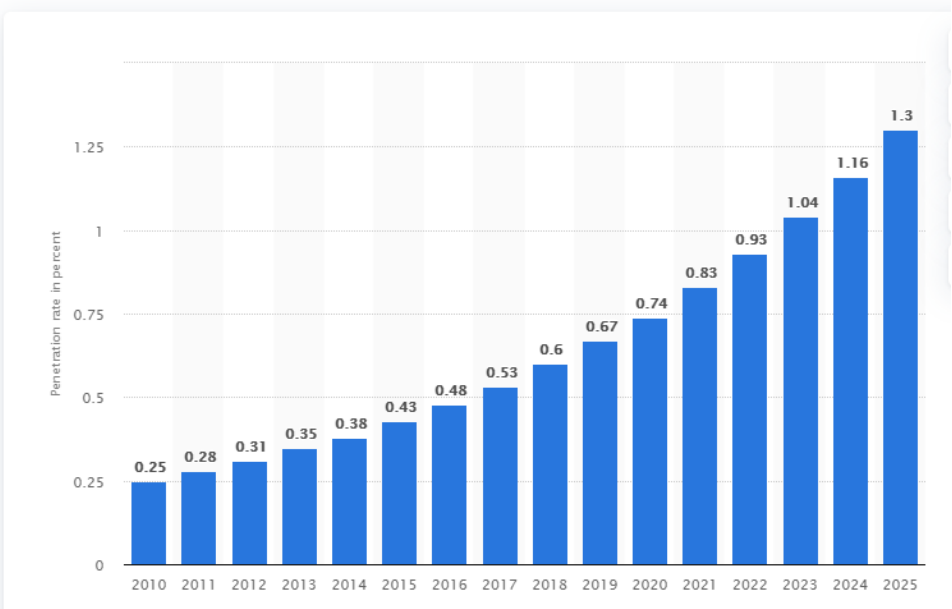


Figure 2-19: Pakistan- credit card penetration forecast (Statista, 2020c)

launch its services in Pakistan apparently to avoid the possible use of their service for money laundering. Also, it seems that PayPal had not have very good expansion results in the region because of the government policies. For example, India, where PayPal entered in 2017 to benefit from the market gap present in one of the world's biggest markets, is struggling to compete with the local players. The Indian government has banned keeping money in the PayPal account, and everyone is ought to transfer all the receipts in the local bank accounts. Similarly, in Bangladesh, PayPal account holders are forbidden to send money from Bangladesh to foreign countries (Qureshi, 2019). Since PayPal is struggling in the other relatively bigger markets in the region, it may not like to start its services in Pakistan until the government gives certain assurances.

2.10.2.4 THE LEGAL AND REGULATORY ENVIRONMENT

Digitally carried out transactions are not specifically recognised by Pakistan's existing federal and provincial laws. Existing laws are vague, and terms, jurisdictions, actions, procedures, penalties are still needed to be defined and incorporated in the relevant regulations. Pakistan's present E-Commerce regulatory framework is based upon Electronic Transactions Ordinance – 2002 (ETO-2002), Payment Systems, Electronic Fund Transfers Act -2007 (PSEFT-2007), and Pakistan Electronic Crime Act 2016 (PECA 2016). ETO 2002 gives legal recognition to digital documents, records, and digital signatures. The PSEFT -2007 deals with the establishment of payment system providers and operators in Pakistan. PECA defines electronic crimes and recommends relevant penalties/ punishments. Besides, other relevant general policies and regulations like those related to banking and finance issued by the state bank of Pakistan (SBP) and import and export regulations of the Federal Bureau of Revenue (FBR) also apply to E-Commerce. The consumer in Pakistan is protected through general consumer protection regulations, laws, and policies both at the federal and provincial levels. Pakistani institutional infrastructure deals with providing consumer courts, consumer protection bodies, consumer rights, standardization of products, etc. The laws and regulations do not exclude electronic trade/ transactions. However, due to the absence of clauses that specifically consider the ubiquitous nature of digital trade, consumers find it difficult to approach E-Commerce consumer courts, and courts find it difficult to determine the territorial jurisdiction. Consumer protection and data protection acts also exist, but they need to be

updated like all other relevant laws. Consumer protection, distance selling, and data protection laws are also needed to be introduced/ updated and advertised to the general public to win their trust in electronic commerce (GOP, 2019b).

2.10.2.5 LOGISTIC SERVICE PROVIDERS

Generally, Pakistani E-Commerce players outsource the deliveries to third-party service providers that specialise in logistic services. For an efficient and reliable logistic service, modern information, and communication technology (ICT) based applications supported by a reliable and robust road network are very important. In Pakistan, E-Commerce players can choose from state-owned Pakistan Post and some other private sector courier companies for the delivery of products (GOP, 2019b). Pakistan post (http://www.pakpost.gov.pk/) is Pakistan's state-owned postal service that provides services at relatively cheaper rates. The company has recently introduced a few measures to support E-Commerce in Pakistan. For example, in January 2019, the Pakistan post introduced an export service "EMS" plus that can be used by businesses to send and track the consignments to the Kingdom of Saudi Arabia, UAE, Japan, UK, Thailand, and Australia (GOP, 2019b). Top logistic services providers in the private sector include TCS (https://www.tcsexpress.com/), Leopards Courier (http://leopardscourier.com/pk/), Muller, and Phipps (http://mulphilog.com/) (Lalani, 2020). Other international logistic companies like FedEx(https://www.fedex.com/en-pk/home.html), DHL (https://www.dhl.com/pk-en/home.html), and TNT (https://www.tnt.com/express/en_pk/site/home.html) also operate in Pakistan. The courier companies usually collect money on behalf of sellers from the local buyers upon delivery.

2.10.3 GOVERNMENT INITIATIVES

In May 2018, the Ministry of Information Technology and Telecommunication (MoITT) published a "Digital Pakistan Policy" to achieve the following objectives.

- Holistic digital strategy
- Sectorial digitisation
- Promotion of e/m – Commerce
- Promote innovation and entrepreneurship in IT sector.
- Increase software exports.
- Increase ICT readiness.
- Increase Digital Inclusion
- Promote e-governance.
- Increase foreign and local ICT investment.
- Standardisation of ICT to maximise utility.

The policy emphasises encouraging the delivery of public services through ICT-based solutions in all sectors like agriculture, health, medicine, justice, and education. The policy also suggests measures to achieve the above-outlined objectives through legislation development, human resource development, Increased software export, promotion of ICT among girls, local manufacturing of hardware, e-governance, placement of dedicated IT personnel in the public sector organisations, and establishment of government's cloud. At the end of the document, a role responsibility matrix lists the policy initiatives relevant to key areas, ministries and focal organisations (GOP, 2018).

In August 2019 Ministry of Commerce (MOC) published the E-Commerce policy framework(GOP, 2019a). The 37-page document identified nine concerning areas, including the regulatory environment, financial inclusion, SME empowerment, youth empowerment, consumer protection, ICT infrastructure,

Logistics, Taxation, Data sovereignty and Global connectivity with multilateral nations. The document analysed the present state of each area, pointed towards deficiencies, and suggested possible solutions. The framework also recommended the formation of an E-Commerce council both at federal and provincial levels to provide strategic direction for E-Commerce promotion, monitor E-Commerce collaboration issues, foster coordination, create awareness, and report matters to the cabinet (GOP, 2019a). Later, in October 2019, the commerce division of the Government of Pakistan released a 61-page E-Commerce policy which was approved by the federal cabinet chaired by prime minister Imran khan (GOP, 2019c). The policy recognises the potential of E-Commerce for the economic growth of Pakistan by increasing cross border trade, provision of jobs to the youth, and empowering SMEs. Key policy points include allowing Card Not present (CNP) transactions through a local market player PayPak in domestic transactions. For international digital transactions, the policy recommended badging of PayPak with international players like visa, and master cards. The policy recommended that the State Bank of Pakistan (SBP) release detailed guidelines for online traders to set up accounts in the local banks. Maintenance of physical addresses was made mandatory for all online traders. The policy also recommended the formation of a single-window hub to facilitate online traders through an appropriate act. The Federal Bureau of Revenue (FBR) was tasked to update, amend, or introduce new clauses into the existing laws, regulations, and policies and make them compatible with the digital environment. Several task forces and committees were also suggested to look after relevant areas of concerns identified in the policy framework and policy itself. The development of E-Commerce in Pakistan appears to be a government priority and government seems to be taking steps to help E-Commerce businesses by providing tax breaks and other incentives. However, true success is contingent on the implementation of all policies and the successful completion of various E-Commerce-related projects.

2.11 SUMMARY

The chapter commenced with a concise introduction to E-Commerce, delving into various definitions and interpretations of the term. Despite different views on scope of all definitions agree that E-Commerce technologies are based on Internet. Although there has been a constant increase in internet penetration, its quality, affordability, and availability are not same across the globe. E-Commerce has different extensions or subsets like M-Commerce, Social Commerce, and E-Government. M-Commerce is E-Commerce version that typically utilises wireless internet connectivity and handheld or mobile device. Social Commerce or S-Commerce is also E-Commerce but with additional features of “trust agent”. Trust agents are individuals or groups that provide recommendations and feedback about a service or product to the potential buyers or sellers. The boundary between Social Commerce and E-Commerce is blurring now a days as several online sellers have embedded feedback and reviews mechanisms on their platforms. E-Commerce technologies are increasingly adopted by several public sector organisations and governments for public service deliveries and have been termed as public sector E-Commerce, E-Government, or digital government. E-Commerce can be categorised based on the business models both in public and private sectors. Private sector typically has business to customer, business to business and customer to customer business models. Whereas public sector E-Commerce has similar categories like government to citizen, government to government, and government to business. A frequently used term in the literature is e-business. While some scholars have defined E-Commerce as a subset of e-business, others say E-Commerce and e-business are essentially two different names for the same thing. Organisations adopt E-Commerce in varying degrees of sophistication which can be mapped using different models. The chapter briefly described different E-Commerce development models found in literature. While models have different number of stages with relevant characteristics, they map e-platform’s level of sophistication in linear order. Later, a brief introduction of the country Pakistan was presented in the later section and then relevant statistics and facts about internet infrastructure and adoption were discussed. The chapter described some key

players of E-Commerce in Pakistan followed by the status of E-Commerce infrastructure in Pakistan. Statistics indicate that while there are several telecommunication companies in Pakistan, getting quality internet connectivity at affordable rates is still an issue that needs to be addressed. Similarly, lack of secure e payment technologies, poor rail and road infrastructure, lack of speedy and affordable logistics solutions are some of the important areas that need attention. Governments seem to realise the importance of E-Commerce promotion in the country, which is reflected in several measures proposed and introduced by the government. However, the results will depend upon the continuity of the efforts by successive governments and successful execution of different E-Commerce related projects.

CHAPTER 3 E-COMMERCE ADOPTION

3.0 INTRODUCTION

This chapter begins by explaining why E-Commerce is considered an innovation and how its adoption resembles adoption of other innovations. It talks about the different groups or units that adopt E-Commerce and why it's more complicated for organisations to adopt it. Then, it discusses how private and public sector organisations are different and how this could affect their approach to adopting E-Commerce. Finally, it gives a review of past research on E-Commerce adoption in developing countries and Pakistan based studies.

3.1 E-COMMERCE AS AN INNOVATION

Humans always thought of doing something in a better way and this pursuit has driven the innovation. While history of innovation is as old as mankind, innovation related research has recently gained momentum. Innovation has several aspects and dimensions; consequently, a single academic discipline cannot cover all the aspects of innovation. Thus, we find researchers exploring different aspects of innovation using lenses of social sciences, economics, engineering, information and communication technology, and life sciences. Few scholars have also studied it with the interdisciplinary approaches for a more holistic view (Faulkner, 2016, Borrego et al., 2010, Fichman and Kemerer, 1993, Allen, 2000).

It is important to distinguish between invention and innovation. The invention is the first occurrence of an idea, thought, or process that may lead to an improved product or service. On the other hand, innovation is the commercialisation of that idea or process. The other important distinction between invention and innovation is element of usefulness in innovation (Fagerberg, 2004). An invention must be useful (especially in business and organisational context) to qualify as an innovation (Read, 2000). Depending upon nature, an invention can take several years to become invention. The time lag is a function of “requirements” to practically implement an invention in the form of product, idea, or service. The exception, however, does exist; mostly in the field of life sciences/ biotechnology, the invention may become innovation within negligible time. While inventions are made anywhere in laboratories, universities, or organisations, innovations normally occur in organisations and firms (Fagerberg, 2004).

There is no single definition of innovation. However, most of the scholars defined innovation as an idea, process, practice, or object perceived as new by a unit of adoption (Rogers, 2010) that may be achieved through the use of new technologies and business information (Afuah and Tucci, 2003). There are three types of innovation product innovation, process innovation, and organisational innovation (Boer and During, 2001).

The new borderless and networked business ECO system has forced the organisations to operate in a more competitive environment. Consequently, today’s managers have increasing pressure to search for a competitive advantage. In the new information age, innovation is the vital ingredient of competitive advantage. Organisations seek to reduce costs, improve processes, increase profitability, and sometimes merely survive due to innovation adoption. Organisational innovation adoption is an iterative process that starts from creating or modifying an idea (invention) and applying it practically to offer new services, products, policies, and structures (Read, 2000).

In current competitive environment, E-Commerce has become part of organisations and our social system in the past few years. E-Commerce is a combination of two inventions: the internet and world wide web. Businesses use E-Commerce to connect with the world for trade and gain greater market reach; individuals or buyers get access to sellers from around the world. E-Commerce technologies improve general commerce, internal and external connections, collaboration, general computation,

and operations. In addition, E-Commerce can also create certain new and unique opportunities through its inherent characteristics. Depending upon firm's strategic orientation and perceived strategic value, managers seek to drive competitive advantage by E-Commerce adoption at the firm level (Kwun et al., 2010, O'Regan and Abby, 2005, Saffu et al., 2008, Venkatraman, 1989, Wang and Ahmed, 2009, Zwass, 2003).

From the above discussion, it is evident that E-Commerce qualifies to be treated as an innovation. Several previous E-Commerce adoption studies have based their theoretical foundations on innovation adoption theories (Abbas et al., 2018, Abbasi et al., 2017, Ahmad and Siraj, 2018, Ali and Ishaq, 2019, Alyoubi, 2015, Awa et al., 2015b, Molla and Licker, 2005a, Nasimi et al., 2018, Boateng et al., 2009).

3.2 ORGANISATIONAL LEVEL E-COMMERCE ADOPTION

According to Rogers (1995), the innovation is adopted by "adopters" through a certain process in a "social system." Adopters are the "unit of analysis". and in the E-Commerce context, "the unit of adoption" is usually either "individual" or "organisation". Organisational level E-Commerce adoption is complex as compared to individual-level E-Commerce adoption as there is a complex combination of personal level and organisational level variables involved in the adoption process. The organisational characteristics and personal characteristics of the decision-makers play a significant role in adopting any new idea or innovation (Rogers, 1995).Organisations can be broadly categorised as private or public sector organisations. In the context of Pakistan, according to 2018 figures of "securities and exchange commission of Pakistan" there were 87,620 registered companies in Pakistan out of which 3058 were public, 77085 were private, 5182 were SMCs, 1001 were foreign companies (from UK, USA, China, Australia, France, and Germany) and rest of them were placed in "other" categories (SECP, 2018). Although another category can be classified as "Semi-Government", they are very few. Organisations tend to have sector-specific characteristics because of different structures (Cats-Baril and Thompson, 1995). Moreover, the employees of the two sectors also behave differently (Do Monte, 2017). This structural and behavioural difference that exist between two sectors can impact the E-Commerce adoption processes as well.

3.2.1 PUBLIC SECTOR MENAGEMENT VERSUS PRIVATE SECTOR MANAGEMENT

Difference in organisational environment due to structural and cultural differences may influence decisions and behaviours of managers in public and private sectors. The "constitution" of the public sector intentionally maintains a barrier between policymakers and policy implementers. As a result, while the legislature originates policy, it does not implement it and implementers are usually constrained by legislation. In contrast, in the private sector, no charter prohibits higher management from participating in the implementation process. Similarly, top management is frequently involved in strategic decision-making alongside external directors and this relationship between policymakers and policy implementors is desired. Another structural divergence is caused by civil service rules. Civil servants do not typically rely fully on their political bosses for their rewards, appointments, and punishments, whereas in the private Sector, this is the norm rather than the exception. Finally, public sector organisations are more open to the external environment than private sector organisations because they are more sensitive to public needs and opinions. Aside from the structural differences, both sectors are culturally distinct. Bureaucracy (usually regarded as a negative influence in public administration) is nearly always at conflict with progressive forces in public sector organisations. Thus, managers in public sector organisations must deal with two often opposing forces. public sector organisations often have a parallel regulatory procedure (such as ethics committees, ombudsman, etc) that private sector organisations lack. These structural and cultural variations between the two sectors consequently impact not only the whole management process, but also on behaviours, perceptions, and choices of individuals (Ring and Perry, 1985a). The inherent difference in two sectors effects

projects executions as well. Thus, scholars argue that frameworks for IT project management and risk management developed in private sector may not be appropriate for public sector organisations(Cats-Baril and Thompson, 1995). Employees of the two sectors can also behave differently as they differ in terms of extrinsic motivation (Buelens and Van den Broeck, 2007), commitment towards the organisation(Lyons et al., 2006), and satisfaction from work (Borges, 2013). With significant differences at the organisational, managerial, and employee level, the E-Commerce adoption in each sector is likely to differ in terms of relative importance and influence of the determinants on adoption decisions.

3.2.2 E-COMMERCE IN DEVELOPING ECONOMIES– A REVIEW OF THE RESEARCH

An appropriate literature survey strategy was adopted in this research project to ensure that literature resources and search terms align closely with the research objectives. Each resource selected was scrutinized for its relevance, credibility, and applicability to my research questions. A systematic survey methodology was adopted as suggested by Ferrari (2015) and Nsanzumuhire and Groot (2020) by following by forming the research questions, identifying the potential search sources, defining screening criteria and developing themes or categories for further analysis. Literature survey was done to find answer to the following questions.

1) What factors have been studied in E-Commerce adoption in developing countries (other than Pakistan) both at individual and organisational level?
2) What factors have been studied in E-Commerce in Pakistan and how can we categorise them into different research stream?
3) What methodologies and data processing techniques have been used in the studies?
4) What were the results outcome?

The scope of this survey was deliberately extended to all developing countries to the extent of E-Commerce adoption to get idea of latest trends in E-Commerce adoption studies in different developing countries. However, since Pakistan was primary focus of this project, all studies based in Pakistan related to E-Commerce (not just adoption) were examined and were categorised according to different research themes to identify the latest trends not only in E-Commerce adoption but research areas that require attention. Moreover, all subcategories of E-Commerce like mobile commerce, social commerce and public sector E-Commerce were included and examined in the context of Pakistan only. The decesion to include all subcategories of E-Commerce in Pakistani context only as opposed to extending it to other developing countries was motivated by intention to keep the results more focused and manageable.

In terms of resources selection, most prominent sources of Information sciences databases were identified by examining the list of databases maintained by university's library. In addition, search term "mobile commerce", "E-Commerce", "E-Government", "Social commerce" "E-Commerce adoption" and "organisational E-Commerce adoption" was used with "or" operator in google scholar and names of the databases/journals where that research was published was noted and appended in the list obtained by library. Following search terms were used to retrieve results.

1) E-Commerce adoption in Developing Countries
2) Mobile Commerce Pakistan
3) Social Commerce Pakistan
4) E-Government Pakistan
5) Public sector E-Commerce Pakistan
6) E-Commerce adoption Pakistan

7) E-Commerce Pakistan

The search criteria used in different data bases is summarised in Table 3-1. These search terms were carefully selected in consultation with the research supervisor to ensure their relevance to the study's objectives, which involve investigating E-Commerce adoption in Pakistan. Additionally, terms encompassing Social Commerce and Mobile Commerce, seen as subsets of E-Commerce, along with E-Government, representing E-Commerce applications in the public sector, were also included. The literature survey covered research studies published during 2000 to 2020 for developing countries and between 1995 to 2022 for Pakistan based studies. Only research papers were considered for examination and review and any unpublished work or thesis were dropped. Papers were scanned for key words followed by abstract, introduction and conclusion section scan. Papers other than E-Commerce adoption in developing countries (other than Pakistan) were dropped. Any study done in Pakistan irrespective of its theme was retained for further analysis. Next a search for Pakistan based studies was conducted. All complete studies found were screened based on keywords, abstract, introduction and conclusion sections and were retained for further analysis. A carefully predefined literature survey strategy including search questions, comprehensive search terms aligned with the objectives of this study, choice of relevant resources, inclusion and exclusion criteria was adopted to ensure the study is grounded in most relevant and latest information available.

Table 3-1: Search criteria used in literature survey.

Sr No.	Database	Search Criteria
1	Science Direct	The search string was put in “Find Articles with these terms”. All other fields were left blank except the “Years” field where the time range was entered.
2	Taylor and Francis online	The search term was entered, and “Publication Date” was restricted to 1995-2022 using the “Custom Range” radio button.
3	ACM Digital Library	The search term was used in “The ACM full-text collection”. The string was searched “within anywhere” and the publication date was restricted to 1995-2022.
4	EBSCO Business Source Premier (EBSCO host)	The search term was broken as the database offers “or” operators in different fields. All other fields were left at default settings. Results were filtered for the time range 1995-2022 using the “publication date” filter in the search features.
5	ABI Inform (Pro Quest- One Academic)	The search term was used in the database. Full-text search was clicked, results were filtered to journals only and filter was applied for the time span.
6	Google Scholar	The search term was used with or operator, “with all of the words” was selected and time range was specified

.

3.2.2.1 ORGANISATIONAL E-COMMERCE ADOPTION IN DEVELOPING ECONOMIES

This section briefly reviews the existing literature about organisational E-Commerce development in developing countries context other than Pakistan. Several hurdles prevent the developing economies to adopt or take advantage of the full potential of E-Commerce and using it as a tool to reduce the current digital trade gap between the developed and developing economies (Alyoubi, 2015). Scholars have used qualitative, quantitative, or mixed research methods to study organisational E-Commerce adoption in DEs. Also, a variety of conceptual or theoretical frameworks have been used. Data analysis varies from simple descriptive representations to the more advanced statistical techniques like Partial Least Square Structural Equation Modelling (PLS-SEM), Discriminant Analysis and Logistic Regression.

Quantitative studies typically identify a few latent variables as the drivers or barriers of E-Commerce adoption, and model them on a single, extended, or a combination of technology or innovation adoption frameworks (Boateng et al., 2009). Most frequently studied constructs in E-Commerce studies are the perceptions of decision-makers about the technical characteristics of the E-Commerce technology (i.e., perceived usefulness, Perceived Ease of Use, relative advantage, etc.), personal characteristics of the managers (innovativeness, strategic orientation, education, and age, etc.), organisational factors (strategic orientation of the firm, firm size, IT readiness, etc.) and, environmental characteristics (suppliers pressure, availability of consultants, government support, IT infrastructure, Readiness of the country etc). Then depending upon the statistical model and statistical techniques applied, researchers either compare the means (T-test or ANOVA), find relationships (by employing techniques like correlation), or do causal study (through structural equation modelling or simply regression) to explain the “variation” in the E-Commerce adoption. In Qualitative studies, researchers try to determine the determinants of E-Commerce adoption through interviews and observations (Rahman, 2013, Agwu, 2012, Kurnia et al., 2015b). A summary of quantitative studies both at organisational level and individual level studies of E-Commerce adoption are summarised in Table 3-2.

3.2.2.2 E-COMMERCE IN PAKISTAN

Pakistan based studies were analysed separately for further analysis. All studies were categorised into different themes. At international level, we can observe a sequence of logical pattern of research issues related to different phases of innovation diffusion life cycle. Like other innovations, E-Commerce research also follows a logical sequence that starts by assessing prospects and challenges, and then adoption, implementation, post implementation and eventually interaction with individuals and entities. Themes extracted after semantic analysis of international E-Commerce literature was used to categorise Pakistani E-Commerce literature. Although author was open to “inductive approach” (Ryan and Bernard, 2003)as well, all themes were priori themes emerged because of characteristics of the phenomenon under investigation. In the public sector, we can categorise the literature on similar themes. Literature addressing the opportunities and challenges of E-Government in developing economies (Ndou, 2004b, Scott et al., 2009, Wescott, 2001, Alshehri and Drew, 2010), literature addressing the implementation and adoption issues including the determinants of E-Government adoption (Drew and J, 2011, Basu, 2004, Reffat, 2003, Singh et al., 2007, Alhujran, 2009, Ifinedo and Singh, 2011), literature related to assessing the project assessments (Esteves and Joseph, 2008, Hsieh et al., 2013, Schuppan, 2009, Wu and Guo, 2015) and literature based on policies/strategies for a successful E-Government (Gil-García and Pardo, 2005, Chen and Perry, 2003, Gil-García, 2007).

Examination of international E-Commerce literature revealed that a stream of research on the potential benefits, limitations, and opportunities of e-commerce exits that started immediately after E-Commerce was introduced (Setyowati et al., 2021, Ray, 2011, Goldstein and O’Connor, 2000).e and describe potential benefits, problems, and opportunities in a broad or specific context. Some studies

just provide the current status of E-Commerce , or E-Commerce-related factors, such as the proportion of e-commerce sales in a general or specific context, the tele density, the Internet penetration rate, or the adoption rate of e-commerce (Purcell and Toland, 2004, Singh et al., 2001). Then another research stream is focused on examining organisational and consumer characteristics that may affect the adoption, acceptability, or dissemination of E-Commerce (MacGregor and Vrazalic, 2005, MacGregor and Vrazalic, 2006, Migiro, 2006). Another research stream is about E-Commerce installation and post-implementation issues (Saha and Kumar, 2014, Chan and Swatman, 1999a, Chan and Swatman, 1999b). We can also include studies that compare the real advantages of E-commerce with the perceived or promised benefits in post implementation studies category (Lu, 2003, Zhong et al., 2022, Standing and Lin, 2007). A small proportion of studies provide solutions to some E-commerce challenges and suggest how to deal with the obstacles may well be placed together (Niranjanamurthy and Chahar, 2013, Aulkemeier et al., 2016). Finally, we find some literature reviews that summarise the available E-Commerce literature in various contexts (Bask et al., 2012, Khoo et al., 2018, Chua et al., 2005). Figure 3-1 describes the number of studies falling in different identified themes.

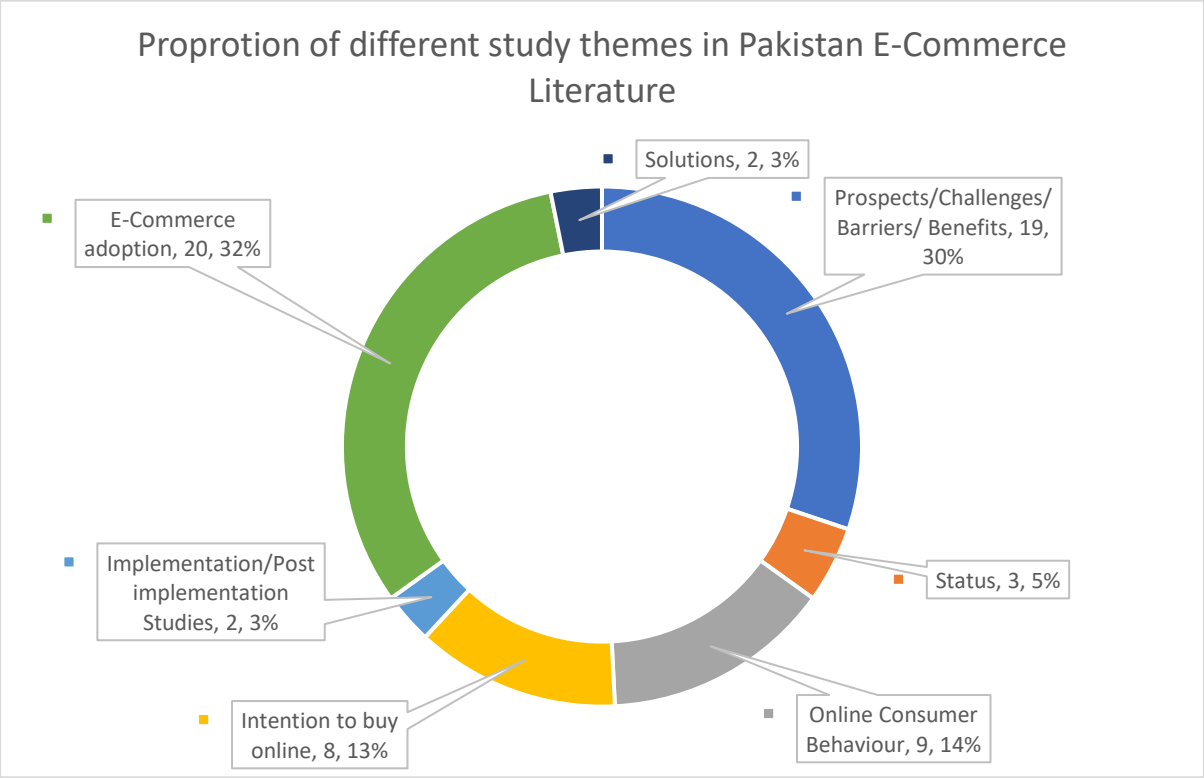


Figure 3-1 Proportion of different themes in Pakistani E-Commerce Literature.

The author carefully examined the literature and found that based on the classification used in the section 3.3.2, a significant proportion of the total research was about prospects, challenges, and potential opportunities of E-Commerce adoption in Pakistan. Scholars have highlighted importance of E-Commerce adoption in both private and public sector s of Pakistan (Arshad and Zaidi, 2020, Afreen, 2004). Studies point to several potential benefits and opportunities of E-Commerce adoption in Pakistan including increased cross border trade due to greater market reach (Kemal, 1998, Hashim et al., 2013, Zia et al., 2022), better organisational performance, efficient business operations, increased business opportunities, customer satisfaction and job performance (Azeem et al., 2015). Most frequently mentioned challenges and barriers included absence of infrastructure, online trade laws,

government policies, telecommunication infrastructure, trained human resource, e-payment solutions ,logistic services , lack of E-Readiness and high adoption cost (Kemal, 1998, Arfeen and Khan, 2009, Khan and Arshad, 2010, Syed and Shaikh, 2012, Khan et al., 2010, Agren and Barbutiu, 2018, Ghouri et al., 2018, Ali and Ishaq, 2019, Imtiaz et al., 2020, Chandio et al., 2018). Lack of trained human resource, inadequate technical skills and lack of conducive organisational environment have been found impacting E-Commerce adoption in public sector by several decesion makers in some qualitative studies as well (Arfeen et al., 2017, Arfeen and Khan, 2012). Abid and Noreen (2006) studied factors that impact e-banking adoption by surveying both banks and consumers to find the level of adoption and inclination towards or reluctance to adopt e-banking by banks and E-Readiness of the consumers. They collected data from users and non-users of e-banking services and found that e-banking adoption was low, consumers did not have enough awareness, and most banks intended to adopt full-scale e-services. From the consumers' point of view, lack of trust was the top mentioned reason for reluctance towards E-Banking adoption. The authors, however, did not define the "level of e-banking adoption" or the scales for measuring the variables. So, although authors used statistical methods to infer the results in this study, they inferred the results based on the "descriptive statistics." In their qualitative research, Khan and Arshad (2010)collected interview responses of conveniently selected ten respondents and found that the Pakistani market was not mature for E-Commerce. They argued that some social issues peculiar to the Pakistani society like the joint family system (which, according to the researchers, inhibits entrepreneurship), perceived fun while shopping at the high street, and inflation retard the E-Commerce adoption in Pakistan. In addition to the above-mentioned sociocultural factors, researchers also mentioned another 16 barriers grouped into five categories. The findings were based on interview responses and were not tested empirically. In another study, Khan et al. (2010) analysed composite E-Readiness index values obtained from the United Nation's E-Readiness Index to discuss the challenges faced by the Government of Pakistan to increase the country's E-Readiness. They discussed Pakistan's score against each constituent factor of the E-Readiness Index (Web Measure, Telecom Measure, and Human Capital measure) and suggested measures for improvement.

Some studies describe the current status of E-Commerce conclude that Pakistan lags behind many regional counterparts (Shafique and Mahmood, 2008). Shehzad et al. (2017) did strength-weakness-opportunities and threats (SWOT) analysis based on the current context and examined the usability of selected Pakistani E-Commerce websites, while Idrees et al. (2020) compared the technologies used in Pakistani websites with UK's fashion industry websites. Both studies conclude that usability of websites impact individual level purchase decisions and Pakistani websites need to include more advanced features.

A significant proportion of Pakistani E-Commerce literature is about online consumer behaviour. Most frequently mentioned variables affecting online consumer behaviour include e-service quality, e-satisfaction (Khan et al., 2019), perceived benefits, perceived trust , perceived risk (Adnan, 2014, Haider and Nasir, 2016), domain specific innovativeness, shopping orientation (Ahmed et al., 2017c), some psychological factors Sohaib and Kang (2014), website design, and information quality (Nasimi et al., 2018). At business to business level , "relationship nature safety", "relationship nature", ", "relationship extent", "organisation age" and "mutual values" were found to affect the online behaviour (Tanveer, 2021). Some authors studied role of customer satisfaction with customers, loyalty by studying range of online products offered like online funds transfer services, phone banking, provision of range of online payment methods Zafar et al. (2022) and service quality (Wattoo and Iqbal, 2022)

Some scholars studied implementation and post implementation E-Commerce adoption challenges and perceived benefits. Implementation challenges appear to be the same factors that impact E-Commerce adoption decisions (perhaps authors treated adoption and implementation interchangeably) , for

example lack of infrastructure, no online culture, lack of trained human resources, lack of collaboration, resistance to change, and top leadership commitment(Qaisar and Khan, 2010). In another post implementation study, Khan et al. (2014b) found that organisations tend to perform better after adoption of E-Commerce and e-supply chain management.

A relatively small proportion of studies suggested some E-Commerce operational solutions mostly relevant to the "last mile" or logistic decisions (Naseem et al., 2021a, Naseem et al., 2021b).

Organisational level E-Commerce adoption seems to be one of the most frequently studied area in Pakistani E-Commerce literature. Seyal et al. (2004) based their research on the technology organisation and environment (TOE) model and studied E-Commerce adoption in Small and Medium Enterprises (SMEs) of Pakistan. They grouped 6 factors, measured by 24 items into 3 domains of Technology, Organisation and Environment to explain variation in the E-Commerce adoption. The study employed "stepwise regression analysis" to test 6 hypotheses. The usage of stepwise regression allowed the researchers to establish the relative importance of each determinant. The study found a positive relationship between E-Commerce adoption and (1) Task variety (2) Management Support (3) Perceived Benefits (4) Extrinsic Motivation and (5) Government Support and a negative relationship between Organisational Culture and E-Commerce Adoption. However, there seem to be serious issues with the usage and operationalisation of different latent variables. The authors used constructs of Teo and Tan (1998) in their studies, however no details of scale used were found in the original cited reference. Similarly, authors have not mentioned whether they used "factors scores" or "composite scores" in regression. Kshetri and Dholakia (2005) did their non empirical research in south Asian context with a focus on India and Pakistan and found that cultural, cognitive, and institutional factors were affecting internet and E-Commerce diffusion in the region.

In another study at individual level of E-Commerce adoption Mazhar et al. (2012) found that technical trust, worthiness, site quality, user experience lead to trust and positive word of mouth generation which facilitate E-Commerce adoption .Saeed et al. (2013) noted that at individual level, E-Commerce adoption was positively related to website usability. In another individual level E-Commerce adoption study , Ashraf et al. (2014) extended the standard Technology Acceptance Model with "trust", validated and tested it in two countries : Canada and Pakistan. The model explained 29% and 52% variation in Pakistan and Canada respectively. While Perceived usefulness, Perceived Ease of Use, and perceived behavioural control were found common predictors of intention to buy online in both countries, trust was found affecting Perceived Ease of Use (PEOU). They also noted that while PEOU was significantly and positively impacting intention to buy online in Pakistan, the relationship was non-significant in Canadian context. Mehmood et al. (2014) focused e-banking adoption and noted that "perceived usefulness", "privacy", "security", "web design", "trust" and "self- efficacy" explain 73% of variance in e-banking adoption . Rind et al. (2017b) studied individual level mobile commerce adoption by investigating relationships of perceived cost, perceived risk, perceived usefulness, Perceived Ease of Use, and perceived usefulness with mobile commerce acceptance and noted cost and risk factors were important variables influencing the mobile commerce adoption decision. Hassan et al. (2018) studied determinants of Social Commerce adoption by investigating role of trust and social presence on Social Commerce adoption. They noted that social presence positively was related to Social Commerce adoption through the mediation of experience that customer gets. While they found trust impacting adoption decision, trust itself was influenced by trust disposition, integrity, benevolence and competence of the seller. Abbas et al. (2018) based on 250 responses found that Perceived Credibility, Relative advantage, management support, government support and mimetic pressure predicted E-Commerce adoption decision. Sair and Danish (2018) established relationship of performance expectancy and effort expectancy with intention to adopt mobile commerce through mediating role of

"personal innovativeness" .Rahi et al. (2019) in their empirical study of internet adoption at individual level found that Assurance, customer service, effort expectancy, facilitating condition, performance expectancy and website design were positively related to internet banking adoption decision at individual level. Hussain et al. (2020) based their study on "resource-based theory (RBT) and "diffusion of innovation" theory (DOI) and found that top management support and competitive pressure were positively related with E-Commerce adoption through direct and mediation. However, adoption cost and government support had insignificant effects on E-Commerce adoption. In a post Corona context, Raza and Khan (2021) noted that perceived lack of alternatives , perceived usefulness, Perceived Ease of Use, subjective norms, were predicting E-Commerce adoption decision at individual level. However, perceived risk, perceived behavioural control and attitude did not have significant connection with E-Commerce adoption intention. Corona fear was found moderating the relationship of perceived risk, perceived usefulness, subjective norms with attitude. Table 3-3 , summarises all individual and Organisational E-Commerce adoption studies in Pakistani context. Some authors studied intention to buy online at individual level. While these studies were included in the E-Commerce adoption studies in developing countries context, they were placed in an independent category in Pakistan based studies as strictly speaking these studies are about factors that motivate or prevent a prospective customer from buying anything online. Table 3-4 summarises some "intention to by online" studies in Pakistani context.

From the above summary of Pakistan-based studies, we can conclude that researchers have explored the potential benefits, challenges, constraints, and determinants of E-Commerce adoption both in the public and private sectors. However, there is a paucity of Pakistan-based E-Commerce studies, especially "E-Commerce adoption" at organisational level. Almost all studies seem to investigate role of the usual "suspects" and as such no significant innovation is seen in terms of variables used, conceptual model applied and data analysis techniques. Thus, it is important to study E-Commerce adoption using more relevant "suspects" in the developing countries context. Moreover, almost all E-Commerce adoption studies in the context of Pakistan tend to terminate at the initial adoption decision. Literature indicates that the influencing variables could be different at different adoption levels, so a knowledge gap exists in Pakistani E-Commerce literature in terms of finding relevant determinants in different levels of adoption. Public sector E-Commerce seems to be least studied area in Pakistani context. In fact, the author could not find a single quantitative study related to E-Commerce adoption in the public sector. As mentioned in section 3.2.1, not only that public and private sector organisations have different characteristics, but their employees or managers also tend to have different characteristics. Since organisational level innovation adoption involves variables related to organisation and employees (Rogers, 1995), the whole dynamics of E-Commerce adoption can be different. Study and comparison of E-Commerce adoption in public and private sectors can give useful input for future research and can provide useful insight for the decision-makers at the organisational/ national level. The author could not find a single study comparing E-Commerce adoption in both sectors.

Table 3-2:Determinants of E-Commerce adoption in developing economies Source: Literature Survey

Sr. No	Author	Scope of study	Factors studied	Results	Industry
1	Molla and Licker (2005b)	South Africa	"Perceived Organisational and Environmental E-Readiness Factors" with different stages of "E-Commerce Adoption"	"E-Readiness" factors found discriminating at different levels of "E-Commerce Adoption" at varying degrees	General Organisational
2	Pham et al. (2011)	Vietnam	"Trust", "Perceived Strategic Value of E-Commerce", "Organisational Readiness", "External Pressure", "Complexity", "Perceived Ease of Use", "Perceived Usefulness", "Perceived Risk"	Relationships hypnotised only (not empirically tested)	SMEs
3	Lip-Sam and Hock-Eam (2011)	Malaysia B2B only	"Firms IT strategy", "External pressure", "CEO's Characteristics".	All factors found influencing the E-Commerce adoption	General Organisational
4	Shah Alam et al. (2011)	Malaysia	"Relative advantage", "Compatibility", "Perceived Ease of Use", "Organisational Readiness", "Security", "Perceived Cost", "Managers' Characteristics".	All factors found relevant except perceived cost and manager's characteristics	SMEs
5	AlGhamdi et al. (2011)	Kingdom of Saudi Arabia	"Culture", "Competitive Advantage", "Logistic Issues", "Online Payment Options", "ICT Infrastructure", "Legislative Issues", "Trust", "Product/ Business Compatibility", "Cost Effectiveness", "Setup Cost", "Awareness", "Governmental Support".	A qualitative study. All factors found relevant in E-Commerce adoption	Retailers
6	Al-Hudhaif and Alkubeyyer (2011)	Kingdom of Saudi Arabia	"Perceived Organisational E-Readiness", "Perceived External E-Readiness".	All factors positively related	General organisational
7	Rowe et al. (2012)	Vietnam	"Employees' knowledge of E-Commerce", "Resources of the Enterprise", "Size of the Enterprise". "Attitudes of Managers towards Innovation", "Intensity of Competition", "Support of Industries", "Support of Government", "Competition of Suppliers and Buyers", "Compatibility of the Innovation", "Complexity of the	"Strategic Orientation of the Enterprise", "Firm's Globalisation Orientation", "Manager's Knowledge of the New Information Technologies and of E-Commerce", "National IT Infrastructure", "Perceived Relative	General SMEs

Sr. No	Author	Scope of study	Factors studied	Results	Industry
			innovation", "Perceived Risk", the "Strategic Orientation of the Enterprise", "Firm's Globalisation Orientation", "Manager's knowledge of the new information technologies and of E-Commerce", "National IT Infrastructure", "Perceived Relative Advantages".	Advantages" were not found related to adoption. "Complexity of the Innovation" and "Perceived Risk" negatively related. All other variables positively related	
8	Wanyoike et al. (2012)	Kenya	"Relative Advantage", "Compatibility", "Complexity", "Trialability", "Observability".	All factors found significantly related except "Trialability" and "Complexity".	SMEs
9	Rahayu and Day (2015)	Indonesia	"Perceived Benefits", "Perceived Compatibility", "Perceived Cost", "Technology Readiness", "Firm Size", "Customers/Suppliers Pressure", "Competitor Pressure", "External Support", "Owner's Innovativeness", "IT Ability", "IT Experience".	All positively related except "Perceived Compatibility", "Perceived Cost", "Firm Size", "Competitor Pressure", "Customers, and Suppliers' Pressure".	General SMEs
10	Al-Bakri and Katsioloudes (2015)	Jordan	Internal organisational factors: "E-Commerce strategy", "Experience", and "Perceptions of managers". External Organisational Factors: "Local and global readiness of technology partners". External pressure",	All factors found positively related	General SMEs
11	Al-Somali et al. (2015)	KSA	"Relative advantage", "Compatibility", "Cost", "Security", "Language", "IT readiness", "Management team support", "Learning orientation", "Receptivity towards Change", "Strategic Orientation". Formalisation Level", "Decentralisation Level", "Market force influence", "Economic Downturn Influence", "Competitive Pressure", "Regulatory and Environment Pressure", "National E-Readiness", "Technology Consultants' Participation".	Stage oriented statistic model Non interactive adoption (in order of significance): "Technology Consultants' Participation", "Regulatory and Legal Environment", "Management team Support", "IT Readiness", "Trading Partners' Pressure", "Strategic Orientation", "Economic Downturn". Interactive adoption (in order of significance): "IT Readiness", "Management Team Support", "Regulatory and Legal Environment", "Technology Consultants' participation". Stabilisation (in order of significance):	General Organisations

Sr. No	Author	Scope of study	Factors studied	Results	Industry
				"Technology Consultants' participation", "Regulatory and Legal Environment", "Cost", "Strategic Orientation", "Management Team Support", "Market Force Influence", "Economic Downturn Influence" and "IT Readiness".	
12	Ahmad et al. (2015)	Malaysia	"Perceived Relative Advantage", "Perceived Compatibility", "Perceived Complexity", "E-Commerce Knowledge", "Management's Attitude towards E-Commerce", "External Change Agents", "Pressure from Trading Partners", "Pressure from Competitors".	All factors found related except "Perceived Complexity", "Pressure from Trading Partners and Competitors"	General organisations
13	Awa et al. (2015b)	General	"Scope of Business Operations (SBOs)", "Firm's Size (FS)" "Organisation Mission (OM)", "Facilitating Conditions (FCs)". "Individual Difference Factors (IDFs)", "Social Influence or Subjective Norms", "Perceived Usefulness (PU)", "Perceived Ease of Use (PEOU)", "Perceived Behavioural Control (PBC)", "Perceived Service Quality (PSQ)", "Consumer Readiness (CR)", "Competitive Pressure (CP)", "Trading Partners' Readiness (TPR)", "Perceived Trust (PT)".	All factors found positively influencing factors	General
14	Agwu and Murray (2014)	Nigeria	"Infrastructure", "External Pressure", "Sociocultural Factors", "Size of Firm", "Resource Availability", "Organisational Culture", "Trained HR", "Perceived Benefits", "Perceived Risks", "Perceived Trust", "Perceived Cost", "Age of Manager", "Occupational Relevance", "Language and Education".	Only propositions made. All factors influence the E-Commerce adoption	SMEs
15	Hajli et al. (2014a)	Iran	"Organisational Readiness", "Awareness".	Both factors found significantly related	SMEs

Sr. No	Author	Scope of study	Factors studied	Results	Industry
	Hasbullah et al. (2016)	Malaysia	“Attitude”, “Subjective Norms”, “Website Usability”.	All factors found positively related with intention to buy online	Individual
16	Ocloo et al. (2018)	Ghana	“Compatibility”, “Complexity”, “Top Management Support”, “Organisational readiness”, “Employees IT knowledge”, “Intensity of competition”, “Business partner’s pressure”, “Government Support”.	All factors found to influence different development stages with different magnitude	SMEs
17	Bringula et al. (2018)	Philippines	“Perceived price”, "Perceived Quality”. “Perceived trust”, “Personal Capability”, "Interest”, “Preference”, “Convenience”, and “Limitation”.	“Trust” and "Security” were found positively related to the “Intention to Buy online”. “Quality” was not found to influence the "Purchase intentions”	*Individual*
18	Thomas et al. (2018)	Generation Z - India	Product presentation, Perceived interactivity, and Trust	“Online Product Presentation” and "Interactivity of website” positively relates to the "Intention to buy online” through mediating role of” Trust”.	*Individual*
19	(Bringula et al., 2018)	Philippines	Perceived price, Perceived quality, Perceived trust, Personal capability, Interest, Preference, and Convenience, Limitation	“Trust” and "Security” were found positively related to the “Intention to buy online”. “Quality” was not found to influence the “Purchase intentions”	*Individual*
20	Wei et al. (2018)	China	“Perceived Usefulness”, “Perceived Ease of Use”, “Perceived Convenience”, “Perceived Money Saving”, “Perceived Time Saving”, “Fashion Innovativeness”, and “Friends’ circle”.	“Perceived usefulness” and “Intentions to Buy online Positively related”. No relationship between “Perceived Ease of Use” and “Buying Intentions”. “Perceived Convenience”, “Perceived Money Saving”, "Fashion Innovativeness” explains “Perceived Usefulness”. “Friends’ Circles” related to the “Intention to Buy Online”.	*Individual*
21	Bauerová and Klepek (2018)	Czech Republic	“Perceived Usefulness”, “Perceived Ease of Use”, “Attitude”.	“Perceived Ease of Use” positively related to “Behavioural intention “through mediating effect of "Perceived usefulness”.	*Individual*

Table 3-3: Determinants of E-Commerce adoption in Pakistan - source: Literature Survey

S.No	Name of Author (s)	Factors	Result	Study level
1	Seyal et al. (2004)	Technological, Organisational and Environmental factors.	"Task Variety", "Management Support", "Perceived Benefits", "Extrinsic Motivation", "Government Support" positively related to "E-Commerce Adoption"	Organisational level
2	Kshetri and Dholakia (2005)	Literature survey-based study involving only secondary data.	"Normative", "Cultural", "Cognitive", and "Institutional Factors" affect "E-Commerce and Internet Adoption"	Individual +Organisational
3	Mazhar et al. (2012)	"Perceived Technical Trust Worthiness", "Perceived Site Quality", Users' Web Experience, "Perceived Risk", "Word of Mouth". "Perceived Trust" and "Word of Mouth Generation" were studied as dependent variable.	"Perceived Technical Trust worthiness", "Perceived site quality", "User web experience" were predictor of "Perceived Trust" and "Word of mouth generation". "Word of mouth seeking" had moderating effect on relationship between all independent variables and dependent variables.	Individual
4	Saeed et al. (2013)	Involved calculation of usability of selected websites	"Usability" was found positively related to "E-Commerce adoption"	Individual
5	Ashraf et al. (2014)	All standard constructs of Technology Acceptance Model and "Trust".	"Perceived usefulness", "Perceived Behavioural Control" predict "Attitude". PEOU and "Trust" were found positively related to PEOU. PEOU was directly significantly related to only in Pakistan not in Canada	Individual
6	Mehmood et al. (2014)	"Perceived Usefulness", "Privacy", "Security", "Web Design", "Trust" and "Self-Efficacy".	All factors found positively related to E-Commerce adoption	Individual

S.No	Name of Author (s)	Factors	Result	Study level
7	Abbasi et al. (2017)	“Security”, “Privacy”, “Ease of Use”, “Reluctance to Change” and “Access to Internet”, Dependent variable “Internet Banking Decesion”	“Security”, “Privacy”, “Ease of use”, and “Access to Internet” found to influence "Decision to do Internet Banking”. “Reluctance to Change" not found significant predictor of “Decesion to Do Internet Banking”	Individual
8	Aslam et al. (2017)	“Perceived Compatibility”, “perceived usefulness”, “subjective norms”, “Perceived Ease of Use”, and Perceived Security” Dependent variable: “Attitude towards Mobile Payment”	“Perceived Compatibility”, “Perceived Usefulness” and “Subjective Norms” found to influence the dependent variable. “Perceived Ease of Use” and “Perceived Security” did not prove statistically significant predictor.	Individual
9	Rind et al. (2017a)	“Perceived Ease of Use”, “Perceived” Usefulness”, “Perceived Cost”, and “Perceived Risk”. Dependent Variable: “Behavioural Intention to use Mobile Commerce”	“Perceived cost” and “Perceived risk” found to have negative influence on the "Behavioural intention to use mobile commerce”. “Perceived Ease of Use” was found to have a causal link with “Behavioural Intention to use Mobile Ecommerce” through mediating effect of “Perceived Usefulness”	Individual
10	Sair and Danish (2018)	“Performance Expectancy”, “Effort Expectancy”, “Personal Innovativeness”. Dependent Variable: “Intention to Adopt Mobile Commerce “	“Performance Expectancy” and “Effort Expectancy” were found statistically significant predictor of the “Intention to Adopt Mobile Commerce” through mediating role of “Personal Innovativeness”	Individual
11	Hassan et al. (2018)	“Social presence”, “Trust, Disposition”, “Integrity”, “Benevolence”, “Customer Experience” and “Competence of the Seller”	"Disposition”, "Integrity”, "Benevolence” and “Competence of	Individual

S.No	Name of Author (s)	Factors	Result	Study level
			the seller" were found determinants of the "Trust". "Trust" and "Social Presence" determine the "Social Commerce adoption" through mediation of "Customer Experience".	
12	Abbas et al. (2018)	Selected Technological, Organisational and Environmental factors	"Perceived Credibility", "Relative Advantage", "Management Support", "Government Support" and "Memetic Pressure" was found related to "E-Commerce Adoption"	Organisational
13	Agren and Barbutiu (2018)	"Trust", "Digital divide", "Gender", "Security laws"	All factors found to influence the progress of E-Commerce	Individual
14	ur Rahman et al. (2018)	"Data protection", "Trust", "Utilitarian motives" and "Hedonic motives"	"Data protection", "Trust" and "Utilitarian motives" found to influence the "Online shopping"	Individual
15	Ali and Ishaq (2019)	"Cultural Factors", "Lack of Privacy", "Lack of Legal Structure", "Illiteracy", "Lack of Awareness".	All factors found to influence the progress of "E-Commerce in Pakistan".	Individual
16	Nazir (2019)	"Availability and Quality of the latest ICT Infrastructure Units", "National Online Readiness", "Internet Speed", "Online Payment Security and Data Privacy Mechanism", "Power Expertise", "Traditional Business Selling Methods", "Consumer's Preference of Cash on Delivery Payment", "Lack of Consumers' Confidence in E-Commerce", "Technological Awareness" and "Education in the Society", "Lack of Governance and Local Business Institutes Support", "Owner/ Managers' Characteristics"	Qualitative study based on case study of 8 organisations. All factors found relevant in the context of E-Commerce adoption.	Organisational

S.No	Name of Author (s)	Factors	Result	Study level
17	Rahi et al. (2019)	"Website Design", "Customer Service", "Perceived Easiness", "Effort Expectancy", Assurance, "Social Influence", "Facilitating Conditions", and "Reliability ". Dependent Variable: "Intention to Adopt Internet Banking"	All factors found to influence the internet banking adoption. All positively related except effort expectancy which was negatively related.	Individual
18	Hussain et al. (2020)	Study based on Resource Based Theory (RBT) and Diffusion of Innovation (DOI) Theory.	"Management Support" and "Competitive Pressure" were found positively related with "E-Commerce Adoption" through direct and mediating factors	Organisational
19	(Javed, 2020a)	"Payment Gateways", "Poor ICT Infrastructure", "Heavy Taxes" on ICT products, "Lack of "E-Payment Regulations", and "Lack of E-Payment Infrastructure".	All factors found related to E-Commerce Adoption.	Organisational
20	Raza and Khan (2021)	"Perceived Lack of Alternatives", "Perceived Usefulness", "Perceived Ease of Use", "Perceived Risk", "Perceived Behavioural Control", "Corona Fear".	"Perceived lack of alternatives", "Perceived usefulness", "Perceived Ease of Use", "Subjective Norms", were positively related to "E-Commerce Adoption Decision". "Perceived Risk", "Perceived Behavioural Control" and "Attitude" was not found related to "E-Commerce adoption intention". "Corona Fear" was found moderating the relationship of "Perceived Risk", "Perceived Usefulness", "Subjective Norms" with "Attitude".	Individual

Table 3-4: Determinants of intention to buy online source: Research Survey.

Sr N0	Name of Author	Scope	Factors	Results
1	Hajli (2013)	Pakistan	“Rating and reviews”, "Forums and Communities”, "Recommendations and Referrals”, "Perceived Usefulness”, “Trust”	All constructs modelled to influence the
2	Adnan (2014)	Pakistan	"Psychological Factors”, "Perceived”, “Perceived Risk”, “Hedonic Emotions”, "Web Design”.	“Psychological Factors” and "Perceived Advantages” had positive relationship with "Buying Intentions” while "Perceived Risk” had a negative relationship. “Hedonic Emotions” and "Web Design” were found non-significant.
3	Haider and Nasir (2016)	Pakistan	"Financial Risk”, "Product Risk”, "Convenience Risk”, "Non-delivery Risk”, and "Return Policy Risk”	All factors found negatively related to online buying.
4	Ahmed et al. (2017b)	Pakistan	“Perceived Benefits”, "Domain-Specific Innovativeness”, and “Shopping Orientation”.	“Domain-Specific Innovativeness” and “Shopping Orientation” were found positively related to "Online Buying Decesion”.
5	Bhatti and Rehman (2019)	Pakistan	“Social Risk”, “Psychological Factors”, “Government Role”, “Cultural Factors”	All factors influenced the “Online Shopping” “Social Risk” and “Psychological Factors” had negative relationship with “Online Shopping”, “Cultural Factors” positively moderated the between “Social Risk” and “Online Shopping”.
6	Zaki et al. (2019)	Pakistan	“Product quality”, "Application Safety”, "Delivery Guarantee”, and "Offers”.	All factors found positively related to Buying intention
7	Rehman et al. (2019)	Pakistan	” Trust”, “Commitment”, “Perceived Ease of Use”, Perceived Usefulness”, “Attitude”, “Subjective Norms”, “Perceived Behavioural Control”, “Consumers’ Purchase Intention”, Dependent Variable: “Online Shopping Behaviour”.	“Perceived Ease of Use”, Perceived Usefulness”, “Attitude”, “Subjective Norms”, “Perceived Behavioural Control”, had a direct relationship between “Online Shopping Behaviour” and indirect relationship through mediating effect of “Consumers’ Purchase Intention”. This indirect relationship was found to be moderated by “Trust” and “Commitment”.

8	Tanveer (2021)	Pakistan	"Relationship Nature Safety", "Relationship Nature", "Non-Betrayal", "Service Improvement", "Transmission", "Buyer of Being Pious", "Relationship Extent", "Organisation Age" and "Mutual Values"	“Relationship Nature” positively related with "Safety”, "Organisation Age”, "Relationship Extent” Non-betrayal, and "Service Improvement” but no significant relationship with “Mutual Values”. “Transmission” moderated the link between relationship nature and buyback intention. Relationship type correlated with "Buyer Piety”

3.3 SUMMARY

E-Commerce, an innovation reshaping traditional business processes, buying behaviour, and business models, has been analysed through various innovation adoption models. It can be adopted by individuals, groups, departments, or entire organizations, each encountering distinct challenges and dynamics in the adoption process. Organisational E-Commerce adoption is a relatively intricate process. This complexity arises from the interplay of various factors spanning personal, organisational, and environmental dimensions. Hence, comprehending the intricacies of E-Commerce adoption requires a thorough examination of these multifaceted variables. Organisations vary not only within sectors but also significantly across different sectors. The chapter then described why study of E-Commerce adoption in the context of public and private sector is important. Public and private sector entities typically exhibit distinct structural characteristics. Moreover, managers and decision-makers in these sectors often have different preferences, choices, and behavioural patterns. The variance in organisational and managerial levels within each sector could mean potential differences in the variables or the extent of their impact on E-Commerce adoption behaviour. In subsequent sections, summary of existing literature in the context of developing economies and Pakistan was presented. Scholars have studied several factors in the context of organisational E-Commerce adoption using both qualitative and quantitative research methods. In the context of Pakistan, several factors such as trust and security, infrastructure and connectivity, education and awareness, payment systems, cultural attitudes, government regulations and policies, economic factors, demographics, website usability and online marketplace features has been studied in different organisational and individual level E-Commerce adoption studies. The literature review revealed that lack of quality Pakistan based E-Commerce studies. In many instances, authors ignored statistical or general research principles. Furthermore, scholars tended to focus on conventional constructs, thereby lacking innovation, as they did not try to explore more relevant alternatives. This failure limited the depth and scope of their research. One of the main limitations of current research is that existing studies have primarily focused on the initial levels of adoption, often ignoring more advanced stages and post-implementation issues. Organisations typically adhere to a linear E-Commerce adoption pattern, progressing from initial adoption to more advanced and sophisticated levels. However, in certain instances, they may bypass a stage and directly adopt the most advanced level. It is important to study impact of variables on different E-Commerce adoption levels as same influencing factors may have varying impacts on each stage of advanced e-commerce adoption. Furthermore, the majority of studies have focused on SMEs, with limited attention given to large organisations. There is a notable absence of comparative studies examining e-commerce adoption within the public and private sectors, despite potential differences between the two. Lastly, an important yet unexplored aspect is the comparison between the real and perceived benefits of E-Commerce adoption, which warrants further investigation. It is essential to understand the difference between the two to better assess the success of E-Commerce adoption and make informed decisions about future investments in this area. E-Commerce adoption is sensitive to cultural and economic factors. While research has been conducted in the context of developing economies, it's important to note that socio-economic indicators not only vary between developed and developing countries, but also significantly across different developing countries themselves. This may lead to considerable variations in E-Commerce adoption within these countries. Therefore, it's not feasible to generalise findings from one developing economy to another due to these inherent disparities, and thus a country specific study is necessary for more accurate results. Overall, the literature review highlights the need for more comprehensive and relevant studies on E-Commerce adoption in the Pakistani context. This will help to fill the gap in knowledge and provide a better understanding of the factors that influence E-Commerce adoption in Pakistan and the impact of these factors on the success of E-Commerce adoption.

CHAPTER 4 THEORETICAL FRAMEWORKS USED IN PREVIOUS RESEARCH

4.0 INTRODUCTION

The chapter provides a brief overview of the most frequently used theoretical frameworks used in the E-Commerce adoption. The chapter begins with a classification of frameworks and then explores into the specifics of key frameworks such as the Diffusion of Innovation theory, the Technology Acceptance Model (TAM), the Unified Theory of Acceptance, the Theory of Planned Behaviour, the Theory of Reasoned Actions, Technology Organisation and Environment Model and the Perceived E-Readiness Model. This chapter also discusses the merits and shortcomings of each model based on critical analysis and literature review. Finally, it sets the grounds for selection of appropriate framework for this study.

4.1 CLASSIFICATION OF FRAMEWORKS USED FOR E-COMMERCE ADOPTION STUDIES

While E-commerce is an innovation (discussed in section 3.1), it diverges from conventional innovations due to its distinctive traits and features. It inherently possesses ubiquity, enabling global accessibility through standardised frameworks. Additionally, its unique attributes, such as richness, diverse interaction modes, information density, customisability, and sociability, present significant challenges for scholars from a single discipline to thoroughly explore and understand its complexity (Laudon and Traver, 2014). The extant literature delineates a multitude of factors that can potentially influence the adoption or diffusion of E-Commerce. These factors can be systematically categorised into five distinct domains: technical, managerial, organisational, cultural, and environmental. The choice of framework employed by researchers to study these factors is contingent upon the specific focus of the study and the academic discipline it is grounded in. This underscores the multifaceted nature of E-Commerce adoption and the need for a comprehensive approach to understand its dynamics (Boateng et al., 2009).

To examine the possible influence of unique attributes of the technology on its adoption decesion, researchers often utilise technology adoption frameworks such as the Technology Acceptance Model (TAM) (Davis, 1985) and the Diffusion of Innovation Theory (DOI) (Rogers, 1995). These frameworks typically focus on analysing the impact of technology attributes, such as relative advantage, compatibility, trialability, observability, risk and cost, on the decision-making process of E-Commerce adoption (Gefen and Straub, 2000b, Lee et al., 2001, Wei et al., 2009) .

Perceptions and traits of managers also impact organisational E-Commerce adoption as it is a complex interplay of personal and organisational level traits. The managerial determinants of E-Commerce adoption pertain to the attributes of the decision-makers and managers involved. Previous research has explored the impact of various managerial and organisational characteristics on E-Commerce adoption, such as the perceived strategic value of the technology, personal/organisational innovativeness, size, and structure of the firm (Leonard-Barton and Deschamps, 1988, Young and Jordan, 2008, Yigitbasioglu, 2015). These studies have drawn upon theoretical frameworks such as the "Theory of Planned Behaviour" (Ajzen, 1985) and "Theory of Reasoned Actions" (Fishbein and Ajzen, 1975) to understand the influence of these factors.

Cultural and environmental contexts also play a crucial role in E-Commerce adoption and thus, several culture and environment frameworks have been developed to study factors like language, power distance, E-Readiness, government support, and competitor pressure (Bajaj and Leonard, 2004b, Okoli and Mbarika, 2003, Singh and Gilchrist, 2002, Travica, 2002, Wolcott et al., 2001) and tested in several E-Commerce studies (Abed, 2020, Ghobakhloo et al., 2011, Awiagah et al., 2016).

Finally, Some comprehensive studies take into account the interrelationships between these factors and use integrated frameworks like the Technology, Organisation, and Environment (TOE) framework

(Tornatzky et al., 1991) and the frameworks developed by Grandón and Pearson (2004). So, several theoretical frameworks have been used to study E-Commerce adoption and its various influencing factors. Most frequently cited E-Commerce adoption frameworks are briefly introduced in the following sections.

4.2 DIFFUSION OF INNOVATION THEORY (DOI)

Rogers presented his "Diffusion of Innovation" (DOI) in his book first published in 1962 (Rogers, 1962). Since then, another five editions have been released with latest in 2003. DOI is a quite popular theory and has been used to study innovation adoption both at the individual (Lien and Jiang, 2017, Chatterjee and Eliashberg, 1990, Zhang et al., 2015) and organisational level (Mustonen-Ollila and Lyytinen, 2003, Akça and Özer, 2014). Innovation diffusion is according to Rogers is "Uncertainty Reduction Mechanism" which involves a sequential process that communicates innovation to the members of social system over time using communication channels.

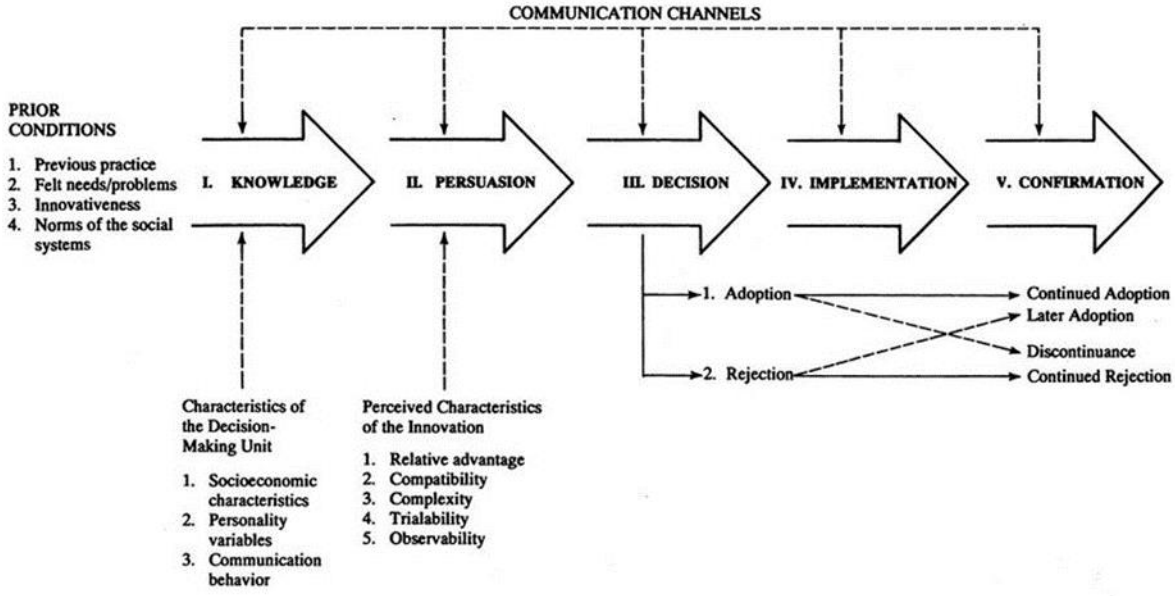


Figure 4-1:Innovation Adoption Decision Process (Rogers, 1995)

An innovation adopter is the unit of analysis in a specific context, for example an individual, department, or organisation acting as "Social Units" within a social system. According to the DOI, social units within the social systems can be termed as "Opinion Leaders". "Change Agents". and "Champions." The opinion leaders are placed at the centre of the communication network; they drive their position through their expertise, knowledge, competence, and leadership. They are typically imitated by others and thus can influence the adoption or rejection of an innovation. Change agents are like opinion leaders but are external to a specific system. They usually exert their influence within systems through opinion leaders. The innovation champion within the organisation can overcome the barriers and bottlenecks. Their involvement in the innovation adoption process substantially enhances the success rate of innovation (Rogers, 1995)

According to Rogers and Marshall (2003), potential adopters can be categorised based on their "Innovativeness" (degree of likelihood of adoption of innovation earlier than the others). DOI also describes the proportion of each category in social system (Figure 4-2). The innovation is first adopted by the "Innovators" followed by "Early Adopters" Early Majority". "Late Majority" and finally, by "Laggers. It is important to note that this classification assumes that innovation is fully adopted (not

partially adopted) and does not include “Non-Adopters”. In the organisational innovation adoption context, certain organisational characteristics can be related to an organisation's innovativeness. Innovativeness in turn affects innovation adoption. Organisational structure has also been related to organisational level innovation adoption decision. Organisations can be classified based on their degree of centralisation (spread of control within the organisation), degree of complexity (presence of different specialisations/ skills), degree of formality (the extent to which organisations follow policies and rules), interconnectedness (the degree of presence of interpersonal links), organisational slack (availability of resources at the disposal) and size (large/ small / medium). Except for the degree of centralisation, all other features are positively related to innovativeness i.e., the larger the organisation the more innovative it tends to be. Characteristics of organisational leadership have also been related to

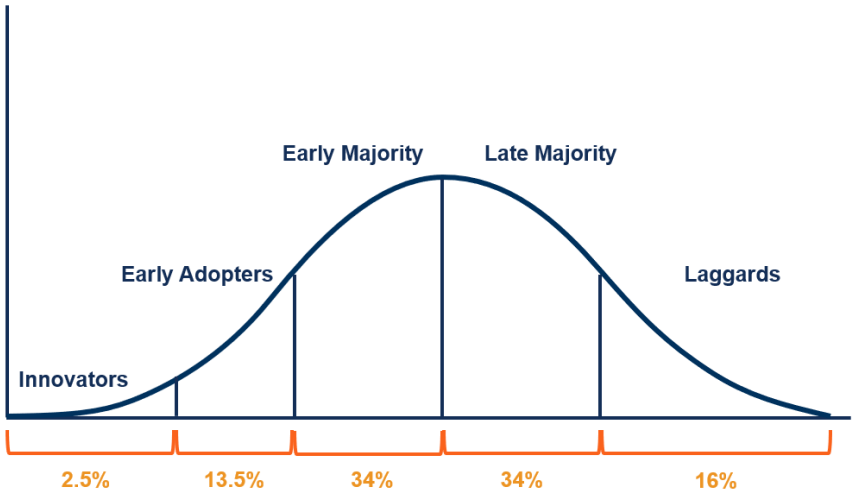


Figure 4-2 Categories of adopters (Rogers, 1995)

organisational innovativeness. Organisations having leadership with a positive attitude towards change tend to be more innovative. Similarly, “Organisation Openness” (a measure of how an employee of an organisation is linked to the members of the society external to the organisation) has been positively related to organisational innovativeness (Rogers, 1995) . Innovation is adopted in a social system at varying rates (Figure 4-3).

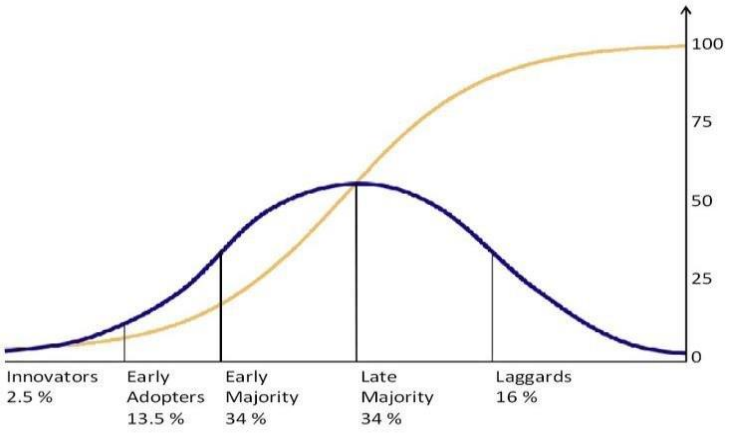


Figure 4-3: Innovation Rate of Adoption- Source: (Rogers, 1995)

Innovation adoption rate is typically an S-shaped curve and indicates that a small number of adoption units initially adopt the innovation. The number of adopters tends to increase as time passes, and at a

specific saturation point, the rate starts to decline eventually. While the innovation characteristics largely influence this rate, some social system variables also play an important role.

While Everett Rogers' Diffusion of Innovation theory has been extensively used in studies, it has also been subject to certain criticisms. These critiques of the theory include:

Cultural Bias: Rogers' theory was developed in a Western context and has been criticised for being culturally biased. For example, it has been argued that it may not be applicable to non-Western cultures where social networks and decision-making processes may be different (Rogers et al., 2014, Lundblad, 2003).

Limited Application: Others have pointed out that the theory is limited in its application, as it only applies to the spread of new ideas and technologies within a population, and does not consider the broader social, economic, and political factors that influence the adoption of innovations.

Lack of Empirical Evidence: Some scholars have argued that there is a lack of empirical evidence to support the theory, and that more research is needed to validate its various propositions. Limited understanding of innovation processes: The theory has been criticised for its limited understanding of the innovation process and for not fully taking into account the role of factors such as power dynamics and organisational culture in shaping the diffusion of innovations (Peres et al., 2010, Emmitt, 1997, MacVaugh and Schiavone, 2010).

4.3 TECHNOLOGY ACCEPTANCE MODEL (TAM)

Numerous studies have used the Technology Acceptance Model to investigate the technological factors influencing the adoption of E-Commerce mostly at the individual level (Pipitwanichakarn and Wongtada, 2019, Riantini, 2018). Davis suggested the very first version of this model in 1985 in his PhD thesis at MIT Sloan School of Management (Davis, 1985). The model draws from the "Theory of Reasoned Action" (TRA) (Ajzen and Fishbein, 1980), previously employed by researchers to forecast the success of specific information systems. Davis (1985) argued that variation in the actual system use can be explained by the motivations and motivations are influenced by stimuli that depend upon the characteristics of the system (Figure 4-4)

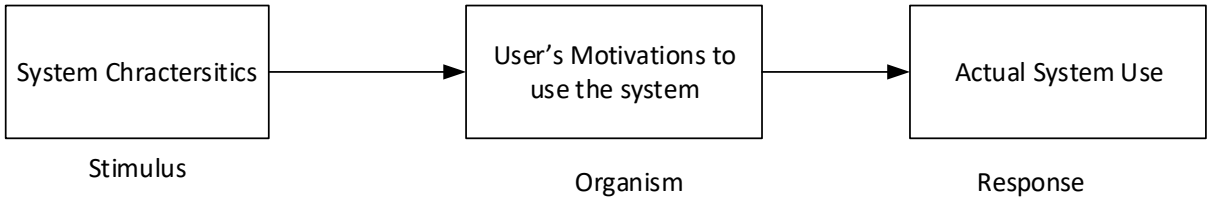


Figure 4-4: TAM Concept (Davis, 1985)

According to the original TAM model, "Perceived Usefulness" and "Perceived Ease of Use" lead to "Attitude" towards usage. Both "Perceived Ease of Use" and "Perceived usefulness" are affected by the external stimuli that, in turn, depend upon the system's characteristics Figure 4-5. Three constructs, Perceived Ease of Use, Perceived Usefulness, and Attitude towards usage explain the motivation of the potential user. Attitude towards system usage in this model was the major determinant of the Actual system usage. The model received significant attention and empirical support. The researchers applied this model in several studies in its original and extended/modified form(Lee et al., 2003).

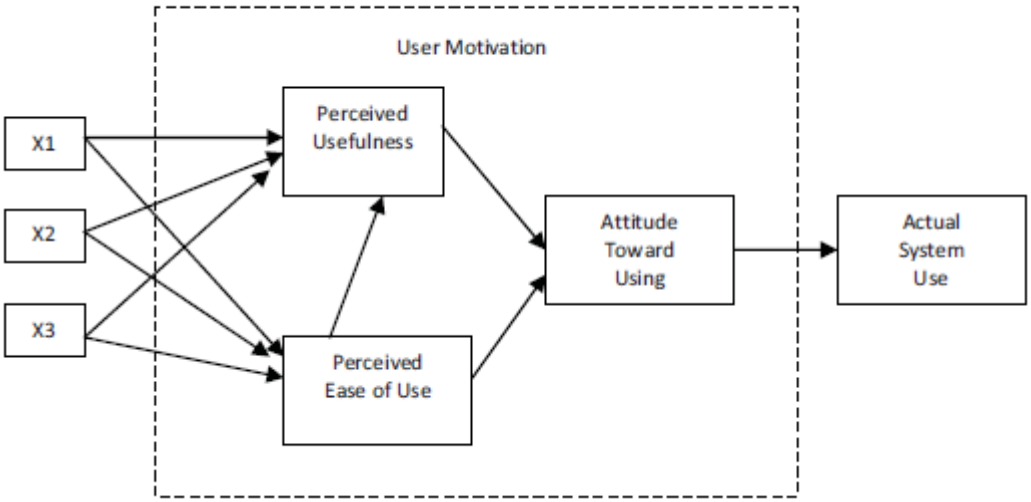


Figure 4-5: TAM – Determinants of Perceived Usefulness and Perceived Ease of Use (Davis, 1985)

Davis himself improved the model several times by introducing new variables and modifying the relationships in the original model. Davis et al. (1989) introduced the first modified model of the Technology Acceptance Model and introduced another variable called "Behavioural Intention to use the system" in the original model (Figure 4-6). Data collected from 107 users indicated a strong correlation between user's "Intention" and "Actual System Use." They also found a strong relationship between Perceived Usefulness and Behavioural Intention to Use. Perceived Ease of Use was also found weekly correlated to the Behavioural Intention to use, but that may subside with time. The direct relationship between Perceived Usefulness and Perceived Ease of Use meant that the "Attitude Towards Using" was no more required.

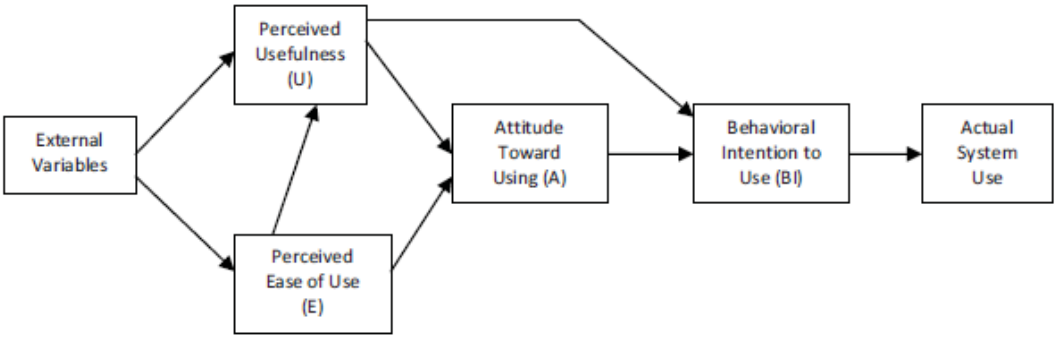


Figure 4-6: Modified TAM source(Davis et al., 1989)

Findings of the studies led to a new version of TAM (Figure 4-7). The new TAM model eliminated the unexplained direct effects of systems characteristics on the "Attitude Towards Using" variable. Also, external factors (that may influence system use) like System Characteristics, Users Training, User Participation in the design process and nature of implementation were given due consideration (Davis and Venkatesh, 1996).

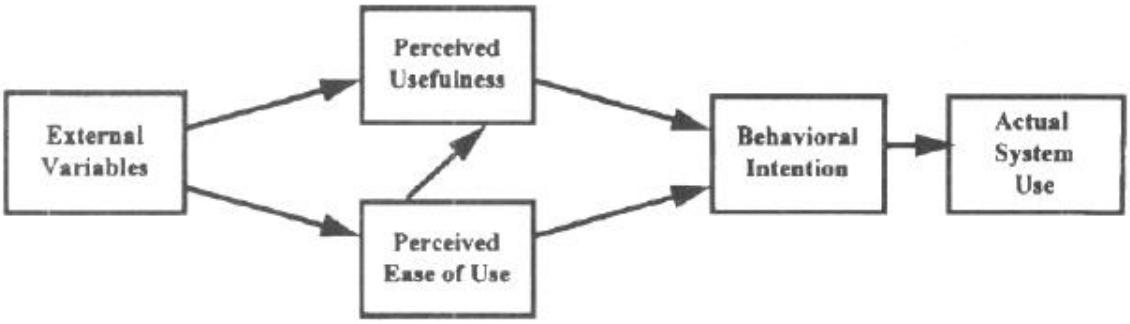


Figure 4-7: TAM (final version) source: (Davis and Venkatesh, 1996)

Although TAM remained immensely popular among researchers and has been cited very frequently in innovation adoption studies; however, some scholars think that there were several shortcomings in the model, and real problems of technology acceptance have been ignored in the model (Lee et al., 2003). While Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) are determinants of "intention to use" they do not remain constant. As time passes, individual perceptions about usefulness and ease of use usually change. For example, some individuals may find a system difficult to use, but by the time individuals can learn to use a system without much mental effort, which may lead to change in the initial perceptions about the system use. Therefore the influence of these two constructs normally starts to decline as time passes (Kamel and Assem, 2003). Therefore, the two constructs (PEOU and PU) seem to be important only at the initial stage of the decision to adopt a technology. Another inherent deficiency in the model stems from its inability to consider the diverse contextual factors that can impact technology adoption. Several previous studies have questioned the predictive power of the two constructs (PEOU and PU). So while Legris et al. (2003), in their review of literature on TAM, found that it was quite successful in predicting the information system usage, they concluded that other contextual constructs/ variables need to be added in the framework. Several scholars have extended the original TAM model and added some contextual constructs to account for the contextual reasons. Kamel and Assem (2003) did research based on TAM to study the electronic payment and electronic delivery channel adoption in Egypt and concluded that "Trust" as an external attribute was influential in the cultural context of Egypt in the innovation adoption decision. They argue that while the organisations need to offer value proposition to customers, the provision of reliable tools and technologies customised according to the local values and culture are equally important to win customers' trust. In another study, Kamel and Hussein (2004) used constructs from TAM and Diffusion of Innovation Theory as theoretical bases to predict the IT-based hotel reservation solution usage in an organisation. The study highlighted the significance of considering the "Negative Perceptions" and unaddressed concerns of the employees that may translate into "Resistance Towards Change" and ultimately result in project failure. Raitoharju (2005) also pointed towards the inability of TAM to account for the direct and indirect stress that may influence the technology adoption decision. Some scholars argue the possible role of sociotechnical factors in the technology adoption decision. For example, Shachak et al. (2019) mentioned the over simplistic nature of the TAM . They emphasised the need to find a more comprehensive framework incorporating the contextual sociotechnical issues, issues related to the multiuser needs and some temporal factors as the implementation of information technology is a dynamic process. Technology adoption process is also influenced by several psychological factors/ attributes of the adoption unit. TAM does not consider the "Intrinsic Factors or Motivations" in the context of the adoption unit. The consumer, for example, may not only want to accomplish a task but may also seek to drive emotional satisfaction, and only emotions (not rational assessment of usefulness or ease of use) determine the adoption or non-adoption decision of the innovation (Taherdoost, 2018). TAM on its own covers technology acceptance or non-acceptance quite reasonably but it's over

simplistic nature fail to cover several other relevant variables and thus a significant number of used TAM with different contextual factors (Al-Emran et al., 2018, Awa et al., 2015b, Fatokun, 2023, Sorce and Issa, 2021). So, while several past studies have widely employed standard TAM and it received considerable empirical support as well, its inherent shortcoming of ignoring contextual factors makes it suitable only in limited environments and circumstances.

4.4 UNIFIED THEORY OF ADOPTION AND USE OF TECHNOLOGY (UTAUT)

This model was proposed by Venkatesh et al. (2003). The theory consolidates the constructs of Theory of Reasoned Action (TRA), Technology Acceptance Model, Motivational Model, Theory of Planned

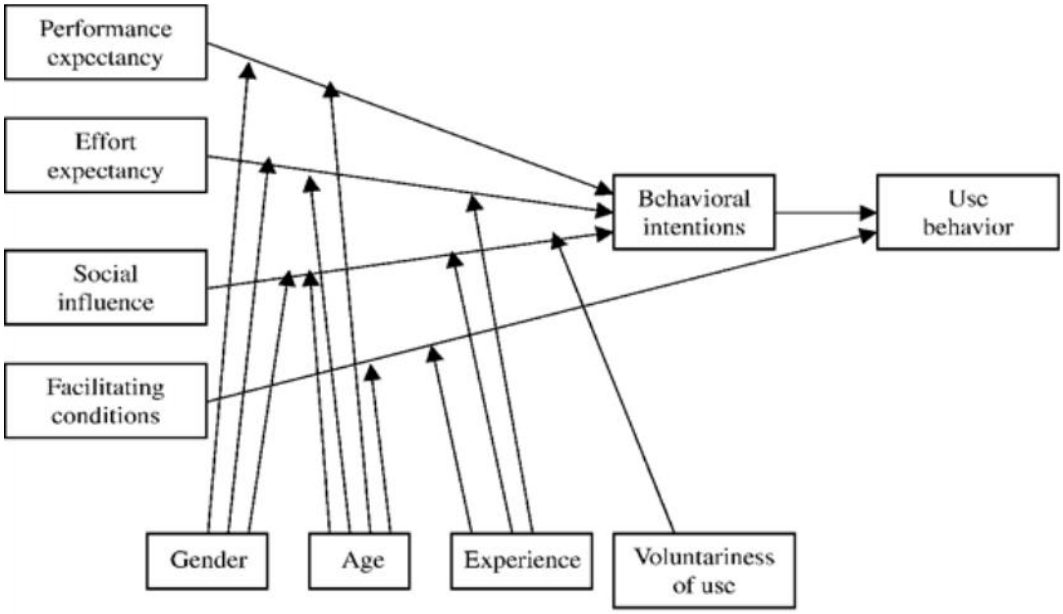


Figure 4-8: UTAUT model source: Venkatesh et al. (2003)

Behaviour, Model of Personal Computer Uses, Diffusion of Innovation Theory and Social and Cognitive theory to explain the variation in the intention to use information systems and subsequent behaviour through four constructs named "Performance Expectancy", "Effort Expectancy", "Social Influence" and "Facilitating Conditions"(Dwivedi et al., 2019). The original model (Figure 4-8) explained a 70 percent variation in the intention and 50% in the actual usage. Except for "Facilitating Conditions" all the constructs directly explain the intention. "Facilitating conditions" directly relate to the actual usage behaviour. The model also incorporates the moderating effects of gender, age, experience, and voluntariness on all relationships.

UTAUT has been applied in several studies in different contexts. Koivumäki et al. (2008) studied mobile services usage based on UTAUT, Eckhardt et al. (2009) used this framework to explain the technology adoption through workplace social referent groups, Curtis et al. (2010) studied social media adoption in USA based study using this framework and Verhoeven et al. (2010) studied variation in computer usage frequency by using this model as a theoretical foundation.

Researchers used the original model and extended UTAUT for their studies in several studies. Lin and Anol (2008) added construct called "online social support" to study network information technology usage. Wang et al. (2009) studied mobile learning adoption by extending the UTAT with two constructs, "Perceived Playfulness" and "Self-Management of Learning" Cody-Allen and Kishore (2006) extended the UTAUT theory with "E-Quality, "Trust", and "Satisfaction" constructs to study E-Business. Hoque and Sorwar (2017) added "Technology Anxiety" and "Resistance to Change" in the original UTAUT model and studied the adoption of "M-Health". In another study Chao (2019) extended the UTAUT

model to investigate "Mobile Learning Adoption," introducing "Mobile Self-Efficacy" and "Trust" as independent variables, "Perceived Enjoyment" and "Satisfaction" as mediating variables, and "Perceived Risk" as a moderating variable. Isaac et al. (2019) also based their studies on UTAUT but added an independent variable “Task-Technology Fit” and four outcome variables “Decision Quality”, “Communication Quality”, “Knowledge Acquisition” and “User Satisfaction” in the context of “Internet Adoption”.

The UTAUT model has received criticism for its complexity, requiring a minimum of 8 independent variables to predict technology acceptance behaviour. Some researchers argue that the model's increased predictive power is due to the addition of moderating variables, rather than providing a true reflection of the underlying phenomena. As a result, while UTAUT is acknowledged as applicable in various contexts, some scholars propose to combine its elements to create a simpler version that better captures the essence of technology acceptance (Bagozzi, 2007, van Raaij and Schepers, 2008, Li, 2020).

4.5 THEORY OF PLANNED BEHAVIOUR (TPB)

The Theory of Planned Behaviour (TPB) (Ajzen, 1985) was introduced by Ajzen in 1985 as an extension of the Theory of Reasoned Action (Fishbein and Ajzen, 1975) (Figure 4-9). TPB is a social psychological model that predicts human behaviour by examining the interplay of three key factors: attitudes, subjective norms, and perceived behavioural control. The model suggests that individual’s behaviour is influenced by their beliefs about the consequences of that behaviour, the social pressure to engage in (or not engage in) the behaviour, and their perceived ability to control the behaviour. TPB posits that when an individual has a positive attitude towards a behaviour, feels social pressure to engage in it, and perceives themselves as having the control to engage in the behaviour, they are more likely to engage in the behaviour. Conversely, if an individual has a negative attitude, feels social pressure not to engage in the behaviour, and perceives themselves as lacking the control to engage in the behaviour, they are less likely to engage in the behaviour. TPB has been widely used in the fields of health behaviour, environmental behaviour, and consumer behaviour, among others. However, it has received criticism as well. According to TPB, a person's planned behaviour, such as the decision to adopt E-Commerce, is directly influenced by their intentions towards that behaviour. These intentions, in turn, are shaped by their attitudes towards the planned behaviour. In the TPB model, the intention construct fully mediates the relationship between attitudes and the target behaviour. Even when attitudes alone appear to explain the target behaviour, the intention still serves as a mediator that transforms attitudes and other factors into an intention and eventually into actual behaviour. This over reliance on intention is problematic as intention is sometimes not a good predictor of real behaviour especially when they are formed due to influence of some exogenous factors, which may be temporal (like informal cues from surroundings and work status).

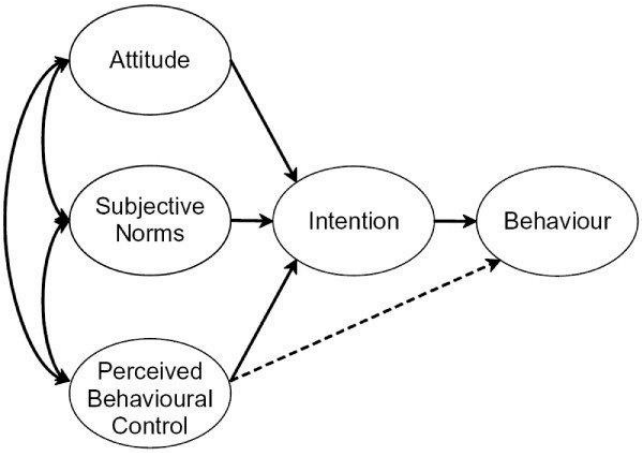


Figure 4-9:Theory of Planned Behaviour- Source : Ajzen (1985)

According to Ajzen (2011), there is a "random error" issue with the theory of planned behaviour measurement model. The constructs of the model typically have reliability scores of less than 0.75 or 0.8. Additionally, the correlation between these constructs is generally not higher than 0.6. The key relationship between intention and behaviour, which is the focus of the model, can vary significantly depending on the circumstances. Ajzen is not alone in his criticism of the theory. Other researchers have also questioned the validity of the relationship between intentions and behaviour when there is a significant time lag between the measurement of intentions and observation of behaviour (i.e., more than 5 weeks). During this time, various intervening factors can impact attitudes, beliefs, and perceived behavioural control, which in turn can modify intentions. Therefore, the time between the measurement of intentions and behaviour can moderate the relationship between intention and behaviour. Generally, a shorter interval between the measurement of intentions and observation of behaviour leads to a stronger correlation between intention and behaviour (Conner et al., 2000).

Desires and impulses play a significant role in shaping decisions. These desires and impulses, and thus decisions, are influenced by both individual factors such as control over desires and motivations, as well as contextual factors that trigger or impact them. The level of control that individuals have over their desires and impulses varies greatly depending on the situation and the individual. As a result, the relationship between intention and behaviour is highly subjective and influenced by a range of personal and situational factors. This highlights the complex and dynamic nature of human decision-making and the need to consider a range of factors in order to understand and predict behaviour (Ajzen, 2011).

Similarly, the relationship between intention and behaviour may not be very significant in specific behaviour domains. Sometimes subjects do not have “actual control” to perform a target behaviour. For example, in a study that involved examining sleep-related behaviour the “intention”- “behaviour” relationship was found to be weak since individuals were not able to stop distressing ideas before going to bed. So, their intention to sleep could not be translated into target behaviour. So, subjects had a false perception of the behavioural control over the intended behaviour (sleep). Thus the relationship between perceived behavioural control and target behaviour can also be very weak in certain contexts and “perceptions of control” are not always an accurate proxy of “actual control” (Kor and Mullan, 2011)

The TPB model relies on self-reported data, which can result in self-presentational bias and compromise the accuracy of its findings (Armitage and Conner, 2001). Additionally, the TPB assumes that individuals

form behavioural, normative, and control beliefs rationally, an assumption that does not always reflect reality (Ajzen, 2011) . The model has been criticised for ignoring factors such as norms and behavioural evaluations that could have improved its predictive power (Davies et al., 2002, Yousafzai et al., 2010). Furthermore, direct measurement of perceived behavioural control without considering an individual's control beliefs can lead to misleading results (Davies et al., 2002). To address these issues, Ajzen (2011) added two constructs, "Willingness to Perform a Behaviour" and "Social Support" to the model in order to increase its predictive power and take into account additional important factors. From the above discussion, it appears that while TPB has been widely applied in several studies it may not always be the best choice for predicting behaviour, particularly in complex or rapidly changing situations.

4.6 THEORY OF REASONED ACTION (TRA)

The Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975) is a social psychology theory that explains human behaviour as a result of intention. According to the theory, behaviour is determined by an individual's intention to perform the behaviour, which is in turn influenced by their attitude towards the behaviour and their perceived subjective norm, or the perceived social pressure to perform the behaviour. The TRA is based on the idea that individuals make decisions about their behaviour based on a rational and deliberate calculation of the costs and benefits. Attitude towards the behaviour is determined by an individual's beliefs and evaluations about the behaviour and its consequences. Perceived subjective norm is influenced by an individual's perception of the norms and expectations of important social groups, such as family and friends, as well as their motivation to conform to these norms. According to TRA “Attitudes” and “Subjective Norms” drive “Behavioural Intention” and “Behaviour” link (Figure 4-10). The construct “Attitude” in the model is an individual’s perceptions about a specific behaviour and has two elements (1) evaluation of the outcome and (2) strength of the behavioural beliefs. “Subjective Norms” are related to the “Perceived Social Pressure” to perform or nor perform an action. The construct “Subjective Norms” is also composed of two components “Normative Beliefs” (what society expects from an individual) and “Motivation to Comply” (how important a particular attainment is for a specific person). The factor “Intentions” contain all the motivating factors towards a specific behaviour. The TRA has been widely applied in a variety of fields, including marketing, communication, health behaviour, and environmental sustainability. It has been used to understand and predict behaviour in various domains, such as substance abuse, environmental behaviour, and physical activity and in the past few years, the theory has been widely applied in the field of information sciences to predict target behaviour (Taherdoost, 2018). The theory received considerable and justifiable attention immediately after it was proposed. A substantial number of empirical studies validated the theory, and thus the model seemed to predict the behaviours and intentions. The model was thus widely applied to identifying the target areas to influence the behaviour (Sheppard et al., 1988). It is important to note that the model only predicted the “Behaviour” not “Outcome of Behaviour” (i.e. achieving a distinction in an exam or getting some approvals from some authority) and was only valid for the behaviours that are directly under the volitional control of the subject (Sheppard et al., 1988). Despite receiving empirical support and validation, scholars have also critiqued the model.

The model explains the variation in “Actual Behaviour” very well when voluntary behaviour is being predicted and the target behaviour does not involve any restrictions or uncertainties on the attainment of the target behaviour or consequences thereof (Ajzen, 2011). For example, in certain circumstances, an individual may not try an activity that has higher degrees of failure to protect their ego. Thus, the relationships among constructs have a definite relationship with the element of uncertainty in the outcome of certain behaviour.

A person may not be able to perform a target behaviour despite the strong intentions. For example, despite having a strong intention to buy a car, an individual might not be able to buy because of car finance refusal. The model may have predictivity issues when intentions are formulated well in advance of the target activity as larger periods between intentions and activity may result in modified intentions and activity due to the interference of several factors.

The model's validity is also poor in situations when a particular activity may require a condition to be met that may not be in direct control of the subject or when activities or targets require successful negotiations or when a subject intend to achieve a goal target, but the target itself requires the individual to attain certain skills or qualifications (Kan and Fabrigar, 2017).

TRA has also been criticised for not addressing the situations where more than one choice of behaviour is available. The presence of alternatives can drastically impact the whole formation of intention formation. The choice of alternate behaviour is translated into the intentions and behaviour through "subjective norms" and "attitude", the more positive they are towards a certain behaviour more likely the subject is to perform that behaviour. However, there are several situations when several choices of behaviours are quite similar, and all the behaviours have similar attitudes and subjective norms. So, while an individual may choose action A, others with similar "subjective norms" and "attitude" may choose behaviour B. The model thus may lead to inaccurate findings in situations where a choice of behaviour exists (Sheppard et al., 1988).

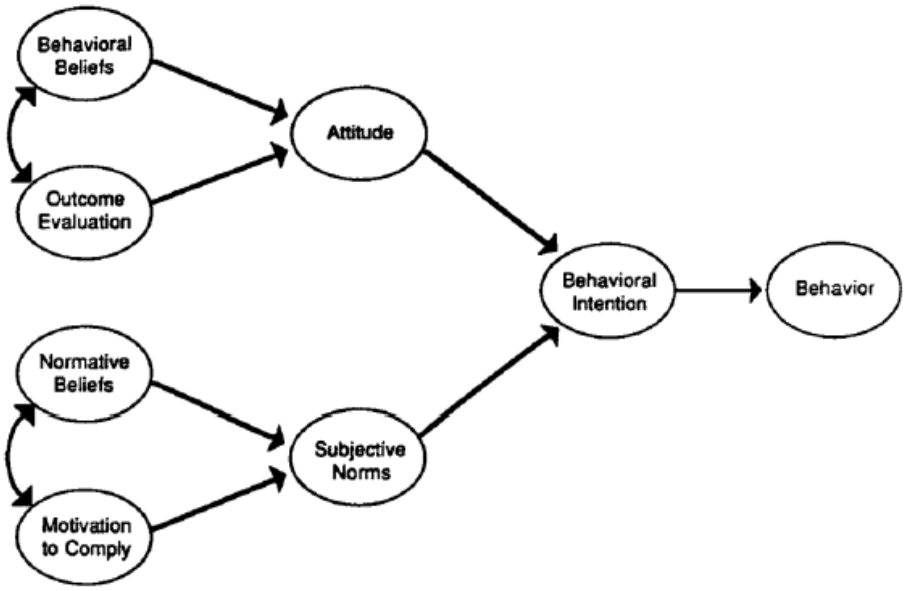


Figure 4-10: Theory of Reasoned Action – Source: Fishbein and Ajzen (1975)

4.7 ENVIRONMENT AND CULTURAL MODELS

Environment and cultural models examine the relevant environmental and cultural determinants that influence an organisation's decision-making process regarding the adoption of E-Commerce. Following are some models that capture impact of culture and environment.

Singh and Gilchrist (2002) proposed a three-part framework for understanding the adoption of E-Commerce in organisations. The first layer, the infrastructure layer, focuses on the availability of telecommunication services, internet access, and cost-effectiveness. The second layer, the commercial layer, is concerned with building a comprehensive logistics infrastructure, streamlining export procedures, and ensuring a trained workforce in the market. The final layer, the Trust layer, looks at the factors that impact trust, including balancing property rights laws, trade regulations, and agreement procedures with both the benefits of the export market and domestic market interests. The authors emphasise that having a favourable infrastructure, supportive logistics, expert consultation services for E-Commerce implementation, and a trusted E-Commerce technology environment are crucial drivers of E-Commerce adoption. They advocate for a collaborative effort between the public and private sectors to foster a favourable environment for E-Commerce.

Okoli and Mbarika (2003) investigated the diffusion of E-Commerce in sub-Saharan Africa through three key areas: the sophistication of internet usage, the telecommunication and ICT environment, and the commerce infrastructure. Their framework (Figure 4-11) was informed by previous studies conducted by Travica (2002), Vladimir (1996), and (Wolcott et al., 2001). The framework highlights differences between the developed and developing economies, pointing out that nepotism and corruption pose as significant barriers to the diffusion of E-Commerce in developing economies.

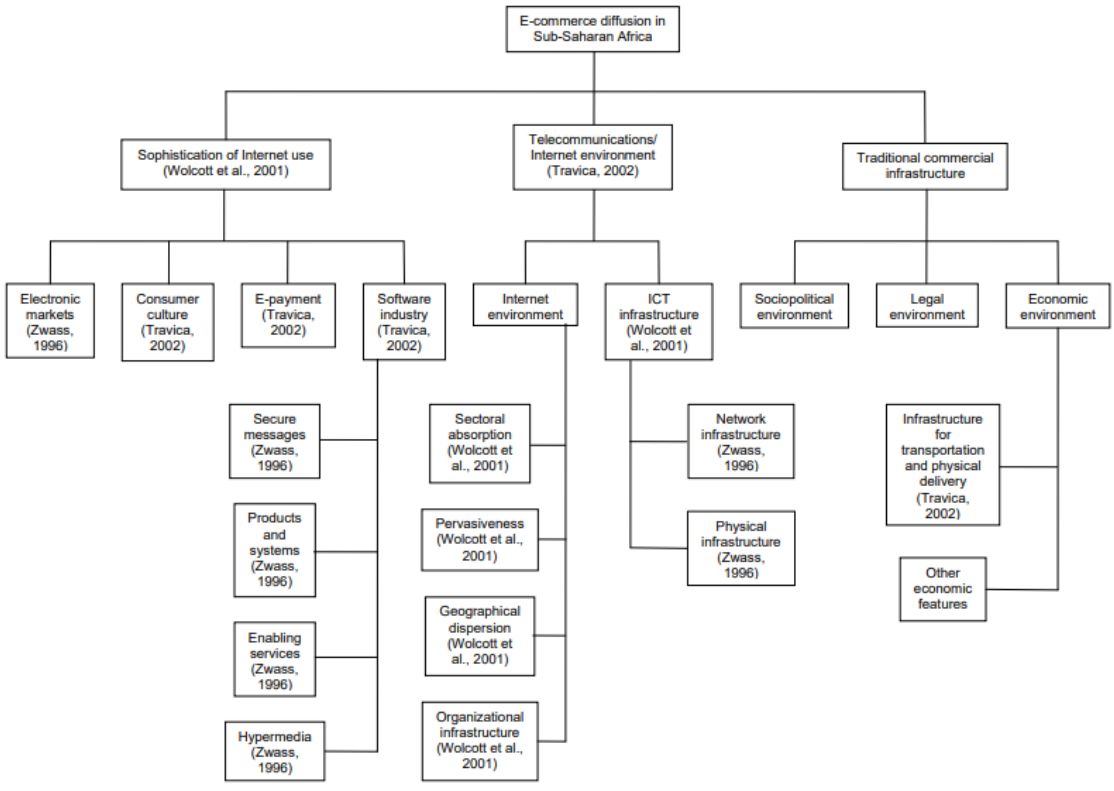


Figure 4-11: Okali and Mbarika Framework Source: (Okoli and Mbarika, 2003)

Bajaj and Leonard (2004a) proposed a framework (Figure 4-12) to examine the interplay between Culture, Policy, and Technology in shaping E-Commerce readiness. Their study found that factors such as online transactional trust, trust in government institutions, corruption in dealings, shopping preferences, and technology infrastructure all influenced E-Commerce readiness. The framework identifies three dimensions of E-Commerce challenges and how they are interrelated. For instance, effective policies and regulations related to E-Commerce can positively impact the culture dimension by reducing security concerns and increasing trust in virtual environments. The implementation of secure technologies such as SSL or TLS, as well as secure payment technologies like PayPal or escrow, can also increase trust levels and influence the culture dimension of the framework.

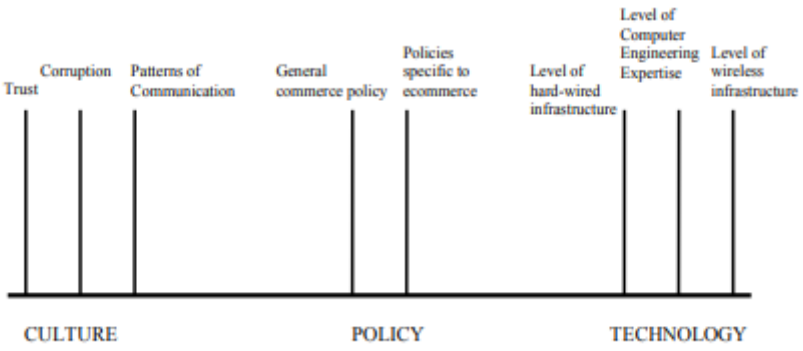


Figure 4-12: E-Readiness frame work source: Bajaj and Leonard (2004a)

4.8 TECHNOLOGY – ORGANISATION – ENVIRONMENT MODEL (TOE)

The Technology Organisation Environment (TOE) framework was developed by Tornatzky et al. (1991) and is considered a comprehensive framework covering the variables from technological, organisational, and environmental contexts. The TOE model recognises that the successful adoption and assimilation of technology within an organisation depend on a complex interplay of factors across these three dimensions. Technological context includes all relevant technologies available to a business including those already in use and those available but not adopted yet. Existing technologies are important for the organisations as they set a broad limit on the scope and pace a business can adopt. Organisational context includes resources, processes and characteristics of the organisation including size of organisation, its degree of centralisation, quality of human resources and number of slack resources available. Environmental contexts refer to firm's industry, competitors, social, political and environment around the organisation. The framework has been used to explain variation in innovation adoption in technological, industrial, and national cultural contexts. For example, scholars have used the TOE framework to explain E-business adoption (Lin and Lin, 2008), electronic data interchange (EDI) adoption (Chwelos et al., 2001), and ERP adoption (Enterprise Resource Planning) (Pan and Jang, 2008). While the model received empirical support from many studies, not all studies have used the same set of variables in the three contexts depending upon the type of innovation/ technology, industry, and

culture. (Awa and Ojiabo, 2016, Abed, 2020, Karia and Soliman, 2017, Grover, 1993, Alhassan et al., 2020, Giampietri and Trestini, 2020, Lee et al., 2015).

Despite the framework's great explanatory power, the TOE model has been criticised for not covering the “managerial issues” as a separate context. The variables in the “organisational context” tend to compete with the “managerial issues”. and thus, managerial issues are not fully captured when studied under “organisational contexts”. Therefore, some scholars have extended the TOE by adding managerial context or building model by adding additional “E-Readiness” context in the original TOE model (Grandon and Pearson, 2003, Molla and Licker, 2005a).

4.9 PERCEIVED E -READINESS MODEL (PERM)

E-Readiness is particularly crucial in developing countries which affects their ability to adopt ICT based technologies. Factors such as the availability of telecommunication infrastructure, the level of workforce education, the stability of government institutions, and the presence of secure payment systems can all impact E-Readiness. Therefore, a thorough study of E-Readiness levels is essential to understand a developing country's potential to leverage ICT technologies like E-Commerce (Molla and Licker, 2005b, Molla et al., 2010). In 2005, Molla and Licker (2005a) introduced an E-Commerce adoption model that focuses on two main constructs: Perceived Organisational E-Readiness (POER) and Perceived External E-Readiness (PEER) (Figure 4-13). The model considers various internal organisational, external, managerial, and technological factors that can influence an organisation's decision to adopt E-Commerce. The model is based on two stages of E-Commerce adoption: the initial adoption and institutionalisation (ongoing usage). POER represents the extent to which an organisation's management perceives their organisation as being equipped with the necessary knowledge, human resources, financial resources, commitment, and governance to adopt E-Commerce. PEER, on the other hand, is a measure of support from government, market forces, and support industries as perceived by the management. This model has received empirical validation and has been modified and used in several studies over the years, with researchers using Discrimination Factor Analysis to determine the relative importance of different variables in POER and PEER in both stages of E-Commerce adoption (Al-Hudhaif and Alkubeyyer, 2011, Hoque and Boateng, 2017, Matsinhe and Kabanda, 2019, Uwamariya et al., 2015) .

The model received wide acceptance but comes with some limitations as well. It does not account several socio economic and psychological factors (Abdulhakeem et al., 2017) . Also, due to a greater variability in the environments within developing nations and ever changing nature of the e-technologies , the model needs to be tested in country specific settings regularly to accommodate any changes in e-technologies (Dada, 2006, Chipembele and Bwalya, 2016, Berthon et al., 2008, Khokhar and Serajuddin, 2015b).

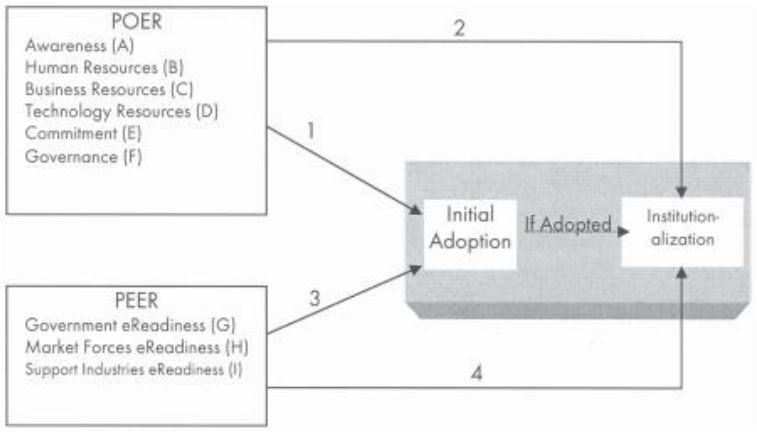


Figure 4-13: Perceived E-readiness Model(PERM)- (Molla and Licker, 2005a)

From the above discussion we can conclude that while there are several models used in information sciences research to study E-Commerce adoption, none of them explains the E-Commerce adoption comprehensively. Even the integrated models also appear to ignore some factors that are especially pertinent in developing countries context. Table 4-1 presents list of some studies with models applied.

Table 4-1: Theoretical Frameworks used in different E-Commerce Adoption Studies- Source: Literature Survey

S.No	Reference	Conceptual Framework
1	Qiu and Li (2008)	Technology Acceptance Model (TAM)
2	Fuller et al. (2009)	
3	Klopping and McKinney (2004)	TAM + Task Technology Fit
4	Awa et al. (2015b)	TAM + TPB + TOE
5	Gefen et al. (2003)	TAM + Trust
6	Johar and Awalluddin (2011)	TAM extended – Moderation of Consumer Traits
7	Fayad and Paper (2015)	TAM extended with 4 outcome variables expectation, E-Commerce in use, Process Satisfaction, and outcome satisfaction. Actual behaviour measured instead of intention
8	ALraja and Aref (2015)	TAM extended with "perceived risk"
9	Ayo et al. (2011)	TAM + Task-Technology Fit (TTF)
10	Shih and Chen (2013)	TAM+TTF
11	Lee et al. (2001)	TAM+ Perceived Risk
12	Riantini (2018)	TAM
13	Syarifudin et al. (2018)	TAM
14	Cho (2017)	TAM extended with Expectation disconfirmation theory
15	Mon (2020)	TAM + five porters forces
16	Panjaitan et al. (2019)	TAM extended with perceived risks
17	Molla and Licker (2005a)	Perceived E-Readiness Model (PERM)

4.10 SUMMARY

Organisational E-Commerce adoption refers to the process by which organisations make decision to adopt and integrate electronic commerce into their business processes. To study and understand this process, several models and frameworks have been developed. The Technology Acceptance Model (TAM) is one of the most widely cited frameworks in the literature. This model focuses on the technological determinants of innovation adoption and posits that technology adoption requires "Intentions to adopt" the technology. The two main determinants of adoption intentions are Perceived Usefulness (PU) and Perceived Ease of Use (PEOU), which determine how useful and easy to use the technology is perceived to be. These determinants are influenced by external factors, such as trust and culture. However, TAM has been criticised for its limited validity at different stages of innovation adoption and for not covering certain contextual influences. Diffusion of Innovation theory focuses on the attributes of the technology itself and how these attributes influence the innovation adoption process. The theory posits that certain organisational and individual level variables, such as relative advantage, cost, and trialability, play a role in innovation adoption decisions. Theories of Reasoned Action (TRA) and Theory of Planned Behaviour (TPB) are two popular frameworks that focus on the managerial traits that influence the innovation adoption process. TPB, for example, argues that the manager's perceived behavioural control, perceived subjective norms, and attitude towards a certain target behaviour, determine their intentions to perform the behaviour. Other frameworks focus on the external factors that influence innovation adoption, such as the E-Readiness of the country, partners, and culture. Technology-Organisation-Environment (TOE) and Perceived E-Readiness Model (PERM) are two models that aim to cover a broad range of factors, including technical, organisational, and environmental domains. While these frameworks have been extensively studied and have received empirical validation, they are not comprehensive enough to provide guidance on addressing the barriers and constraints to technology adoption and efficiently deploying technology to realise its potential benefits. In summary, these models and frameworks provide different perspectives on E-Commerce adoption and its determinants, ranging from technological factors to managerial and organisational variables and external environmental and cultural factors. While capturing every pertinent variable in the model appears very challenging, selection of right variables in model leads to a more focused and contextually valid model.

CHAPTER 5 RESEARCH MODELS AND HYPOTHESES

5.0 INTRODUCTION

Chapter 5 picks up where Chapter 4 left off, which discussed technology adoption theories and their limitations by ignoring important variables. To address these gaps, this chapter delves deeper into the specific theoretical models, proposes the most pertinent models in Pakistani context, that capture influence of a range of factors. Four statistical models are proposed and discussed in the chapter to answer the research questions, taking into consideration the cultural context of technology adoption and its impact on the variables under study. The variables and relationships are grounded in previous research findings and will be tested through empirical data collected from a representative sample. This chapter will provide a comprehensive examination of the theories guiding this research project.

5.1 THEORETICAL FOUNDATION

A careful examination of the Information Systems adoption models suggests that most of the models do not capture the influence of all relevant variables in the innovation adoption decision. For example, the technology acceptance model (TAM) is not considered appropriate for information systems (IS) adoption studies in small and medium scale organisations. Moreover, it fails to capture the unique contextual factors of developing Economies (DE) (Dwivedi et al., 2009a). Similarly, while unified theory of acceptance and use of technology (UTAUT) explains a large proportion of up to 70% variation in the IS adoption, the model is criticised for using a large number of independent variables that "artificially" increase the predictive power of the model (Bagozzi, 2007, van Raaij and Schepers, 2008, Li, 2020). Behavioural intention, which is related to the target behaviour in this model fails to capture the influence of external factors that may prevent adopters from actually adopting the IS despite having a strong desire to do so (Venkatesh et al., 2008). TAM, UTAUT, and theory of planned behaviour (TPB) are some of the most cited theoretical models with similar constructs, but they are not suitable in all contexts. The three models tend to be preordained, focusing on the end-user or individual-level variables. Information system adoption decision at the organisational level is a complex interplay of several contextual factors. Only individual-level variables cannot comprehensively capture the organisational level IS adoption process (Abdulhakeem et al., 2017). Diffusion of Innovation Theory (DOI) also ignores the contextual factors of small organisations operating in developing economies (Dwivedi et al., 2009a). This research aims to find E-Commerce adoption factors in a developing country's context. Developing Economies like Pakistan are usually not e-ready and lack the necessary infrastructure, resources, and feasible environment (UN, 2023b). As mentioned in section 3.2.2.2 no existing study has assessed and investigated the level and impact of E-Readiness factors on E-Commerce adoption in Pakistan so E-Readiness factor model appears to be a good choice for this study. Nevertheless , E-Commerce adoption cannot be explained by only E-Readiness factors, some Technological and Behavioural Control Factors have also been found to impact innovation or E-Commerce adoption (Tornatzky et al., 1991, Rogers, 1995). So, selected Technological and Behavioural Control Factors have also been studied in separate model.

Before discussion on the suggested models used in the study, it would be pertinent to refer to the research questions. The study is aimed at finding answers to the following questions.

1. How do E-Readiness factors relate to organisational E-Commerce adoption in Pakistan's public and private sectors?
2. How do Technological and Perceived Behavioural Control factors relate to organisational E-Commerce adoption in Pakistan's public and private sectors?
3. Do E-Readiness, Technological and Perceived Behavioural Control factors have significantly different relationships with E-Commerce adoption in public and private sectors of Pakistan?

4. How do E-Readiness, Technological and Perceived Behavioural Control factors relate to different levels of organisational E-Commerce adoption in Pakistan as discriminating factors?

Four models were developed and empirically tested to find the answers. Model A was developed to find nature and magnitude of relationship of E-Readiness factors with organisational E-Commerce adoption (through intention to adopt E-Commerce as proxy variable). Model B explores the relationship of Technological and Behavioural Control factors with organisational E-Commerce adoption (through intention to adopt E-Commerce as proxy variable). Model C examines the relationship between E-Readiness different stages of E-Commerce adoption within organisations by mapping organisational E-Commerce adoption on E-Commerce Maturity Model (Figure 5-6) adopted from (Rao et al., 2003) and (Symonds, 2000), while Model D investigates same relationships but using Technological and Behavioural Control factors as independent variables (Table 5-1) . The study used "Perceived E-Readiness Model" (Molla and Licker, 2005a) to audit the organisational and environmental E-Readiness and effect thereof on organisational E-Commerce adoption decision (Model-A). Molla and Licker (2005b) successfully tested the model in relation to two stages of E-Commerce adoption through multifactor discriminant factor analysis (MFDA) . However, this study used same E-Readiness constructs in a different way using a different statistical technique (discussed in section 5.2). To address the second research question, which aims to examine the relationship between Technological and Behavioural Control Factors with E-Commerce adoption decisions, the study modelled technological characteristics, due to their excellent predictive powers (Ghobakhloo et al., 2011). While perceptions influence intentions which in turn impacts the actions and behaviours(Rogers et al., 2014, Fishbein and Ajzen, 1975, Davis, 1985, Davis, 1989), intentions and social behaviours are directly or indirectly influenced by an individual's ability to perform an action (Ajzen, 1985). Since, organisational and environmental factors were already added in independent model through POER and PEER, selected factors of Technological characteristics and Perceived Behavioural Control (PBC), from the theory of planned behaviour (Ajzen, 1985), were used as predictors to capture technological factors and perceptions about "controllability". especially in the context of the public sector , where major decisions often lie outside the organisation (Ring and Perry, 1985a). The third research question will be answered through Multi Group Analysis (MGA) using sector as moderating variable in model A& B, and finally, research question 4 is answered through models C and D using same independent variables as in model A and B but using E-Commerce development stages as outcome variables and Multinominal Logistic Regression as statistical technique (section 5.5.2).

Table 5-1: Research Questions, Models, Variables and Hypotheses

Research Question	Model	Independent Variables	Dependent Variable(s)	Corresponding Hypotheses
1	A	E-Readiness factors (POER+PEER)	Intention to adopt E-Commerce	HA1-HA9
2	B	Technological Factors Perceived Behavioural Control	Intention to adopt E-Commerce	HB1-HB6
3	Not Applicable	Moderating Effects of sector in model A& B studied	Intention to adopt E-Commerce	HAM1-HAM9 HBM1-HBM6
4	C	E-Readiness factors (POER+PEER)	Level-0, Level-1, Level-2, Level-3 Level-4	HC1(a,b,c,d)-HC9 (a,b,c,d)
	D	Technological Factors Perceived Behavioural Control		HD1(a,b,c,d) HD6(a,b,c,d)

5.2 CONCEPTUAL MODEL- A (PERCEIVED E-READINESS FACTORS)

This model was developed to find answer to the first research question. Perceptions influence beliefs, attitudes and intentions and social behaviours (Davis, 1985, Davis, 1989, Cao and Everard, 2008, Graf, 2020, García-Sánchez et al., 2020, Ajzen, 1985), and perceptions about the E-Readiness of organisation or environment impact the organisational level E-Commerce adoption decision (Molla and Licker, 2005b). Perceived E-Readiness model was exclusively developed to measure internal and external E-Readiness as perceived by the decision makers of the organisations. The model was proposed in 2005 (Molla and Licker, 2005a) and later empirically validated and tested (Molla and Licker, 2005b). PERM comprehensively captures, measures, and models managerial, organisational, and environmental E-Readiness factors as perceptions. The dependent variable in the model is "Intention to adopt E-Commerce." Since perceptions influence behaviours directly and through the mediation of intentions towards a behaviour (Ajzen, 1985, Fishbein and Ajzen, 1975), we can propose that perceptions about E-Readiness can influence E-Commerce adoption behaviour through intention to adopt E-Commerce (Figure 5-1) . Description of dependent and independent variables of the model is presented in the following sections.

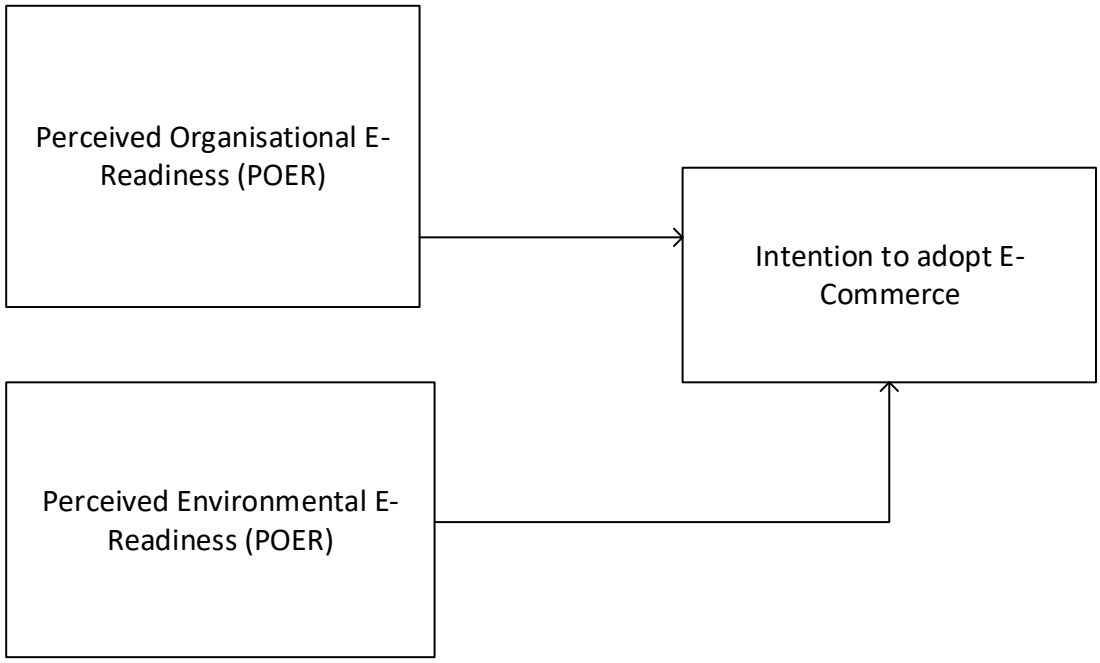


Figure 5-1: Conceptual model A - adopted from Molla and Licker (2005a) and Ajzen (1985)

5.2.1 DEPENDENT VARIABLE: INTENTION TO ADOPT E-COMMERCE AS PROXY OF E-COMMERCE ADOPTION

The intention is simply a measure of willingness and determination of an individual to perform a certain behaviour and Behavioural Intention (BI) is the subjective probability that individual will perform a target behaviour" (Fishbein and Ajzen, 1975). BI captures the "motivational" and "probability" of "likelihood of performing an action" on a scale from the subjects and can also be considered as "degree to which a person resolves to act in a certain way" (Hrisos et al., 2009). BI is one the most widely modelled construct in the social sciences and has been used to forecast demand of a certain product in marketing (O'Connor et al., 2016), predict certain human behaviours in human resource research (Schreurs et al., 2011, Carlson et al., 2017), in health sciences to predict certain health related

behaviours (Radtke et al., 2014, Hagger and Chatzisarantis, 2009, Chatterjee and Sennott, 2020). Most scholars assume that BI is a good proxy of the target behaviour. The theory of reasoned action (Fishbein and Ajzen, 1975) states that people do what they intend to do and do not do what they do not intend to do. Thus, in several behavioural theories of social significance state include "behavioural intention" as a proximal determinant of "target behaviour".

Meta-analysis shows that "Behavioural Intention" is a strong predictor of behaviour. The magnitude of the Intention behaviour relationship can be gauged through correlation analysis, causation analysis, or BI's predictive validity as a proxy of actual behaviour. Hrisos et al. (2009) did a meta-analysis of intention-behaviour relationships in several contexts, including health, exercise, and purchase behaviours, and found a correlation between two constructs ranging from 0.44 to 0.82. The meta-analysis also showed that the correlation between the two constructs is context sensitive. However, correlation is not the same as causation. Correlation without causation is also statistically possible, and the relationship may be influenced by biases (social, response, and common method). Causation can be studied by manipulating the "BI" and measuring "Actual Behaviour" for several values of BI. A meta-analysis of such studies shows that when BI is changed, "actual behaviour" also moves in the same direction but to less extent (Webb and Sheeran, 2006). This means although measuring only intentions as a proxy of actual behaviour may inflate the strength of the relationship between BI and actual behaviour, the BI does cause actual behaviour. Finally, the BI and actual behaviour relationship strength can be studied by finding how well BI predicts the actual behaviour. The best method to study the predictive power of BI is to find whether intentions measured by a specific sample accurately or comparably predict the behaviour of other comparable sample or population. A meta-analysis showed a significant correlation of the sample data with the population data (Morwitz et al., 2007). However, the predictive accuracy depends upon the types of the products and the way BI and actual behaviour are summarised(Jamieson and Bass, 1989). The relationship between Behavioural Intention (BI) and actual behaviour is influenced by several other factors such as the stability and certainty of the intention, repeated measures of the intention, and the level of thought put into forming the intention (BASSILI, 1993, Pieters and Verplanken, 1995). A strong BI-behaviour relationship is more likely when intentions are formed with certainty and confidence, are stable over time, and are formed after carefully considering the consequences of certain behaviours. On the other hand, if the intentions are uncertain or formed without careful thought, the relationship between BI and behaviour may be weakened (Conner et al., 2000) . Along with intentions, behaviour in question also affects the BI – Behaviour relationship. An individual may have strong intentions to act in a certain way, but the behaviour in question may not be under volitional control. It is a common observation, especially in health behaviours where the subject intends to sleep yet cannot because of lack of control over the behaviour. Similarly, unaccomplished new year resolutions are another example of poor control on the target behaviour despite having intentions. That explains why "perceived behavioural control" concept was added in models that relates to the intentions. Strong behavioural control over the target action logically leads to a strong relationship between intentions and behaviour. Some behaviours are challenging to perform because of the difficulty involved. Thus it is quite possible to have volitional control over the action, but perceived difficulty in performing the behaviour may lead to a poor intention-behaviour relationship (Trafimow et al., 2002). For example in a study, women found it embarrassing to ask their partners to use condoms despite having complete control over the behaviour in the question (Chan and Fishbein, 1993). Finally, the time gap between the measurement of intentions and behaviour is also important and Ajzen has repeatedly pointed out that there should be a minimum time gap between measurement of Intentions and Behaviour (Ajzen, 2020).

So, is it justified to use "intention to adopt E-Commerce" as a dependent variable in this study? As mentioned above, there exists a statistically significant correlation and causation between "Behavioural

Intentions" and "Behaviour". In fact Fishbein and Ajzen (1975) state that *"If one wants to know whether or not an individual will perform a given behaviour, the simplest and perhaps most efficient thing one can do is ask the individual whether he intends to perform the behaviour"*. While the relationship is moderated by contextual factors, it still seems to be a good choice to study E-Commerce adoption behaviour. The decision to adopt organisational E-Commerce requires careful thought and thus the "intentions" formed tend to be stable and well informed. The decision-makers are confident about their decisions, and it is very less likely that they change their minds. So well formed intentions result into a strong BI and behaviour relationship (Conner et al., 2000). E-Commerce adoption decision in organisations is a onetime decision and does not require repeated actions that normally tend to make intentions as a weaker predictor of some behaviours like regular exercise or quitting smoking (Scholz et al., 2008). While behavioural control has also been identified as a moderating factor of BI -behaviour relationship, and in certain cases managers may not be able to "adopt E-Commerce" despite having strong intentions due to lack of control over their behaviour , we must acknowledge that since management makes the business case for investments for approval by higher authorities, their intention to adopt E-Commerce still affect the target behaviour (Subramanian and Nosek, 2001, Saffu et al., 2008). Similarly, while Ajzen states that Intentions and behaviours should be measured with a minimal time gap, some scholars argue that the relationship can not only stay constant for longer periods but can even get stronger especially in case of E-Commerce adoption decisions (Randall and Wolff, 1994). So, in view of the above, the author believes that using "Intention to adopt E-Commerce" as a proxy of E-Commerce adoption behaviour is perfectly justified.

5.2.2 INDEPENDENT VARIABLES- MODEL -A

5.2.2.1 PERCEIVED ORGANISATIONAL E-READINESS

Perceived Organisational E-Readiness (POER) is part of the perceived E-Readiness models (PERM) and captures the internal E-Readiness of a firm as perceived by decision makers (Molla and Licker, 2005a, Molla and Licker, 2005b). POER audits the organisational E-Readiness by collecting the perceptions of managers on following.

(A) AWARENESS

The innovation diffusion or adoption is typically a stagged process. "Awareness" is often the first stage and is usually underrepresented (Larsen, 2011). Organisations need to be aware of the potential benefits and associated risks of the adoption of an innovation. The perceptions of benefits and risks are thus important influencing factors in the initial stage of E-Commerce adoption process. The Diffusion of Innovation Theory (DOI) (Rogers, 1995) states that the innovation adoption is a process that starts from the initial knowledge of innovation and terminates at the decision to adopt or reject an innovation. As organisational innovation adoption involves interplay of organisational and individual level variables, personal perceptions of the managers do matter in organisational level decisions especially when managers and staff are quite comfortable with existing practices, processes, and technologies. Proper awareness about the capabilities of innovation in question may play an important role in this initial "pre-adoption phase"(Aarons et al., 2011, Damanpour and Schneider, 2006, Garland et al., 2010). However, there is relatively low awareness about efficient usage and associated benefits in developing economies (Cloete et al., 2002, Montealegre, 1996, Montealegre, 1999b). Studies indicate that ability of managers and decision-makers to develop such know-how about the innovation positively relates to the E-Commerce adoption decision (Molla and Licker, 2005b).

(B) RESOURCES (HUMAN RESOURCES, BUSINESS RESOURCES, TECHNOLOGY RESOURCES)

The Resource component in the POER refers to the level of relevant human, technological and business resources (Powell and Dent-Micallef, 1997, Zhuang, 1999, Elia et al., 2021, Ausat and Suherlan, 2021).

Availability of the appropriate resources enables organisations to respond to the challenges and avail themselves the opportunities to gain competitive advantage (Hartman et al., 2001). Many organisations of the developing economies lack the necessary infrastructure, expertise, and experience to do business electronically, paperless, and cash-free. The resulting culture thus can impede E-Commerce adoption in developing economies to a great extent (Moodley, 2003, Odedra-Straub, 2003). So, it is important to measure and investigate availability of relevant resources to the organisations.

Organisational resources can be categorised into two main categories, tangible and non-tangible. Tangible resources include physical assets such as plant, equipment, and financial resources. On the other hand, non-tangible resources encompass an organisation's knowledge and reputation. These resources are critical to organisations as they provide a competitive advantage in both the short and long term. In addition to tangible and non-tangible resources, organisational capabilities also play a crucial role in innovation generation and adoption. The utilisation and deployment of available resources are only beneficial to organisations if they possess the capabilities to best utilise them. This requires the integration of all resources, both tangible and non-tangible, along with organisational capabilities to drive results (Barney, 1991, Marino and Lange, 1983, Chiu and Liaw, 2009). Although there is no clear consensus on the connection between the resources available to a firm and its output, it is widely acknowledged among scholars that these resources are crucial (Chiu and Liaw, 2009).

Having a single resource is not enough, competitiveness and strategic advantage are derived from a varied set of organisational resources, which form the foundation of effective performance. For instance, Information Technology was once seen as a disruptive technology that provided a strategic advantage to many organisations. However, with increased standardization and reduced ownership costs, it has become a commodity that is widely accessible at an affordable price. In such a scenario, it cannot form the basis of a strategic advantage but can only support or facilitate strategy implementation. Hence, organisations must have the right human resources to leverage Information Technology effectively to support the development of sound strategies and implement them to achieve a competitive advantage (Carr and Carr, 2004).

One of an organisation's most important assets is its skilled and knowledgeable employees (Chwelos et al., 2001, Wang and Cheung, 2004) . Human Resources have an enormous impact on an organisation's E-Commerce endeavour. A lack of information technology training and knowledge among staff employees could hinder E-Commerce adoption in several ways. For example, while general technical orientation of all staff is important for successful E-Commerce operations, the abilities of key decision-makers in estimating the expected returns on investment from E-Commerce adoption is also important for organisational E-Commerce adoption decisions. Forward-thinking management, adept at aligning E-Commerce investments with the needs of the organisation, on the other hand, has demonstrated a link to successful E-Commerce integration (Al-Hudhaif and Alkubeyyer, 2011, Elia et al., 2021).

Business Resources in the model refer to the organisational capability, financial resources, communication styles and availability of organisational slack to adopt E-Commerce (Hartman et al., 2001, Zhuang, 1999) . Since organisations need resources to maintain a certain level of output, organisational learning and competitive advantage (Bueno et al., 2010), several modern organisations now maintain a “buffer of resources” or “organisational slack” to face disruptive changes. The buffer or slack includes range of resources including human resources, technology, information, and financial resources (Pan et al., 2020). While there are divergent views on the relationship between organisational slack and performance (Pan et al., 2020, Lai and Guynes, 1997, Chiu and Liaw, 2009), there is consensus on the availability of the right set of resources and organisational slack to respond to the challenges of the modern business environment (Mohr, 1969, Kimberly and Evanisko, 1981, Marcati et al., 2008). Despite the declining cost of Information Technology, E-Commerce adoption still requires significant

financial resources. These resources are necessary to acquire and customise the appropriate E-Commerce application, as well as for training employees, paying for consulting services, and acquiring the necessary hardware and software. Previous studies have shown a positive correlation between Information Technology adoption and the financial resources of an organisation (Lertwongsatien and Wongpinunwatana, 2003, Hong and Zhu, 2006). In addition to the financial resources, some other capabilities and assets of a firm are equally important. These business resources influence organisational IT innovation adoption. For example “openness of the firm”, existing business relationships, risk-taking behaviour, and financial resources impact the information technology-based innovation adoption (Hartman et al., 2001).

Technological Resources in POER refer to the existing level of information technology base (Hartman et al., 2001, Powell and Dent-Micallef, 1997). Innovation is quickly adopted if the characteristics of the innovation are in line with the existing values and practices. Information Technology (IT) “extensive” organisations are more likely to adopt IT-based innovations (Lertwongsatien and Wongpinunwatana, 2003, Rahayu and Day, 2015). The technological base of an organisation is thus a very important factor that can influence E-Commerce adoption. Previous research established a positive link with E-Commerce adoption and availability of technological resources(Gregory et al., 2019, Abed, 2020), business resources (Elia et al., 2021, Wang et al., 2020) and human resources (Mexmonov, 2020, Sedyastuti et al., 2021)

(C) COMMITMENT

The commitment construct in the context of E-Commerce adoption refers to the dedication of key decision-makers in an organisation towards achieving goal of E-Commerce adoption. The behaviour of top management affects innovation adoption in several ways, including providing essential resources such as funds, training opportunities, and staff induction. These "resources" related to top management (Top Management Support Resources - TMSR) have a significant impact on project completion. While the level of change management required for innovation adoption may vary based on the characteristics of the innovation, the support of top management for change management (TMSC) increases the receptiveness to innovation adoption and essential. Additionally, successful innovation adoption also requires that middle management understands the core objectives and goals of the organisational innovation adoption. The sharing of top management's vision increases middle management buy-in. Thus, different dimensions of top management support influence the innovation adoption process at different levels (Dong et al., 2009). The literature suggests that the lack of top management support is one of the key factors responsible for information and communication technology project failures in developing countries (Montealegre, 1998; Wang and Cheung, 2004). In developing countries, the consistency of top management support is also a challenge as new management may view ongoing projects with scepticism and withdraw support resources, compromising innovation adoption (Galliers et al., 1998). Numerous studies have established a positive relationship between the commitment of leadership and the adoption of Information and Communication Technology-based solutions (Willcocks and Griffiths, 1997, Maduku et al., 2016, Young et al., 2001, Barham et al., 2020, Alsadi et al., 2021) .

(D) GOVERNANCE

Governance in the POER refers to the Information Technology Governance, which is part of overall corporate governance. Information Technology Governance is a framework aimed at efficiently managing the information technology within an organisation and driving value from IT investments (itgovernance, 2021). The frameworks are in the form of tactical and operational models that help organisations decide how to achieve IT-related objectives, allocate resources, and make IT investment decisions (Willcocks and Griffiths, 1997, Pereira et al., 2013). IT Governance model as a part of overall

corporate governance model, also defines what place an organisation gives to the adoption of ICT based solutions at different levels of the ICT adoption process i.e. from basic level to advanced level of adoption (Pereira et al., 2013, Hartman et al., 2001). While several studies show a positive relationship between IT-friendly IT Governance structure/ model with the ICT based solutions (Hartman et al., 2001, Pereira et al., 2013), most of the organisations in developing countries usually do not have well defined IT Governance structure or their IT governance model or the model is not IT-friendly (Palacios, 2003).

Based on the above discussion, we can hypothesise.

HA1: Awareness about E-Commerce is significantly positively to the intention to adopt E-commerce.

HA2: Availability of relevant Human Resources is significantly positively to the intention to adopt E-commerce.
HA3: Availability of relevant Business Resources is significantly positively related to the intention to adopt E-commerce.
HA4: Technology Resources are significantly positively related to the intention to adopt E-commerce.

HA5: Commitment toward E-Commerce adoption is significantly positively to the intention to adopt E-commerce
HA6: Governance is significantly positively to the intention to adopt E-commerce.

5.2.2.2 PERCEIVED EXTERNAL E-READINESS (PEER)

Perceived external E-Readiness captures the E-Readiness level of the environment within which an organisation operates. The external E-Readiness audit is done by collecting responses on three major factors - Government Readiness, Market forces Readiness, and Supporting Industries E-Readiness.

(A) GOVERNMENT E-READINESS

Governments play a crucial role in promoting Information Technology (IT) adoption by organisations. They can create a favourable environment to adopt IT solutions by establishing a supportive institutional framework. The level of government support affects the organisations' confidence and their plans for using IT, particularly in E-Commerce (Dutta et al., 2004, Oxley and Yeung, 2001, Chege and Wang, 2020, Chen et al., 2019a). The government's E-Readiness in PEER is related to the factors that are under the government's control and are normally reflected in the form of supportive infrastructure, legal and regulatory infrastructure, and E-Commerce usage directives related to consumers/traders (Kuan and Chau, 2001, Oxley and Yeung, 2001, Ahmad et al., 2013, Ramanathan et al., 2014). Governments' E- Readiness promotes E-Commerce adoption and exerts pressure on organisations to adopt E-Commerce (Molla and Licker, 2005b). In developing countries, government readiness is especially significant as the competitiveness among businesses is heavily influenced by the relationship between the government and businesses rather than the market forces. As a result, businesses' strategies, plans, and models to compete are heavily dependent on government policies and preferences. Governments in developing economies typically control technology-related policies and priorities, making their priorities, commitments, and preparedness towards IT development critical factors in the adoption of IT-based solutions in these countries (Montealegre, 1999a, Montealegre, 1998). Impact of Government E-Readiness has been empirically tested in many studies, and a positive relationship between government E-Readiness and E-Commerce adoption has been established. The firms who adopted E-Commerce perceived greater government E-Readiness than non-adopter firms (Kuan and Chau, 2001, Wang and Cheung, 2004, Effendi et al., 2020, Najib and Fahma, 2020).

(B) MARKET FORCES E- READINESS

"Market Forces" is an old and frequently used concept in economics theories and refers to the competitive pressure exerted by certain forces in the free economy. While market forces influence the price and output level in the market (Cleaver, 2011), market pressure can also influence the market in several other ways, including organisations' behaviour towards innovation adoption (Molla and Licker, 2005b). The basic market forces in economics are supply and demand, however, anything that can affect the free market can be called a market force (Spacey, 2018). The intensity and magnitude of pressure exerted by the market forces can dictate the competition rules and force the firms to make a certain decision(Cleaver, 2011). Market Forces E- Readiness in the PEER refers to the extent to which the customers, competitors, and partners of a specific firm have applied and adopted E-Commerce or the level of their preparedness to adopt E-Commerce (Molla and Licker, 2005b).

E-Commerce adoption follows the "network" externality principal which says the perceived benefits or surplus perceived from a product change with a change in the number of other users consuming same product (Liebowitz and Margolis, 1995) and usually, the most potent drivers of E-Commerce adoption are related to the external social system of the organisation (Au and Kauffman, 2001). So, when organisations perceive that their customers, suppliers, and competitors have already adopted E-Commerce or are ready to accept , they feel pressure to adopt E-Commerce (Au and Kauffman, 2001, Wang and Cheung, 2004). Unlike developed economies where the E-Commerce adoption rate is much higher, developing economies may tend to have low levels of market forces E-Readiness. Thus Market forces E-Readiness could be an important driving factor for firm-level E-Commerce adoption in developing economies context (Humphrey et al., 2003b). Several, previous studies have positively linked adoption of E-Commerce by a firm's competitors, suppliers, and customers to firms E-Commerce adoption decision (Al-Hudhaif and Alkubeyyer, 2011, Al-Somali et al., 2015).

(C) SUPPORT INDUSTRIES E-READINESS

Support Industries E-Readiness in PERM captures the E-Readiness of the E-Commerce supporting industries as perceived by the organisation's decision-makers. Organisations need initial support in the form of consultations before deciding to adopt E-Commerce. In addition, E-Commerce may require constant and periodic input from several relevant organisations to keep E-Commerce applications at optimum levels at different stages of E-Commerce adoption (Molla and Licker, 2005b). In addition to the initial consultations, other support industries linked to successful E-Commerce adoption and operations are the financial (banking) and transportation industries (Humphrey et al., 2003a, Travica, 2002). The availability of secure online payment processing platforms is an important factor in E-Commerce adoption both at the organisational and individual level (AlGhamdi et al., 2011, Ardiansah et al., 2020, Dada, 2006). Similarly, readiness of the third-party logistics services providers is also another facilitator of the organisational E-Commerce adoption as most of the products ordered online are required to be physically delivered to the buyers both within and across border. Timely delivery is now increasingly becoming the basis of competition among online sellers in developed countries as well (Winkenbach and Janjevic, 2018, Xu et al., 2008). It is important to audit the perceived preparedness of all the three crucial support industries in developing countries. Contrary to developing economies, the IT, financial, and logistic services provider industries are mature enough to exert a push pressure for organisational E-Commerce adoption in developed countries (Hartman et al., 2001, Hadidi, 2003, Humphrey et al., 2003a), however, in developing economies supporting industries E-Readiness still seems to be an influential factor in organisational level E-Commerce adoption (Al-Hudhaif and Alkubeyyer, 2011, Sindakis and Aggarwal, 2022, Lestari, 2019).

Based on the above, we can hypothesise the following for the sub-constructs PEER.

HA-7: Government E-Readiness is significantly positively related to the Intention to adopt E-commerce.
HA-8: Market Forces E-Readiness is significantly positively related to the Intention to adopt E-commerce.
HA-9: Support Industries E-Readiness is significantly positively related to the Intention to adopt E-commerce.

Based on the above we can present the suggested model (A) with hypotheses as presented below in Figure 5-2.

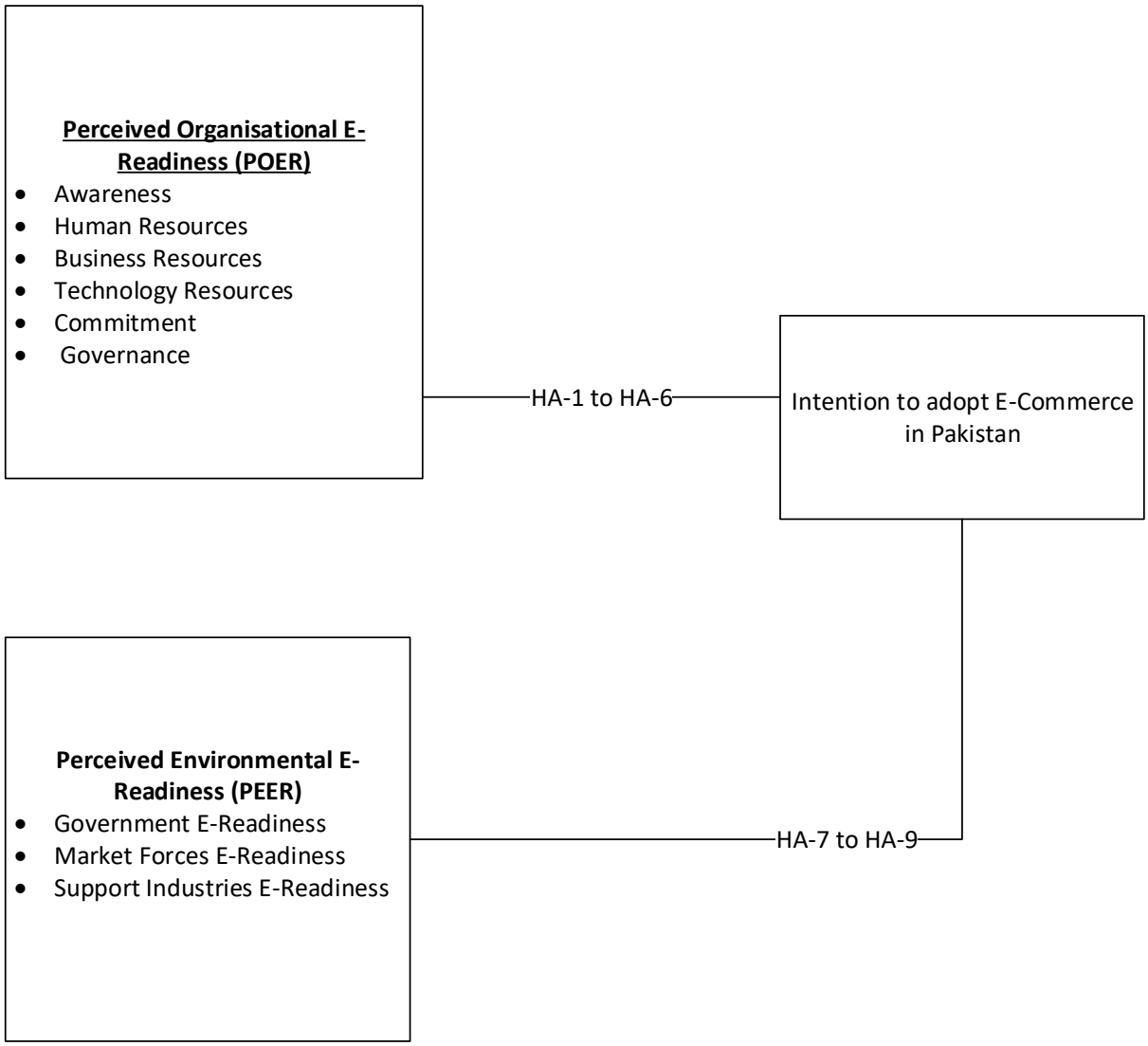


Figure 5-2: Conceptual Model A- E-Readiness Factors model (Hypotheses)

5.3 CONCEPTUAL MODEL -B (TECHNOLOGICAL AND PERCEIVED BEHAVIOURAL CONTROL FACTORS)

Model B (Figure 5-3) is developed to answer research question 2 (section 1.3) by investigating the relationship among technological factors along with the perceived behavioural control with intention to adopt E-Commerce. The depended variable "intention to adopt E-Commerce" again has been used as proxy of E-Commerce adoption behaviour.

5.3.1 TECHNOLOGICAL FACTORS

Several previous studies have empirically proved that perceptions about technology characteristics for example its perceived ability to be used advantageously affect technology adoption decisions (Cruz-Jesus et al., 2019, Sayginer and Ercan, 2020, Effendi et al., 2020, Chatterjee et al., 2021). In this study, technology constructs refer to the perceived attributes of E-Commerce technology that influence its perceived ability to be used advantageously. According to Tornatzky and Klein (1982), these attributes can be divided into primary (objective) characteristics, such as cost, size, and security, and secondary (subjective) characteristics, such as relative advantage and ease of use. Secondary characteristics have a more significant impact on technology adoption decisions, with technology characteristics in general explaining a significant proportion (49% to 87%) of innovation adoption (Rogers, 1995). Researchers have studied a combination of several technological attributes in E-Commerce adoption studies (Limthongchai and Speece, 2003, Rahayu and Day, 2015, Alrousan and Jones, 2016). However, impact of these technological attributes are highly contextual, and we find that certain technology characteristic found significantly related to the innovation adoption in one study are found irrelevant in the other (Al-Somali et al., 2010). In this study, we are studying the following technical characteristics of E-Commerce.

1) Perceived Relative Advantage
2) Perceived Compatibility
3) Perceived Ease of Use
4) Perceived Cost Acceptability
5) Perceived Security

Perceived Relative Advantage refers to the degree to which an innovation is considered better than the process/technology it is replacing (Rogers, 1995). Innovations that have clear and unambiguous advantages over the existing processes/technology are adopted readily. This is perhaps the first and most important characteristic that justifies the innovation adoption. In other words, we can say that "relative advantage" is the *sine qua non* for innovation adoption (Greenhalgh et al., 2004). Relative advantage alone cannot ensure innovation adoption, the innovation in question needs to be compatible with the current processes, needs, values, beliefs, and history.

Perceived Compatibility is a measure of the degree to which an innovation is considered compatible with existing needs, practices, values etc. An innovation perceived as compatible is likely to be adopted easily (Rogers, 1995, Rogers and Marshall, 2003).

Another, characteristic related to use of innovation is Perceived Ease of Use (PEOU). PEOU is the degree to which the use of an innovation is perceived to be free of effort (Davis, 1985). Information systems perceived as easy to use are more easily adopted by businesses(Lee et al., 2001, Tan and Teo, 2000). PEOU can have both direct and indirect effects on innovation adoption depending upon the reason for adoption. Motivation to adopt E-Commerce could be "intrinsic" or "extrinsic". PEOU can directly be related to the adoption of an innovation If the reason for adoption is intrinsic. In contrast, in cases where the innovation adoption is extrinsic (outcomes or results of adoption), the PEOU can influence the innovation adoption through perceived usefulness/ relative advantage etc. (Gefen and Straub, 2000a). However, in the case of E-Commerce adoption, the adoption motivations are likely to be a blend of intrinsic (ease of navigation, better interface) and extrinsic (improve the overall performance), the PEOU is likely to have both direct and indirect effects. For example, the easy-to-learn and use interface of E-Commerce is likely to increase the perceived value of the E-Commerce system. PEOU not always influences the innovation adoption decision as this relationship is highly contextual (Chau, 1996,

Gefen, 2000, Igbaria et al., 1995, Keil et al., 1995). However, in an E-Commerce context, a significant number of studies have empirically established a positive relationship between PEOU and E-Commerce adoption decision (Wei et al., 2009, Gangwar et al., 2015, Looi, 2005, Chooprayoon et al., 2007, Fayad and Paper, 2015).

ICT innovations that require data transfer over the internet have a unique associated **"Security Concern"** with them and can be defined as the degree to which the internet platform is deemed to be secure for data or financial transactions(Zhu et al., 2006a). Internet is based on open standards, and unlike legacy electronic data exchange (EDI) it gives little or no control over the data exchange and access. Organisations and customers thus may be concerned about information security, privacy, and unauthorised data access(Stewart and Segars, 2002). In certain cases where E-Commerce is integrated with the whole value chain, organisations may exchange core corporate data and financial transactions, leading to security concerns. In addition, especially in developing economies, E-Commerce is relatively a new phenomenon. Most developing economies lack mature institutional infrastructure to support the E-Commerce related contracts that protect and support online transactions (Thatcher et al., 2006, Li and Xie, 2012). Literature indicates an increased security concern retards the innovation/ IT adoption(Zhu et al., 2006a, Abed, 2020, Ayob et al., 2021). Another, technological factor, is cost associated with E-Commerce adoption. information and communication technology (ICT) based innovations adoption requires financial investment for an initial purchase of the software and hardware infrastructure and employee training (Chircu and Kauffman, 2000). In addition to the initial costs involved, ICT based solutions may also require business restructuring, costs related to the provision of a single integrated technology base by combining fragmented IT modules, business process reengineering costs, and maintenance and upgrade costs (Zhu and Kraemer, 2005, Zhu et al., 2006b) which may inhibit technology adoption (Sharma and Citurs, 2005). Several previous studies have established a negative relationship between perceived cost of technology and its adoption (Toh et al., 2009, Carlsson et al., 2006).

5.3.2 PERCEIVED BEHAVIOURAL CONTROL

Not all actions are fully under an individual's control, so even with a strong positive attitude towards an action, they may not be able to perform it. This is why the concept of perceived behavioural control (PBC) was introduced in behaviour models, to capture a person's perception of their capability to act. (Carrington et al., 2010). This construct was introduced as a determinant of intention and behaviour to account for behaviours which are not voluntary (Ajzen, 1985). Later, the construct was used in several other social behaviour theories as well, including health belief model (Strecher and Rosenstock, 1997), protection motivation theory (Rogers and Prentice-Dunn, 1997), and health-action process approach (Schwarzer, 2002). While some scholars call it similar to self-efficacy that has been incorporated with different labels within the psychology theories (Wallston, 2001), others argue that it is not as simple as self-efficacy, rather it is a multidimensional formative construct having lower-order constructs which do not always correlate (Armitage and Conner, 1999, Trafimow et al., 2002). Ajzen (2002), in his research article, tried to clarify the conceptual and operational ambiguities of the PBC concept. According to Ajzen, PBC is a second-order construct with two lower-order constructs named "Perceived Controllability" and "Perceived Self-Efficacy". Perceived controllability refers to the degree of perceived "external" control to perform a behaviour, and "Perceived Self-Efficacy" refers to the degree of perceived internal control to act. So, controllability measures the extent to which acting is under the actor's direct control and is affected by the factors like cooperation from others, availability of finances, and habits (Ajzen, 2002). Perceived Self-Efficacy is "internal" in nature and is determined by time, willpower, skills, and abilities. This lower order construct resembles conceptually with similar construct of Bandura et al. (1999). Both lower order constructs, do relate to each other in some cases while in

certain cases they appear to be unrelated (Trafimow et al., 2002). It is important to measure PBC in our study because for two main reasons (1) the locus of control relevant to several E-Commerce adoption inputs in the developing economies is likely to be in government's control (Montealegre, 1999a, Montealegre, 1998) and (2) there could be a significant difference in the perceived behavioural control in public and private sectors (Cats-Baril and Thompson, 1995). In the Theory of Planned Behaviour, perceived behavioural control influences not only the intentions but actual behaviour as well. Several studies have empirically tested this relationship (Mishra, 1970, Pavlou and Fygenson, 2006, Uzoka et al., 2007). Based on the above, we propose the following conceptual model with constructs borrowed from constructs of Technology constructs of TOE-based studies (Zhu et al., 2006a, Moore and Benbasat, 1991), Perceived Behavioural Control and Intention to adopt E-Commerce (Behavioural Intention) from the Theory of Planned Behaviour (Ajzen, 1985).

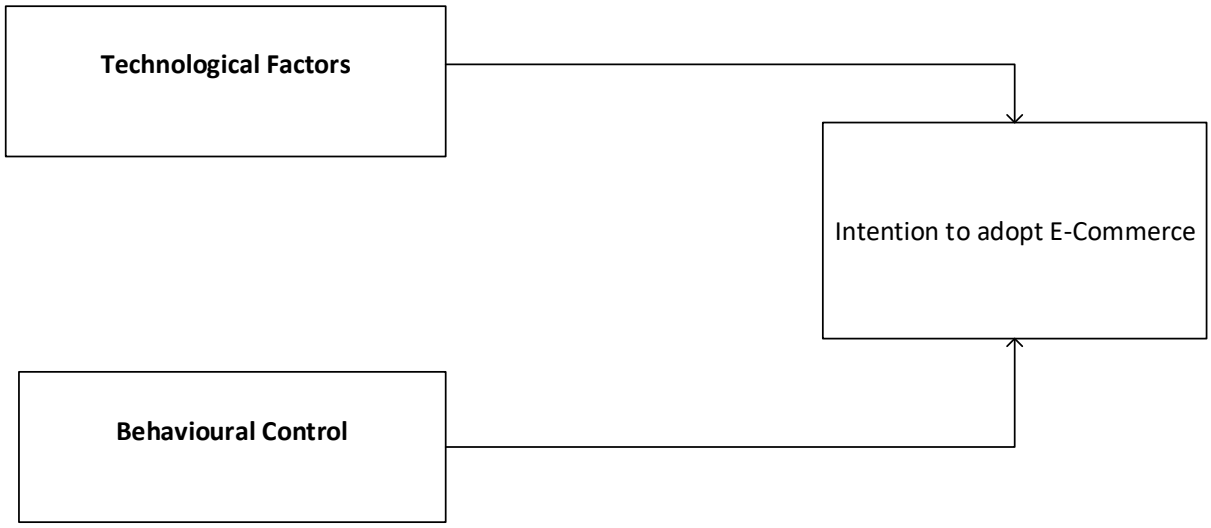


Figure 5-3: Conceptual model-B Technological and Perceived Behavioural Control factors model. Adopted from Technology Organisation Environment model (Tornatzky et al., 1991) and Theory of Planned Behaviour (Ajzen, 1985) .

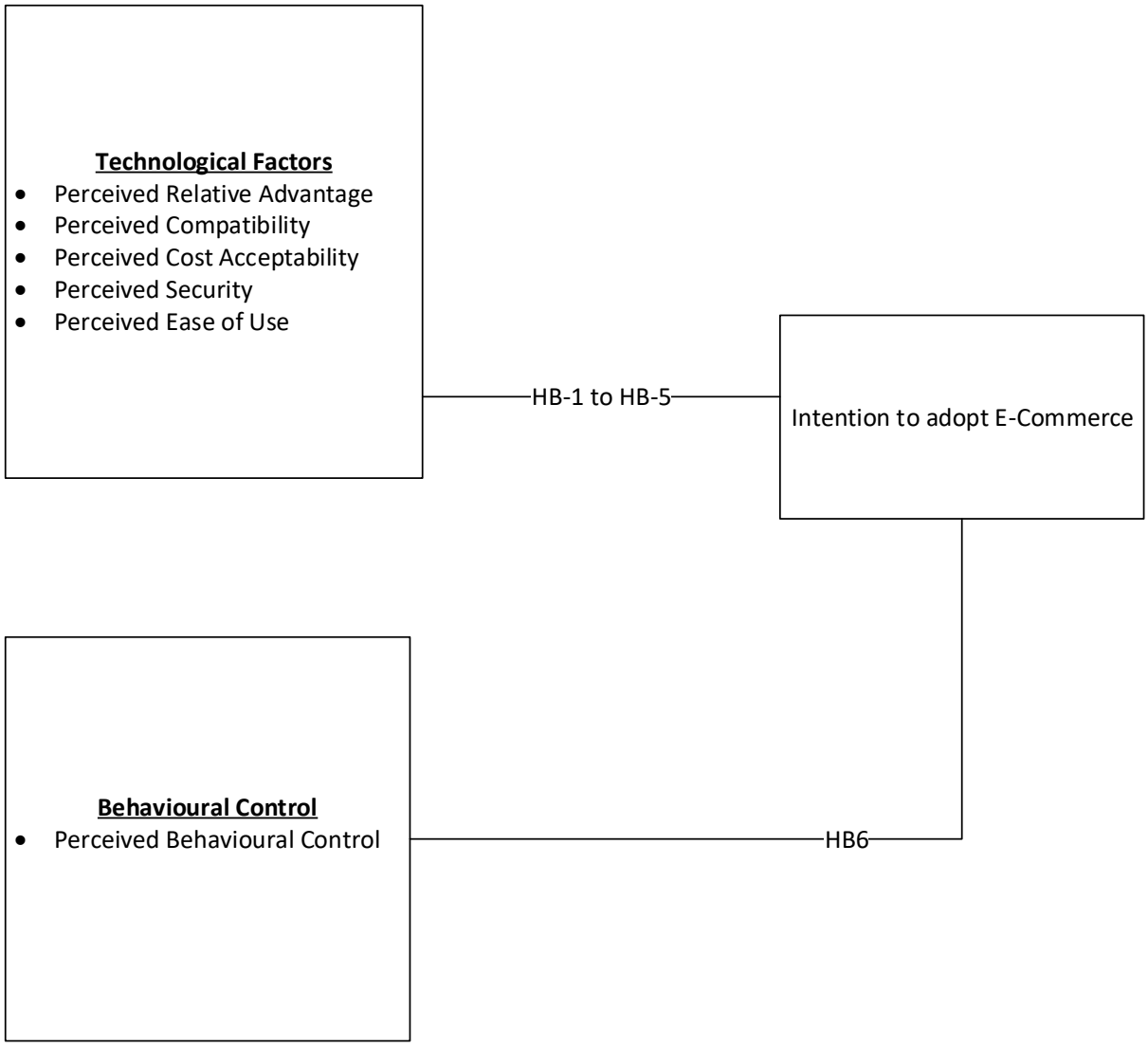


Figure 5-4: Conceptual Model B – Hypotheses, Source Author.

Based upon the above discussion, we can hypothesise that.

HB-1: Perceived Relative Advantage of E-Commerce is significantly positively related to intention to adopt E-Commerce.
HB-2: Perceived Compatibility of E-Commerce is significantly positively related to the intention to adopt E-commerce.
HB-3: Perceived Cost Acceptability is significantly positively related to the Intention to adopt E-commerce.
HB-4: Perceived Security is significantly positively related to the intention to adopt E-commerce.
HB-5: Perceived Ease of Use is significantly positively related to the intention to adopt E-commerce.
HB-6: Perceived Behavioural Control is significantly positively related to the intention to adopt E-commerce.

The conceptual model (B) along with hypotheses is presented in Figure 5-4.

5.4 COMPARISON OF MODELS IN PUBLIC AND PRIVATE SECTOR - MODERATION EFFECT OF SECTOR

To answer, the third research question (section 1.3), datasets were divided into public and private sectors and then any possible moderating effect of sector was studied through "Multi-Group Analysis" (MGA). Figure 5-5 explains the conceptual model to study the moderation effect of sector on model A and B.

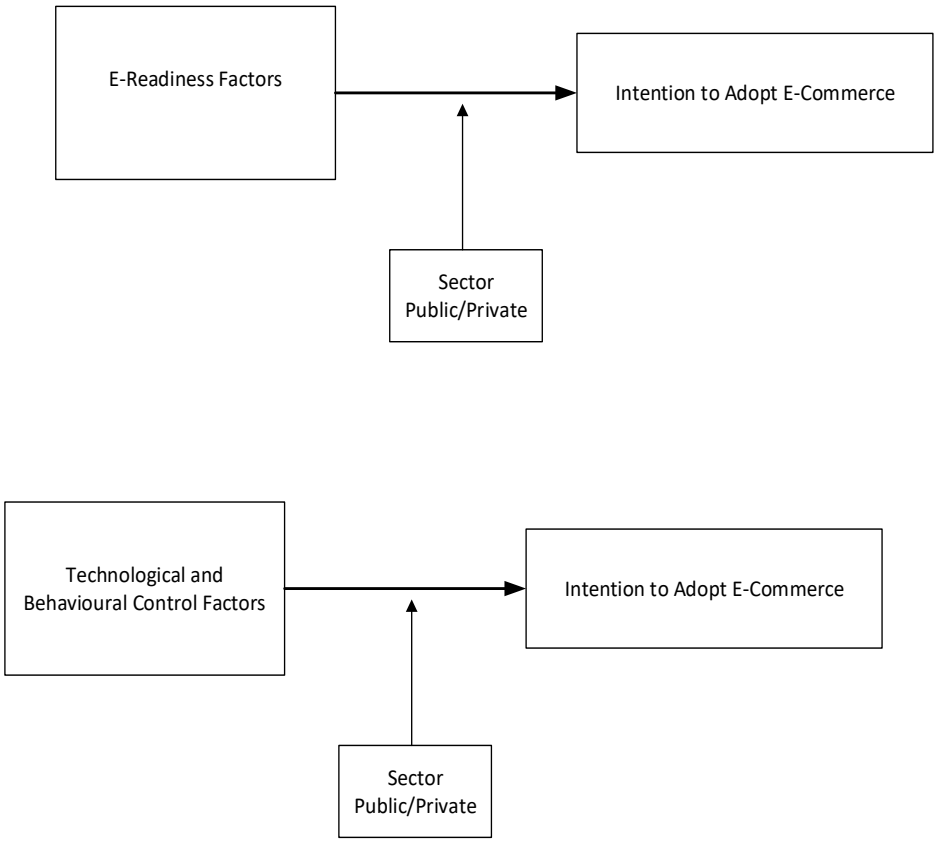


Figure 5-5: Comparison of public and private sector.

As explained in section 3.2.1, public and private sectors may have different E-Commerce adoption approach due to distinct purposes, control structures, and objectives. Hence relationships of Model -A and Model-B could have moderating effects of sectors and we can hypothesise this moderation as follows.

5.4.1 MODERATION EFFECT OF SECTOR ON PERCEIVED E-READINESS FACTORS MODEL

HAM1: Awareness about E-Commerce and intention to adopt E-commerce relationship is moderated by sector.
HAM2: Availability of relevant Human Resources and intention to adopt E-commerce relationship is moderated by sector.
HAM3: Availability of relevant Business Resources and intention to adopt E-commerce relationship is moderated by sector.
HAM4: Technology Resources and intention to adopt E-commerce relationship is moderated by sector.

HAM5: Commitment toward E-Commerce adoption and intention to adopt E-commerce relationship is moderated by sector.
HAM6: Governance and intention to adopt E-commerce relationship is moderated by sector.

HAM-7: Government E-Readiness and Intention to adopt E-commerce relationship is moderated by sector.
HAM-8: Market forces E-Readiness and Intention to adopt E-commerce relationship is moderated by sector.
HAM-9: Support industries E-Readiness and Intention to adopt E-commerce relationship is moderated by sector.

5.4.2 MODERATION EFFECT OF SECTOR ON TECHNOLOGICAL AND PERCEIVED BEHAVIOURAL CONTROL FACTORS MODEL

HBM-1: Perceived Relative Advantage of E-Commerce and intention to adopt E-Commerce relationship is moderated by sector.
HBM-2: Perceived Compatibility of E-Commerce and intention to adopt E-commerce relationship is moderated by sector.
HBM-3: Perceived Cost Acceptability and Intention to adopt E-commerce relationship is moderated by sector.
HBM-4: Perceived Security and intention to adopt E-commerce relationship is moderated by sector.
HBM-5: Perceived Ease of Use and intention to adopt E-commerce relationship is moderated by sector.
HBM-6: Perceived Behavioural Control and intention to adopt E-commerce relationship is moderated by sector.

5.5 STAGES OF E-COMMERCE DEVELOPMENT – RELATIONSHIP OF E-COMMERCE DETERMINANTS WITH DIFFERENT E-COMMERCE ADOPTION LEVELS

The adoption of E-Commerce innovation within an organisation is a phased process, which involves several steps and factors that may impact its implementation and integration with the existing business processes differently at each stage. The variables, such as organisational culture, technology infrastructure, and market demand, can influence the speed and success of the adoption (Rogers, 1995, Rohrbach et al., 1993). To study, how different clusters of variables impact each development phase, it was important to map E-Commerce development on some model. So, an E-Commerce development model was proposed based on the literature survey. Next, impact of predictor variables of model A and B was studied on each stage of E-Commerce development (Figure 5-6). Thus, two models model C (Figure 5-7) and model D (Figure 5-8) were used to study the impact of E-Readiness factors and technological and behavioural factors on each proposed E-Commerce adoption stage. Following sections describe the proposed E-Commerce development model. Each stage of E-Commerce development is expplained in detail in following sections and summrised in Table 5-2.

5.5.1.1 NON-INTERACTIVE E-COMMERCE ADOPTION

Non -Interactive E-Commerce adoption is the first level of adoption in the proposed model. This level is often driven by the present or anticipated performance gap which organisations try to cover through innovation adoption (Hyötyläinen, 1998, Rogers, 1995). The stage is usually a result of the “initiation or pre-adoption stage”. Firms at the initiation stage engage in activities that help them make decisions to

adopt or reject an innovation (Rogers, 1995, Lin and Lee, 2005). The output of this stage is the formation of attitudes towards innovation adoption and the decision to adopt or reject an innovation (Rogers, 1995). The attitudes are important. If decision-makers within an organisation have positive attitudes toward innovation adoption, they allocate necessary resources for the adoption of innovation (Meyer and Goes, 1988). Non- Interactive E-Commerce adoption results from "positive attitudes" formed by the decision-makers in the organisations. The decision-makers have already recognised the importance of E-Commerce adoption, its possible benefits. According to Norris et al. (2000), a company's early E-Commerce activities are almost always intended to reach the customer, and later activities are aimed at streamlining all value chain activities to deliver great value/ experience to the customer. Hartman et al. (2001) described this stage as the "Net Readiness era". characterised by organisational usage of the internet as a bulletin board for brochures, a list of telephone numbers and/or emails, and product catalogues. However, the net is used as a one-way publishing tool at this stage.

5.5.1.2 INTERACTIVE E-COMMERCE ADOPTION

The key difference between the "non interactive" and "interactive" stage is the organisational capability to engage in two-way communication with consumers and businesses. This stage is characterised by a website that enables the customers to do dialogue, ask questions about products/services, demand, and dictate to the company (Hartman et al., 2001). In addition to the information provided on the website (in the non-interactive stage), this stage may allow customers to order, provide feedback, or engage with the customer services. The second stage thus allows the firms to not only reach but engage the customers as well (Le and Koh, 2002). The website may host certain databases and display the page content dynamically. In the public sector, citizens/ businesses can fill and submit forms online, submit any query, order some product or service but cannot pay at the website. The interactive website at this stage provides information to the users and collects the same from the customers and disseminates it to the concerned departments. Ideally, at this stage, organisations need to ensure that the information gathered is used wisely by all relevant departments in addition to the sales or marketing department. This stage may require a certain level of business process re-engineering or restructuring of the organisation to deal with the information inflow through the web. For example, a dedicated customer service or sales team may be required to deal with online orders/ queries (Rao et al., 2003, Vlosky, 1999).

5.5.1.3 TRANSACTIVE/PORTAL ADOPTION

The transactive/ Portal adoption is different from stage -2 mainly due to an online transaction facility, usage of cookies, and individual account creation facilities. Organisations use information collected through the website to provide personalised recommendations about the services and products to their customers. The stage may also include online communities that allow website users to discuss common interests and share their views/feedback (Timmers, 1999). Websites having e-auction facilities or e-marketplaces (where different sellers sell products on a single website) are common examples of this stage. Citizens/ businesses can pay online for licenses, passports, identity cards, or other products and services in the public sector. The stage requires a greater degree of technical know-how and financial investment. Thus, organisations must have enough financial resources, necessary internal competencies at this stage (Rao et al., 2003). Since the main feature of this stage is the online transaction capability and customisation, the organisations need to pay special attention to providing a secure online environment sourced at competitive rates (Bishop, 1999). In addition, organisations need to ensure that important structural changes are in place to allow safe storage and proper usage of personalised information gathered through websites (Rao et al., 2003).

5.5.1.4 INTEGRATIVE ADOPTION

Integrated E-Commerce adoption is the most advanced stage of E-Commerce development in proposed four stage model. The hall mark of this stage is integration. All the business processes within the organisation are integrated. Usually, E-Commerce operations are integrated through enterprise resource planning (ERP) modules like supply chain management, customer services management, material management, production planning, financial management, and human resource management, depending upon the level of integration and type of business (Raymond et al., 2006, Luttighuis and Biemans, 2000, Frank, 2004, Hesterbrink, 1999). There is a real-time information flow between different functional departments of the organisation or (in some cases) with suppliers as well. All the relevant departments are integrated both vertically and horizontally (Layne and Lee, 2001). This means that the internal functional departments are interconnected and may integrate relevant departments at the same government level and different government levels.

Table 5-2: Mapping of different stages of organisational E-Commerce development.

Level	Level Name	Characteristics (private sector)	Characteristics (public sector)
1	Non interactive	Business e-mail Static website with no two-way communication Downloadable information from the website	Official e-mails of different relevant functional departments or Single E-mail for communication with citizens, businesses, and other governmental organisations. Static website with no two-way communication. Downloadable forms from the website
2	Interactive	Web site with two-way communication capability Online query submission/ online forms submission. Online ordering but no financial transaction facility. Web pages that dynamically generate/refresh the page content	Web site with two-way communication capability Online query submission/ online form submission. Online ordering of services or products but no financial transaction facility. Web pages that dynamically generate/refresh the page content
3	Transactive/ Portal	Websites/ portals that allow financial transactions. The website/portal allows a customer to make a personalised account with your organisation. Online Communities	Websites/ portals that allow financial transactions (paying bills online, renewing licenses etc.) The website/portal allows a customer to make a personalised account with the organisation. Online Communities
4	Integrative	All relevant functional departments/ business processes are integrated.	All relevant functional departments within the organisation and business processes are integrated. The web portal/ website is integrated with other relevant departments/ organisations of the public sector.

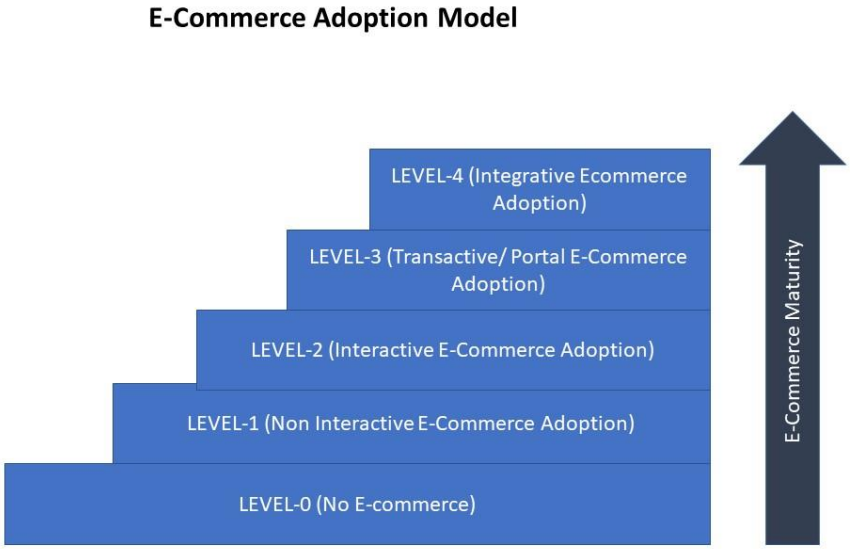


Figure 5-6: E-Commerce adoption development model adopted from Rao et al. (2003) and Symonds (2000).

5.5.2 CONCEPTUAL MODELS FOR STUDY OF INFLUENCE E-READINESS, TECHNOLOGICAL AND PERCEIVED BEHAVIOURAL CONTROL FACTORS ON E-COMMERCE DEVELOPMENT STAGES (MODEL-C, MODEL-D)

Pakistani E-Commerce studies typically analyse E-Commerce adoption as a singular dependent variable, often neglecting to examine the different stages of E-Commerce development (sophistication) within organisations and the influence of independent variables across different levels of sophistication (Seyal et al., 2004, Abbas et al., 2018, Nazir and Zhu, 2018). Therefore, it was essential to study factors that have discriminating impacts on the E-Commerce adoption stages. To study the influence of E-Readiness, Technological factors, and Perceived Behavioural Control on adopted E-Commerce development model (Figure 5-6), another two models were developed by using original predictor variables in models A and B and using each stage of E-Commerce development as outcome variable. Previous studies have established that factors that relate to initial E-Commerce adoption decisions can also relate to higher maturity levels of E-Commerce within organisations with varying strength and impact on each stage (Molla and Licker, 2005b, Abdulhakeem et al., 2017). This makes argument for the following hypotheses.

5.5.2.1 E-READINESS FACTORS AND ORGANISATIONAL E-COMMERCE DEVELOPMENT HYPOTHESES

HC 1a: Awareness of E-Commerce is significantly positively related to the organisational non interactive E-Commerce adoption in Pakistan.
HC 1b: Awareness of E-Commerce is significantly positively related to the organisational interactive E-Commerce adoption in Pakistan.
HC 1c: Awareness of E-Commerce is significantly positively related to the organisational Transactive/portal E-Commerce adoption in Pakistan.
HC 1d: Awareness of E-Commerce is significantly positively related to the organisational Integrative E-Commerce adoption in Pakistan.

HC 2a: Human Resources availability is significantly positively related to the organisational non interactive E-Commerce adoption in Pakistan
HC 2b: Human Resources availability is significantly positively related to the organisational Interactive E-Commerce adoption in Pakistan
HC 2c: Human Resources availability is significantly positively related to the organisational Transactive/ Portal E-Commerce adoption in Pakistan
HC 2d: Human Resources availability is significantly positively related to the organisational integrative E-Commerce adoption in Pakistan
HC 3a: Business Resources availability is significantly positively related to the non-interactive organisational E-Commerce adoption in Pakistan.
HC 3b: Business Resource availability is significantly positively related to the Interactive organisational E-Commerce adoption in Pakistan.
HC 3c: Business Resources availability is significantly positively related to the transactive/ portal organisational E-Commerce adoption in Pakistan.
HC 3d: Business Resource availability is significantly positively related to the integrative organisational E-Commerce adoption in Pakistan.
HC 4a: Technology Resources availability is significantly positively related to the organisational non interactive E-Commerce adoption in Pakistan
HC 4b: Technology Resources availability is significantly positively related to the organisational Interactive E-Commerce adoption in Pakistan
HC 4c: Technology Resources availability is significantly positively related to the organisational transactive/portal E-Commerce adoption in Pakistan
HC 4d: Technology Resource availability is significantly positively related to the organisational integrative E-Commerce adoption in Pakistan
HC 5a: Commitment toward E-Commerce adoption is significantly positively related to the organisational Non interactive E-Commerce adoption in Pakistan.
HC 5b: Commitment toward E-Commerce adoption is significantly positively related to the organisational Interactive E-Commerce adoption in Pakistan.
HC 5c: Commitment toward E-Commerce adoption is significantly positively related to the organisational transactive/ portal E-Commerce adoption in Pakistan.
HC 5d: Commitment toward E-Commerce adoption is significantly positively related to the organisational integrative E-Commerce adoption in Pakistan.
HC 6a: Governance is significantly positively related to the organisational non interactive E-Commerce adoption in Pakistan
HC 6b: Governance is significantly positively related to the organisational Interactive E-Commerce adoption in Pakistan
HC 6c: Governance is significantly positively related to the organisational transactive/ portal E-Commerce adoption in Pakistan
HC 6d: Governance is significantly positively related to the organisational integrative E-Commerce adoption in Pakistan
HC 7a: Government E-Readiness is significantly positively related to the organisational non interactive E-Commerce adoption in Pakistan
HC 7b: Government E-Readiness is significantly positively related to the organisational Interactive E-Commerce adoption in Pakistan
HC 7c: Government E-Readiness is significantly positively related to the organisational integrative E-Commerce adoption in Pakistan
HC 7d: Government E-Readiness is significantly positively related to the organisational integrative E-Commerce adoption in Pakistan
HC 8a: Market Forces E-Readiness is significantly positively related to the organisational non interactive E-Commerce adoption in Pakistan.

HC 8b: Market Forces E-Readiness is significantly positively related to the organisational interactive E-Commerce adoption in Pakistan.
HC 8c: Market Forces E-Readiness is significantly positively related to the organisational transactive/ portal E-Commerce adoption in Pakistan.
HC 8d: Market Forces E-Readiness is significantly positively related to the organisational integrative E-Commerce adoption in Pakistan.
HC 9a: Support Industries E-Readiness is significantly positively related to the organisational non interactive E-Commerce adoption in Pakistan.
HC 9b: Support Industries E-Readiness is significantly positively related to the organisational Interactive E-Commerce adoption in Pakistan.
HC 9c: Support Industries E-Readiness is significantly positively related to the organisational transactive/ portal E-Commerce adoption in Pakistan.
HC 9d: Support Industries E-Readiness is significantly positively related to the organisational integrative E-Commerce adoption in Pakistan.

5.5.2.2 TECHNOLOGICAL AND PERCEIVED BEHAVIOURAL CONTROL FACTORS AND ORGANISATIONAL E-COMMERCE DEVELOPMENT HYPOTHESES

HD 1a: Perceived Relative Advantage is significantly and positively related to the organisational non interactive E-Commerce adoption in Pakistan.
HD 1b: Perceived Relative Advantage is significantly and positively related to the organisational interactive E-Commerce adoption in Pakistan.
HD 1c: Perceived Relative Advantage is significantly and positively related to the organisational transactive/ portal E-Commerce adoption in Pakistan.
HD 1d: Perceived Relative Advantage is significantly and positively related to the organisational integrative E-Commerce adoption in Pakistan.
HD 2a: Perceived Compatibility is significantly and positively related to the organisational non interactive E-Commerce adoption in Pakistan.
HD 2b: Perceived Compatibility is significantly and positively related to the organisational Interactive E-Commerce adoption in Pakistan.
HD 2c: Perceived Compatibility is significantly and positively related to the organisational transactive/portal E-Commerce adoption in Pakistan.
HD 2d: Perceived Compatibility is significantly and positively related to the organisational integrative E-Commerce adoption in Pakistan.
HD 3a: Perceived Cost Acceptability is significantly and positively related to the organisational non interactive E-Commerce adoption in Pakistan.
HD 3b: Perceived Cost Acceptability is significantly and positively related to the organisational interactive E-Commerce adoption in Pakistan.
HD 3c: Perceived Cost Acceptability is significantly and positively related to the organisational transactive/ portal E-Commerce adoption in Pakistan.
HD 3d: Perceived Cost Acceptability is significantly and positively related to the organisational integrative E-Commerce adoption in Pakistan.
HD 4a: Perceived Security is significantly and positively related to the organisational non interactive E-Commerce adoption in Pakistan.
HD 4b: Perceived Security is significantly and positively related to the organisational interactive E-Commerce adoption in Pakistan.
HD 4c: Perceived Security is significantly and positively related to the organisational transactive/portal E-Commerce adoption in Pakistan.
HD 4d: Perceived Security is significantly and positively related to the organisational integrative E-Commerce adoption in Pakistan.

HD 5a: Perceived Ease of Use is significantly and positively related to the organisational non interactive E-Commerce adoption in Pakistan.
HD 5b: Perceived Ease of Use is significantly and positively related to the organisational interactive E-Commerce adoption in Pakistan.
HD 5c: Perceived Ease of Use is significantly and positively related to the organisational transactive/portal E-Commerce adoption in Pakistan.
HD 5d: Perceived Ease of Use is significantly and positively related to the organisational integrative E-Commerce adoption in Pakistan.
HD 6a: Perceived Behavioural Control is significantly positively related to the organisational non interactive E-Commerce adoption in Pakistan
HD 6b: Perceived Behavioural Control is significantly positively related to the organisational interactive E-Commerce adoption in Pakistan
HD 6c: Perceived Behavioural Control is significantly positively related to the organisational transactive/portal E-Commerce adoption in Pakistan
HD 6d: Perceived Behavioural Control is significantly positively related to the organisational integrative E-Commerce adoption in Pakistan

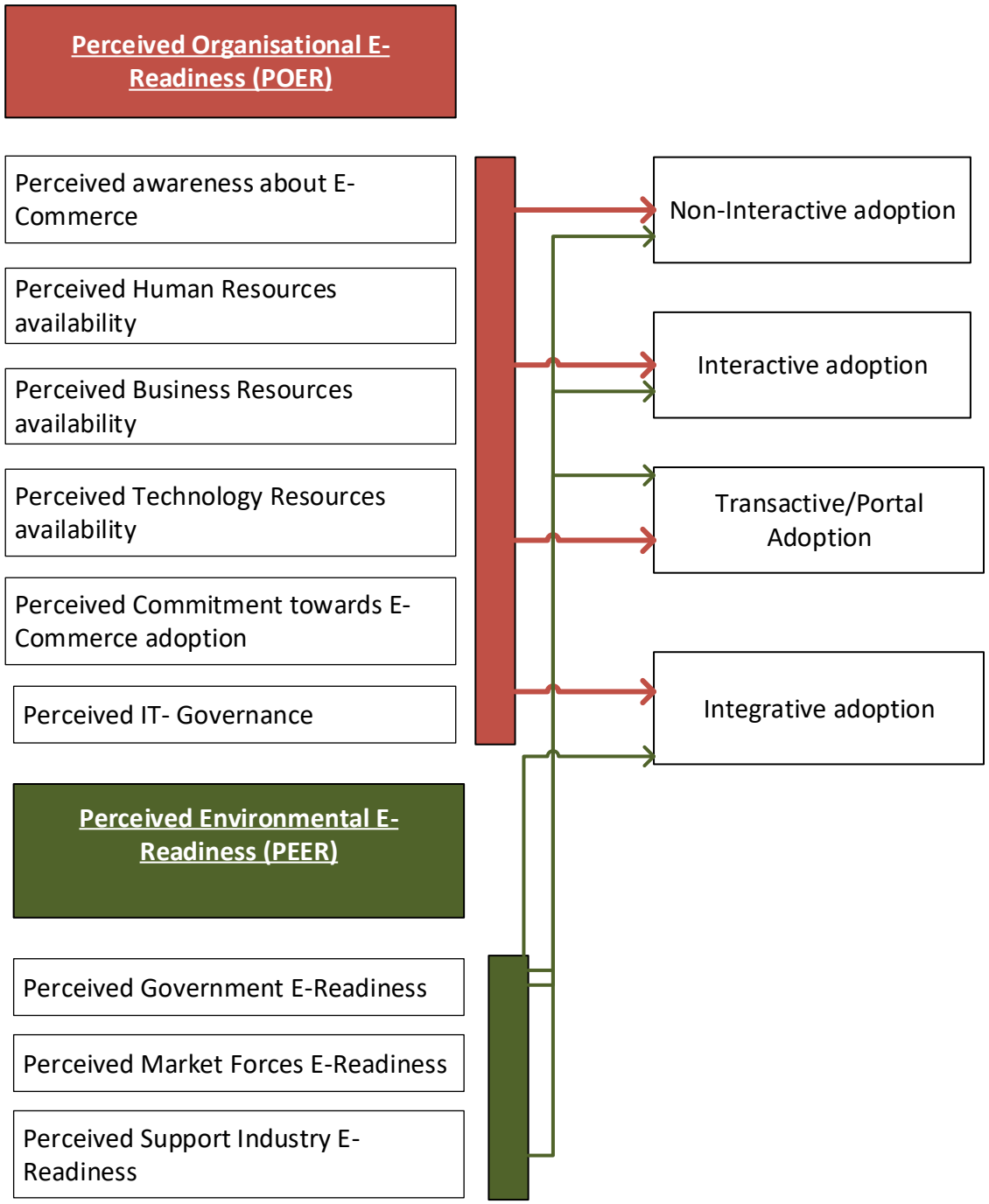


Figure 5-7: Conceptual model (C) source: Author.

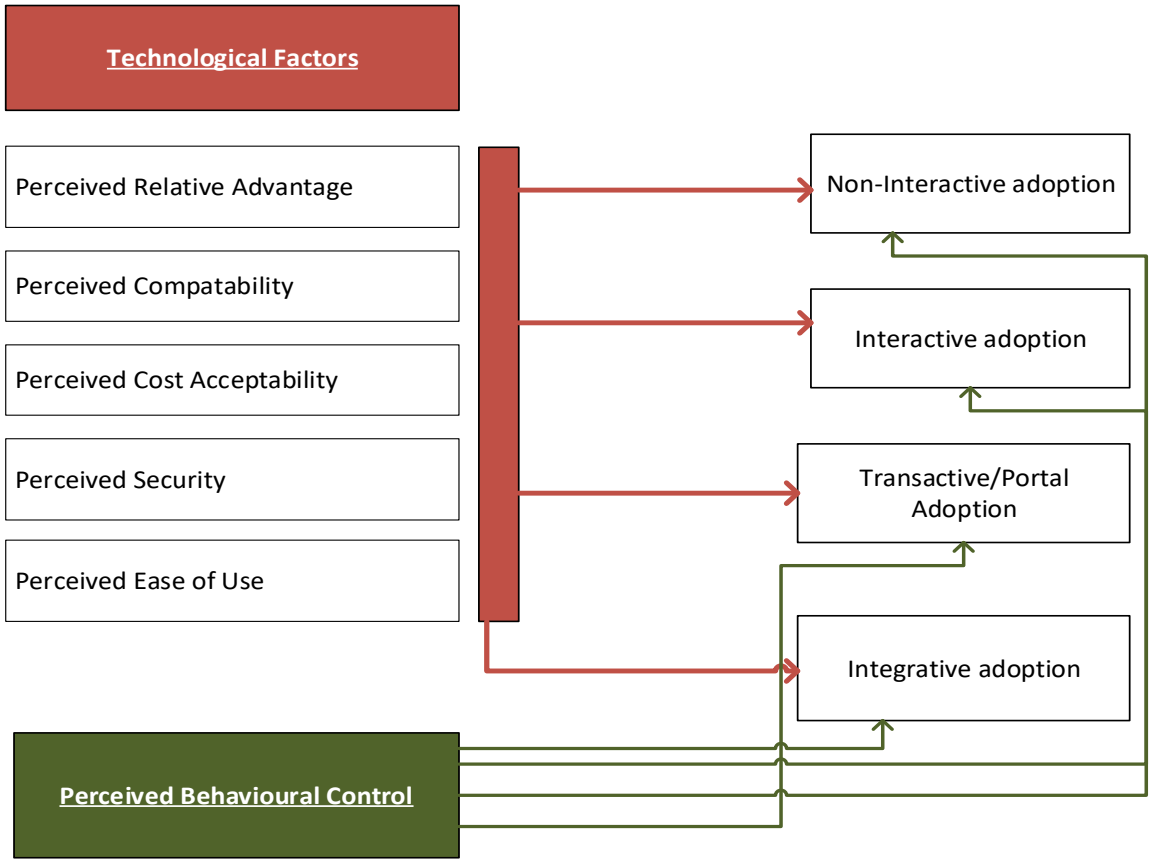


Figure 5-8: Conceptual model (D), Source: Author.

5.6 SUMMARY

This chapter provided a thorough description and justification for the statistical models used in the study to address the research questions. The study introduced two statistical models for a developing economy like Pakistan, Model A and B. These models were developed to examine the relationship between the E-Readiness factors and the organisational E-Commerce adoption decision (Q1) and between Technological and Behavioural Control Factors and the organisational E-Commerce adoption decision (Q2), respectively (please refer to section 1.3). Conceptual Model A draws its independent variables from the Perceived E-Readiness Model (Molla and Licker, 2005a) and adopts the "Intention to adopt E-Commerce" as the dependent variable and a proxy for actual E-Commerce adoption from Theory of Planned Behaviour (Ajzen, 1985). The relationships among the variables were hypothesised based on a comprehensive literature review. Conceptual Model B utilised selected technological variables from previous Technology -Environment – Organisation model (Tornatzky et al., 1991) based studies, "Perceived Behavioural Control" and Intention to adopt E-Commerce adoption from the Theory of Planned Behaviour (Ajzen, 1985). Conceptual Models C and D were developed to answer Research Question 4 and examine the relationships between E-Readiness factors and the maturity stages of E-Commerce adoption in an organisation (Model C) and between Technological and Behavioural Control Factors and the maturity stages of E-Commerce adoption (Model D). The four dependent variables in Models C and D (non-adoption, interactive adoption, transactive/portal adoption, and integrative adoption) were borrowed from an earlier proposed E-Commerce development/maturity models of Rao et al. (2003) and Symonds (2000). The relationships among the variables in both Models C and D were hypothesised based on previous studies and will be tested through empirical data.

CHAPTER 6 RESEARCH METHODOLOGY

6.0 INTRODUCTION

This chapter discusses the research methods used to meet the study's objectives. As previously mentioned in Chapter 5 (section 5.1), multiple statistical models were used to answer the research questions. The current chapter serves numerous important purposes. Firstly, it provides a complete overview of the research philosophy, research paradigm, and research strategy followed by providing justification of chosen philosophy, paradigm and strategy and how chosen methodology aligns with the overall study goals. Secondly, details of the characteristics of the sample, data collection methods, and the ethical considerations are provided in the subsequent sections of the chapter. Thirdly, the chapter describes the scales used to measure constructs and concepts of the model. Following operationalisation of the constructs, the chapter outlines the data analysis techniques employed, ensuring that the results are analysed in with suitable and relevant statistical techniques in a systematic and accurate manner.

6.1 RESEARCH PHILOSOPHIES AND APPROACHES

The outcomes of research are heavily influenced by the decisions made throughout the research process. To achieve meaningful and valid results, the researcher must clearly outline their decisions regarding the research process and its outcomes, which are often based on philosophical principles. These principles are related to the theoretical foundation of thinking, the method of cognition, and the perspective or viewpoint that the researcher adopts during the research process. These decisions and approaches help the researcher explore reality, gain knowledge, analyse, and interpret their findings. There are three main branches of research philosophy: Ontology, Epistemology, and Axiology (Saunders et al., 2009).

6.1.1 ONTOLOGY

The most essential consideration in any research is ontology, which deals with the certainty about the nature or existence of the research items under investigation (Moon and Blackman, 2014). The ontology assumptions are concerned with the nature of social reality (Blaikie and Priest, 2019) . These assumptions make claims about what kinds of social phenomena exist or can exist, how they exist, and how they are related". Ontology is defined in business and information sciences research as "the science or study of being" that deals with the nature of reality. An ontology is a belief system that represents a researcher's understanding of what constitutes a fact (Blaikie, 2010). To put it another way, ontology is intertwined with the central question of whether social things should be viewed objectively or subjectively. As a result, objectivism (or positivism) and subjectivism are two key characteristics of ontology. While the literature suggests numerous ontological viewpoints (Feyerabend, 1985, Morton, 1996, Stokes, 1998, Slevitch, 2011, Ansari et al., 2016), the two primary types of ontological positions in management and information sciences study are (1) objectivism (2) and subjectivism (Saunders et al., 2009). Objectivism is the belief that social entities exist outside of the researcher and that objective reality exists independently of the subject, whereas subjectivism believes that social phenomena/research objects are created because of social actors' actions and that social actors' perceptions play an important role in the creation of a social phenomenon. Subjectivism is connected with Social Constructionism, which refers to the subjective interpretation of a reality, and thus reality is socially constructed (for example, diverse perceptions of a situation by different individuals) (Saunders et al., 2009).

6.1.2 EPISTEMOLOGY

While ontology refers to the beliefs about how a researcher views a social phenomenon/reality, epistemology concerns what acceptable knowledge can be obtained about the phenomenon or reality. According to Blaikie and Priest (2019) Epistemology can be defined as “the theory of knowledge,

especially in regard to its methods, validation and the possible ways of gaining knowledge of social reality, whatever it is understood to be". A researcher can adopt different methods to study a reality. ***Positivist*** research philosophy assumes that the knowledge gained about the objects that are tangible and real (like furniture, computers, etc.) through the senses (observation) constitutes the real knowledge. The researcher only collects the observations and objectively interprets the results. Usually, hypotheses are formed based on the existing theories and then tested empirically through data collection. The hypotheses are thus verified (when empirical data supports the hypothesis) or rejected when empirical data does not support the hypothesis. A failed hypothesis may ultimately lead to a modified/ new hypothesis that may be tested subsequently through the same process. The positivist approach assumes that research objects have a separate and independent of researcher existence and thus results are less biased as there is no interference of feelings and perceptions in the data collected (Saunders et al., 2009). The positivist approach in social sciences is similar (but not identical) to how natural sciences approach physical world. The approach normally seeks to deduce the results using quantitative methods (Payne and Payne, 2004). On the other hand, ***Realism*** is a branch of Epistemology that separates realty from human mind and is like the positivism in the sense that it utilises scientific approach (Saunders et al., 2009). The main difference between positivism and realism is that while positivism claims that observations, logics and experimental evidence can verify existence of a reality, realism theory on the other hand assumes that external world exists independent of conceptual schemes of researcher (Hasan, 2019). There are two types of realism (1) Direct realism and (2) Critical realism. Direct realism assumes that whatever is seen or experienced through senses is the accurate portray of reality. Critical Realism argues that the images and observations of the external world could be deceptive and may not accurately portray the real world and what we see and observe are not actually the things but their images or sensations(Saunders et al., 2009). ***Interpretivism*** is a kind of entomology that emphasise the need to account for the differences between different humans in our role as a social actor. According to this theory, the humans interpret their everyday social roles in accordance with the individual meanings given by humans that interpret roles differently(Saunders et al., 2009). This approach is opposite to the Positivist approach and hence also referred as "Anti Positivist" approach and says that social realties cannot be studied by using scientific methods of natural sciences. Hall mark of interpretivism is the belief that concepts and languages used by researchers in the research process shape the perceptions of the external social world that they are investigating (Macionis and Gerber, 2011). During research process, it is not always possible and is somewhat unrealistic choosing one philosophical position over the other, so ***Pragmatism*** paradigm focuses on "what works in a given situation" rather than considering something absolutely or objectively right or real. Research questions in social sciences can be answered using qualitative and quantitative data collection and processing techniques. Qualitative and quantitative research is based on unique incompatible assumptions that led to notorious "Paradigm wars" (Oakley, 1999, Creswell, 2011). However, researchers in social sciences are now increasingly employing both qualitative and quantitative techniques to answer research questions in a single project. This led to a new philosophical position known as "Pragmatism"(Bryman, 2016). This philosophical position argues that research questions determine the choice of research philosophy, data collection, and data processing techniques (qualitative or quantitative) adopted (Saunders et al., 2009). The paradigm advocates that choosing a single scientific method could be used to assess the true reality of the world. Pragmatism is thus suitable when research necessitates usage of combination different scientific enquiry methods. According to this philosophy, choice of scientific enquiry method is guided by the research question. A particular philosophical approach may be suitable for finding answers to one research question and may not be appropriate for the other (that may require another philosophical approach) (Saunders et al., 2009).

6.1.3 AXIOLOGY

Axiology is the branch of philosophy that relates to the judgements about the values(Saunders et al., 2009). Values play an important role in the process of social enquiry and the personal values of the researcher(s) should be considered if we want credible research results. From philosophical viewpoint axiology relates to aesthetics, ethics, and religion. In the social research context, axiology is what researcher(s) believe is valuable and ethical. Personal ethical values are embedded in the research paradigms. Throughout the research process, the researcher's decisions are guided by the ethical values one possesses (Killam, 2013, Heron, 1996). So, researcher's personal values, ethics, and beliefs determine whether a certain research topic is more important to be investigated, a certain philosophical approach and or data collection technique is more appropriate to find the answer to research questions. Due to the importance of axiological skills in the research process, some scholars suggest writing down the personal statement of values in relation to research topics. It may be of use to the researcher and other research stakeholders (Saunders et al., 2009).

6.2 RESEARCH APPROACHES

Research projects involve theories that may or may not be clear at the beginning of the research project. How much a researcher is clear about the relevant theory is an important factor that guides the research design. Depending upon the research topic, a researcher may adopt a deductive or inductive approach (Saunders et al., 2009). The deductive approach involves the development of theory and hypothesis and then testing it empirically. On the other hand, the inductive process involves a collection of the data and theory development based on the data collected. While there is rigid division in the two approaches, it is perfectly fine to combine both approaches in a single research project depending upon the research questions (Saunders et al., 2009).

6.3 RESEARCH DESIGN

Informed by the research philosophy and approaches, a researcher designs a research project. The research design involves deciding three elements: research strategies, research choices, and time horizon. Research design covers research questions into an actionable research project (Robson and McCartan, 2016) and organise/ list the research activities that help the researcher to gain research aims and objectives (Easterby-Smith et al., 2012). It also provides the framework to plan the data collection and its subsequent treatment/processing (Iacobucci and Churchill, 2010). Research design is important as it provides an essential link between underlying theory and logic with the empirical data collected (Nachmias and Nachmias, 2008). A research design is a reflection of the relative, subjective importance of different dimensions of the research process and influences the lower-level research activities and procedures like sampling, data collection, and data analysis/processing (Bell et al., 2018, Limpanitgul et al., 2009).

6.3.1 RESEARCH STRATEGIES

A research question may require descriptive, explanatory, or a combination of both, i.e., descriptive-explanatory answers, that relate to the research's purpose. Research purpose wise, research can be categorised as exploratory, descriptive, and explanatory. Research purpose determines and influences the research design and its elements because each of the three requires a different set of lower-level procedures in the research process(Saunders et al., 2009). Exploratory studies seek to gain new insights, find answers to new questions, or answer the same questions through different angles. Descriptive research is aimed at finding an accurate profile of individuals, events, social phenomenon, or situations. Explanatory research explains a happening, event, or other social phenomena. Depending upon the research questions, a research project may have more than one research purpose. A research project may have descriptive, exploratory, and explanatory questions simultaneously.

Similarly, in some instances, a research project may require an accurate description before exploratory or explanatory research is started (Robson and McCartan, 2016). A researcher has several research strategies available to choose from for each type of research. While some research strategies are associated with a specific type of research (descriptive, exploratory, or explanatory), associating research strategies to a single research type is often over-simplistic (Yin and Hollweck, 2015). Most frequently employed research strategies include experiment, survey, case study, action research, grounded theory, ethnography, and archival research.

Experimental strategy is the default research strategy of the natural sciences; however, it is also widely used in the social sciences (especially in phycology). The researcher studies the relationships between dependent and independent variables by manipulating the independent variable(s). Resultantly, the researcher may discover causal relationship(s) between variable(s), the relative importance of the independent variable(s) in changing the dependent variable(s), and their magnitude of effect on the dependent variable(s) (Hakim, 2000).

The survey strategy is commonly employed in deductive research and is widely used in business/information science research. Typically, the approach is used to discover what, how many, who, where, and how many questions. The survey technique is commonly used for exploratory and descriptive research since it is a cost-effective way to acquire relevant data from a large population (Saunders et al., 2009). Survey data are mostly collected using a questionnaire, which can be self-administered, mailed, or asked in interviewers. The use of questionnaires in research assumes that respondents will be able and willing to reply accurately (Burns, 2000). A researcher may opt to develop a questionnaire (also known as structured interviews) and ask it of interviewees in person by physically visiting to them via telephonic interviews, or may choose to administer the questions via post, e-mail, or online. While a "structured interview" is a questionnaire survey performed by the interviewer, a major proportion of the research community prefers to use the term "questionnaire" for situations in which the chosen sample answers a series of questions (usually closed questions). Self-completion questionnaires are often referred to as self-administered questions. Both self-administered questionnaires and organised interviews have distinct advantages and disadvantages (Bryman, 2016). In this project, the term questionnaire survey refers to a self-administered questionnaire in which the respondent answers a series of prepared questions.

A case study strategy is most appropriate when the researcher want to comprehend the research context and the relevant processes at work (Morris and Wood, 1991). This research technique can answer why, what, and how (what and how are typically connected with survey strategy) and is thus appropriate for explanatory or exploratory research (Saunders et al., 2009).

Action research strategy implies a higher level of collaboration between the researcher and a client. A solution is generated through thoughts and collaborations based on the diagnosis of the problem (Bell et al., 2018). Action research assumes that social systems are always changing, with researchers and research being part of the social system (Collins and Hussey, 2003). The action research strategy is typically used to improve certain activities. The procedure is organised around specific action and evaluation steps. Improvements to present methods are suggested based on the data collected and its following critical analysis (Saunders et al., 2009).

Grounded Theory is most connected with inductive research and can be described as "theory building" through iterative inductive and deductive processes. "Grounded theory" refers to a collection of systematic inductive approaches for doing qualitative research targeted at theory formation" Lewis-Beck et al. (2003). The researcher attempts to identify difficulties in a specific setting and how various relevant social actors deal with them. Then appropriate research propositions are developed, tested

(by the deductive process), and (if necessary based on test results) additional propositions are developed and tested again until a theory is created (Saunders et al., 2009).

Ethnography stems from the field of anthropology and is significantly rooted in inductive research. The researcher aims to describe and explain the social world inhabited by the research subjects. The strategy is often referred to as "naturalistic" (not to be confused with naturalism that refers to positivist approach) as the researcher contextually studies the phenomenon and do not rely on the extensive usage of data that may oversimplify the complexities of the social world. The strategy helps the researcher to understand a phenomenon in the context and then understand it with the perspective of the research subjects involved in the social system (Saunders et al., 2009).

Finally, Archival research utilises the data driven from the administrative records and documents but should not be confused with the "secondary data analysis". The difference between "secondary data analysis" and archival research is based on the "purpose of the data collection. " Unlike "secondary data analysis" where data is collected for research purpose, archival data is collected and analysed as part of reality being studied (Hakim, 2000).

6.3.2 DATA COLLECTION AND PROCESSING TECHNIQUES

In social sciences research, qualitative and quantitative terms are widely used to differentiate the two primary data collection and analysis techniques employed in the research. Quantitative research methods typically involve surveys as a data collection technique and use statistical procedures (graphs, regression, ANOVA, etc.) for data analysis. On the other hand, the qualitative research method involves processing non-numeric data gathered through interviews, for example, and subsequent categorisation. This is worth noting that while some authors like Saunders et al. (2009) call usage of qualitative or quantitative techniques and procedures as research choices other researchers may give it a different name; for example Pickard (2013) call it research methodology associated with each research paradigm , Tashakkori and Teddlie (2010) used the term research design and Johannesson and Perjons (2014) call it research methodology and count it as one of the three elements of research paradigms. There are four types of research method choices available to the researcher (1) mono method, (2) multiple methods, (3) multi-method, and (4) mixed methods. Some authors, on the other hand, categorise the available research methods choices as (1) quantitative, (2) qualitative, and (3) mixed methods (Pickard, 2013).

Depending upon the research questions, a researcher may opt for Mono Method by using quantitative or qualitative data collection and processing techniques or multiple methods when more than one data collection and analysis technique are used. The mono method uses qualitative or quantitative data collection techniques and subsequent data processing through quantitative or qualitative procedures. On the other hand, when multiple methods are used, there are four possible combinations (1) Multimethod Quantitative (2) Multi-method Qualitative (3) Mixed Method research (4) and Mixed Model Research. Multi-Method Quantitative research studies use more than one quantitative technique for data collection (for example, questionnaire survey and observation) and associated quantitative data processing techniques. On the other hand, the qualitative multi-method uses more than one qualitative data collection technique (for example, in-depth interviews and diary accounts) and analyses data using associated qualitative data analysis techniques. Mixed methods studies involve using qualitative and quantitative techniques and associated data processing techniques (for example, using the questionnaire survey and in-depth interviews for data collection and analysing the data using relevant qualitative or quantitative data analysis techniques). The major difference between multi-method and mixed-method is that multi-methods use qualitative or quantitative data collection/processing techniques; on the other hand, the mixed-method approach mixes both

qualitative and quantitative. It is quite possible for a researcher to qualities quantitative data by converting numeric data into narrative for qualitative data analysis or quantities qualitative data for quantitative analysis. If this data collection/analysis approach is used, it is called the Mixed Model research method choice (Tashakkori and Teddlie, 2010).

6.3.3 TIME HORIZON

Time Horizon consideration is another aspect of the research design which depends on the research question. A particular research question may require a snapshot of a phenomenon called a "Cross-Sectional" study. In contrast, a longitudinal study is a "diary" like and study developments in a specific time range. In a cross-sectional study, data is collected from different groups simultaneously, while in longitudinal studies, data is collected from the same group repeatedly in a given time range (Figure 6-1). In both cross-sectional and longitudinal studies can answer a variety of research questions. Cross-sectional studies tend to be shorter and thus are relatively cheaper. In some instances, cross-sectional studies may provide an idea of correlations among variables at the initial stage of research later the correlation may be studied in longitudinal research (Easterby-Smith et al., 2012, Thomas, 2020a, Thomas, 2020b).

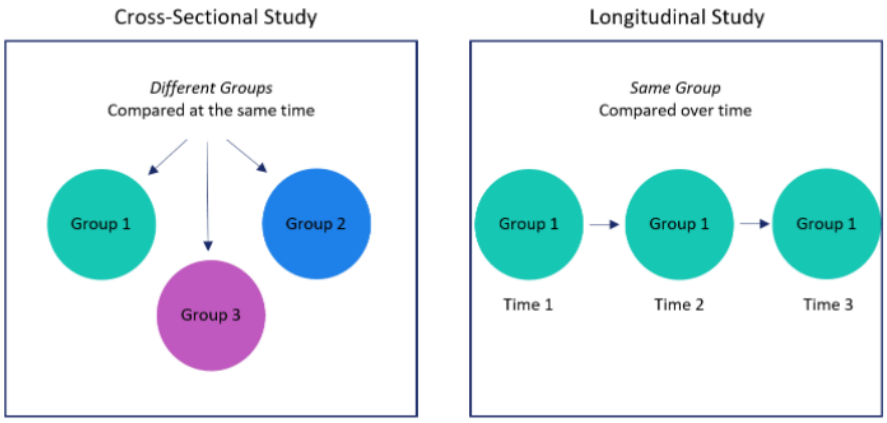


Figure 6-1: Cross-Sectional vs Longitudinal Study adopted from(Thomas, 2020b).

6.4 CHOSEN RESEARCH PHILOSOPHY AND RESEARCH APPROACH.

Choosing the right research approach for the project is crucial and involves selecting appropriate ontological, epistemological, and methodological assumptions, and methods and techniques to answer the research questions (Creswell, 2019). This project aims to find answers to the following questions.

1. How do E-Readiness factors relate to organisational E-Commerce adoption in Pakistan's public and private sectors?
2. How do Technological and Perceived Behavioural Control factors relate to organisational E-Commerce adoption in Pakistan's public and private sectors?
3. Do E-Readiness, Technological and Perceived Behavioural Control factors have significantly different relationships with E-Commerce adoption in public and private sectors of Pakistan?
4. How do E-Readiness, Technological and Perceived Behavioural Control factors relate to different levels of organisational E-Commerce adoption in Pakistan as discriminating factors?

After carefully examining the research questions and objectives, choosing a single epistemological or ontological position cannot comprehensively answer all the research questions. The study thus adopts the Pragmatism position. This research project is a contextual study that aims to answer research

questions in a specific cultural, geographical, social, and environmental context. The study aims to find the factors that influence E-Commerce adoption at organisational level in the peculiar cultural context of a developing country and involves measurements of constructs through individual perceptions of the research participants. According to the Pragmatism approach, multiple realities can exist and can be verified empirically (Creswell and Clark, 2017). While this position accepts that reality does exist independent of the human experience, the reality itself is grounded into the environment (Tashakkori and Teddlie, 2010, Goles and Hirschheim, 2000). Another assumption of this philosophical position is that knowledge and reality are based on socially constructed beliefs and habits, and thus, the knowledge is socially constructed (Yefimov, 2004). This project assumes that there is more than one reality (difference of E-Commerce adoption factors and/or their magnitude of influence on E-Commerce adoption process and that contributing factors and their magnitude can change with a change in context); this is perfectly in line with the assumptions of the pragmatism approach that says reality can never be determined once and for all (Pansiri, 2005). This research project involves measuring different constructs through individual perceptions of the social actors. The perceptions are guided by unique individual knowledge based on personal experience and personal world view. This assumption is also common in this research project and pragmatism stance (Poluhina, 2015). Finally, since our research questions may involve investigation through variety of perspectives, Pragmatism position seems to best suit this project as it allows the researcher to adopt the philosophical and/or methodological position that best suits the research questions and is often associated with mixed or multi-method research methodology (Kaushik and Walsh, 2019). The study is descriptive. To find the answers to research questions, several relevant constructs / latent variables have been statistically modelled, and hypotheses are formed. The model and related hypotheses are formed based on the previous theories, logical reasoning, and results of the previous relevant research. Previous research and empirical findings in the same field thus formed the rich source of concepts for statistical modelling and related hypotheses (section 5.2,5.3,5.4,5.5) . The hypotheses will be tested based on the data collected from the respondents. So, to answer the research questions (section 1.3), we will be adopting quantitative data collection and data analysis techniques with a deductive approach.

6.5 RESEARCH DESIGN OF THE PROJECT

As outlined in section 6.4, this deductive contextual study adheres to the principles of “Pragmatism” acknowledging that no single perspective can fully capture reality, thereby recognising the non-absolute nature of reality. Figure 6-2 describes the research philosophy, research approach, and research design of the study. The study aims to describe the factors that influence E-Commerce adoption and factors relevant to different E-Commerce development stages within the organisation. The study purpose is thus descriptive. A descriptive study is a statement of the affairs at a certain time. The researcher cannot manipulate the variables involved and attempts to identify, or determine “what is”(Ethridge, 2004). Descriptive studies are typically aimed at providing an accurate picture and situation of a phenomenon (Johnson and Christensen, 2000) by examining and analysing the relationship(s) among non-manipulative variables (Saunders et al., 2009). Descriptive studies are ideally suited for describing, explaining and validating research findings(Dudovskiy, 2021). Descriptive research typically involves formulating research hypotheses with a pre-planned structured design. Research hypotheses are usually verified through empirical data collected through survey questionnaires (Johnson and Christensen, 2000).

6.5.1 CHOSEN RESEARCH STRATEGY

Based on the nature of the four research questions, it is determined that a Survey strategy is the best approach for data collection. The Survey method was chosen as the most suitable option for this research project as it allows for testing and constructing theories based on the perceptions, beliefs,

characteristics, and preferences of organisational decision makers. Surveys are considered an effective tool for data collection in such a scenario. (McCombes, 2020). It is an excellent data collection method for research that involves hypothesis testing or aims to find the characteristics of a population(Jackson, 2015, Dudovskiy, 2021). Survey as data collection strategy has been used extensively in the social (Straits, 2005) and several MIS /organisational level E-Commerce adoption studies (McKnight et al., 2002, Mensah et al., 2005, Molla and Heeks, 2007, Molla and Licker, 2005a, Molla and Licker, 2005b, Nasco et al., 2008). The survey method can be used for both qualitative and quantitative research (Ponto, 2015, Pickard, 2013), is considered to be an economical option as compared to the other options (like observations and experiments), and the collected data is easy to analyse (Dudovskiy, 2021). Survey design for this stage is discussed in detail in later.

6.5.2 RESEARCH CHOICE

The project finds answers to research questions through statistical modelling, and so, the chosen research choice for this study is quantitative. Quantitative research involves systematically collecting quantifiable data and subsequent processing and analysis through different statistical or mathematical techniques. The researcher typically explains the phenomenon through a set of variables. Quantitative research is best suited for this project as it is recommended for correlational studies that involve testing hypotheses and is widely used in natural and social sciences research (Bhandari, 2020). In social sciences, quantitative research may involve the representation of empirical statements of the respondents numerically(Cohen et al., 2002). Quantitative research typically involves defining abstract concepts/ latent variables in tangible terms in social sciences. Data is typically collected through a standard protocol, and thus the study can be replicated in different settings. Quantitative research choice allows direct comparison of similar research studies in various settings. Statistical data processing techniques allow for processing large volumes of data collected from samples and thus result in more accurate generalisations about the population (Bhandari, 2020). Given the nature of the research questions, model used to test hypotheses about relationships, the research choice for this study is “Quantitative”.

6.5.3 TIME HORIZON CONSIDERATION

This investigation is a cross-sectional study as we will be studying the E-Commerce adoption phenomenon at a particular time. The study takes a snapshot of the research phenomenon at a specific time, and a cross-sectional study is an appropriate choice for such studies (Easterby-Smith et al., 2012). Longitudinal studies are normally suited in projects that study the development of a phenomenon over a specific time by collecting responses from the same group after specific intervals (Saunders et al., 2009). Longitudinal studies typically require more time, are expensive, and normally lack a control sample, resulting in biased findings (Pedhazur and Schmelkin, 2013). So due to the nature of our research questions availability of limited time and resources for the project, we opted to cross a sectional study and collected data at a single point in time through the survey. Figure 6-2 summarises the research philosophy, approach and research design.

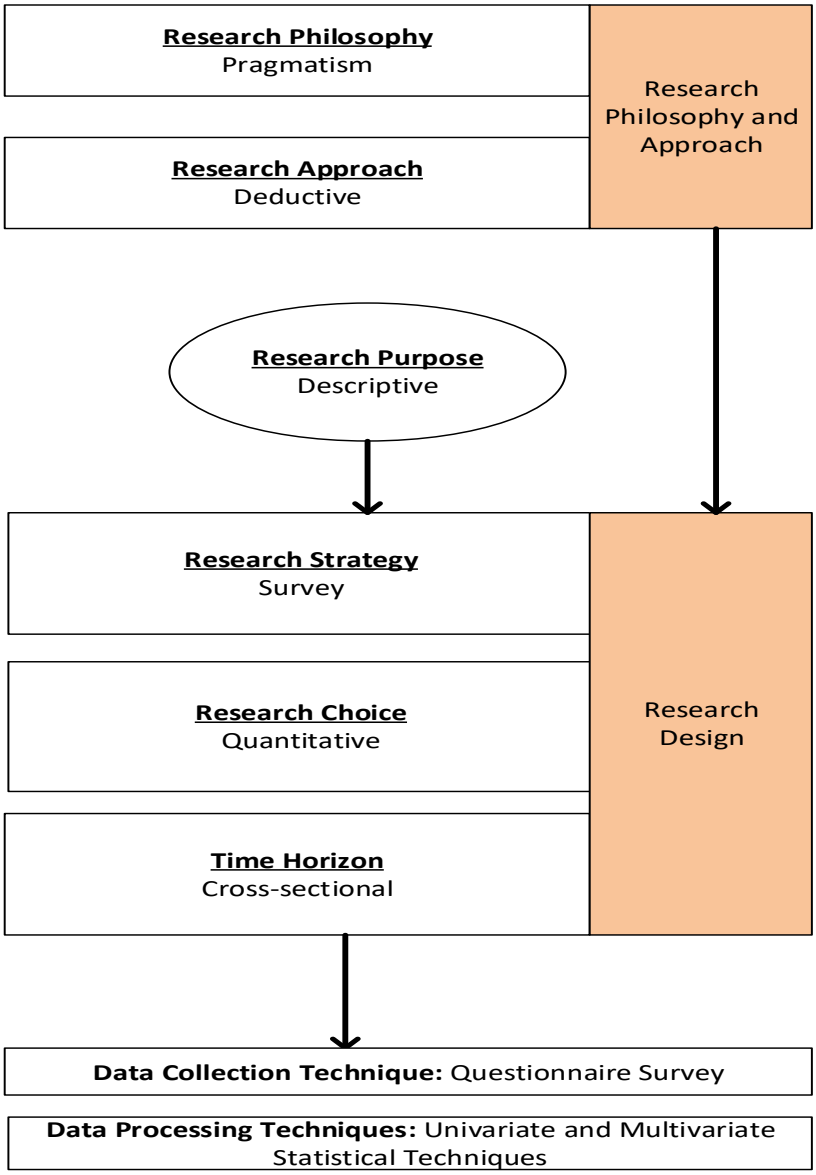


Figure 6-2: Research Philosophy, Approach and Research Design.

6.5.4 TECHNIQUES AND DATA ANALYSIS PROCEDURES.

This research project is expected to collect quantitative and qualitative data through survey in two phases. Data collection and data analysis techniques used in both phases are listed below.

6.5.4.1 DATA COLLECTION TECHNIQUE

The chosen data collection technique for this study is "Questionnaire Survey." There are several advantages of using this data collection technique. Questionnaire surveys typically do not involve the recruitment of interviewers, and thus, a significant cost related to the wages and training of the interviewers is saved. In addition, since self-administered questionnaires are usually pre-coded (closed questions), a significant data analysis cost is also saved. The questionnaire survey is thus an economical choice (Saunders et al., 2009, Nachmias and Nachmias, 2008, Bynner et al., 1979). The respondents of this project are located in different parts of the country and questionnaire surveys are an excellent choice when the response is sought from a large sample of geographically dispersed respondents (Bynner et al., 1979). Questionnaire surveys are less intrusive, as the respondent can complete the

questionnaire survey at a time that best suits them, resulting in a large response rate. The respondents can take enough time to think or consult others before recording their responses. The response is likely to be more accurate and refection of the true picture because this survey technique allows a greater degree of anonymity. The respondent is likely to record the actual response (a desirable objective) in the absence of the interviewer. On the other hand, data collected through interviews may involve more than one interviewer in projects, affecting the findings because of interviewer variability (as every interviewer will be asking a question in their style). Thus Questionnaire survey provides a more credible uniform / standardised response is (Bryman, 2016). Questionnaire survey techniques, while valuable for gathering data efficiently, present several potential limitations as well. These include the risk of response bias, where participants may provide socially desirable or acquiescent responses, compromising the accuracy of data. For example, in this study due to inherent risks of "self-selection", respondents may exhibit social desirability bias by showing a desire to adopt e-commerce even if they do not genuinely intend to do so. Similarly, they may inaccurately categorise their organisation's level of E-Commerce adoption, introducing bias and potentially skewing the results.

Moreover, questionnaires may lack depth compared to qualitative methods, limiting the exploration of complex topics. Low response rates and sampling issues can also undermine the generalisability of findings. In absence of the survey author, misinterpretation of questions or missing data may affect the validity of results. Despite these limitations, questionnaire surveys remain a widely used tool in research. Above mentioned potential risks can be mitigated by adhering to good practices. The questionnaire needs to be designed very carefully as a poorly designed questionnaire may result in a low response rate and a significant proportion of missing and not valid data. A good questionnaire tends to have fewer open questions as closed questions are easier to answer. In addition, the questionnaire should be designed well so that it is easy to follow and ensures that the respondent does not fail to answer filter question(s) or inadvertently omit a question (Bryman, 2016). The questionnaire was developed keeping in view all the characteristics of a good questionnaire survey.

6.5.4.2 DATA PROCESSING / ANALYSIS TECHNIQUES

There are three basic types of statistical techniques , univariate, bivariate and multivariate (Denis, 2021). Univariate techniques are the most basic and simple form of statistical data analysis and involve only one variable, or more than one variable but analysed separately. The major purpose of the univariate analysis is to describe the data, summarise, and find patterns in it and cannot be used to find relationships or causes (Babbie, 2020). Univariate techniques help screen the data before complex statistical techniques and thus often reported in preliminary analysis in the research studies. There most frequently used univariate techniques in research studies are *(i) frequency:* usually reported visually as histograms and represents a measure of the number of times an incident, event, or result is observed, (ii) *central tendency:* a calculation that provides an idea of average, typical, or example in distribution and, (iii) *dispersion:* a measure of the spread of the data relative to the centre (Sandilands, 2014b). Bivariate analysis involves two variables and is used to find relationship/ association between them and degree of association. There are two types of bivariate analysis (i) *bivariate correlation* analyses ; a measure of linear association between two variables and (ii) *bivariate regression*; a statistical model that predicts one variable (called outcome or dependent variable) from one other variable (called independent or predictor variable) (Sandilands, 2014a).

Multivariate analysis refers to group of statistical techniques that handle complicated data sets by analysing and finding interrelationships among three or more variables simultaneously (Denis, 2021). Multivariate techniques provide tools for extraction of information, regression, and classification of three or more variables. Some of the multivariate techniques are developed quite recently as they required sophisticated powerful computational power (Grimnes and Martinsen, 2015). Most of the

multivariate techniques work on a common principal of minimizing the sum of squares of vertical distances from the regression line , the technique is also known as “least square”(Miller, 2017). While this study will use different univariate techniques to describe and screen the data using SPSS and R, following multivariate techniques will be used.

(A) PARTIAL LEAST SQUARE STRUCTURAL EQUATION MODELLING (PLS-SEM)

Multivariate statistical techniques are now widely used in social and behavioural sciences research due to the increase in computational power and software availability. These techniques are important for modern research that involves complex models and multiple variables associated with individuals, organisations, or activities. Statistical techniques can be divided into two categories **(i)** first-generation techniques such as regression, ANOVA, and factor analysis, and **(ii)** second-generation techniques such as structural equation modelling, which is being increasingly used in recent years (Hair, 2017). Structural Equation Modelling (SEM) is a term that refers to a collection of approaches used in both experimental and observational research in a variety of domains to assess the causal relationships among variables. It can be described as a combination of two statistical techniques, factor analysis, and multiple regression. SEM allows researchers to use the "latent variables" or "abstract concepts" in the analysis. The latent variables are measured through some related observable variables, also called "items" (Hox and Bechger, 1998). SEM involves two models **(i)** measurement model and **(ii)** Path model that relate different observable or abstract realities through a structure. The structure is a set of equations commonly drawn with arrows and symbols, describing causal links between variables and/or error terms (Tarka, 2018). Measurement model describes the quality of scale used to measure an abstract construct through observable variables. There are two types of measurement models Figure 6-3 . Measurement model is ***reflective***, when construct or latent variable causes variation in items or observable variables and (for example intelligence level predicts the score in examination and problem-solving capability) formative, when construct is predicted by the item or observable variables (vehicle value predicted by age, condition, and millage). A reflective measurement model is represented by arrows pointing towards the item, on the other hand, in formative construct, the items point towards construct. In SEM, latent variables or constructs are usually represented as a circle, and items or observable variables are represented as box/rectangle. Quality and score of measurement model is assessed by factor analysis , which is now an integrated part of most of the SEM software (Sarstedt et al., 2017).

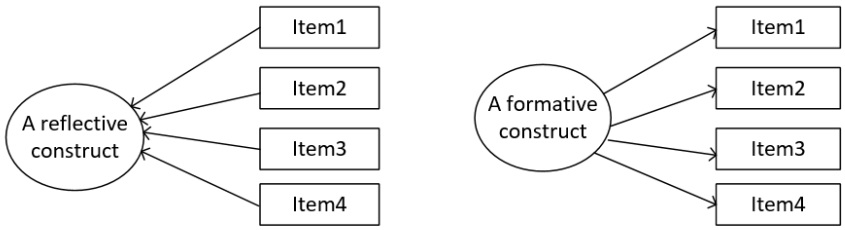


Figure 6-3: Measurement models.

Path Model Figure 6-4 in structural equation modelling represents the hypnotised relationship among variables (Tarka, 2018). Like measurement model, latent variables or constructs in the path diagram are represented circles, while observable variables or items are represented by boxes (observable variables) or circles. Causal relationships (usually hypotheses) are represented as single headed arrows

and double-headed arrows indicate covariance. There are two types of variables in ***exogenous*** (also called external) are often predictor variables and their causes are not included in the model and no arrow point towards them. The endogenous variables (often called outcome or dependent variables) are like the Dependent Variable (DV) in the regression. Endogenous variables are internal and are hypothesised to be the effect of other variables. They have at least one arrow pointed towards them, but are different from dependent variables in ANOVA that they can have arrows emerging from them as well (i.e. they can be hypothesised to be predicted other variables as well) (Iacobucci, 2009). Like, structural model, the quality of path model is assessed through different statistical techniques for "goodness" (Sarstedt et al., 2017). There are two types of SEM, covariance based (CB-SEM) and part least square (PLS-SEM). The type of SEM used in this study is PLS-SEM.

While Covariance based structural equation modelling (CB-SEM) has been widely employed in the social sciences for its ability to validate theories, the popularity of Partial Least Squares Structural Equation Modelling (PLS-SEM) has been on the rise in recent years, especially in the fields of social and information sciences (Al-Emran et al., 2019, Chin et al., 2020) . PLS-SEM adopts an iterative approach that maximises the explanation of variance in the outcome or endogenous variables through a combination of principal component analysis and regression-based path coefficient determination to estimate the parameters of the equations (Sarstedt et al., 2017). In contrast, CB SEM relies on the Confirmatory Factor Analysis (CFA) technique to estimate the factor scores of latent variables and to evaluate the measurement model. The factor scores derived through CFA are then utilised in regression analysis to identify relationships between different variables in the path model (Hair et al., 2011) . The primary distinction between Confirmatory Bayesian Structural Equation Modelling (CB SEM) and Partial Least Squares Structural Equation Modelling (PLS-SEM) lies in their treatment of latent variables. CB SEM, also known as a factor-based measurement model, assumes that a construct or latent variable acts as a common factor that explains the variations among related "items" or observable variables. In PLS-SEM, on the other hand, constructs or latent variables are represented by weighted composites, which are calculated as a weighted linear combination of all the items relevant to the construct. These weighted composites are then employed for further analysis (Hair, 2017). Like general SEM, PLS SEM path model consists of two sub-models, ***structural or inner model*** (also called path model) and measurement or outer model.

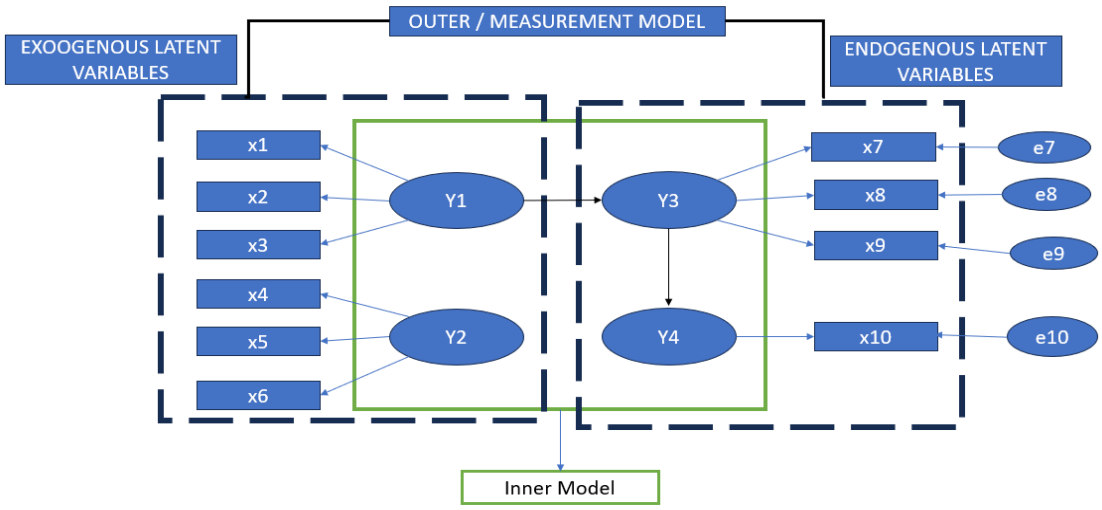


Figure 6-4: Structural Model source ((Hair et al., 2011).

The inner model describes the relationship among constructs, and the outer model represents the relationship between the manifest/ items/observable variables and their respective constructs(Hair, 2017).

PLS-SEM was used in this study to answer research question 1 and 2 (please refer section 1.3). Both CB -SEM and PLS-SEM have their own uses and are used in different research contexts. PLS-SEM was selected as suitable technique because of following reasons.

1) The overarching aim of this study is to forecast and comprehend the variation in the target variable, which is "intention to adopt E-Commerce." However, the use of Confirmatory Bayesian Structural Equation Modelling (CB SEM), which relies on factor-based modelling, may not be appropriate in cases where the theory is still in the developmental stage and the study is of an exploratory nature (Rigdon, 2012).
2) While it is possible to compute factor scores within the CB SEM framework, these calculated scores are not unique. In fact, an infinite number of factor scores could fit the model equally well, resulting in "factor indeterminacy." This issue is compounded by the fact that the correlation between a common factor and any other latent variable or common factor is also "indeterminate." The CB SEM technique uses the estimated factor scores for analysis beyond the measurement model, meaning that the results of the analysis can vary greatly depending on the set of input factor scores used (Henseler et al., 2014) . On the other hand, the Partial Least Squares Structural Equation Modelling (PLS-SEM) framework provides a unique weighted score composite for each latent variable for each observation, which is used as a construct proxy for further analysis(Becker et al., 2013) . This approach eliminates the issue of factor indeterminacy, as the weighted composites are utilised as inputs in ordinary least square regression to minimise error terms and maximise the R-squared value. Given these strengths, PLS-SEM is particularly well-suited for exploratory and predictive studies (Hair, 2017) .
3) In social sciences, the normal distribution of data is a rare occurrence. The Covariance Based Structural Equation Modelling (CB-SEM) approach, which relies on the maximum likelihood method (MLM), typically requires data that follows a normal distribution. Using the parametric CB-SEM framework on non-normal data may result in erroneous and invalid conclusions (Yuan et al., 2000). On the other hand, the Partial Least Squares Structural Equation Modelling (PLS-SEM) technique does not have the requirement of normal data distribution, as it is a nonparametric test (Hair, 2017). While the dataset being analysed meets the acceptable range for normality assumptions, a true continuous normal data is rarely possible in social sciences. So PLS-SEM seems the most suitable option for this study.
4) In comparison to CB SEM, PLS-SEM is capable of handling larger and more complex models, even with a smaller sample size. Shah and Goldstein (2006) were able to identify models with an average of 14 indicators/observable variables and 4.4 latent variables using CB SEM. However, Ringle et al. (2012) found that PLS-SEM could handle an average of 8.12 latent variables in a similar study. This highlights a significant difference between the two techniques in their ability to estimate complex models.
5) PLS-SEM is widely regarded as a robust and powerful technique, utilised across a variety of disciplines. It is particularly well suited for complex predictive studies with smaller sample sizes due to its greater statistical power, even when applied to population data in the common factor model (Sarstedt et al., 2017) . This makes PLS_SEM ideal for handling the large amounts of data generated

by internet research, social networking applications, and social media. As a result, there has been a noticeable increase in the use of PLS-SEM across different disciplines (Hair et al., 2019) .

PLS-SEM was selected for this study due to its advantages, including greater statistical power, its appropriateness for predictive studies, and fewer data distributional requirements. Additionally, the complexity of our model, including many latent and observed variables in Model A and Model B, makes factor-based models a less viable option.

Assumptions of PLS-SEM

Partial least square method has very few assumptions about the data set. According to Hair et al. (2011) following are data characteristics consideration.

- There is no normality assumption as PLS SEM is nonparametric test.
- Robust method can handle missing values and not very sensitive to outliers. However, absence of outliers gives more accurate results.
- No identification issues with small sample size, however, larger sample sizes increase accuracy. As a rule of thumb, the sample size should be 10 times of the maximum numbers or arrows pointed to or from latent variable.
- Absence of multicollinearity.

(B) MULTINOMINAL REGRESSION ANALYSIS

Regression analysis is a powerful tool for understanding and testing complex relationships between variables and constructing prediction equations. However, traditional linear modelling techniques like ordinary least squares (OLS) regression are limited to continuous or categorical independent variables and continuous dependent variables. When the independent variables are continuous or categorical and the dependent variable is categorical, linear modelling is not appropriate and instead, techniques like logistic regression or discriminant analysis must be used. Logistic regression is particularly useful for predicting a categorical outcome as it can handle both continuous and categorical independent variables and is less restrictive about data distribution assumptions. On the other hand, discriminant analysis requires continuous independent variables and adheres to strict data distributional assumptions (King, 2011). In the past two decades, logistic regression has become more popular than discriminant analysis Darlington (1990). Logistic regression transforms the categorical dependent variable and computes the log of the odds ratio of being a particular category. There are three types of logistic regression, binomial logistic regression, ordinal regression, and multinominal regression. The binomial regression technique is useful when we have two categories of outcome or dependent variable. In situations where there are more than two variables, ordinal and multinomial regression can be used. Ordinal regression is indicated when the outcome variable is “ordered”. while multinominal regression is used when there is no meaningful order of the dependent variable (Field, 2013b). Ordinal logistic regression requires that explanatory variables should affect consistently or proportionally across different thresholds (also known as assumption of proportional odds or parallel lines). However, when the condition is not met or due to the nature of research questions, multinominal logistic regression can also be used instead of ordinal regression (Shi, 2019). So even if the outcome variable is ordinal, we can build a nominal regression model if it answers our research questions (Flom, 2010).

Multinominal regression is known by different names like polytomous logistic regression, multiclass logistic regression, softmax regression, multinominal logit, maximum entropy classifier, and the conditional maximum entropy model (Engel, 1988, Menard, 2002, Malouf, 2002). Multinominal

regression is a method in statistics that extends the logistic regression to a multiclass problem. The method is used to predict the probabilities of more than two outcomes distributed categorically. This regression method is an extension of Binary Logistic regression, where the outcome variables are only two(Starkweather and Moske, 2011). Multinominal regression can be used to predict the classes/ categories or the independent discriminant variables for each category compared to the reference category (Field, 2013b).

As explained earlier in this section, the dependent variable in the multinominal regression is the logistic transformation of the odds (logit). The equation can be written as follows.

$$\log(odds) = logit(P) = \ln\left(\frac{P}{1-P}\right) = a + b1x1 + b2x2 + b3x3 + \cdots$$

or

$$p = \frac{\exp(a + b1X1 + b2X2 + b3X3 + \cdots.)}{1 + \exp\,(a + b1X1 + b2X2 + b3X3 + \cdots)}$$

where

p = the probability that a case is in a particular category

exp=the exponential (approx. 20.72)

a= the constant of the equation and

b= the coefficient of the predictor or independent variables

Interpretation of Multinominal Regression Results

1) Significance of Independent or Explanatory variables
   To establish a statistically significant association between the independent and dependent variable (each category) is determined by testing hypotheses. The null hypothesis is that there is no association between the predictor variable and dependent variable. A significance value less than or equal to 0.05 means a statistically significant association, and thus, the null hypothesis is rejected.
2) Effect of the Explanatory Variables
   "Odd ratios" describe the effect of the explanatory or the predictor variables. For continuous variables, odd ratios greater than one means that the "event" is more likely to occur as the value of the predictor variable increases. A value less than 1 means the "event "is less likely to occur with an increase in the value of the predictor variable. Similarly, for categorical predictors, odds ratios of "event occurring" for each level/ category are calculated. Odds ratios greater than 1 mean to indicate a positive, while less than 1 odd ratio indicates a negative relationship between predictor and dependent variable (MinitabExpress, 2019).

It is important to determine how well the model fits the data. Software packages calculate different parameters compared with the predefined tolerance range to determine how good or bad the nominal model is (Field, 2013b).

Multinominal regression was chosen to answer question 4 (please refer to section 1.3) of this research project because the relevant research question involves scaler predictor variables and one out come variable with levels and the possible options for our analysis were multinominal logistic regression, ordinal logistic regression, and multifunction discriminant regression (Bayaga, 2010, Field, 2013b, Field, 2013a). Multifunction function discriminant analysis requires strict assumptions about linearity, distribution and homoscedasticity and is more suited when researcher wants to find the discriminating variables at each category, the research question of this study is finding association of each variable with different categories and for that ordinal or multinominal regressions are considered best. While ordinal logistic regression requires ordered categorical outcome variable, multinominal regression is capable of handling both ordered and unordered variables (Hosmer et al., 2000a, Long, 1997) . Ordinal regression analysis requires the dataset to meet the condition of "Proportional Odds"(each independent variable has an identical effect at each cumulative split) and tested through " test of parallel lines"(Campbell and Donner, 1989, Hosmer et al., 2000a).

Assumptions of Multinominal Regression

Literature indicates different assumptions that the data needs to meet for accurate nominal model estimation. Assumptions include (1) A linear relationship exists between any continuous predictor and logit of the outcome variable, (2) Independence of errors (3), and absence of multicollinearity(Field, 2013b). On the other hand, some scholars also mention "independence of irrelevant alternatives" IIA condition should also be tested. Hauseman-McFadden test is normally used to test this condition, but no established and reliable algorithm has been developed for the test (Vijverberg, 2011). Roughly, IIA means that the addition or removal of alternative outcome categories/levels does not influence the odds among the remaining categories of the dependent variables(UCLA, 2021). While the absence of "influencer outliers" has also been mentioned as a condition that data needs to meet (Schwab, 2002). There is a divergent view on the removal of outliers from the data. Outliers do represent the variability in the data set. While some scholars argue the removal of outliers before a model is estimated (Judd et al., 2011), others argue against it (Orr et al., 1991). The major assumptions for multinominal regression are the absence of multicollinearity (Hua et al., 2021) and that observations and dependent variables must be mutually exclusive (no observation should fall in more than one category of the dependent variable) and exhaustive (every observation must fall into some category of the dependent variable) (Field, 2013b, Allen, 1997). Since Multinominal regression uses the maximum likelihood method for parameter estimation, thus an appropriately large size sample is required (minimum 10 -20 observations per predictor variable) (Agresti, 2003, Hosmer et al., 2000b).

(C) CONFIRMATORY FACTOR ANALYSIS

While measurement model of the latent variables is assessed through built in modules in the PLS-SEM software, a robust confirmatory factor analysis algorithm was used in the study to further ascertain the quality of measurement scale. Confirmatory Factor Analysis (CFA) is a statistical technique that verifies the factor structure of a set of indicator/manifest variables. The technique tests the hypothesis that a significant relationship exists between manifest variables or item variables and the underlying concept or construct. The relationship between construct and observable variables is defined based on the theory, empirical investigation, or a priori and verified through CFA (Suhr, 2006). The CFA results are sensitive to the research hypothesis, sample size, distribution, and missing data (Schumacker and Lomax, 2004). Contrary to most statistical tests that often use only a single statistical test to establish the significance, CFA relies on several tests to verify the quality of the model fit to empirical data. The

Chi-Square Test determines the degree of variation between the predicted and observed covariance matrices. A "statistically significant" ($p<0.05$) value close to zero indicates little difference between observed and predicted covariance matrices. Another index, the Comparative fit index (CFI), is the discrepancy function adjusted for the sample size. So, while the Chi-Square test has inherent sample size issues, CFI analyses the model fit by examining and adjusting for the discrepancies between the hypothesized model and data. A value of 0.9 is deemed a good fit (Gatignon, 2014, Hu and Bentler, 1999). Root Mean Square Error of Approximation (RMSEA) reflects residuals in the model. This index overcomes the sample size issues between the hypothetical model, optimally chosen parameter estimates, and covariance matrix of population. The values range from 0 to 1, and a smaller value indicates a better fit(Hu and Bentler, 1999). The magnitude of the relationship between the manifest variables and construct is calculated as factor loading. The standard factor loading estimate varies between zero and one. A value of 0.6 or higher is considered a good relationship between construct and indicator variables (Awang, 2012). The most frequently used estimation method in CFA is the Maximum Likelihood (ML) method. There are robust algorithms of the CFA available as well that use robust standard errors and robustly scaled test static to account for any data distribution and outlier problems in the empirical data(Padgett and Morgan, 2021). This study used a robust variation of the ML method, MLM (maximum likelihood algorithm but with robust standard errors and a Satorra-Bentler scaled Chi-Square), to check the measurement model.

6.5.4.3 MEASUREMENT OF LATENT VARIABLES/ CONSTRUCTS

All the latent variables/ Constructs were measured using previously validated scales used in several previous research. Please refer to

Table 6-1 and Table 6-2 for details of the scales used.

Table 6-1:Measurement scale of constructs used in Perceived E-Readiness model.

Sr No	Construct Name	Construct Abbreviation	Total Indicators	Literature Reference (adopted from)
1	Awareness	AW	7	(Molla and Licker, 2005a)
2	Human Resources	HR	2	
3	Business Resources	BR	6	
4	Technology Resources	TR	6	
5	Governance	GV	8	
6	Market Forces	MF	2	

7	Government E-Readiness	GR	4	
8	Support Industries E-Readiness	SI	4	(Molla and Licker, 2005a)
9	Commitment	CT	5	
10	Intention to adopt E-Commerce	IN	2	(Ajzen and Fishbein, 1972, Agarwal and Prasad, 1999, Luarn and Lin, 2005, Gao et al., 2011)

Table 6-2: Measurement scale of constructs used in the Technological and Perceived Behavioural Control factors model.

Sr No	Construct Name	Construct Abbreviation	Total Indicators	Literature Reference (adopted from)
1	Perceived Compatibility	PC	4	(Zhu et al., 2006a)
2	Perceived Behavioural Control	PB	3	(Taylor and Todd, 1995)
3	Perceived Security	PS	2	(Zhu et al., 2006a)
4	Perceived Cost Acceptability	CA	2	(Zhu et al., 2006a)
5	Perceived Relative Advantage	RA	2	(Zhu et al., 2006a)
6	Perceived Ease of Use	PE	4	(Moore and Benbasat, 1991)
7	Intention to adopt E-Commerce	IN	2	(Luarn and Lin, 2005, Gao et al., 2011, Agarwal and Prasad, 1999)

6.6 RESEARCH POPULATION AND SAMPLING

In any research, population is the focus of the study. This is a large set of individuals or objects about which inference will be made. A research population often has common characteristics and features (Pickard, 2013). A sampling frame is the actual list of the individuals or objects from which the sample is drawn and should ideally include the entire research population, excluding any object/ individual not part of the population (McCombes, 2019). It is not feasible to study the entire research population in most projects, so a representative sample is drawn from the research population. The sampling process refers to selecting a few from many to do an empirical study. The researcher needs to be very careful about the sampling process as it provides weight and credibility to the entire research. A researcher can use several sampling techniques depending on the purpose of the investigation (Pickard, 2013). There are two main types of sampling techniques available (1) Probability and (2) Non- Probability or Purposive sampling. Qualitative studies tend to use probability sampling, while qualitative research use

nonprobability or purposive sampling as a rule of thumb. The quantitative research projects aim to draw generalizations for the populations (larger than the samples) based on the data collected from the representative samples. Except for a few quantitative exploratory /evolutionary studies, quantitative studies tend to use probability sampling to provide a statistical basis for generalisation to a broader group (Pickard, 2013, Adwok, 2015, Thompson, 1999). The logic of statistical generalisation however demands that (1) the sample should represent the entire population, (2) the population itself needs to be defined properly, and (3) the sample was drawn from the population using probability sampling. Moreover, the sampling frame needs to be adequate, and sampling bias needs to be eliminated/ minimised (Saunders et al., 2009). There are four types of probability sampling techniques available.

Simple Random Sampling: In this technique, there are equal and known chances of an object from the sampling frame to be selected for research independently from the other members of the sampling frame (Saunders et al., 2009, Sharma, 2017, Pickard, 2013).

Systematic Sampling: As an alternative to simple random technique, one of the restricted sampling techniques is "systematic sampling" and involves the selection of every n^{th} element from the sampling frame (Sekaran and Bougie, 2016, Sharma, 2017). So it is similar to simple random sampling but differs in the sense that instead of randomly selecting, objects are chosen from a regular interval.

Stratified Sampling: Different subgroups or segments within the population often have different parameters on a certain variable of interest. To draw a meaningful result from the research, the data is needed to be collected to capture the responses of each subgroup in the population. Stratified sampling is the technique recommended in this situation. It involves the division of a population into mutually exclusive smaller subgroups known as strata. A random or systematic sample from each stratum is drawn in proportion or disproportion of the members of the stratum. Disproportionate sampling decisions are made when there is a greater spread of the size of starta (i.e. some stratum are too large or too small) or a greater variability is expected within a stratum (Sekaran and Bougie, 2016).

- ***Cluster Sampling:*** Cluster sampling also involves dividing the population into smaller subgroups, but each subgroup has the same characteristics as other sample members. Unlike stratified sampling, where samples are drawn from subgroups, cluster sampling involves selecting objects randomly from all subgroups. Clusters can be identified based on geographic location. So, while this technique is similar to stratified sampling, the groups termed clusters in this sampling technique can be naturally occurring. The clusters within a population are identified, numbered, and then selected based on random sampling, and then data from selected clusters are collected (Sekaran and Bougie, 2016, Saunders et al., 2009).

In nonprobability sampling designs, not every object of the population has a chance to be selected as a sample object, and population objects have no probabilities attached to their being chosen as sample subjects (Saunders et al., 2009, Sekaran and Bougie, 2016). While the technique is cost-effective and easier to access, it may lead to a higher degree of sample biasness. The inferences about the population made based on nonprobability sampling are weaker than the probability sampling. However, researchers still aim to choose a representative sample of the population (Sekaran and Bougie, 2016). There are four types of nonprobability sampling.

- Convenience Sampling: This is one of the easiest and most inexpensive ways to gather the initial data. However, the results obtained based on convenience sampling are not generalisable (Sekaran and Bougie, 2016).

- Voluntary Response Sampling: This sampling technique is inexpensive and easy to reach. The difference between convenience and voluntary sampling is that the respondents themselves volunteer to take part in the research, while in convenience sampling, the researcher(s) contacts the potential respondents (McCombes, 2019).
- Purposive Sampling: In this type of sampling, the researcher chooses the respondents deemed most suitable for the purpose of the research. So, this type of sampling is recommended when the research question demands obtaining information from a specific target group. There are two types of purposive samples (1) Judgement Sampling: which involves a choice of subjects that are in the best position to provide information about a specific social phenomenon, and (2) Quota Sampling: in this purposive sampling technique, a quota is assigned to each subgroup present in the population of interest (McCombes, 2019).
- Snowball sampling: This sampling method is used normally when the population is not easy to access. A respondent is recruited, and other respondents are recruited from the contacts of the already recruited participant. Thus each recruited participant "snowballs" as the researcher contacts other respondents of each subject (Pickard, 2013).

Given that the study collected responses from both public and private sectors and expected great variance in the responses, the sampling method used in the study was "stratified." The method allowed to divide the sample population into groups and then choose randomly from all representative groups. As the units chosen were based on probability sampling, we can safely make generalisations. Other probability sampling techniques were not found suitable in our circumstances because of presence of different groups with varying sizes and distinct characteristics in the population of interest (Parsons, 2014).

6.6.1 RESEARCH SAMPLE

The research population for the project is Pakistani businesses from both public and private sectors. To have a larger sample frame that represents the population we are interested in, we selected our respondent organisations from Federal Board of Revenue (FBR). A letter from PhD advisor was obtained and request was made to the concerned department. In addition, a list of companies from local chamber of commerce was obtained. Data from both sources were appended together in a csv file and duplicate records were removed. Empirical data was collected in two phases. Data collected from the source was entered in a spreadsheet and then was divided based on the sectors. Although there are "Semi Government" organisations in Pakistan, but they tend to call themselves government organisations. Like Sui Northern Gas Pipelines Limited is a semi government organisation working under Ministry of Petroleum and Natural Resources, but it is still called a government organisation and categorised as public sector organisation in databases of FBR and Chamber of Commerce. Although three sectors were included in the survey, no response was received for "Semi Government" sector. A colour code scheme was used in questionnaire survey to distinguish sectors based on the source data; the collected responses further confirmed two sector categorisations generally used. The data was imported into the R environment and as a single data frame and then subdivided into two data frames based on sector, df_public and df_private. Both data frames were reshuffled using R script and then every 5^{th} record yielding randomly selected 345 public and 976 private records. Processed data frames were exported as two sheets in single XLSX (Excel file) and each industry was assigned a unique code. Industries were contacted requesting consent to take participate in study. Those who agreed were asked about the number of potential respondents holding decesion making position within organisation and their preferred survey completion method. Subsequently another two columns in each sheet were added to record potential respondents and running sum against each record. Industries were selected

from the list once enough respondents were achieved through the running sum column. Notably, there was a significantly higher number of potential respondents per industrial unit in the public sector, possibly due to its inherently larger horizontal organisational span. For survey details please refer sections 7.5.1.1 and 7.5.2.1 . Received responses were recorded in an excel file. Most of survey questions were closed ended so development of a coding scheme or set of categories to systematically classify the qualitative responses into meaningful groups was not required. All categorical responses were assigned a predefined code value, while Likert scale responses were coded 1 (strongly disagree) to 5 (strongly agree). Survey responses were then entered in Excel sheet for further analysis in other software.

6.6.2 SURVEY DESIGN

Survey design is a very important aspect of the research project as it effects the survey quality through response rate (Baruch and Holtom, 2008, Beerten et al., 2000, Davern, 2013). While a hundred percent response rate is rarely achieved in voluntary studies (DeMaio, 1980), scholars target the maximum response rate (Baruch and Holtom, 2008). Several issues related to questionnaires can affect nonresponse rate, including content/construction of questions, questionnaire administration method, and questionnaire length. Difficult to understand, sensitive, and poorly worded questions normally lead to frustration, which eventually increases the nonresponse rate (Sahlqvist et al., 2011, Vicente and Reis, 2010, Pickard, 2013). Literature indicates several guidelines for preparation of quality questionnaire. The length of the survey should be appropriate to avoid response fatigue. The sentences should be clear to understand and interpret. An appropriate questionnaire length and clear wording increase reliability while minimising the respondent bias. Moreover, the questionnaire should aim to avoid Jargon and use excessive technical terms; the questions should be understandable and as short as possible, and all possible responses should be covered in multiple-choice questions. The sequence of questions should allow the respondent to complete the questionnaire in the minimum possible time without excessive cognitive load (Pickard, 2013, Saunders et al., 2009). The questionnaires measured different constructs relevant to the research questions. Both consisted of a closed question style to encourage respondents to select the answer that best describes their opinion. Closed questions take less time to answer, so a researcher can expect a greater response rate. In contrast to open-ended questions, closed-ended questions do not discriminate between the less talkative or less articulate respondents. Finally, closed-ended questions do not put the cognitive load on respondents as responding to the questionnaire only involves a “Recognition Task” and does not involve any “Recall Task” (Foddy and Foddy, 1994). Before administration, the questionnaires were submitted to the departmental ethical committee and approval was obtained. The questionnaires were administered by providing access to an online version of the questionnaire on “Qualtrics” and through the post/by hand.

6.6.2.1 PRE-TEST AND PILOT TEST

Ensuring that the research instrument works as intended is very important. Consistency and accuracy are two important desired qualities of a survey. It is important that a survey measures what it is expected to measure (validity) and produces the same measurements if used over and over again in similar conditions (reliability) (Pickard, 2013). A very common practice in the research is to distribute the survey instrument to the associated research participants or experts to ensure the validity and reliability of the survey instrument. Pilot testing flags the problem areas (like over-complicated or inappropriate questions) in the research questionnaire that may cause research failure or impact the research quality. In addition, pilot testing helps establish the feasibility of the main research, gives an idea that sampling technique, sampling frame, and sapling size are right for the study, highlights any logistics and financial issues (Hassan et al., 2006, Van Teijlingen and Hundley, 2001). The instrument

can be pilot tested on the friends and experts(Presser and Blair, 1994) called experts driven pretesting or on a small segment of the population called respondents driven pretesting (Ferketich et al., 1993).

This study used the "Experts Driven" pretesting. The research supervisor at the University of Strathclyde was requested to comment on the questionnaires. The questionnaires were then amended according to the suggestions of the supervisor. After getting ethical approval from University's authority, the questionnaires were shared with two professionals in a large management consultancy firm in Pakistan for their feedback. Finally, three high-profile organisational heads in the sample frame were requested to comment on the survey questionnaire. Necessary changes were made to improve the survey content. Some definitions were added to the questionnaire to clarify the questions. A divergent view exists on the minimum recommended participants for the pilot study; the recommended minimum number of participants varies from 12 to 30 (Hunt et al., 1982). A total of 55 questionnaires were distributed to individual from 5 organisations, and they were requested to be critical and raise any concerns over the survey instrument content and data were checked for consistency. Final questionnaire used in the study are represented as Appendix A.

6.7 SUMMARY

The chapter started with description of the different research philosophies and approaches utilised in social sciences research, followed by a discussion on the discussion on the chosen research philosophy. Pragmatism was chosen as a guiding philosophy of this project due to the relative and contextual nature of reality being studied. Since we tested hypotheses grounded in the previous research, the study employed a deductive approach. The chapter also described and justified the data processing methods, data collection technique, data collection strategy and time horizon. This project is a quantitative study sampled the population frame through "Stratified" sampling ensuring appropriate representation from public and private sectors. The data was collected from sample through questionnaire survey prepared following the good practices. To ensure the quality of questionnaire, it was pilot tested and approval from the University's ethical committee was obtained. All the constructs were measured using pre - validated scales used in previous studies and were added in the questionnaires. A range of univariate and multivariate techniques were selected to analyse and infer the data, using software like SPSS, SMART PLS and languages like R and Python. While typical descriptive analysis was presented using univariate techniques, inferential analysis utilised multivariate techniques like Partial Least Square Structural Equation Modelling, Confirmatory Factors Analysis (CFA) and Multinominal Logistic Regression.

CHAPTER 7 DATA ANALYSIS

7.0 INTRODUCTION

Effective preparation of data prior to hypothesis testing is of utmost importance to ensure that accurate and reliable results are obtained, any underlying issues are identified and addressed, and the efficiency and statistical power of the analysis are improved. In particular, the appropriate handling of missing data and outliers is critical in ensuring accurate and reliable results in data analysis. Similarly, most of the predictive/ classification statistical techniques are sensitive to the data distribution and multicollinearity. The current chapter starts with a comprehensive description of the different available strategies for dealing with missing data, followed by the selection of the most suitable strategy for the research being conducted. Subsequently, the chapter focuses on an extensive discussion of the available options for utilizing construct scores in the model. Next, the chapter underlines the significance of the shape of the data distribution in data analysis and then examines the data distribution and outliers of the two datasets utilised in the study. The phenomenon of multicollinearity is discussed in the subsequent section along with results of multicollinearity tests for the datasets used in the study. To provide a comprehensive understanding of the data, the chapter presents a detailed description of the datasets by calculating the mean, median, interquartile range, and frequencies. The chapter conducts hypothesis testing using two statistical techniques for each of the two datasets, and the results are presented in tabular form.

7.1 TREATMENT OF MISSING DATA

Missing data is a concern in almost all empirical research (Jamshidian, 2004). Data collected from the sample may have several quality issues, including redundancy, incompleteness, and noise (Acuna and Rodriguez, 2004). Real world data sets typically have missing values, and data scientists spend considerable time preparing data for analysis (Cios and Kurgan, 2005). While missing values is a problem in all empirical research, researchers who collect data from a large population through questionaries specifically face this problem (Raaijmakers, 1999). Missing data in a dataset could be a result of a variety of reasons, including (1) respondents not knowing the answer, (2) not having enough information or knowledge to answer the question, (3) believing the question does not apply to them, (4) feeling uncomfortable answering certain sensitive questions (e.g., about their gender, income levels, taxes etc.), (5) simply forgetting to answer the question, and (6) failing to complete some sections due to time constraints (Tsikriktsis, 2005, Allison, 2001, Graham et al., 2013). Statisticians divide missing data into three groups (1) Missing Completely at Random -MCAR: The highest level of randomness, The likelihood of missing data on any attribute is independent of attribute value , (2) Missing at Random (MAR): When the likelihood of missing data on every attribute is not determined by its own value, but by the values of other elements and (3) Not Missing at Random (NMAR): Missing data depends on the variable itself (Peng and Lei, 2005). Missing data can bias the results, impair generalisability and reduce power, ultimately translating into the research's compromised internal and external validity (Hardy et al., 2009). According to general guidelines, If the rate of missing data is less than 1%, it is unlikely to affect the results; 1-5% is manageable, 5-15% requires sophisticated methods to handle, and more than 15% is likely to impact interpretation severely(Acuna and Rodriguez, 2004).Newman et al. (2009) have defined three levels of “nonresponse” (Figure 7-1) ; (1) “Item-level nonresponse” is when a respondent fails to respond to certain items/ observable variables of a latent construct, (2) “Scale Level nonresponse” is when the respondent does not respond on the whole construct, (3) or in “person/ survey level nonresponse” the respondent does not return whole survey questionnaire at all. Nonresponse levels are nested, and an item level nonresponse can lead to scale level, leading to survey level nonresponse (Newman, 2014).

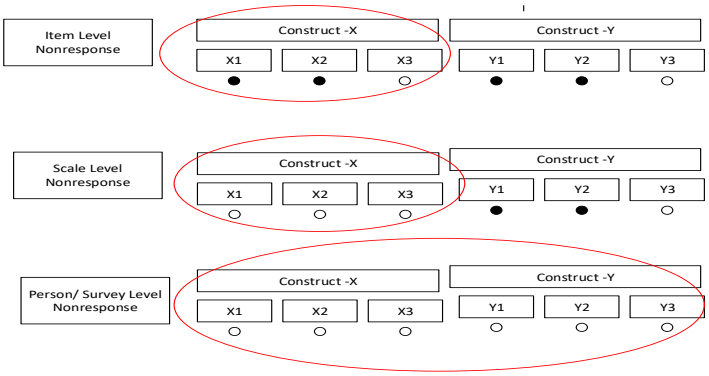


Figure 7-1: Nonresponse levels adopted from(Newman, 2014)

Literature indicates several approaches and techniques for dealing with missing data, each with its own set of strengths and drawbacks. However, only a few strategies have received universal acceptance (Allison, 2001). Most often used techniques to deal with missing values include "listwise deletion", "pairwise deletion", "imputation", and "expectation maximum algorithm" – EM (Little and Rubin, 1989).

The Listwise deletion strategy involves deleting all observations with missing values (Allison, 2001). The main advantages of this strategy are simplicity and consistent estimates of the covariance matrix as the same cases are used in all estimations (Bollen, 1989). However, deleting cases with missing values may result in the loss of a large amount of data despite having few missing values (Hulland et al., 1996). In effect, this procedure converts item level or scale level missing data into a survey or person level missing data (Newman et al., 2009). A large volume of sample data loss may result in decreased power(Gilley and Leone, 1991) and bias in parameter estimation (Donner, 1982). Pairwise deletion attempts to prevent the massive data loss from the "listwise deletion method." The method does not include a variable with a missing value. Still, it utilises the case when examining other variables with non-missing values in a particular statistical technique. This method aims to prevent conversation of item level and/or scale level missing data to survey or person level missing data (IBM, 2020). Consider a correlation matrix as an example of how pairwise deletion works. A correlation measures the strength of the link between two variables. The correlation coefficient will consider the data for each pair of variables for which data is available. As a result, paired deletion maximises all data accessible on a case-by-case basis. So, in summary, depending on the statistical model, it excludes the case when a particular variable with a missing value is in the model but will include the case when a variable with a missing value is not included in the model, and other variables in the model do not have missing values. This strategy has the advantage of increasing the power of your analysis. While this method preserves a great deal of data, the main disadvantage is that different calculations in a single research study may involve different observations (Malhotra et al., 2017). Different observations in a single study may result in problems with the interpretation of chi-square (Bollen, 1989). Sometimes pairwise deletion may construct a "not positive define" matrix, and thus regressions cannot be computed (Allison, 2001). Imputation method technique for imputation of missing data on a variable entails replacing the missing values with a value derived from an approximation of the variable's distribution in the dataset(Donders et al., 2006). The most straightforward method for estimating or imputing missing data is to use marginal mean imputation (Allison, 2001). While this method also prevents loss of data and inconsistent results (because of the same number of observations in all calculations), selecting the right/ suitable cases for imputation is an issue, especially in small datasets (Humphries, 2013). The Expectation Maximum Algorithm (EM), as the name implies, has an expectation step and a maximisation step. The estimation step involves the calculation of sample moments such as means, variances, and covariances. Missing values are substituted with the estimations in the second step (Maximisation), maximum

likelihood estimations of the covariance matrix using the values estimated in the first step, and then an algorithm starts a loop the step one and two until specified convergence is achieved (i.e., the difference in estimates among successive iterations are very small). EM algorithm is believed to give good results regardless of sample size and percentage of missing data (Davey, 2009, Dempster et al., 1977, Enders, 2001). While EM method is superior to imputation as it preserves the multivariate relationships (important in regressions and factor analysis), it still underestimates the error value. It thus is suitable only when the standard error of the individual item is of no significance (Little and Rubin, 1989). In this study, list-wise deletion method was used to treat missing values, which is a default method in most statistical packages for calculating regression estimates and other test statistics. There is only a small percentage of missing data in the datasets used in the study, and the missing data does not appear to have any specific pattern or association (i.e., completely random). List wise deletion is best method to treat missing data when data is missing completely at random (MCAR), the dataset is large, and the proportion of missing data is small (Allison, 2001, Patrician, 2002).

7.2 SUMMATED AND FACTOR SCORE

This section explains how latent variable scores were computed and used in two statistical techniques used in the study. This study involves two statistical techniques Partial Least Square Structured Equation Modelling (PLS-SEM) and Multinominal Regression Analysis. The PLS-SEM algorithm computes latent variables' proxies corresponding to reflective or formative models and uses them for further calculations (Figure 7-2). Depending upon the statistical model, PLS-SEM calculates latent variables using two different modes – Composite Model Mode (for composite statistical models) and Common Factor Model Mode (for common factor statistics models). When all reflective constructs are used in the “composite statistical model”. “composites” are calculated through “Mode A”. and the “outer loadings” are a measure of the correlation between the latent variable and the observable variables. Whereas in the case of a formative construct, composites are calculated through “Mode-B”. and outer weights are regression weights calculated by keeping observable variables as independent and construct as the dependent variable. PLS-SEM mimics the common factor statistical model by using either Mode A or Mode B depending upon the type of construct (i.e., reflective or formative) (Hair et al., 2017, Hair et al., 2014, Sarstedt et al., 2016). The PLS-SEM algorithm involves two stages. Stage 1 involves four steps, (1) estimation of the latent variable scores (Y1, Y2, and Y3) using scores of observable variables and the relationship between observable variables and constructs(w1 to w7- calculated in step 4) (2) estimation of relationship among constructs (P1and P2) (3) estimation of inner latent scores using latent variable scores of independent latent variables and proxies of the relationship between independent latent variables and dependent variables (based on Y1, Y2, Y3 – Step1 and P1, P2: Step-2 (4) Estimation of proxies for coefficients in the measurement models (the relationships between indicator variables and latent constructs with scores from Step 3; W1 to W7). Stage Two: For each partial regression in the PLS-SEM model, final estimates of coefficients (outer weights and loadings, structural model linkages) are computed using the ordinary least squares approach (Hair et al., 2011).

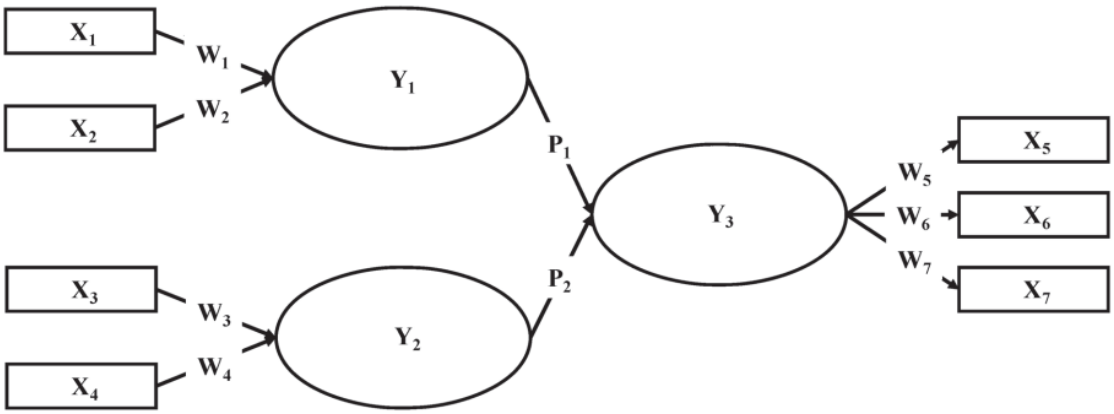


Figure 7-2: Inner and Outer Model in SEM source and calculation of factor scores (Hair Jr et al., 2016)

While PLS-SEM uses latent scores for estimations in PLS-SEM, "Summated Scores" were used in Multinominal Logistic Regression. A summated score is obtained by merging all "Manifest" or "Observable" variables that measure different aspects of the same "Latent Variable" or "Construct". The total mean of all observable/ manifest variables is employed in further analysis (Hair, 1992). A summated score is considered a good proxy of all aspects of the construct and reflects all the different dimensions or elements of a construct in a single value (Forslund, 2007). Let's say a latent variable X is measured through three manifest variables x1, x2, and x3; the summated score of latent variable x is obtained by adding values of x1, x2, and x3 and then diving by 3 (Figure 7-3).

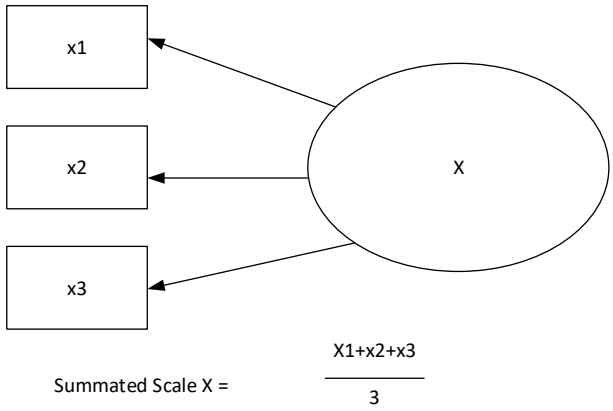


Figure 7-3:Summated Scores (Hair, 1992)

Summated scales have been used in several empirical studies (Behrman and Perreault Jr, 1982, Piercy et al., 1999). However, it is very important to ensure the quality of the measurement model by checking the unidimensionality of the scale through exploratory or confirmatory factors analysis (Hair, 1992). Although PLS SEM's algorithm will also ensure unidimensionality, we will use the confirmatory factors analysis technique again before using the summated scales in Multinominal Logistic Regression.

7.2.1 RELIABILITY AND VALIDITY OF SCALES

The quality of research can be assessed through reliability and validity. Reliability and Validity refer to how well a method, technique, or test measures and how consistent the results are. The validity ensures that a scale measures what it is supposed to measure (accuracy of the scale), and reliability is about the consistency of measurement results. So, a greater reliability means we can expect similar results when the research is repeated in similar conditions. Validity means that results are measuring what they were

supposed to measure. It is important to note that a reliable measure may not be valid (i.e., results are reproducible, but they do not measure what was supposed to measure). On the other hand, if a test produces accurate results, it should be normally reproducible. So generally, a valid measurement is reliable as well (Middleton, 2022). There are two types of constructs (i) Reflective and (ii) Formative. In the reflective constructs, observable variables are realised from the construct (latent variable), and causal priority is from the construct to the items (observable variables). Since all item variables explain the same construct, a high correlation among the item variables is expected, and the removal of an item from the construct does not normally change the nature of the construct. On the other hand, the observable variables are explanatory in the formative constructs, and the causal priority is from indicators (observable variables) to the construct. Item level high correlations are not expected as each item represents a different dimension of the underlying construct. Thus, removing an item from the construct is likely to impact the nature of the formative construct (Freeze and Raschke, 2007). Reliability of the reflective constructs is established through Cronbach Alpha. Validity of the construct is established through Convergent validity (i.e. indicators explain a significant proportion of the underlying construct) and Discriminant validity (indicators should explain the much lower variance of other constructs) establishes the validity in validity of a reflective construct (Roberts and Thatcher, 2009, Hanafiah, 2020, Freeze and Raschke, 2007). This study used all pre-validated reflective constructs used in several previous studies. The reliability and validity of the constructs used in this study have already been established in several studies. While PLS-SEM reports the reliability and validity of the construct, a "robust" version of confirmatory factors analysis was carried out to further confirm the validity and reliability of the constructs for use in multinominal regression analysis.

7.2.1.1 ROBUST CONFIRMATORY FACTOR ANALYSIS OF CONSTRUCTS USED IN THE STUDY.

Confirmatory Factor Analysis of the constructs used in this research was performed using Lavaan 0.6-8 in R. The estimation method used was the Robust version of the Maximum Likelihood Estimator (MLM). The process normally ended after 72 iterations for E-Readiness constructs and after 54 iterations for technological and behavioural measurement model. All item variables loaded nicely to the respective constructs. The recommended factor loadings are 0.5 for a newly developed scale and minimum 0.6 for established scales (Hair et al., 2011). Appendix-B gives the robust confirmatory factor analysis output for the two measurement models. R language library **semtools** were used to calculate different indicators of reliability/validity. Two indicators, "alpha" and "omega or Rhu" reflect the reliability of the measurement model. The recommended minimum value for alpha is between 0.70 to 0.95 (Nunnally, 1994, Bland, 1997, DeVellis and Thorpe, 2021). The recommended cut-off value for omega / rhu is >= 0.7 (Hair et al., 2006). Average Variance Extracted (AVE) is a measure of construct validity, and the recommended value is >=0.5 (Hair et al., 2006). So based on our results, we can conclude that the reliability and validity of our constructs is established (Table 7-1 and Table 7-2). The measurement model fit index values are a measure of model quality. The values are presented in Table 7-3 and Table 7-4. The recommended cut-off values for chi-square is P>0.05 (non-significant), Root mean square error (RMSEA) ≤ 0.08, Comparative Fit Index (CFI) >=0.95 and Normed Fit Index (NFI) >= 0.90 (Brown, 2015, Schreiber et al., 2006). We can see that all model fit indices values fall within the recommended range.

Table 7-1: Reliability and validity of constructs – Perceived E-Readiness factors model

	AW	HR	BR	TR	CT	GV	MF	GR	SI	IN
alpha	0.93	0.80	0.91	0.91	0.90	0.92	0.78	0.84	0.84	0.79
Omega/ Rakove's Rhu	0.93	0.81	0.91	0.91	0.90	0.92	0.80	0.84	0.84	0.80
AVE	0.65	0.68	0.63	0.64	0.65	0.61	0.67	0.57	0.57	0.66

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt E-commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

Table 7-2: Reliability and Validity of the constructs- Technological and Perceived Behavioural Control factors model

	PC	CA	PS	PB	PE	RA	IN
alpha	0.83	0.77	0.70	0.82	0.86	0.78	0.77
Omega/ Rakove's Rhu	0.83	0.79	0.70	0.82	0.86	0.78	0.78
AVE	0.55	0.66	0.55	0.60	0.60	0.65	0.64

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

Table 7-3: Measurement Model Fit Summary - Perceived E- Readiness factors model

Fit Index	Value
RMSEA	0.036
CFI	0.954
NFI	0.886

Table 7-4: Measurement Model Fit - Technological and Perceived Behavioural Control factors model

Fit Index	Value
RMSEA	0.01
CFI	0.99
NFI	0.94

7.3 DATA DISTRIBUTION AND OUTLIERS

To statistically describe a real-world phenomenon, it's necessary to comprehend the underlying processes. However, since we often lack precise knowledge of these processes, statistical methods depend on assumptions regarding their probability. Probability is a mathematical measure of "chance." In the context of the social sciences, probability tells us about how the numbers calculated from "samples" relate to the numbers from the "population"(Steven, 2004). "Probability distribution" tells us about the chances of an event happening. There are several probability distributions in statistics, including basic probability distribution, binomial and normal distributions (Foster et al., 2014). Most of the statistical techniques like regressions and other parametric tests used in social sciences research require a normal distribution of variables (Steven, 2004). A perfect normal distribution histogram is a bell-shaped curve, the mean lies within the middle, mean and median are equal, and the curve is symmetrical about the mean. Most data points lie close to the mean, the frequency around the mean is high, and the curve never touches the X-axis (Figure 7-4).

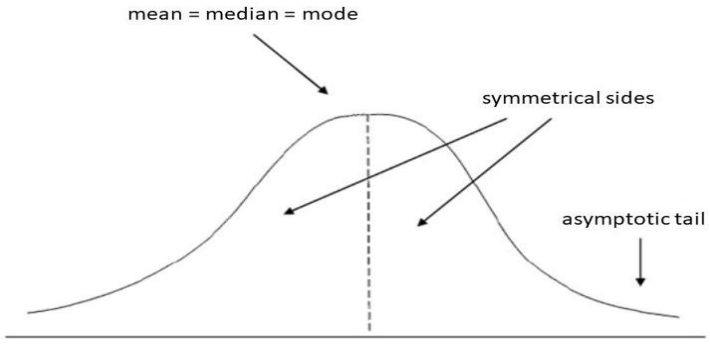


Figure 7-4: A typical Normal Curve Source (Hair, 1992)

However, real-life data sets are rarely perfectly normally distributed. We just analyse the natural datasets to assess how close they are to the normal distribution and set different thresholds for the datasets to deviate from a perfectly normal distribution (Stine and Foster, 2011). The real dataset in Social science is rarely normally distributed (Hair et al., 2019). . Several factors affect the distribution of a dataset. A distribution may not be a normal distribution because of more than one distribution within a dataset, a temporal drift, the presence of one or more outliers, and asymmetrical behaviour (Scibilia, 2015). There are several tests and techniques that can be used to test whether a dataset is close to a normal distribution. Typically used methods for testing the normality of continuous data are the Shapiro-Wilk test, the Kolmogorov-Smirnov test, skewness, kurtosis, histogram, box plot, P-P Plot, Q-Q Plot, and mean with standard deviation (Mishra et al., 2019) . However, several scholars advocate usage of visual methods or methods that calculate indicators of physical shape of the cure like skewness, kurtosis and comparison of mean, median and standard deviation (Griffin and Steinbrecher, 2013, Kozak and Piepho, 2018). Datasets having observations more than 30 to 40 typically fail the normality tests that check the null hypothesis against the assumptions of normality (Pallant, 2020, Öztuna et al., 2006). Moreover, they check that the population from which sample was drawn was normal and thus it is possible to have a normal sample withdrawn from non-normal population and so some scholars advise not to use them to check the normality assumptions normally associated with parametric tests (Ian, 2011). One of the most frequently and widely accepted method to infer the distribution of a dataset is through calculation of skewness and kurtosis and comparing them with allowable threshold. Skewness and Kurtosis are two indicators that reflect the shape of frequency curve or histogram. Skewness tells about the symmetry or asymmetry of the distribution curve, and kurtosis tells about the "tail" of the dataset (Thode, 2002). There is no consensus on the acceptable range. Some scholars recommend a range of -2 to +2 for skewness and -7 to +7 for kurtosis (Hair et al., 2006, Ryu, 2011), others take more lenient view and accept values of -3 to +3 and -10 to +10 for skewness and kurtosis respectively. Values above this threshold are considered deviant from the normal distribution (Cain et al., 2017).However, structural equation modelling is quite robust technique and can withstand typical deviations from normality (Griffin and Steinbrecher, 2013) . Table 7-5 and Table 7-6 list two data sets' skewness and kurtosis values, and we can see that our datasets meet the recommended requirements.

Outliers are observations/data points that deviate from most of the data's trends. Outliers can be univariate or multivariate. A univariate outlier is a data point that has an unusual value of one variable; a multivariate outlier, on the other hand, is a combination of extreme scores on two or more variables and can influence the statistical results. Most parametric statistical tests require outliers to be removed (Jarrell, 1992, Hawkins, 1980, Bhandari, 2021). Outliers may result from natural variation in the

population, inaccurate data entry, faulty distribution assumptions, equipment fault, and measurement errors. However, extreme values in the data set do not necessarily mean a bad quality dataset (Bhandari, 2021). A researcher can delete the outliers or transform data to use parametric tests or retain them in the data set if outliers are because of natural variations in the population. As a guide retaining the outliers in the dataset is a better option when you are not sure about the cause of outliers (Bhandari, 2021). For data analysis, the researcher can use nonparametric tests or choose from a variety of "robust" parametric statistical tests while retaining outliers (Osborne and Overbay, 2004). Nonparametric tests rely upon "rankings" or medians, and they are unaffected by the extreme values and only represent the relative position to other data points (Scibilia, 2015).

Commonly used outlier detection methods include Box plot which compares the quartile values and individual data points but it is not considered a good choice (Sim et al., 2005) especially in high dimensional data(Hodge and Austin, 2004). One of the popular methods to identify the outliers is to flag all the data points that are more than three standard deviations away from the mean (3 sigma rule) (Pukelsheim, 1994). This method is more sensitive than box plot or quartile test (Chikodili et al., 2021). All our data points in the datasets are within the three standard deviations from the mean. It is important to remember that outliers are a function of the distribution type, and thus any datapoint flagged as an outlier is contextual. The data points markedly away from the main clusters can be classified as outliers (Kou et al., 2007, Stevens, 1984, Hadi et al., 2009). Z score test is a parametric test, and involves calculation of z scores of each variable of interest for more meaningful analysis (Polit, 2013), any datapoint with z score more than 3.29 absolute is considered outlier (Tabachnick et al., 2013). A python script was run to compare the z scores with recommended range presented as Appendix C. From the two results we can see that no datapoint was flagged as an outlier. Multivariate outlier detection is very important for accuracy of multivariate analysis but is often neglected or skipped in research studies. Mahalonobis distance (MD) method (Mahalanobis, 1936) is the standard method for multivariate outliers detection. The method involves calculation of Mahalanobis distance by comparing the distance of each data point from the centre of the data in a multidimensional space while accounting for variable correlation. The formula for calculation of MD is as follows.

$$D^2 = (x - m)^T . C^{-1} . (x - m)$$

Where:

$D^2 = Square\ of\ the\ Mahalanobis\ distance$

$x = Vector\ of\ the\ observation\ (row\ in\ a\ dataset)$

$m = Vector\ of\ mean\ values\ of\ \ varaibles$

$C^{-1} = inverse\ covariance\ matrix\ of\ \ varaibles$

Then a critical value for the chi-squared is calculated based on the appropriate degree of freedom and significance. The Mahalanobis distance is then compared with the critical value and outliers are identified with a certain significance level. However, the outliers detection is contextual and not all points above the calculated threshold are outliers (Filzmoser, 2004). Manual process to detect outliers using Mahalanbis distance using tables was quite tedious, however, now researchers can use several statistical software and libraries in the languages like R and Python to run Mahalanobis distance test (Filzmoser, 2004). A python script was run on both datasets to detect any multivariate outliers based on the Mahalanobis distance method with 0.01 significance level. The results and script used are

appended as Appendix- D. No multivariate outlier was detected based on the comparison of threshold calculated. Given that both datasets passed the skewness and kurtosis test for normality, a more precise Z score test (Chikodili et al., 2021) for univariate outlier detection, and Mahalanobis distance test for multivariate outliers detection the author decided to retain all datapoints without any transformations to preserve natural variance in the data. Also, in this study, statistical techniques like "PLS-SEM". is insensitive to distribution (Hair et al., 2019), Confirmatory Factor Analysis using "Robust methods". and Multinominal Logistic Regression that produces reliable statistical results when distribution or outliers assumptions are not met (Scibilia, 2015, Osborne and Overbay, 2004).

Table 7-5: Skewness and Kurtosis - Perceived E-Readiness factors model.

Construct	N	Mean	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
AW	448	3.444	-.368	.115	-.700	.230
HR	448	3.411	-.289	.115	-.741	.230
BR	448	3.364	-.117	.115	-.826	.230
TR	448	3.373	-.201	.115	-.854	.230
GV	448	2.994	-.064	.115	-.698	.230
MF	448	3.518	-.386	.115	-.685	.230
GR	448	3.650	-.487	.115	-.333	.230
IN	448	3.683	-.547	.115	-.438	.230
SI	448	3.591	-.334	.115	-.599	.230
CT	448	3.365	-.310	.115	-.761	.230
Valid N (listwise)	448					

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt e-commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

Table 7-6: Skewness and Kurtosis - Technological and Perceived Behavioural Control factors model.

Construct	N	Mean	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
PC	347	3.548	-.338	.131	-.651	.261
PB	347	3.406	-.244	.131	-.614	.261
PS	347	3.774	-.544	.131	-.480	.261
CA	347	3.735	-.574	.131	-.240	.261
RA	347	3.236	-.052	.131	-.879	.261
PE	347	3.653	-.326	.131	-.646	.261
IN	347	3.644	-.361	.131	-.628	.261
Valid N (listwise)	347					

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

7.4 MULTICOLLINEARITY

The presence of a significantly higher correlation between the independent constructs (variables) can potentially hinder the relative importance of the independent variables in explaining the dependent variables in statistical models and weakens the statistical power of the model (Yoo et al., 2014, Alin, 2010). Therefore, the absence of multicollinearity is a prerequisite of several statistical tests. One established method to rule out multicollinearity is to prepare a correlation matrix. Variables with a correlation coefficient below 0.80 are considered to exhibit no multicollinearity problem in the model (Malhotra et al., 2017). In addition, in the context of regression, two other standard diagnostics

Variance Inflation Factor (VIF) and tolerance values are also used to determine the presence of multicollinearity. VIF is the measure of inflation in the variances of the parameter estimates due to collinearity among the independent variables. It thus indicates how much the variance of the regression coefficients (Beta) is inflated by the high correlation among the predictor variables. A VIF of 1 means no relationship between a particular predictor and remaining predictors in the model and consequently no inflation in the parameter estimates (Beta). Tolerance, on the other hand, is the proportion of the variance in the predictor that the other predictor variables cannot account. As a rule of thumb, VIF values above 4 are problematic and indicate the presence of multicollinearity. On the other hand, a tolerance value below 0.2 indicates the presence of multicollinearity (Senaviratna and Cooray, 2019).

Table 7-7 and Table 7-8 show the correlation matrix of the variables used in perceived E-Readiness and technological and behavioural model respectively. There is no correlation coefficient >0.8 among independent constructs. Table 7-9 and Table 7-10 show VIF values of E-Readiness and technological & Behavioural Factors. All the values are less than 4. Thus, there is no multicollinearity issue in the out two models.

Table 7-7: Correlation matrix Perceived E-Readiness factors

	AW	HR	BR	TR	GV	MF	GR	IN	SI	CT
AW	1	0.31	0.27	0.34	0.24	0.26	0.06	0.36	0.07	0.3
HR	0.31	1	0.28	0.29	0.24	0.21	0.06	0.28	0.08	0.17
BR	0.27	0.28	1	0.37	0.16	0.21	0.05	0.3	0.08	0.27
TR	0.34	0.29	0.37	1	0.19	0.2	0.04	0.33	0.09	0.32
GV	0.24	0.24	0.16	0.19	1	0.15	0.11	0.34	0.08	0.24
MF	0.26	0.21	0.21	0.2	0.15	1	0.13	0.25	0.04	0.21
GR	0.06	0.06	0.05	0.04	0.11	0.13	1	0.28	0.06	0.07
IN	0.36	0.28	0.3	0.33	0.34	0.25	0.28	1	0.26	0.43
SI	0.07	0.08	0.08	0.09	0.08	0.04	0.06	0.26	1	0.11
CT	0.3	0.17	0.27	0.32	0.24	0.21	0.07	0.43	0.11	1

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt e-commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

Table 7-8: Correlation matrix Technological and Perceived Behavioural Control factors

	PC	PB	IN	PS	CA	RA	PE
PC	1	0.22	0.3	0.11	0.16	0.07	0.22
PB	0.22	1	0.22	0.14	0.17	0.1	0.24
IN	0.3	0.22	1	0.39	0.17	0.28	0.14
PS	0.11	0.14	0.39	1	0.11	0.09	0.12
CA	0.16	0.17	0.17	0.11	1	0.18	0.17
RA	0.07	0.1	0.28	0.09	0.18	1	0.22
PE	0.22	0.24	0.14	0.12	0.17	0.22	1

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

Table 7-9: VIF values Perceived E-Readiness factors model.

Construct	VIF
AW	1.30
HR	1.23
BR	1.26
TR	1.33
GV	1.14
MF	1.14
GR	1.03
SI	1.02
CT	1.24

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt e-commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

Table 7-10: VIF Values Technological and Perceived Behavioural Control factors model

Construct	VIF
PC	1.10
PB	1.12
PS	1.04
CA	1.09
RA	1.08
PE	1.15

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

7.5 SAMPLE PROFILE

The data for this study was collected in two phases. In phase 1 data was collected on E-Readiness factors, while in phase 2 collected data on Technological and Behavioural Control Factors. Since study of interaction of sectors and E-Commerce adoption level were important information that was required to answer some research questions of the project, both questions were made mandatory in the Qualtrics questionnaire. Paper questionnaire was also colour coded to distinguish responses from both sectors. In the cases where we found missing information about E-Commerce adoption levels in the paper questionnaires, we followed up with the organisations to obtain the necessary information about their E-Commerce adoption levels. To maximise the participation, a local coordinator who had work experience in local stock exchange company was requested as a coordinator in Pakistan who had well connections in the industrial sector of Pakistan. Selected sample organisations were contacted and their willingness to take part in the survey was sought. Organisations were requested to nominate a focal person from human resource department to help collect responses. The focal persons were then contacted, and they were asked as to how many relevant decision makers are willing to participate in the survey. Accordingly, number of questionnaire survey pack was sent to the organisation. Qualtrics survey link was shared with organisations that preferred to participate online. Data was collected between August 2021 to October 2021. Most of the questionnaire packages were sent by post or by hand. Only a negligible fraction of responses was received on “Qualtrics” (Table 7-11 and Table 7-23. Periodic reminders and constant follow-up with the organisations were ensured to get the responses within the appropriate time window. Reminders and follow-ups are among key factors affecting the survey response rate(Connelly et al., 2003, Fan and Yan, 2010). Most of the industries were not doing

"business as usual" because of the COVID-19-related issues. While a researcher should not expect a hundred percent response rate in volunteer surveys (DeMaio, 1980), scholars try to get the maximum response rate as a greater number of responses increase the statistical power, small confidence intervals, and increased credibility of the study (Rogelberg and Stanton, 2007). There are divergent views on the acceptable response rate, and we find 50% (Roth and BeVier, 1998, Babbie, 1990), 60 % (Fowler Jr, 2013), and 80% (De Vaus and de Vaus, 2013) as minimal acceptable response rate in the surveys. The first questionnaire delivery was finished by mid of April 2021, and we received all responses by the end of June 2021. Phase two questionnaire was delivered by the end of July 2021, and we received responses by the end of September 2021.

7.5.1 E-READINESS FACTORS AND ORGANISATIONAL LEVEL E-COMMERCE ADOPTION

7.5.1.1 SURVEY RESPONSE BREAKDOWN

In first phase of the research project, responses on perceived E-Readiness model were collected from the sample organisations. In this phase 240 private and 90 public sector organisations were sent a total of 596 survey packs. With the exception of four all responses were received through post. Table 7-11 and Table 7-12 give details about the Phase-1 survey.

Table 7-11: Perceived E-Readiness factors model survey questionnaire response rate.

Total Survey Questionnaire sent(A)	596		
	Through Post	Online	Total
Total Responses Received (B)	469	4	473
Total Valid Responses Received(C)	445	3	448
Percentage of Responses Sent (C/A)	74.66%	0.50%	
Valid Response Percentage Share	99.33%	0.67%	

In the private sector, 256 responses were received, out of which 242 were used in the study. The highest number of responses were received from level 1 organisations followed by level 2, level 0, level 3, and 4 (Table 7-12). Although, a total of five levels of E-Commerce adoption were defined in original proposed E-Commerce adoption level model. Only two responses in category 4 were received from the Private Sector, no level 4 response was received from public sector. Thus, the author decided to merge two cases of level four into level three because (a) there was no level four case in the Public sector organisations and thus retaining two cases of Private Sector organisations could prevent us from studying the moderation effect of sectors (b) the cases in level 2 organisations were too few as compared to other levels, and that could impact the overall reliability of the calculations. Level four organisations have already achieved the level three adoption level, and collapsing outcome variables/ categories in our multinomial regression was not expected to affect the results (Rodríguez, 2007). Given that collapsing categories with rare events in regressions iimproves the "asymptotic approximation" (Murad et al., 2003), merger of level four and level three categories was justified. In the Public sector, 217 survey responses were received and out of those, 206 responses were valid and used in the study. The number of responses wise, level 1 was at the top, followed by level2, level 0, and level 3.

Table 7-12: Survey Responses Breakdown- Perceived E-Readiness factors model.

Level	Private Sector			Public sector		
	Total Responses Received	Missing/non-usable	Valid Responses	Total Responses Received	Missing/non-usable	Valid Responses
Level0	47	2	45	45	3	42
Level1	94	5	89	89	4	85
Level2	73	6	67	61	4	57
Level3	40	1	39	22	0	22
Level4	2	0	2	0	0	0
Total	**256**	**14**	**242**	**217**	**11**	**206**

7.5.1.2 SUMMARY OF DATA

The dataset used in the project has a comparable representation of both public and private sectors (Table 7-12) from a variety of industry type. While in this study, data on variables such as designation, industry type, age, industry type and qualifications were initially collected with the intention of exploring their direct and indirect effects, these analyses were not done due to potential complexity of statistical models and time constraints. The study only used latent variables and categorical variable sector in the models. Future research projects may find value in exploring other variables in greater depth. Statistics show that decision making in the organisations is mostly male dominant (Table 7-20). Most of the organisations were in level1 or level2 of the E-Commerce maturity level (Table 7-17). As the intended respondents of this project were senior decision makers, most of the respondents in the dataset had a senior role within organisations (Table 7-23) with different educational backgrounds but mostly graduates or post graduates (Table 7-22) and age groups (Table 7-21) . Table 7-13 provides a quick summary of the overall data by providing central tendency, variability, and range information. Interquartile range of the dataset is presented in Table 7-14, which gives an idea of data variability and spread. We can notice that the mean and median are close which is a typical reflection of near to normal data. We can see that the highest-ranking independent/predictor construct in the Perceived E-Readiness factors model is “Government E- Readiness” (GR), followed by “Support Industries E-Readiness (SI)”. “Market Forces” (MF), “Awareness” (AW), “Human Resources R” (HR), “Commitment” (CT), “Technology Resources” (TR), “Business Resources” (BR), and “Governance” (GV). As we collected the responses on 5 points Likert scale (1= lowest and 5= Highest), we can see that most perceived E-Readiness is above average (i.e., towards the positive side), except for “Perceived Governance” (mean: 2.99).

Table 7-13: Summary of data – Perceived E-Readiness factors model.

Construct	Cases	Mean	SD	Median	Min	Max	Range
IN	448	3.68	1.01	4	1	5	4
GR	448	3.65	0.89	3.75	1	5	4
SI	448	3.59	0.88	3.75	1.25	5	3.75
MF	448	3.52	1.09	3.5	1	5	4
AW	448	3.44	1	3.57	1	5	4
HR	448	3.41	1.04	3.5	1	5	4
TR	448	3.37	0.97	3.5	1	5	4
CT	448	3.37	1.02	3.4	1	5	4
BR	448	3.36	0.97	3.5	1	5	4
GV	448	2.99	0.95	3	1	5	4

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt e-commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

Table 7-14: Interquartile range - Perceived E-Readiness factors model

	AW	HR	BR	TR	GV	MF	GR	IN	SI	CT
0%	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.25	1.00
25%	2.71	2.50	2.67	2.67	2.25	2.50	3.25	3.00	3.00	2.60
50%	3.57	3.50	3.50	3.50	3.00	3.50	3.75	4.00	3.75	3.40
75%	4.29	4.50	4.17	4.17	3.62	4.50	4.25	4.50	4.25	4.20
100%	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt e-commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

Table 7-17 shows the sector-wise means of the constructs used in the PERM model. We can see that overall; the constructs mean in the Private Sector is relatively higher than in the public sector. In the Private Sector, the highest-scoring construct is “Awareness” (AW), followed by “Human Resources” (HR), “Technology Resources” (TR), “Support Industries E-Readiness”. (SI)”. Market Forces” (MF), “Commitment” (CT), “Business Resources” (BR), “Government E-Readiness” (GR) and “Governance” (GV). In the public sector, the top-ranking construct is “Government E-Readiness (GR)”. Support Industries E- Readiness” (SI), “Market Forces” (MF), “Awareness” (AW). Business Resources” (BR), “Commitment” (CT), “Human Resources” (HR), Technology Resources” (TR), and finally “Governance” (GV). Except for “Intention to adopt E-Commerce”. “Support Industries E-Readiness”. and “Government’s E-Readiness”. factor means are higher in the Private Sector. Table 7-18 shows the level-wise means and we can notice means increases as the level of E-Commerce adoption increases.

Table 7-15: Perceived E-Readiness model sectors representation.

Sr No	Sector	Frequency	Percentage
1	Private	242	54%
2	Public	206	46%
Total		448	100%

Table 7-16: Sector wise Constructs Mean- Perceived E-Readiness factors model.

Sector	AW	HR	BR	TR	GV	MF	GR	IN	SI	CT
Private	3.66	3.63	3.51	3.63	3.03	3.52	3.49	3.64	3.54	3.52
Public	3.19	3.16	3.19	3.07	2.95	3.52	3.83	3.74	3.65	3.18

Table 7-17: E-Commerce adoption levels - Perceived E-Readiness factors model

Sr. No	Level	Cases
1	level0	87
2	level1	174
3	level2	124
4	level3	63
Total		448

Table 7-18: Level wise means - Perceived E-Readiness model.

Level	AW	HR	BR	TR	GV	MF	GR	IN	SI	CT
level0	2.52	2.84	2.63	2.54	2.14	2.72	3.33	2.86	3.32	2.42
level1	3.42	3.16	3.25	3.4	3.21	3.36	3.64	3.71	3.42	3.51
level2	3.88	3.89	3.76	3.52	3.18	3.99	3.69	3.91	3.73	3.6
level3	3.93	3.95	3.91	4.17	3.2	4.11	4.04	4.3	4.15	3.82

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt e-commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

Table 7-19: Industry Distribution- Perceived E-Readiness factors model

Industry	Public	Private
Construction and Building	19	11
Insurance and financial services	29	22
Computer and electronic products manufacturing	0	33
Electrical materials and accessories	0	3
Food and Beverages	5	21
Motor and Autos	0	13
Medical Care/Hospitals	13	22
Textile and Clothing	0	30
Transportation	12	14
Tourism and Hospitality	4	7
Training and consultancy	5	8
Utility Provider	39	4
Publication and Printing	6	11
Education / University/School/Collage	18	13
Telecom	8	19
Public service delivery	37	2
Other	7	5
Missing	4	8
Total	206	242

Table 7-20: Perceived E-Readiness model- Gender distribution.

Sr. No	Sector	Missing	Male	Female	Total
1	Public	12	166	28	206
2	Private	15	184	43	242
Total		27	350	71	448

Table 7-21: Age distribution Perceived E-Readiness model.

Age	Public	Private
Missing	6	8
21-29	15	34
30-39	51	52
40-49	55	61
50-59	76	75
60 and over	3	12
Total	206	242

Table 7-22:Education distribution- Perceived E-Readiness factors model.

Education	Sector	
	Public	Private
Nil	0	0
Primary	0	0
High School	0	2
Trade Qualification/ Diploma/FSc/ FA or equivalent	0	29
Graduate	102	116
Postgraduate	93	77
Missing	11	18
Total	**206**	**242**

Table 7-23: Designation distribution - Perceived E-Readiness factors model.

Designation	Public	Private
President/Managing Director/Chief Executive Officer	42	53
Deputy Managing Director/ Senior General Manager/ General Manager	60	67
Line Manager / Information Manager/ Chief Information Officer	51	57
Upper Middle Management	30	32
Middle Management	20	26
Missing	3	7
Total	**206**	**242**

7.5.2 TECHNOLOGICAL AND PERCEIVED BEHAVIOURAL CONTROL FACTORS AND ORGANISATIONAL LEVEL E-COMMERCE ADOPTION

7.5.2.1 SURVEY RESPONSE BREAKDOWN

In second- phase of the research project, responses on Technological and Behavioural Control Model were collected from the sample organisations. In this phase 160 private and 80 public sector organisations were sent a total of 467 survey packs. With the exception of three all responses were received through post. Table 7-24 and Table 7-25 give details about the Phase-2 survey.

Table 7-24: Survey response rate- Technological and Perceived Behavioural Control factors model.

Total Survey Questionnaire sent(A)	467		
	Trough Post	Online	Total
Total Responses Received (B)	398	3	401
Total Valid Responses Received(C)	344	3	347
Percentage of Responses Sent (C/A)	73.66%	0.64%	
Valid Response Percentage Share	99.14%	0.86%	

Most of the responses were received from level one followed by level two, three and level zero. In the private sector, 218 responses were received, out of which 192 were valid, while in public sector 183 responses were received out of which 155 were valid and used in the study. The highest number of responses were in level two, followed by level 1, level 3, and level 0. No response was received from any level 4 organisation in both sectors. Please refer to Table 7-25 for details about the responses received of second survey.

Table 7-25:Technical and Perceived Behavioural Control factors survey responses breakdown.

Level	Private Sector			Private Sector		
	Total Responses Received	Missing/non-usable	Valid	Total Responses Received	Missing/non-usable	Valid
Level0	39	6	33	34	6	28
Level1	61	7	54	57	5	52
Level2	69	6	63	51	7	44
Level3	49	7	42	41	10	31
Level4	0	0	0	0	0	0
Total	**218**	**26**	**192**	**183**	**28**	**155**

7.5.2.2 SUMMARY OF DATA

The mean and median were found close (Table 7-26), moreover, the standard deviation and interquartile range (Table 7-27) gives the idea of data spread. We can conclude that most of the datapoints are clustered around the mean. All means are greater than three (mid or neutral point), which means that all perceptions trend positively. Like phase one, the constructs mean was comparatively higher in Private Sector than the public sector in most of the cases (Table 7-28). Similarly, factors mean tend to increase as the level of E-Commerce of adoption increases (Table 7-29). Most of the organisation classed them as level two and level one (Table 7-30). There was a comparable representation of both public and private sectors in the dataset (Table 7-31). Females proportion in the survey was around fifteen percent, which again indicates that decision making in organisations is male dominant (Table 7-33). Most of the respondents had senior roles (Table 7-36) having predominately graduate qualifications (Table 7-35 within organisation within age group of 40 to 59 years (Table 7-34. Like phase one, the dataset contained a fair representation of variety of industry type (Table 7-32).

Table 7-26:Summary of data- Technological and Perceived Behavioural Control factors model.

Construct	Cases	Mean	Standard Deviation	Median	Min	Max	Range
PC	347	3.55	0.92	3.75	1	5	4
PB	347	3.41	0.98	3.33	1	5	4
IN	347	3.64	0.97	3.50	1	5	4
PS	347	3.77	0.95	4.00	1	5	4
CA	347	3.73	0.97	4.00	1	5	4
RA	347	3.24	1.05	3.50	1	5	4
PE	347	3.65	0.89	3.75	1	5	4

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-Commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

Table 7-27: Interquartile range - Technological and Perceived Behavioural Control factors model.

	PC	PB	IN	PS	CA	RA	PE
0%	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25%	3.00	2.67	3.00	3.00	3.00	2.50	3.00
50%	3.75	3.33	3.50	4.00	4.00	3.50	3.75
75%	4.25	4.00	4.50	4.50	4.50	4.00	4.50
100%	5.00	5.00	5.00	5.00	5.00	5.00	5.00

Table 7-28: Constructs Means -Sector wise – Technological and Perceived Behavioural factors model.

Sector	PC	PB	IN	PS	CA	RA	PE
Private	3.72	3.66	3.48	3.72	3.87	3.36	3.84
Public	3.33	3.09	3.85	3.84	3.57	3.09	3.42

Table 7-29: Technological and Perceived Behavioural Control factors model constructs mean (level wise).

Level	PS	PC	CA	PB	IN	RA	PE
level0	3.45	2.98	3.04	2.59	3.05	2.53	3.00
level1	3.48	3.52	3.64	3.15	3.68	3.08	3.43
level2	4.01	3.78	4.08	3.88	3.70	3.36	3.88
level3	4.12	3.73	3.95	3.77	4.01	3.87	4.19

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-Commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

Table 7-30: Frequency of E-Commerce adoption levels - Technological and Perceived Behavioural Control factors model.

Sr.No	Level	N
1	level0	61
2	level1	106
3	level2	107
4	level3	73
Total		347

Table 7-31: Sectors representation- Technological and Perceived Behavioural Control factors model.

Sr. No	Sector	Frequency	Percentage
1	Private	192	55%
2	Public	155	45%
Total		347	100%

Table 7-32:Industry distribution- Technological and Perceived Behavioural Control factors model.

Industry	Public	Private
Construction and Building	7	15
Insurance and financial services	30	8
Computer and electronic products manufacturing	0	9
Electrical materials and accessories	0	1
Food and Beverages	0	19
Motor and Autos	0	8
Medical Care/Hospitals	16	29
Textile and Clothing	0	33
Transportation	14	11
Tourism and Hospitality	2	3
Training and consultancy	6	9
Utility Provider	29	2
Publication and Printing	6	7
Education / University/School/Collage	6	4
Telecom	8	12
Public service delivery	16	0
Other	7	10
Missing	8	12
Total	**155**	**192**

Table 7-33: Gender distribution- Technological and Perceived Behavioural Control factors model.

Sector	Missing	Male	Female	Total
Private	9	150	33	192
Public	6	126	23	155
Total	15	276	56	347

Table 7-34:Age Distribution- Technological and Perceived Behavioural Control factors model.

Age	Private	Public
Missing	5	7
21-29	11	5
30-39	45	16
40-49	53	57
50-59	76	69
60 and over	2	1
Total	**192**	**155**

Table 7-35: Technical and Perceived Behavioural Control factors education distribution.

Qualification	Public	Private
Nil	0	0
Primary	0	0
High School	0	5
Trade Qualification/ Diploma/FSc/ FA or equivalent	0	18
Graduate	55	85
Postgraduate	94	76
Missing	6	8
Total	**155**	**192**

Table 7-36: Designation distribution- Technological and Perceived Behavioural Control factors model

Designation	Public	Private
President/Managing Director/Chief Executive Officer	70	83
Deputy Managing Director/ Senior General Manager/ General Manager	51	61
Line Manager / Information Manager/ Chief Information Officer	13	11
Upper Middle Management	10	26
Middle Management	5	7
Missing	6	4
Total	**155**	**192**

7.6 HYPOTHESES TESTING

7.6.1 E-READINESS FACTORS AND ORGANISATIONAL E-COMMERCE ADOPTION

This section addresses research question one and part of research question three by testing hypotheses HA1 to HA9 and comparing the E-Readiness factors model in the public and private sectors. To compare the model in these two sectors, the "multi-group analysis" (MGA) algorithm of the Smart PLS-SEM software was used. This algorithm divided the entire dataset into two groups based on the variable "sector." Then, each PLS-SEM algorithm was run on each sub-dataset, and any statistically significant differences were noted. The PLS-SEM algorithm produced four outputs: the first for the complete dataset (private plus public), the second for the Private Sector, the third for the public sector, and the fourth for the MGA output. The output for the complete dataset will be used to answer research question one since it contains representations of both public and private sector organisations.

7.6.1.1 EXPLANATORY/ PREDICTIVE POWER

In structural equation modelling, assessing the coefficient of determination is one of the major steps. The coefficient of determination or R squared is a measure that reflects the predictive or explanatory power of a model. So R2 is the percentage of variance explained by a set of independent variables used in a specific model (Cox, 1972). In PLS-SEM, R squared is the predictive power, while in Covariance

based Structural Equation Model (CB SEM), GoF (Goodness of Fit) is the measure that tells about the explanatory power of the model (Hair Jr et al., 2017). Although R squared is commonly used to assess a linear model's predictive ability in an optimistic manner, it tends to rise as the number of predictors in the model increase, even if the new predictors do not improve the model's predictive power. In other words, if there are more predictors in the model, the coefficient of determination tends to be higher. However, modified R squared considers the number of predictors and their impact on model performance. When irrelevant predictors are added in the model, adjusted R squared declines. It is critical to remember that R squared adjusted is always less than or equal to R squared (IBM, 2022).

Chin (1998) suggests that an R squared value of > 0.19 indicates very weak predictive power, 0.19 <= R2 < 0.33 is considered weak, 0.33 <= R2 < 0.67 is moderate, and R2 >= 0.67 is indicative of substantial predictive power. However, it is important to note that a low R squared does not necessarily indicate a low-quality model. Instead, it may suggest that the variance in the dependent variable is influenced by numerous other factors/variables that are not included in the model (Moksony and Heged, 1990). Table 7-37 presents the R squared and adjusted R squared values for our three models. It is apparent that the combined model accounts for 41% of the variance in the dependent variable "Intention to adopt E-Commerce" and the private and public sector models explain 37% and 53% of the variance in the dependent variable, respectively.

Table 7-37: Explanatory Power- Perceived E-Readiness factors model.

Model	R2	Adjusted R2
Combined	0.409	0.396
Private	0.370	0.346
Public	0.528	0.507

7.6.1.2 CONSTRUCTS' RELIABILITY AND VALIDITY

Although we already established the Validity and Reliability of the construct through robust confirmatory factors analysis (section 7.2.1), Smart PLS also provides output to check the measurement quality of the constructs (Table 7-38). The internal consistency, or the fact that observable variables measure the same construct, is measured by Cronbach alpha. Rho A is an additional indication of internal consistency or reliability. Cronbach Alpha's recommended cut-off value is between 0.70 and 0.95, according to the literature (Nunnally, 1994, Bland, 1997, DeVellis and Thorpe, 2021), and for omega/rhu is >=0.7 (Hair et al., 2006). Composite Reliability (CR)is yet another measure of internal consistency of the construct; the recommended CR value is equal to or greater than 0.70 (Hair et al., 2014). The ability to measure single construct consistently is also referred as "convergent validity" and is often established through, composite reliability, factors loadings, and average variance extracted (AVE). AVE checks the variance that a particular construct explains compared to the variance due to measurement error and the recommended cut-off value for AVE is >=0.5 (Hair et al., 2006). Composite reliability (CR) is also like Cronbach's alpha but more dependable and a value of 0.7 or above (Sarstedt et al., 2017) is considered acceptable. Once Convergent Validity is established, it means an adequate level of correlation exists between the indicators explaining the same construct (Hair, 2017). Table 7-38,Table 7-39, and Table 7-40 describe the measurement model's quality for the complete, private and public sectors. We can see the measurement models meet the quality guidelines for our complete, private and public sector datasets.

Table 7-38: Constructs' reliability and validity (Complete)- Perceived E-Readiness factors model.

Construct	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
AW	0.927	0.933	0.941	0.696
BR	0.910	0.916	0.930	0.689
CT	0.904	0.908	0.929	0.723
GR	0.839	0.849	0.892	0.674
HR	0.801	0.805	0.909	0.834
GV	0.924	0.931	0.938	0.653
IN	0.794	0.797	0.907	0.829
MF	0.784	0.830	0.901	0.820
SI	0.842	0.870	0.892	0.674
TR	0.913	0.927	0.932	0.695

Table 7-39: Construct reliability and validity (Private)- Perceived E-Readiness factors model

Construct	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
AW	0.927	0.931	0.941	0.697
BR	0.902	0.920	0.924	0.672
CT	0.888	0.900	0.917	0.688
GR	0.843	0.853	0.894	0.678
HR	0.781	0.787	0.901	0.820
GV	0.920	0.932	0.934	0.640
IN	0.740	0.752	0.884	0.793
MF	0.787	0.802	0.903	0.823
SI	0.844	0.863	0.895	0.680
TR	0.905	0.917	0.926	0.677

Table 7-40: Construct reliability and validity (Public)- Perceived E-Readiness factors model.

Construct	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
AW	0.925	0.931	0.940	0.690
BR	0.918	0.919	0.936	0.710
CT	0.918	0.920	0.938	0.753
GR	0.826	0.851	0.884	0.656
HR	0.800	0.805	0.909	0.833
GV	0.932	0.941	0.944	0.677
IN	0.839	0.839	0.925	0.861
MF	0.784	1.206	0.889	0.801
SI	0.844	0.859	0.885	0.662
TR	0.907	0.923	0.927	0.680

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt E-Commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

7.6.1.3 DISCRIMINANT VALIDITY

Discriminant validity is a crucial aspect of research design that ensures that different predictor concepts or latent variables are not related. Two commonly used indicators of discriminant validity are the Fornell and Larcker criterion and the Heterotrait- Monotrait ratio of correlation (HTMT), as stated in Hair (Hair, 2017) . The Fornell and Larcker criterion (Fornell and Bookstein, 1982) compares the square root of the average variance extracted (AVE) with the correlation with other constructs to determine if a particular construct better explains its corresponding indicators than the other constructs. To establish discriminant validity, the square root of AVE of the construct should be greater than its correlation with other latent constructs. HTMT, proposed by Henseler et al. (2015), is another criterion for establishing discriminant validity. The recommended cut-off value for HTMT is less than 0.9, and a value of 1 indicates no discriminant validity. SMART PLS output reveals that all the three datasets (complete, private, and public) passed tests of discriminant validity using both the Fornell-Larcker criterion (Table 7-41, Table 7-42, Table 7-43) and HTMT (Table 7-44, Table 7-45, Table 7-46)

Table 7-41: Farnell-Larcker criterion (Complete)- Perceived E-Readiness factors model.

Construct	AW	BR	CT	GR	HR	GV	IN	MF	SI	TR
AW	0.834									
BR	0.266	0.830								
CT	0.304	0.261	0.850							
GR	0.069	0.061	0.072	0.821						
HR	0.308	0.279	0.169	0.066	0.913					
GV	0.242	0.160	0.239	0.118	0.238	0.808				
IN	0.370	0.307	0.433	0.280	0.278	0.345	0.911			
MF	0.261	0.212	0.219	0.125	0.211	0.168	0.253	0.905		
SI	0.068	0.070	0.112	0.059	0.064	0.093	0.269	0.043	0.821	
TR	0.343	0.362	0.324	0.041	0.285	0.197	0.338	0.208	0.085	0.833

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt E-Commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

Table 7-42: Fornell -Larcker criterion (Private)- Perceived E-Readiness factors model.

Construct	AW	BR	CT	GR	HR	GV	IN	MF	SI	TR
AW	0.835									
BR	0.156	0.820								
CT	0.215	0.207	0.830							
GR	0.122	0.024	0.080	0.824						
HR	0.221	0.188	0.147	0.086	0.906					
GV	0.236	0.082	0.176	0.099	0.307	0.800				
IN	0.316	0.295	0.336	0.255	0.344	0.222	0.890			
MF	0.311	0.191	0.250	0.203	0.289	0.236	0.290	0.907		
SI	0.058	0.026	0.102	0.065	0.091	0.031	0.296	0.103	0.825	
TR	0.192	0.291	0.240	0.035	0.191	0.138	0.306	0.213	0.143	0.823

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt E-Commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

Table 7-43: Fornell-Larker Criterion (Public)- Perceived E-Readiness factors model.

Construct	AW	BR	CT	GR	HR	GV	IN	MF	SI	TR
AW	0.831									
BR	0.329	0.843								
CT	0.344	0.279	0.867							
GR	0.118	0.158	0.140	0.810						
HR	0.322	0.321	0.130	0.149	0.913					
GV	0.241	0.225	0.295	0.146	0.171	0.823				
IN	0.469	0.342	0.546	0.308	0.257	0.463	0.928			
MF	0.226	0.232	0.224	0.052	0.145	0.123	0.248	0.895		
SI	0.136	0.148	0.187	0.026	0.059	0.181	0.266	-0.022	0.813	
TR	0.420	0.391	0.356	0.179	0.284	0.262	0.434	0.215	0.101	0.824

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt E-Commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

Table 7-44: HTMT (Complete)- Perceived E-Readiness factors model.

Construct	AW	BR	CT	GR	HR	GV	IN	MF	SI	TR
AW										
BR	0.294									
CT	0.330	0.294								
GR	0.082	0.097	0.082							
HR	0.358	0.331	0.200	0.087						
GV	0.257	0.173	0.258	0.132	0.278					
IN	0.424	0.357	0.508	0.341	0.348	0.395				
MF	0.299	0.249	0.252	0.160	0.263	0.180	0.315			
SI	0.090	0.087	0.126	0.068	0.096	0.096	0.313	0.070		
TR	0.370	0.402	0.355	0.067	0.334	0.212	0.386	0.239	0.105	

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt E-Commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

Table 7-45: HTMT(Public)- Perceived E-Readiness factors model.

Construct	AW	BR	CT	GR	HR	GV	IN	MF	SI	TR
AW										
BR	0.352									
CT	0.369	0.306								
GR	0.128	0.168	0.162							
HR	0.375	0.371	0.154	0.170						
GV	0.246	0.237	0.307	0.164	0.200					
IN	0.524	0.389	0.620	0.360	0.313	0.513				
MF	0.244	0.272	0.224	0.074	0.179	0.151	0.268			
SI	0.155	0.174	0.200	0.077	0.141	0.178	0.263	0.104		
TR	0.445	0.422	0.381	0.209	0.337	0.268	0.479	0.247	0.123	

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt E-Commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

Table 7-46: HTMT (Private)- Perceived E-Readiness factors model.

Construct	AW	BR	CT	GR	HR	GV	IN	MF	SI	TR
AW										
BR	0.179									
CT	0.232	0.237								
GR	0.138	0.093	0.093							
HR	0.258	0.223	0.177	0.106						
GV	0.261	0.101	0.194	0.123	0.366					
IN	0.374	0.350	0.405	0.316	0.451	0.259				
MF	0.365	0.233	0.294	0.245	0.369	0.278	0.374			
SI	0.084	0.058	0.117	0.073	0.107	0.061	0.366	0.119		
TR	0.205	0.325	0.264	0.064	0.222	0.148	0.358	0.256	0.152	

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt E-Commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

7.6.1.4 COLLINEARITY STATISTICS/ MULTICOLLINEARITY TEST

Regression results can be sensitive to the correlation among the predictors used in the model. Although it is normal to have some correlation among predictor variables in ordinary least square regression, higher correlation can cause inflated standard errors, resulting in unreliable significance tests. Additionally, higher correlations can make it difficult for researchers to establish the relative importance of each predictor variable in the model. To rule out multicollinearity in the model, researchers commonly use the Variance Inflation Factor (VIF), which is a measure of how much the variance of the estimated regression coefficient increases due to multicollinearity. By assessing the VIF values of each predictor variable, researchers can determine if multicollinearity is present in the model and take steps to address it if necessary (Hair, 2017). As a rule of thumb, a VIF value greater than 5.0 indicates problematic multicollinearity among the predictor variables (Hair et al., 2011). SMART PLS provides two collinearity statistics: at the Constructs level (Inner) and items level (outer) VIF. Table 7-47 and Table 7-48 show the collinearity statistics at constructs and item levels, respectively. We can see that VIFs of our models are within the recommended threshold.

Table 7-47: Inner VIF- Perceived E-Readiness factors model

Construct	Intention to adopt E-Commerce		
	Complete	Private	Public
AW	1.302	1.189	1.396
BR	1.247	1.149	1.342
CT	1.239	1.157	1.315
GR	1.029	1.053	1.062
HR	1.221	1.212	1.215
GV	1.148	1.172	1.180
IN			
MF	1.147	1.278	1.122
SI	1.022	1.036	1.075
TR	1.331	1.190	1.436

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt E-Commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

Table 7-48:Outer VIF- Perceived E-Readiness factors model.

Item Variable	VIF		
	Complete	Private	Public
aw1	2.548	2.481	2.684
aw2	2.742	2.681	2.583
aw3	2.273	2.208	2.120
aw4	2.605	2.515	2.665
aw5	2.544	2.680	2.511
aw6	2.632	2.976	2.785
aw7	2.583	2.482	2.449
br1	3.041	3.022	3.101
br2	2.134	2.087	2.184
br3	2.658	2.606	2.646
br4	2.715	2.526	3.106
br5	1.864	1.680	2.007
br6	2.065	2.006	2.384
ct1	2.441	2.084	2.908
ct2	2.103	2.027	2.260
ct3	2.475	2.087	3.170
ct4	2.499	2.133	2.928
ct5	2.460	2.369	2.615
gr1	1.669	1.782	1.607
gr2	1.733	1.781	1.621
gr3	2.048	1.996	2.032
gr4	1.961	1.909	1.924
gv1	2.580	2.367	3.115
gv2	2.194	2.030	2.600
gv3	2.546	2.254	2.988
gv4	2.453	2.576	2.569
gv5	2.344	2.389	2.495
gv6	2.190	2.132	2.392
gv7	2.063	2.083	2.257
gv8	2.051	2.245	2.008
hr1	1.805	1.698	1.799
hr2	1.805	1.698	1.799
in1	1.767	1.526	2.090
in2	1.767	1.526	2.090
mf1	1.713	1.726	1.713
mf2	1.713	1.726	1.713
si1	1.738	1.882	1.731
si2	2.075	1.919	2.280
si3	1.871	1.708	2.117
si4	1.795	1.973	1.727
tr1	2.412	2.231	2.468
tr2	2.439	2.288	2.426
tr3	2.728	2.412	2.966
tr4	2.509	2.038	2.921
tr5	2.121	2.117	1.992
tr6	2.136	2.243	1.927

7.6.1.5 MODEL FIT SUMMARY

Unlike Covariance based structural equation model, in the PLS framework, we cannot assess the "goodness of fit" through inferential statistics (Hair et al., 2011, Sanchez, 2013). Sanchez (2013) introduced a model fit index for the PLS framework in his package "PLSPM". which measures the model's prediction power (not quality), but no threshold has been set yet. Another commonly used fit index is Normed Fit Index(NFI), introduced by Bentler and Bonett (1980) is suitable to measure the goodness of "factor-based models". and the threshold for the composite models is yet to be determined (Henseler et al., 2016). Similarly, Root Mean Square Error Correlation (RMS theta) is also used to assess the model fit, but the thresholds are yet to be determined (Henseler et al., 2016). Currently, the only approximate fit criterion for PLS path models is the "Standardised Root Mean Square Residuals (SRMR), and the recommended cut-off value is > 0.08 (Hu and Bentler, 1998, Hu et al., 1992). Table 7-49 shows the SRMR values of three models, and we can see that all models have SRMR values within the recommended range.

Table 7-49: Model Fit Summary- Perceived E-Readiness factors model

Parameter SRMR Value		
Sector	Saturated Model	Estimated Model
Complete	0.049	0.049
Private	0.051	0.051
Public	0.065	0.065

7.6.1.6 FACTOR LOADINGS

All concepts or constructs (also called latent variables) are measured through observable variables (also called items). The observable variables are linearly related to their corresponding factor/concept/construct/ latent variable. The strength of that relationship is reflected in the factor loading (DeCoster, 1998). In the Partial least square structural equation model (PLS SEM), factor loadings are calculated from the model estimation of the composite models(Hair, 2017). There is diversified opinion on the cut-off value of the factor loadings. So while Stevens (2012) suggests a minimum value of 0.4, others recommend a minimum value of 0.6 (MacCallum et al., 1999, Guadagnoli and Velicer, 1988). Hair (2017) suggests a relatively higher value close to or greater than 0.7. For this study, we will use the recommended range of 0.6. Table 7-50 , Table 7-51 and Table 7-52 show the factor loadings of complete, private, and public models. We can see that all items loaded adequately on their respective factors.

Table 7-50: Factor loadings (complete)- Perceived E-Readiness factors model.

Item	AW	BR	CT	GR	HR	GV	IN	MF	SI	TR
aw1	0.838									
aw2	0.846									
aw3	0.783									
aw4	0.845									
aw5	0.849									
aw6	0.842									
aw7	0.836									

br1	0.884								
br2	0.799								
br3	0.850								
br4	0.848								
br5	0.776								
br6	0.820								
ct1		0.851							
ct2		0.814							
ct3		0.859							
ct4		0.869							
ct5		0.856							
gr1			0.785						
gr2			0.794						
gr3			0.863						
gr4			0.842						
gv1				0.846					
gv2				0.805					
gv3				0.834					
gv4				0.826					
gv5				0.818					
gv6				0.794					
gv7				0.763					
gv8				0.777					
hr1					0.921				
hr2					0.906				
in1						0.917			
in2						0.904			
mf1							0.877		
mf2							0.933		
si1								0.744	
si2								0.858	
si3								0.830	
si4								0.847	
tr1									0.861
tr2									0.841
tr3									0.856
tr4									0.825
tr5									0.798
tr6									0.818

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt E-Commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

Table 7-51: Factor loadings (private)- Perceived E-Readiness factors model

Item Variables	AW	BR	CT	GR	HR	GV	IN	MF	SI	TR
aw1	0.821									
aw2	0.849									
aw3	0.804									

aw4	0.828									
aw5	0.857									
aw6	0.853									
aw7	0.829									
br1		0.882								
br2		0.789								
br3		0.841								
br4		0.836								
br5		0.737								
br6		0.825								
ct1			0.818							
ct2			0.818							
ct3			0.826							
ct4			0.852							
ct5			0.833							
gr1				0.785						
gr2				0.827						
gr3				0.841						
gr4				0.840						
gv1						0.816				
gv2						0.769				
gv3						0.812				
gv4						0.823				
gv5						0.814				
gv6						0.778				
gv7						0.763				
gv8						0.824				
hr1					0.915					
hr2					0.896					
in1							0.908			
in2							0.872			
mf1								0.923		
mf2								0.891		
si1									0.830	
si2									0.833	
si3									0.769	
si4									0.864	
tr1										0.844
tr2										0.817
tr3										0.850
tr4										0.789
tr5										0.819
tr6										0.815

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt E-Commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

Table 7-52: Factors loading (Public)- Perceived E-Readiness factors model.

Item Variables	AW	BR	CT	GR	HR	GV	IN	MF	SI	TR
aw1	0.846									
aw2	0.832									
aw3	0.769									
aw4	0.842									
aw5	0.839									
aw6	0.856									
aw7	0.829									
br1		0.882								
br2		0.809								
br3		0.851								
br4		0.878								
br5		0.799								
br6		0.835								
ct1			0.869							
ct2			0.829							
ct3			0.887							
ct4			0.882							
ct5			0.868							
gr1				0.787						
gr2				0.743						
gr3				0.870						
gr4				0.834						
gv1						0.876				
gv2						0.840				
gv3						0.855				
gv4						0.824				
gv5						0.821				
gv6						0.815				
gv7						0.787				
gv8						0.758				
hr1					0.921					
hr2					0.904					
in1							0.926			
in2							0.930			
mf1								0.816		
mf2								0.968		
si1									0.650	
si2									0.867	
si3									0.879	
si4									0.836	
tr1										0.859
tr2										0.841
tr3										0.849
tr4										0.843

tr5	0.754
tr6	0.796

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt E-Commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

7.6.1.7 PATH COEFFICIENTS

The inner path coefficients are interpreted as a standardised beta in the regression and can be used to assess the effect of a construct on the other construct(s). The coefficients are interpreted as explaining the size of the relationship. The higher the value, the higher strength of the effect. Independent of the effect size, the path coefficient must be statistically significant (i.e., p-value <=0.05) (Sanchez, 2013, Hair Jr et al., 2016, Hair et al., 2019). Table 7-53 , Table 7-54, and Table 7-55 show the inner path coefficients of the relationship among constructs for complete, private and public datasets (path diagrams are also appended as Figure 7-5, Figure 7-6 and Figure 7-7). The highest impacting factor in the complete data set model is commitment, followed by government E-Readiness, support industry E-Readiness, governance, awareness, business resources, and technology resources. Human resources E-Readiness and market forces E-Readiness had a positive but insignificant effect on the intention to adopt E-Commerce. In the Private Sector model, the highest impacting factor was supporting industries E-Readiness, followed by government E-Readiness, human resources E-Readiness, commitment, business resources E-Readiness, and awareness. Technology resources E-Readiness, governance, and market forces E-Readiness had a positive but nonsignificant impact on the intention to adopt E-Commerce. In the public sector model, the largest contributing factor was commitment, followed by governance, awareness, government E-Readiness, support Industries E-Readiness, and technology resources. Market Forces, Human resources E-Readiness, and business resources E-Readiness had positive but nonsignificant effects on the intention to adopt E-Commerce.

Table 7-53: Path model (complete)- Perceived E-Readiness factors model.

Path	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
AW -> IN	0.141	0.147	0.042	3.393	0.001
BR -> IN	0.093	0.095	0.044	2.130	0.034
CT -> IN	0.241	0.238	0.040	5.998	0.000
GR-> IN	0.204	0.201	0.037	5.562	0.000
HR -> IN	0.069	0.065	0.041	1.666	0.096
GV -> IN	0.154	0.152	0.036	4.255	0.000
MF -> IN	0.051	0.052	0.040	1.258	0.209
SI -> IN	0.185	0.188	0.034	5.496	0.000
TR -> IN	0.093	0.093	0.041	2.260	0.024

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt E-Commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

Table 7-54: Path model (Private)- Perceived E-Readiness factors model.

Path	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
AW -> IN	0.140	0.137	0.056	2.506	0.013
BR -> IN	0.152	0.156	0.050	3.044	0.002
CT -> IN	0.170	0.176	0.054	3.141	0.002
GR-> IN	0.176	0.178	0.051	3.437	0.001

HR -> IN	0.181	0.177	0.055	3.271	0.001
GV -> IN	0.045	0.053	0.051	0.880	0.379
MF -> IN	0.031	0.028	0.061	0.508	0.612
SI -> IN	0.218	0.222	0.050	4.339	0.000
TR -> IN	0.109	0.110	0.060	1.818	0.070

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt E-Commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

Table 7-55: Path coefficients (Public)- Perceived E-Readiness factors model.

Path	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
AW -> IN	0.193	0.193	0.056	3.457	0.001
BR -> IN	0.029	0.031	0.060	0.484	0.629
CT -> IN	0.298	0.292	0.051	5.833	0.000
GR-> IN	0.174	0.180	0.049	3.575	0.000
HR -> IN	0.034	0.033	0.058	0.587	0.558
GV -> IN	0.232	0.229	0.050	4.603	0.000
MF -> IN	0.068	0.072	0.048	1.396	0.163
SI -> IN	0.122	0.130	0.047	2.609	0.009
TR -> IN	0.108	0.109	0.055	1.967	0.050

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt E-Commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

7.6.1.8 MODERATION EFFECT OF SECTORS- MULTIGROUP ANALYSIS

If a variable influences the link between a predictor and an outcome variable, it is referred to as a moderator variable (s). A moderating variable might be continuous (measured metrically) or categorical. Based on the category values, a categorical variable can split the whole dataset into smaller subsets. To study the moderation effect, the researcher then compares and tests the differences for each category/group using the sub-datasets to estimate the same theoretical model. (Hair, 2017). In smart PLS, the categorical moderation effect is studied through Multigroup Analysis or MGA (Hair, 2017, Hair et al., 2011). We can see that the only statistically significant relationship difference is between governance and intention to adopt E-Commerce (Table 7-56). We can notice that the relationship of governance is stronger in public sector organisations. Table 7-57 and Table 7-58 describe the difference between factor loadings of two models using standard tests of significance and Welch-Satterthwait test to compare factor loadings respectively. We can notice that very few factor loadings were found significantly different.

Table 7-56:Multi group analysis -path coefficients- Perceived E-Readiness factors model

Path	Path Coefficients-diff (GROUP_sector(private) - GROUP_sector(public))	p-Value original 1-tailed (GROUP_sector(private) vs GROUP_sector(public))	p-Value new (GROUP_sector(private) vs GROUP_sector(public))
AW -> IN	-0.053	0.751	0.497
BR -> IN	0.123	0.051	0.102
CT -> IN	-0.127	0.956	0.088
GR -> IN	0.003	0.491	0.981

GV -> IN	-0.188	0.994	0.012
HR -> IN	0.147	0.029	0.059
MF -> IN	-0.037	0.697	0.607
SI -> IN	0.096	0.090	0.181
TR -> IN	0.001	0.492	0.983

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt E-Commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

Table 7-57: Factors loading comparison- Perceived E-Readiness factors model.

Path	Outer Loadings-diff (GROUP_sector(private) - GROUP_sector(public))	p-Value original 1-tailed (GROUP_sector(private) vs GROUP_sector(public))	p-Value new (GROUP_sector(private) vs GROUP_sector(public))
aw1 <- AW	-0.025	0.785	0.429
aw2 <- AW	0.017	0.284	0.567
aw3 <- AW	0.035	0.203	0.406
aw4 <- AW	-0.014	0.659	0.682
aw5 <- AW	0.018	0.257	0.513
aw6 <- AW	-0.003	0.542	0.916
aw7 <- AW	-0.001	0.504	0.991
br1 <- BR	0.000	0.497	0.995
br2 <- BR	-0.020	0.684	0.633
br3 <- BR	-0.009	0.604	0.792
br4 <- BR	-0.042	0.924	0.153
br5 <- BR	-0.063	0.917	0.166
br6 <- BR	-0.009	0.629	0.743
ct1 <- CT	-0.052	0.944	0.113
ct2 <- CT	-0.011	0.619	0.762
ct3 <- CT	-0.061	0.985	0.030
ct4 <- CT	-0.030	0.901	0.198
ct5 <- CT	-0.035	0.856	0.287
gr1 <- GR	-0.002	0.513	0.974
gr2 <- GR	0.084	0.077	0.155
gr3 <- GR	-0.029	0.772	0.456
gr4 <- GR	0.007	0.451	0.902
gv1 <- GV	-0.060	0.977	0.045
gv2 <- GV	-0.070	0.969	0.063
gv3 <- GV	-0.043	0.923	0.154
gv4 <- GV	-0.001	0.506	0.989
gv5 <- GV	-0.006	0.545	0.910
gv6 <- GV	-0.037	0.791	0.418
gv7 <- GV	-0.024	0.690	0.619
gv8 <- GV	0.066	0.059	0.119
hr1 <- HR	-0.006	0.578	0.843
hr2 <- HR	-0.008	0.605	0.790
in1 <- IN	-0.018	0.879	0.243

in2 <- IN	-0.058	0.999	0.002
mf1 <- MF	0.108	0.052	0.104
mf2 <- MF	-0.077	0.984	0.031
si1 <- SI	0.179	0.014	0.028
si2 <- SI	-0.034	0.807	0.386
si3 <- SI	-0.110	0.981	0.038
si4 <- SI	0.027	0.261	0.522
tr1 <- TR	-0.014	0.664	0.671
tr2 <- TR	-0.024	0.748	0.504
tr3 <- TR	0.001	0.474	0.949
tr4 <- TR	-0.054	0.905	0.190
tr5 <- TR	0.065	0.067	0.135
tr6 <- TR	0.019	0.324	0.648

Table 7-58:Welch-Satterthwait test factors loadings- Perceived E-Readiness factors model

Path	Outer Loadings-diff (GROUP_sector(private) - GROUP_sector(public))	t-Value (|GROUP_sector(private) vs GROUP_sector(public)|)	p-Value (GROUP_sector(private) vs GROUP_sector(public))
aw1 <- AW	-0.025	0.790	0.431
aw2 <- AW	0.017	0.573	0.567
aw3 <- AW	0.035	0.835	0.404
aw4 <- AW	-0.014	0.420	0.675
aw5 <- AW	0.018	0.650	0.516
aw6 <- AW	-0.003	0.110	0.912
aw7 <- AW	-0.001	0.022	0.983
br1 <- BR	0.000	0.015	0.988
br2 <- BR	-0.020	0.454	0.651
br3 <- BR	-0.009	0.270	0.787
br4 <- BR	-0.042	1.342	0.181
br5 <- BR	-0.063	1.364	0.174
br6 <- BR	-0.009	0.321	0.748
ct1 <- CT	-0.052	1.458	0.146
ct2 <- CT	-0.011	0.321	0.748
ct3 <- CT	-0.061	1.981	0.049
ct4 <- CT	-0.030	1.212	0.227
ct5 <- CT	-0.035	1.052	0.294
gr1 <- GR	-0.002	0.037	0.970
gr2 <- GR	0.084	1.357	0.176
gr3 <- GR	-0.029	0.726	0.469
gr4 <- GR	0.007	0.136	0.892
gv1 <- GV	-0.060	1.942	0.053
gv2 <- GV	-0.070	1.727	0.086
gv3 <- GV	-0.043	1.394	0.165
gv4 <- GV	-0.001	0.044	0.965
gv5 <- GV	-0.006	0.167	0.868

gv6 <- GV	-0.037	0.810	0.419
gv7 <- GV	-0.024	0.513	0.608
gv8 <- GV	0.066	1.548	0.123
hr1 <- HR	-0.006	0.181	0.856
hr2 <- HR	-0.008	0.199	0.843
in1 <- IN	-0.018	1.147	0.253
in2 <- IN	-0.058	2.704	0.007
mf1 <- MF	0.108	1.196	0.233
mf2 <- MF	-0.077	2.051	0.041
si1 <- SI	0.179	1.527	0.128
si2 <- SI	-0.034	0.680	0.497
si3 <- SI	-0.110	2.001	0.047
si4 <- SI	0.027	0.626	0.532
tr1 <- TR	-0.014	0.442	0.659
tr2 <- TR	-0.024	0.672	0.502
tr3 <- TR	0.001	0.045	0.964
tr4 <- TR	-0.054	1.248	0.213
tr5 <- TR	0.065	1.464	0.145
tr6 <- TR	0.019	0.451	0.652

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt E-Commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

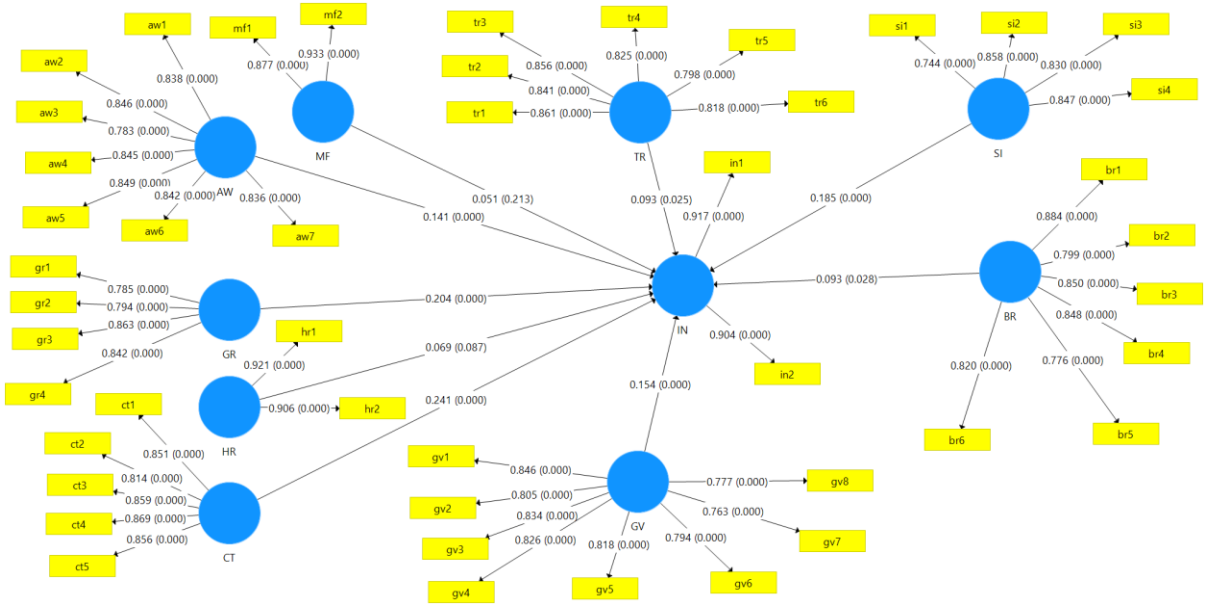


Figure 7-5: Path Model (Complete)- Perceived E-Readiness factors model.

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt E-Commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

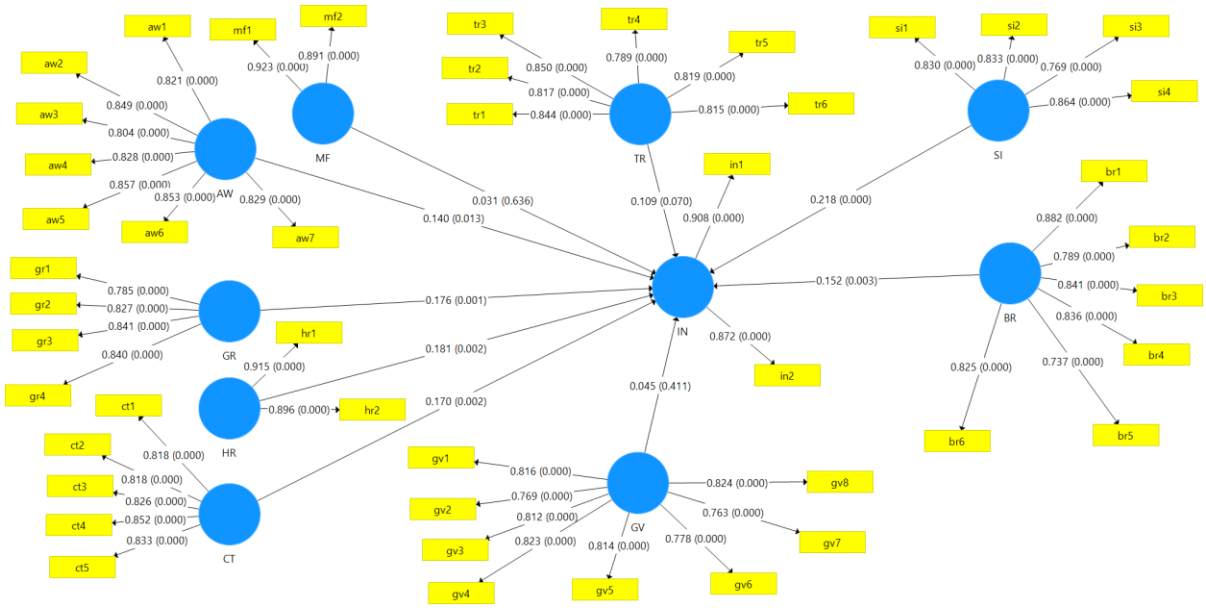


Figure 7-6: Path Model (Private)- Perceived E-Readiness factors model.

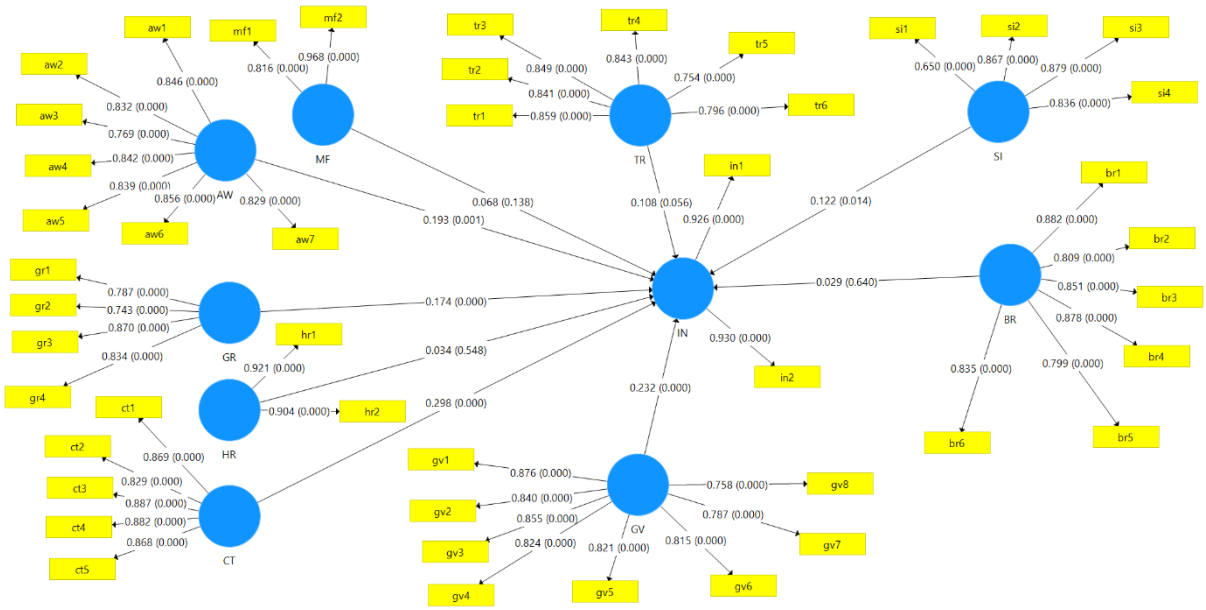


Figure 7-7: Path Model (Public)- Perceived E-Readiness factors model.

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt E-Commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

7.6.2 TECHNOLOGICAL AND PERCEIVED BEHAVIOURAL CONTROL FACTORS AND ORGANISATIONAL E-COMMERCE ADOPTION

Like the model analysis of perceived E-Readiness components, the SMART PLS SEM algorithm generated three model outputs, one each for the entire, private, and public sector datasets. The whole dataset's results were utilised to answer research question 2 and test the associated hypotheses HB1-HB5. The results from the private and public sector s and the multigroup analysis will be used to answer the remaining part of research question three.

7.6.2.1 EXPLANATORY POWER

The complete dataset model explained around 30% of the variation in E-Commerce intention. The same set of predictor variables explained 37% and 39% of the variation in the Intention to adopt E-Commerce in the private and public sector dataset models, respectively (Table 7-59).

Table 7-59: Coefficients of determination- Technological and Behavioural Control factors Model

Data Group	R2	Adjusted R2
Complete	0.295	0.282
Private	0.370	0.350
Public	0.393	0.369

7.6.2.2 CONSTRUCT'S RELIABILITY AND VALIDITY

The detailed criteria to establish reliability and validity of measurement model has already been explained in 7.6.1.2 . Model B also passed the tests for reliability and validity and the convergent validity of the models were thus established for complete, private and public sector datasets (Table 7-60, Table 7-61, Table 7-62).

Table 7-60: Constructs reliability and validity (complete)- Technological and Perceived Behavioural Control factors model

Construct	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
IN	0.772	0.797	0.897	0.813
PB	0.815	0.862	0.886	0.723
PC	0.831	0.832	0.887	0.663
CA	0.774	1.017	0.889	0.802
PE	0.859	0.944	0.899	0.691
RA	0.784	0.794	0.902	0.822
PS	0.699	0.714	0.868	0.767

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-Commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

Table 7-61: Constructs reliability and validity (Private)- Technological and Perceived Behavioural Control factors model

Construct	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
IN	0.758	0.775	0.891	0.804
PB	0.783	0.791	0.873	0.696
PC	0.823	0.827	0.882	0.652
CA	0.774	0.806	0.897	0.813
PE	0.864	0.934	0.903	0.699
RA	0.786	0.787	0.903	0.824
PS	0.731	0.754	0.880	0.786

Table 7-62: Constructs reliability and validity (Public)- Technological and Perceived Behavioural Control factors model

Construct	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
IN	0.778	0.782	0.900	0.818
PB	0.819	0.884	0.888	0.725
PC	0.830	0.832	0.887	0.662
CA	0.785	1.039	0.894	0.809
PE	0.836	0.914	0.884	0.659
RA	0.775	0.806	0.897	0.814
PS	0.665	0.665	0.856	0.749

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-Commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

7.6.2.3 DISCRIMINANT VALIDITY

Discriminant validity (explained in detail in section 7.6.1.3) of constructs in all three models was established through Fornell-Larker Criterion and HTMT. Table 7-63,Table 7-64 and Table 7-65 list the matrix for Farnell Larcker Criterion, and Table 7-66 , Table 7-67 and Table 7-68 list the HTMT of three models. All the values are within the recommended range (explained in section 7.6.1.3)

Table 7-63: Fornell-Larcker Criterion (Complete)- Technological and Perceived Behavioural Control factors model

Construct	IN	PB	PC	CA	PE	RA	PS
IN	0.902						
PB	0.231	0.850					
PC	0.305	0.216	0.814				
CA	0.185	0.167	0.157	0.895			
PE	0.159	0.254	0.229	0.189	0.831		
RA	0.282	0.091	0.071	0.187	0.224	0.907	
PS	0.396	0.147	0.108	0.114	0.135	0.093	0.876

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-Commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

Table 7-64:Fornell-Larcker Criterion (Private)- Technological and Perceived Behavioural Control factors model

Construct	IN	PB	PC	CA	PE	RA	PS
IN	0.897						
PB	0.263	0.834					
PC	0.259	0.090	0.807				
CA	0.262	0.069	0.140	0.902			
PE	0.186	0.162	0.192	0.135	0.836		
RA	0.371	0.095	-0.031	0.134	0.216	0.908	
PS	0.376	0.092	0.097	0.092	0.166	0.078	0.887

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-Commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

Table 7-65: Fornell-Larcker Criterion (Public)- Technological and Perceived Behavioural Control factors model

Construct	IN	PB	PC	CA	PE	RA	PS
IN	0.904						
PB	0.339	0.852					
PC	0.480	0.233	0.814				
CA	0.143	0.213	0.126	0.900			
PE	0.253	0.257	0.187	0.207	0.812		
RA	0.234	0.034	0.135	0.213	0.177	0.902	
PS	0.407	0.253	0.164	0.168	0.141	0.137	0.865

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-Commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

Table 7-66:HTMT (Complete)- Technological and Perceived Behavioural Control factors model

Construct	IN	PB	PC	CA	PE	RA	PS
IN							
PB	0.352						
PC	0.369	0.306					
CA	0.128	0.168	0.162				
PE	0.375	0.371	0.154	0.170			
RA	0.246	0.237	0.307	0.164	0.200		
PS	0.524	0.389	0.620	0.360	0.313	0.513	

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-Commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

Table 7-67:HTMT(Private)- Technological and Perceived Behavioural Control factors model

Construct	IN	PB	PC	CA	PE	RA	PS
IN							
PB	0.338						
PC	0.326	0.137					
CA	0.335	0.091	0.174				
PE	0.202	0.194	0.208	0.151			
RA	0.478	0.127	0.048	0.164	0.263		
PS	0.491	0.147	0.119	0.119	0.199	0.095	

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-Commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

Table 7-68:HTMT(Public)- Technological and Perceived Behavioural Control factors model

Construct	IN	PB	PC	CA	PE	RA	PS
IN							
PB	0.395						
PC	0.596	0.279					
CA	0.172	0.262	0.163				
PE	0.274	0.275	0.228	0.208			
RA	0.297	0.099	0.170	0.249	0.209		
PS	0.563	0.329	0.220	0.235	0.177	0.196	

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-Commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

7.6.2.4 COLLINEARITY STATISTICS

The collinearity results are represented in Table 7-69 and Table 7-70. We can see that both Inner and outer VIF values fall within the recommended range for all models (explained in section 7.6.1.4).

Table 7-69:Inner VIF- Technological and Perceived Behavioural Control Factors model

Construct	VIF (Intention to adopt E-Commerce)		
	Complete	Private	Public
IN			
PB	1.124	1.040	1.190
PC	1.100	1.069	1.100
CA	1.092	1.052	1.125
PE	1.172	1.137	1.138
RA	1.080	1.076	1.091
PS	1.045	1.043	1.108

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-Commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

Table 7-70 Outer VIF- Technological and Perceived Behavioural Control factors model

Item Variable	VIF		
	Complete	Private	Public
ca1	1.662	1.661	1.718
ca2	1.662	1.661	1.718
in1	1.654	1.595	1.680
in2	1.654	1.595	1.680
pb1	1.994	1.663	2.183
pb2	1.720	1.628	1.749
pb3	1.763	1.595	1.776
pc1	1.734	1.798	1.821
pc2	1.753	1.799	1.610
pc3	1.703	1.516	1.967
pc4	1.966	2.062	1.829
pe1	2.086	1.989	2.043
pe2	2.227	2.306	2.035

pe3	2.100	2.182	1.907
pe4	1.743	1.879	1.525
ps1	1.406	1.495	1.329
ps2	1.406	1.495	1.329
ra1	1.713	1.723	1.666
ra2	1.713	1.723	1.666

7.6.2.5 MODEL FIT SUMMARY

The three models (complete, private, and public) had SRMR values within the recommended range (explained in section 7.6.1.5), and thus three models were found fit. Model fit summary is presented in Table 7-71.

Table 7-71:Model fit summary (Technological and Perceived Behavioural Control factors model)

Dataset	SRMR	
	Saturated Model	Estimated Model
Complete	0.051	0.051
Private	0.062	0.062
Public	0.067	0.067

7.6.2.6 FACTOR LOADINGS

All items loaded nicely on the respective factors. Table 7-72, Table 7-73 and Table 7-74 list the factor loadings. All factor loadings are within the suggested range (explained in section 7.6.1.6)

Table 7-72:Factor loadings (complete)- Technological and Perceived Behavioural Control factors model

Item	IN	PB	PC	CA	PE	RA	PS
ca1				0.829			
ca2				0.957			
in1	0.923						
in2	0.879						
pb1		0.887					
pb2		0.877					
pb3		0.783					
pc1			0.806				
pc2			0.809				
pc3			0.813				
pc4			0.829				
pe1					0.852		
pe2					0.850		
pe3					0.899		
pe4					0.712		
ps1							0.899
ps2							0.852
ra1						0.894	
ra2						0.919	

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-Commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

Table 7-73:Factor Loadings (Private)- Technological and Perceived Behavioural Control factors model

Item	IN	PB	PC	CA	PE	RA	PS
ca1				0.877			
ca2				0.926			
in1	0.916						
in2	0.878						
pb1		0.858					
pb2		0.814					
pb3		0.831					
pc1			0.793				
pc2			0.823				
pc3			0.789				
pc4			0.824				
pe1					0.868		
pe2					0.818		
pe3					0.887		
pe4					0.768		

ps1							0.912
ps2							0.860
ra1						0.903	
ra2						0.912	

Table 7-74:Factor Loadings (Public)- Technological and Perceived Behavioural Control factors model

Item	IN	PB	PC	CA	PE	RA	PS
ca1				0.836			
ca2				0.959			
in1	0.913						
in2	0.895						
pb1		0.896					
pb2		0.887					
pb3		0.766					
pc1			0.801				
pc2			0.788				
pc3			0.837				
pc4			0.827				
pe1					0.826		
pe2					0.871		
pe3					0.875		
pe4					0.656		
ps1							0.865
ps2							0.866
ra1						0.877	
ra2						0.926	

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-Commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

7.6.2.7 PATH COEFFICIENTS

Path coefficients of the three models, complete, private, and public, are listed in Table 7-75, Table 7-76 and Table 7-77 respectively. We can see that the factor Perceived Security had the highest effect, followed by Perceived Compatibility, Relative Advantage, and Perceived Behavioural Control. Cost Acceptability and Perceived Ease of Use were found to have nonsignificant effects on Intention to adopt E-Commerce. In the Private Sector, the largest contributing factor was Relative Advantage, followed by Perceived Security, Perceived Compatibility, Perceived Behavioural Control, and Cost Acceptability. The effect of Perceived Ease of Use was found to be statistically insignificant. In public sector organisations, the largest contributing factor was Perceived Compatibility, followed by Perceived Security, Perceived Behavioural Control and Relative Advantage. Perceived Ease of Use and Cost Acceptability had statistically insignificant effect on Intention to adopt E-Commerce. Figure 7-8, Figure 7-9 and Figure 7-10 show the path diagrams for complete, private, and public dataset models respectively.

Table 7-75:Path Coefficients (Complete)- Technological and Perceived Behavioural Control factors model

Path	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
PB-> IN	0.110	0.111	0.043	2.530	0.012
PC -> IN	0.226	0.225	0.048	4.736	0.000
CA -> IN	0.057	0.062	0.043	1.323	0.186
PE -> IN	-0.026	-0.017	0.045	0.562	0.574
RA -> IN	0.220	0.221	0.046	4.739	0.000
PS -> IN	0.332	0.333	0.043	7.762	0.000

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-Commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

Table 7-76:Path Coefficients (Private)- Technological and Perceived Behavioural Control factors model

Path	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
PB -> IN	0.179	0.180	0.054	3.298	0.001
PC -> IN	0.207	0.214	0.059	3.511	0.000
CA -> IN	0.152	0.151	0.062	2.442	0.015
PE -> IN	-0.024	-0.010	0.058	0.413	0.680
RA -> IN	0.322	0.323	0.063	5.092	0.000
PS -> IN	0.304	0.301	0.057	5.344	0.000

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-Commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

Table 7-77:Path Coefficients (Public)- Technological and Perceived Behavioural Control factors model

Path	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
PB -> IN	0.163	0.169	0.068	2.388	0.017
PC -> IN	0.366	0.364	0.064	5.688	0.000
CA -> IN	-0.030	-0.022	0.067	0.452	0.651
PE -> IN	0.086	0.090	0.060	1.440	0.151
RA -> IN	0.132	0.136	0.066	1.996	0.046
PS -> IN	0.281	0.280	0.068	4.100	0.000

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-Commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

7.6.2.8 MODERATION EFFECT OF SECTOR (MULTI-GROUP ANALYSIS).

Two statistically significant path coefficient differences were found for the effect of relative advantage (0.190) and cost acceptability (0.183) and both constructs were more strongly related to intention to adopt E-Commerce in the Private Sector (Table 7-78). The rest of the path coefficient differences were statistically insignificant. All factor loading differences were found to be statistically insignificant (Table 7-79 and Table 7-80).

Table 7-78: Path coefficients MGA- Technological and Perceived Behavioural Control factors model

Path	Path Coefficients-diff (GROUP_sector(private) - GROUP_sector(public))	p-Value original 1-tailed (GROUP_sector(private) vs GROUP_sector(public))	p-Value new (GROUP_sector(private) vs GROUP_sector(public))
CA -> IN	0.183	0.017	0.035
PB -> IN	0.016	0.431	0.862
PC -> IN	-0.159	0.969	0.062
PE -> IN	-0.110	0.910	0.180
PS -> IN	0.024	0.391	0.782
RA -> IN	0.190	0.014	0.029

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-Commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

Table 7-79: Factor Loadings MGA- Technological and Perceived Behavioural Control factors model

	Outer Loadings-diff (GROUP_sector(private) - GROUP_sector(public))	p-Value original 1-tailed (GROUP_sector(private) vs GROUP_sector(public))	p-Value new (GROUP_sector(private) vs GROUP_sector(public))
ca1 <- CA	0.040	0.556	0.889
ca2 <- CA	-0.033	0.851	0.299
in1 <- IN	0.002	0.469	0.937
in2 <- IN	-0.018	0.736	0.529
pb1 <- PB	-0.038	0.799	0.402
pb2 <- PB	-0.073	0.911	0.178
pb3 <- PB	0.064	0.238	0.475
pc1 <- PC	-0.007	0.548	0.904
pc2 <- PC	0.035	0.230	0.459
pc3 <- PC	-0.048	0.845	0.309
pc4 <- PC	-0.003	0.505	0.989
pe1 <- PE	0.042	0.222	0.444
pe2 <- PE	-0.053	0.728	0.544
pe3 <- PE	0.012	0.348	0.697
pe4 <- PE	0.112	0.165	0.330
ps1 <- PS	0.047	0.143	0.286
ps2 <- PS	-0.005	0.540	0.919
ra1 <- RA	0.026	0.375	0.751
ra2 <- RA	-0.014	0.684	0.631

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-Commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

Table 7-80: Welch-Satterthwait Test MGA- Technological and Perceived Behavioural Control factors model

	Outer Loadings-diff (GROUP_sector(private) - GROUP_sector(public))	t-Value(|GROUP_sector(private) vs GROUP_sector(public)|)	p-Value (GROUP_sector(private) vs GROUP_sector(public))
ca1 <- CA	0.040	0.192	0.848
ca2 <- CA	-0.033	0.214	0.831
in1 <- IN	0.002	0.112	0.911
in2 <- IN	-0.018	0.608	0.544
pb1 <- PB	-0.038	0.673	0.502
pb2 <- PB	-0.073	1.238	0.217
pb3 <- PB	0.064	0.625	0.533
pc1 <- PC	-0.007	0.133	0.895
pc2 <- PC	0.035	0.627	0.531
pc3 <- PC	-0.048	0.988	0.325
pc4 <- PC	-0.003	0.066	0.947
pe1 <- PE	0.042	0.484	0.629
pe2 <- PE	-0.053	0.451	0.653
pe3 <- PE	0.012	0.186	0.853
pe4 <- PE	0.112	0.749	0.455
ps1 <- PS	0.047	0.994	0.322
ps2 <- PS	-0.005	0.101	0.920
ra1 <- RA	0.026	0.338	0.736
ra2 <- RA	-0.014	0.182	0.856

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-Commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

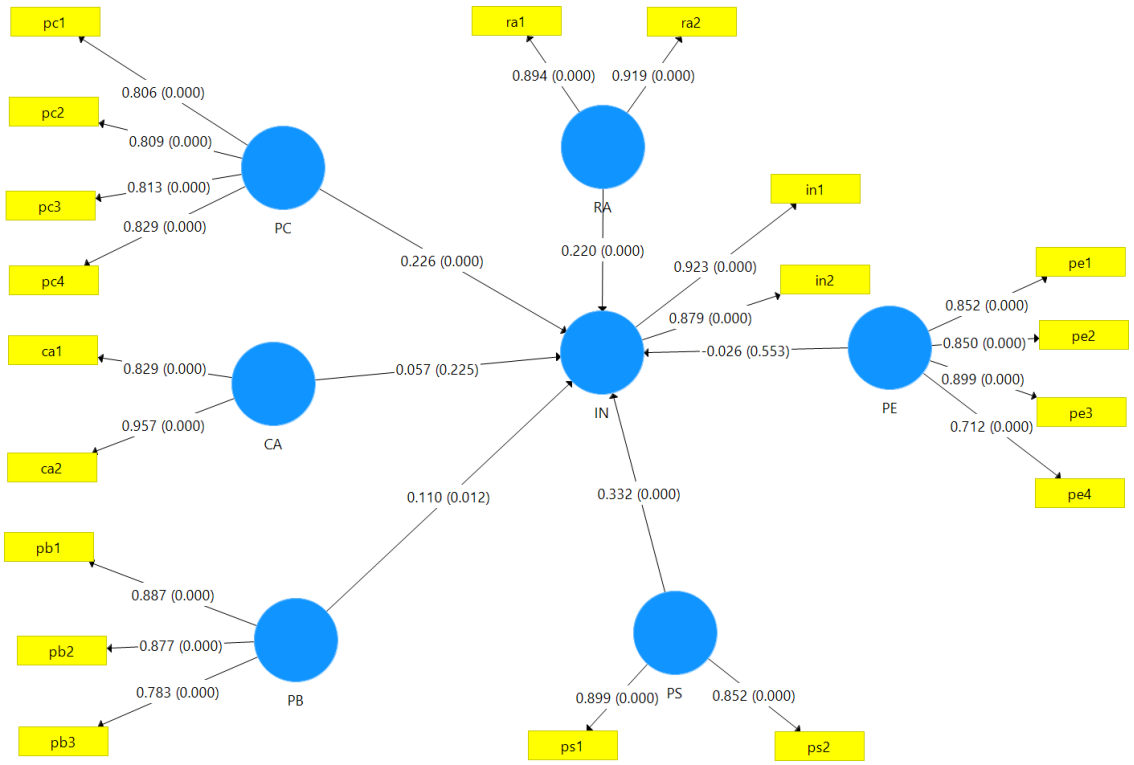


Figure 7-8:Path model Technological and Perceived Behavioural Control factors model (Complete)

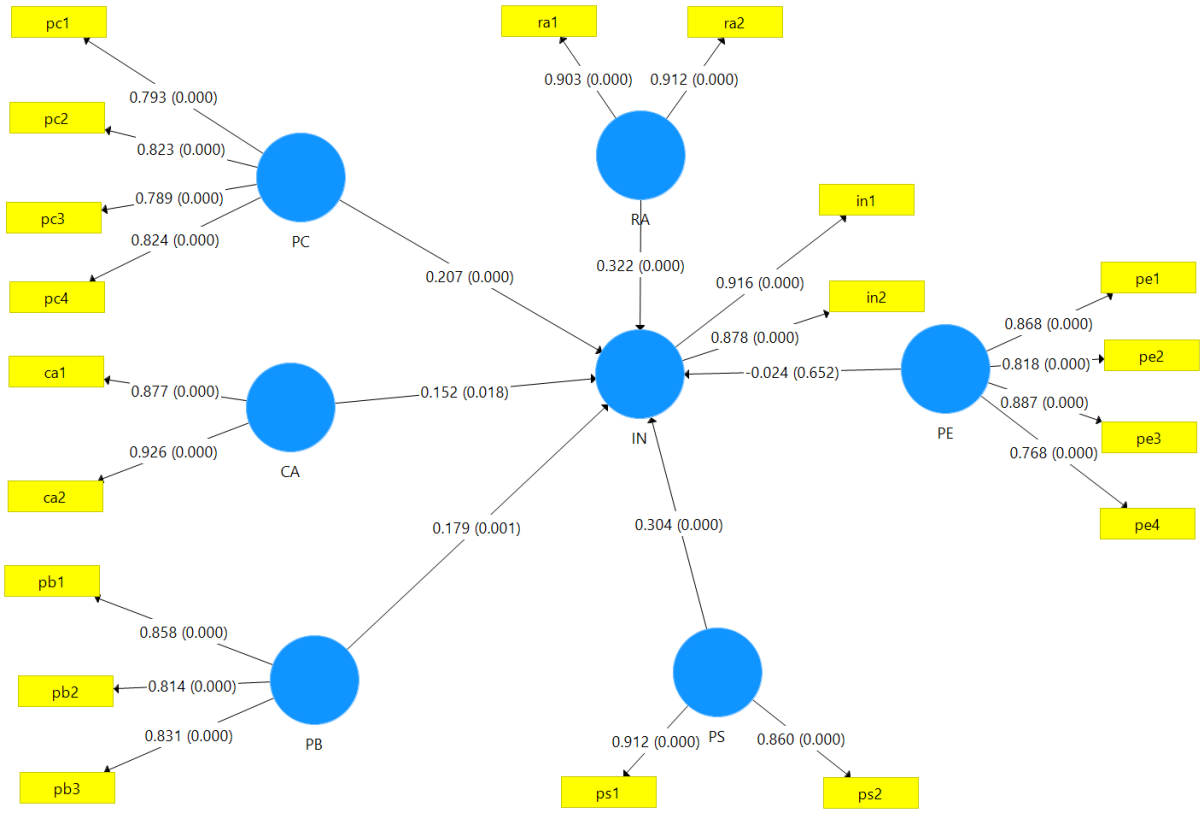


Figure 7-9: Path model Technological and Perceived Behavioural Control factors model (Private Sector)

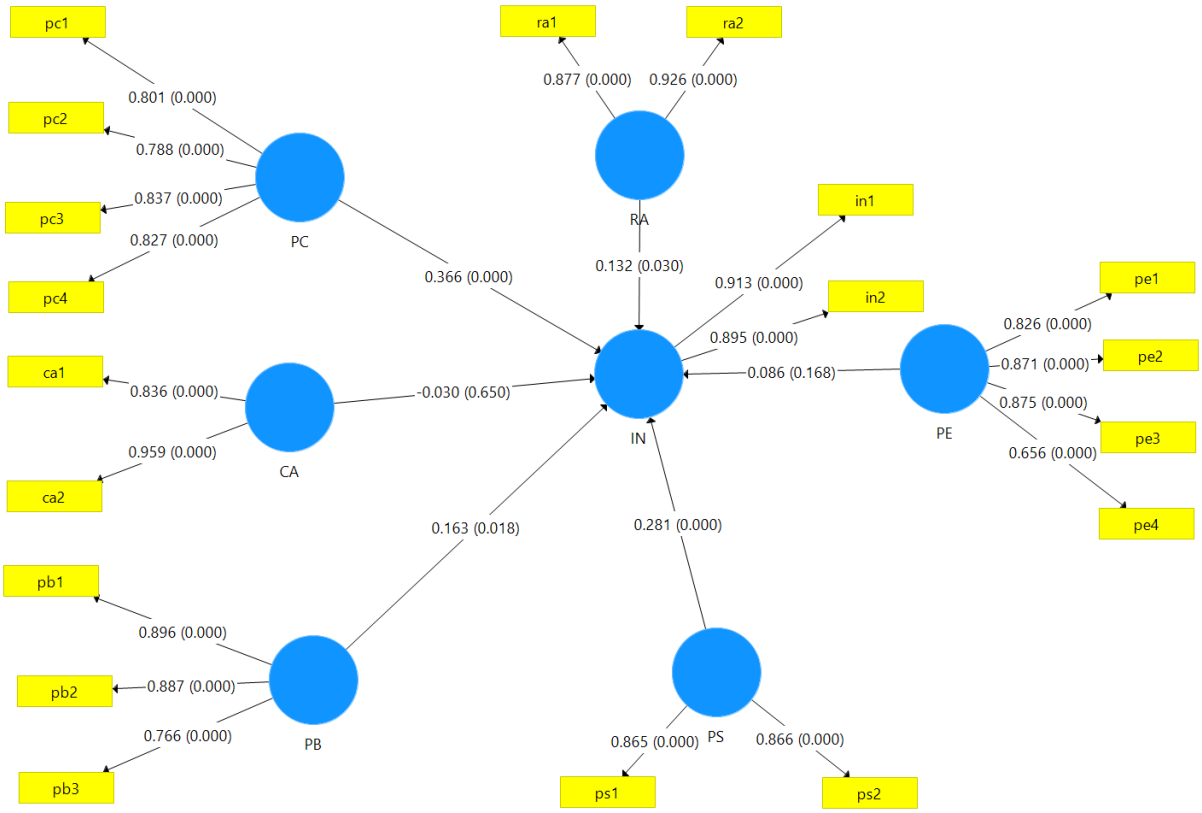


Figure 7-10: Path model Technological and Perceived Behavioural Control factors model (Public sector)

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-Commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

7.6.3 ASSOCIATION OF FACTORS WITH E-COMMERCE ADOPTION LEVELS

Sections 7.6.1 and7.6.2 answered together research question four. Multinomial Logistic Regression (MLR) algorithm was used to find the association of different predictor variables of Model A and B with each development stage of E-Commerce. Due to negligible responses from the organisations with level four stage of E-Commerce adoption, the proposed E-Commerce maturity model was amended as Figure 7-11. Independent or predictor variables of model A were used as predictors and categorical variable with four levels (level 0 to level 3) was used as dependent variable in model C. Similarly, in model D, independent variables of model-B were used to predict four levels of E-Commerce adoption. Model C answers questions HC1- HC9 and Model D answers research questions HD1- HD6. In both models, baseline category was level 0 (i.e. no E-Commerce adoption). Result of two regressions is presented in in following sections.

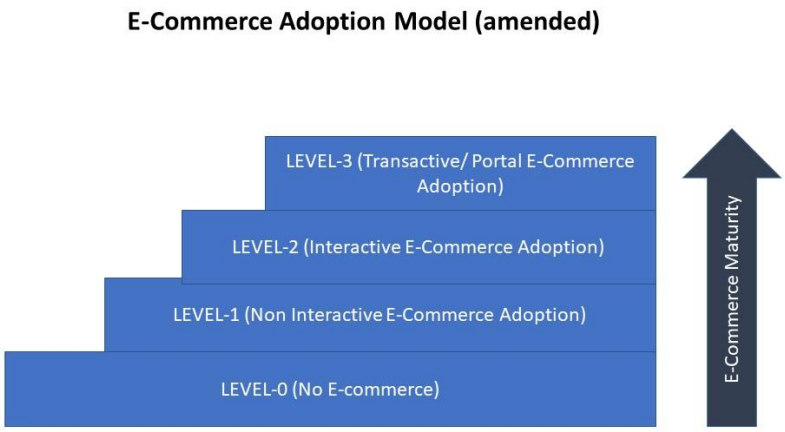


Figure 7-11: E-Commerce adoption development model (amended)

7.6.3.1 PERCEIVED E-READINESS FACTORS AND ORGANISATIONAL E-COMMERCE ADOPTION LEVEL

Multinominal regression algorithm using SPSS was run on the E-Readiness predictor variables and organisational E-Commerce maturity levels. The output of the processing is appended below. Out of 448 valid observations in the perceived E-Readiness model (PERM), 19.4% were in level 0, 38.3% were in level one, and 27.7% were in level three (Table 7-81)

Table 7-81: Case processing summary – perceived E-Readiness factors model

Case Processing Summary			
		N	Marginal Percentage
level	level0	87	19.4%
	level1	174	38.8%
	level2	124	27.7%
	level3	63	14.1%
Valid		448	100.0%
Missing		0	
Total		448	
Subpopulation		448[a]	

a. The dependent variable has only one value observed in 448 (100.0%) subpopulations.

Model fitting information (Table 7-82) is a likelihood ratio chi-square test, and this is the same test as done in the context of binary logistic regression. This test compares a Null Model (a model with no predictors) with a model that includes predictors and a significant value means the presence of predictors improve model significantly as compared to null model (IBM, 2021, Petrucci, 2009). The model D passed the significance test as p value is >0.05.

Table 7-82: Model fitting information – Perceived E-Readiness factors model

Model Fitting Information				
Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	1180.011			
Final	714.423	465.587	27	<.001

Table 7-83 shows the results of another two goodness of fit tests. Pearson and Deviance tests both as chi square tests. These tests also provide additional information about the model's goodness of fit. It is important to note that the model is considered good if we have non-significant values not significant values. Often both tests do not always agree but in our case both tests were non-significant and that means we had a good model (Sarstedt et al., 2017, Domínguez-Almendros et al., 2011, IBM, 2021).

Table 7-83: Goodness of Fit – Perceived E-Readiness factors model

Goodness-of-Fit			
	Chi-Square	df	Sig.
Pearson	958.706	1314	1.000
Deviance	714.423	1314	1.000

Pseudo R Square is another output that SPSS provides as an output of multinomial regression. Although it has a very rough analogy to R square, it should be interpreted with caution. As such, we cannot interpret it as a proportion of the variance explained by the model. Instead of interpreting it as an indicator of explained variance, it should be considered an index of improvement in the model fit (Stevens, 2012, IBM, 2021). SPSS provides three different calculations of Pseudo R square and from results (Table 7-84) we can say that model improved 64%, 69%, and 39% as compared to the null model, according to Cox and Snell, Nagelkerke, and McFadden calculations, respectively.

Table 7-84: Pseudo R-Square – Perceived E-Readiness factors model

Pseudo R-Square	
Cox and Snell	.646
Nagelkerke	.696
McFadden	.395

Likelihood Ratio Test (Table 7-85) is another Chi-Square test that compares the log likelihood in the final model with predictors compared to the null model. This test can be considered a test of each independent variable's effect in the model. The test removes a predictor variable turn by turn and checks if the model fit significantly decreases; if it does, it shows the predictor as significant. As can be seen from the results that all our independent variables significantly improved the model (Domínguez-Almendros et al., 2011, IBM, 2021, Petrucci, 2009).

Table 7-85: Likelihood test ratio – Perceived E-Readiness factors model

Likelihood Ratio Tests				
Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	1016.917	302.494	3	<.001
AW	734.375	19.952	3	<.001
HR	740.310	25.887	3	<.001
BR	738.800	24.376	3	<.001
TR	755.971	41.547	3	<.001
GV	758.014	43.591	3	<.001
MF	758.022	43.599	3	<.001
GR	727.742	13.319	3	.004
SI	755.160	40.737	3	<.001
CT	730.068	15.645	3	.001

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt E-Commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

Next output, parameters estimate tell us which of the factors (independent variables) significantly predict whether an organisation falls into the level 1, 2, and 3 categories (i.e., the comparison group) versus level 0 (i.e., baseline) category. The regression slope of each factor can be interpreted as the predicted change in log odds of belonging to the comparison group, i.e. (level 1, 2, or 3) relative to the baseline group (level 0) per unit increase on the predictor. While units of slopes are log odds, they reflect the predicted likelihood of being in the level 1, 2, or 3 categories (compared to level 0) with changing values on a given predictor/factor. A positive slope (or positive coefficient) means a positive relationship between the predictor and outcome variable. Thus, with an increase in predictor variable value, chances of falling into the comparison category will increase (and falling into the ref category will decrease). A zero coefficient means no relationship between a given factor and the probability of category membership on the dependent variable/ comparison categories (level 1, 2, and 3 in this case). On the other hand, the negative coefficient indicates that the chances of falling into the comparison category decrease with increasing values on a predictor. In contrast, the chances of being in the reference category are increasing. The values in the Exp(B) column are odds ratios and are termed "Relative Risk Ratios (in Stata)" or "Odds Ratio (in SPSS)." These values represent the predicted multiplicative change in the odds of an organisation falling into the 'higher' category of the comparison category of dependent variable (in comparison with the reference category) with a per-unit increase on a predictor. Values greater than 1 indicate that as values on a predictor/factor increase, a case has a greater probability of belonging to the comparison category on the dependent variable and a lower chance of belonging to the baseline/reference category as scores on a predictor increase. Values less than one indicate that the risk of belonging to the comparison group decreases with increasing values on a predictor and the risk of belonging to the baseline category increases. A value equal to 1 indicates no relationship between the predictor and the chances of falling into the baseline or reference category(Kwak and Clayton-Matthews, 2002, Bayaga, 2010, Petrucci, 2009).

In Table 7-86, we can see the slope coefficients and log odds in columns B and Exp(B), respectively. For the level 1 comparison category, we can see that the only negative coefficient is for the regression slope of human resources E-Readiness but is nonsignificant. All other factors in our model are significant and positively correlated with the reference category (i.e., Level 1) except support industries E-Readiness and human resources in level one. The most important factor for level one compared to baseline (level zero) was governance, followed by technology resources, commitment, market forces, awareness, government E-Readiness, and business resources E-Readiness.

For the level two comparison category, all factors except human resource E-Readiness and support industries E-Readiness were significant and positively related to the reference category (i.e., Level two). Governance was found most important factor for determining association with level two of organisational E-Commerce adoption, followed by market forces E-Readiness, business resources E-Readiness, awareness, technology resources E-Readiness, commitment, and government e- readiness.

For the level three comparison category, the only nonsignificant relationship was again human resource E-Readiness. All other factors in our model were significantly determining association with reference category three. The most important factor in determining the association with level three compared to level zero was technology resources, followed by governance, support industries E-Readiness, market forces, business resources E-Readiness, awareness, and government E-Readiness. Moreover, each significant predictor tends to associate strongly with respective E-Commerce adoption stage as the E-Commerce adoption maturity increase.

Table 7-86: Parameter estimates -Perceived E-Readiness factors model

Parameter Estimates							
level[a]		B	Std. Error	Wald	df	Sig.	Exp(B)
level1	Intercept	-15.042	2.174	47.864	1	<.001	
	AW	.548	.229	5.705	1	.017	1.730
	HR	-.287	.218	1.729	1	.189	.751
	BR	.483	.235	4.226	1	.040	1.621
	TR	.999	.254	15.456	1	<.001	2.716
	GV	1.663	.303	30.141	1	<.001	5.273
	MF	.637	.203	9.874	1	.002	1.891
	GR	.523	.230	5.175	1	.023	1.686
	SI	.069	.225	.094	1	.759	1.071
	CT	.795	.223	12.744	1	<.001	2.214
level2	Intercept	-25.598	2.659	92.671	1	<.001	
	AW	1.053	.266	15.710	1	<.001	2.866
	HR	.415	.249	2.778	1	.096	1.515
	BR	1.094	.270	16.412	1	<.001	2.986
	TR	.839	.286	8.631	1	.003	2.314
	GV	1.469	.324	20.542	1	<.001	4.345
	MF	1.300	.238	29.871	1	<.001	3.671
	GR	.531	.258	4.238	1	.040	1.701
	SI	.728	.263	7.691	1	.006	2.072
	CT	.814	.252	10.444	1	.001	2.258
level3	Intercept	-36.674	3.349	119.906	1	<.001	
	AW	1.068	.309	11.930	1	<.001	2.910
	HR	.405	.293	1.910	1	.167	1.499
	BR	1.157	.316	13.381	1	<.001	3.179
	TR	1.912	.349	29.993	1	<.001	6.768
	GV	1.487	.359	17.172	1	<.001	4.425
	MF	1.381	.281	24.151	1	<.001	3.978

GR	1.065	.310	11.806	1	<.001	2.901
SI	1.467	.325	20.411	1	<.001	4.336
CT	.985	.300	10.790	1	.001	2.677

Note: AW=Awareness, BR= Business Resources, CT= Commitment, GR=Governance, IN= Intention to adopt E-Commerce, MF= Market forces readiness, SI= Support Industry, TR= Technological Resources.

7.6.3.2 TECHNOLOGICAL AND PERCEIVED BEHAVIOURAL CONTROL FACTORS MODEL

In the Technical and Behavioural Control factors model, there were 347 cases in total. Of these, 61 cases were classified as level 0 (constituting 17.6% of the total), 106 cases were at level 1 (30.5% of the total), 107 cases were at level 2 (30.8% of the total), and 73 cases were categorized as level 3 (21% of the total). Please refer to Table 7-87 for details.

Table 7-87: Case processing summary (Technological and Perceived Behavioural Control factors model)

Case Processing Summary			
		N	Marginal Percentage
level	level0	61	17.6%
	level1	106	30.5%
	level2	107	30.8%
	level3	73	21.0%
Valid		347	100.0%
Missing		0	
Total		347	
Subpopulation		347[a]	

a. The dependent variable has only one value observed in 347 (100.0%) subpopulations.

The model was found to be significantly improved when predictors were introduced in the model compared to the null model (see explanation in section7.6.3.1). We can see that likelihood Chi-Square test value is significant (Table 7-88), which indicates a model fit.

Table 7-88: Model fitting information (Technological and Perceived Behavioural Control factors model)

Model Fitting Information				
Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	942.863			
Final	686.267	256.597	18	<.001

Other goodness of fit indices also indicate that model is significantly improved with the introduction of predictor variables compared to the null model. Nonsignificant values of Pearson and Deviance tests further confirm that model is fit (Table 7-89).

Table 7-89: Goodness of fit indices (Technological and Perceived Behavioural Control factors model)

Goodness-of-Fit			
	Chi-Square	df	Sig.
Pearson	937.433	1020	.969
Deviance	686.267	1020	1.000

Table 7-90 gives us details of model fit improvement in the form of an index of improvement in the model fit (Pituch and Stevens, 2016). So, we can say that model improves 52%, 56%, and 27% as compared to the null model, according to Cox and Snell, Nagelkerke, and McFadden calculations, respectively.

Table 7-90: Pseudo R -Square values (Technological and Perceived Behavioural Control factors model)

Pseudo R-Square	
Cox and Snell	.523
Nagelkerke	.560
McFadden	.272

All the predictor factors contributed significantly to improving the model except Perceived Compatibility (PC); however, PC is found to be a significant discriminant factor for level 1 and 2 categories compared to the baseline (level 0). Please refer to Table 7-91 for details.

Table 7-91: Likelihood ratio tests (Technological and Perceived Behavioural Control factors model)

Likelihood Ratio Tests				
Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	885.532	199.266	3	<.001
PC	692.825	6.558	3	.087
PB	743.888	57.622	3	<.001
PS	707.889	21.623	3	<.001
CA	707.401	21.135	3	<.001
RA	726.989	40.723	3	<.001
PE	723.040	36.773	3	<.001

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-Commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

All except Perceived Security factor were found to be associated with level one association compared to the baseline category (level zero). Perceived behavioural control was found most important factor followed by relative advantage, Perceived Ease of Use, perceived cost acceptability, and Perceived Compatibility. In the level two category, all predictor variables were found positively related to the reference category. The strongest association was of Perceived Behavioural Control, followed by

Perceived Ease of Use, Perceived Relative Advantage, perceived cost acceptability, and Perceived Security. In level three, Perceived Compatibility was not found to be significant. The rest of the independent variables discriminated the membership of the reference category compared to the baseline category (level zero). In order of importance, Perceived Ease of Use, Perceived Relative Advantage, Perceived Behavioural Control, Perceived Cost Acceptability, and Perceived Security were positively related to the reference category (Table 7-92).

Table 7-92: Parameter estimates (Technological and Perceived Behavioural Control factors model)

Parameter Estimates level[a]		B	Std. Error	Wald	df	Sig.	Exp(B)
level1	Intercept	-8.276	1.615	26.272	1	<.001	
	PC	.466	.208	5.037	1	.025	1.594
	PB	.772	.223	11.993	1	<.001	2.163
	PS	-.103	.201	.265	1	.607	.902
	CA	.512	.193	7.027	1	.008	1.669
	RA	.730	.218	11.224	1	<.001	2.075
	PE	.540	.224	5.791	1	.016	1.716
level2	Intercept	-19.721	2.254	76.547	1	<.001	
	PC	.590	.248	5.664	1	.017	1.803
	PB	1.693	.268	39.793	1	<.001	5.436
	PS	.527	.241	4.779	1	.029	1.694
	CA	1.046	.242	18.726	1	<.001	2.845
	RA	1.061	.249	18.102	1	<.001	2.888
	PE	1.154	.275	17.654	1	<.001	3.172
level3	Intercept	-23.289	2.549	83.503	1	<.001	
	PC	.524	.272	3.706	1	.054	1.689
	PB	1.539	.287	28.737	1	<.001	4.659
	PS	.739	.271	7.458	1	.006	2.094
	CA	.877	.264	11.045	1	<.001	2.403
	RA	1.551	.271	32.650	1	<.001	4.717
	PE	1.665	.312	28.549	1	<.001	5.286

Note: PC=Perceived Compatibility, PB= Perceived Behavioural Control, PS= Perceived Security, CA=Perceived Cost Accessibility, IN= Intention to adopt E-Commerce, RA= Relative Advantage, PE= Perceived Ease of Use.

7.7 HYPOTHESES TESTING RESULTS.

Following sections summarise the results of the hypothesis testing.

7.7.1 PERCEIVED E-READINESS FACTORS MODEL

This section summarises the hypothesis results relevant to research question one.

7.7.1.1 PERCEIVED ORGANISATIONAL E-READINESS (POER)

Sr. No	Hypotheses	Result
1	HA1: Awareness about E-Commerce is significantly positively to the intention to adopt E-commerce.	+
2	HA2: Availability of relevant human resources is significantly positively to the intention to adopt E-commerce.	Not Supported

3	HA3: Availability of relevant business resources is significantly positively related to the intention to adopt E-commerce.	+
4	HA4: Availability of technology resources are significantly positively related to the intention to adopt E-commerce.	+
5	HA5: Commitment toward E-Commerce adoption is significantly positively to the Intention to adopt E-commerce.	+
6	HA6: Governance is significantly positively to the intention to adopt E-commerce.	+

7.7.1.2 PERCEIVED ENVIRONMENTAL E-READINESS (PEER)

Sr. No	Hypotheses	Result
7	HA-7: Government E-Readiness is significantly positively related to the intention to adopt E-commerce.	+
8	HA-8: Market forces E-Readiness is significantly positively related to the intention to adopt E-commerce.	Not Supported
9	HA-9: Support industries E-Readiness is significantly positively related to the intention to adopt E-Commerce.	+

7.7.2 TECHNOLOGICAL AND PERCEIVED BEHAVIOURAL CONTROL FACTORS MODEL

This section summarises the hypothesis testing results relevant to research question 2.

Sr. No	Hypotheses	Result
1	HB-1: Perceived Relative Advantage of E-Commerce is significantly positively related to intention to adopt E-Commerce	+
2	HB-2: Perceived Compatibility of E-Commerce is significantly positively related to the intention to adopt E-commerce	+
3	HB-3: Perceived Cost Acceptability is significantly positively related to the Intention to adopt E-commerce	Not Supported
4	HB-4: Perceived Security is significantly positively related to the intention to adopt E-commerce	+
5	HB-5: Perceived Ease of Use is significantly positively related to the intention to adopt E-commerce	Not Supported
6	HB-6: Perceived Behavioural Control is significantly positively related to the intention to adopt E-commerce.	+

7.7.3 MODERATION EFFECT OF SECTOR

7.7.3.1 PERCEIVED E-READINESS MODEL

Sr. No	Hypotheses	Result
1	HAM1: Awareness about E-Commerce and intention to adopt E-commerce relationship is moderated by sector.	Not Supported
2	HAM2: Availability of relevant Human Resources and intention to adopt E-commerce relationship is moderated by sector.	Not Supported
3	HAM3: Availability of relevant Business Resources and intention to adopt E-commerce relationship is moderated by sector.	Not Supported

4	HAM4: Technology Resources and intention to adopt E-commerce relationship is moderated by sector.	Not Supported
5	HAM5: Commitment toward E-Commerce adoption and intention to adopt E-commerce relationship is moderated by sector.	Not Supported
6	HAM6: Governance and intention to adopt E-commerce relationship is moderated by sector.	+
7	HAM-7: Government E-Readiness and Intention to adopt E-commerce relationship is moderated by sector.	Not Supported
8	HAM-8: Market forces E-Readiness and Intention to adopt E-commerce relationship is moderated by sector.	Not Supported
9	HAM-9: Support industries E-Readiness and Intention to adopt E-commerce relationship is moderated by sector.	Not Supported

7.7.3.2 TECHNOLOGICAL AND PERCEIVED BEHAVIOURAL CONTROL MODEL

Sr. No	Hypotheses	Result
1	HBM-1: Perceived Relative Advantage of E-Commerce and intention to adopt E-Commerce relationship is moderated by sector.	+
2	HBM-2: Perceived Compatibility of E-Commerce and intention to adopt E-commerce relationship is moderated by sector.	Not Supported
3	HBM-3: Perceived Cost Acceptability and Intention to adopt E-commerce relationship is moderated by sector.	+
4	HBM-4: Perceived Security and intention to adopt E-commerce relationship is moderated by sector.	Not Supported
5	HBM-5: Perceived Ease of Use and intention to adopt E-commerce relationship is moderated by sector.	Not Supported
6	HBM-6: Perceived Behavioural Control and intention to adopt E-commerce relationship is moderated by sector.	Not Supported

7.7.4 ASSOCIATION OF E-READINESS, TECHNOLOGICAL AND BEHAVIOURAL CONTROL FACTORS WITH E-COMMERCE ADOPTION LEVELS

7.7.4.1 PERCEIVED E-READINESS FACTORS MODEL

Sr. No	Hypotheses	Result
1	HC 1a: Awareness of E-Commerce is significantly positively related to the organisational non interactive E-Commerce adoption in Pakistan.	+
2	HC 1b: Awareness of E-Commerce is significantly positively related to the organisational interactive E-Commerce adoption in Pakistan.	+
3	HC 1c: Awareness of E-Commerce is significantly positively related to the organisational transactive/portal E-Commerce adoption in Pakistan.	+
4	HC 1d: Awareness of E-Commerce is significantly positively related to the organisational integrative E-Commerce adoption in Pakistan.	Not tested
5	HC 2a: Human resources availability is significantly positively related to the organisational non interactive E-Commerce adoption in Pakistan	Not Supported

6	HC 2b: Human resources availability is significantly positively related to the organisational Interactive E-Commerce adoption in Pakistan	Not Supported
7	HC 2c: Human resources availability is significantly positively related to the organisational transactive/ portal E-Commerce adoption in Pakistan	Not Supported
8	HC 2d: Human Resources availability is significantly positively related to the organisational integrative E-Commerce adoption in Pakistan	Not tested
9	HC 3a: Business resource availability is significantly positively related to the non-interactive organisational E-Commerce adoption in Pakistan.	+
10	HC 3b: Business resource availability is significantly positively related to the interactive organisational E-Commerce adoption in Pakistan.	+
11	HC 3c: Business Resources availability is significantly positively related to the transactive/ portal organisational E-Commerce adoption in Pakistan.	+
12	HC 3d: Business resource availability is significantly positively related to the integrative organisational E-Commerce adoption in Pakistan.	Not tested
13	HC 4a: Technology Resources availability is significantly positively related to the organisational non interactive E-Commerce adoption in Pakistan	+
14	HC 4b: Technology Resources availability is significantly positively related to the organisational interactive E-Commerce adoption in Pakistan	+
15	HC 4c: Technology resource availability is significantly positively related to the organisational transactive/portal E-Commerce adoption in Pakistan	+
16	HC 4d: Technology Resource availability is significantly positively related to the organisational integrative E-Commerce adoption in Pakistan	Not tested
17	HC 5a: Commitment toward E-Commerce adoption is significantly positively related to the organisational non interactive E-Commerce adoption in Pakistan.	+
18	HC 5b: Commitment toward E-Commerce adoption is significantly positively related to the organisational interactive E-Commerce adoption in Pakistan.	+
19	HC 5c: Commitment toward E-Commerce adoption is significantly positively related to the organisational transactive/ portal E-Commerce adoption in Pakistan.	+
20	HC 5d: Commitment toward E-Commerce adoption is significantly positively related to the organisational integrative E-Commerce adoption in Pakistan.	Not tested
21	HC 6a: Governance is significantly positively related to the organisational non interactive E-Commerce adoption in Pakistan	+
22	HC 6b: Governance is significantly positively related to the organisational interactive E-Commerce adoption in Pakistan	+
23	HC 6c: Governance is significantly positively related to the organisational transactive/ portal E-Commerce adoption in Pakistan	+
24	HC 6d: Governance is significantly positively related to the organisational integrative E-Commerce adoption in Pakistan	Not tested
25	HC 7a: Government E-Readiness is significantly positively related to the organisational non interactive E-Commerce adoption in Pakistan	+
26	HC 7b: Government E-Readiness is significantly positively related to the organisational Interactive E-Commerce adoption in Pakistan	+
27	HC 7c: Government E-Readiness is significantly positively related to the organisational integrative E-Commerce adoption in Pakistan	+
28	HC 7d: Government E-Readiness is significantly positively related to the organisational integrative E-Commerce adoption in Pakistan	Not tested
29	HC 8a: Market forces E-Readiness is significantly positively related to the organisational non interactive E-Commerce adoption in Pakistan.	+
30	HC 8b: Market forces E-Readiness is significantly positively related to the organisational Interactive E-Commerce adoption in Pakistan.	+

31	HC 8c: Market forces E-Readiness is significantly positively related to the organisational transactive/ portal E-Commerce adoption in Pakistan.	+
32	HC 8d: Market forces E-Readiness is significantly positively related to the organisational integrative E-Commerce adoption in Pakistan.	Not tested
33	HC 9a: Support industries E-Readiness is significantly positively related to the organisational Non interactive E-Commerce adoption in Pakistan.	Not Supported
34	HC 9b: Support industries E-Readiness is significantly positively related to the organisational Interactive E-Commerce adoption in Pakistan.	Not Supported
35	HC 9c: Support industries E-Readiness is significantly positively related to the organisational transactive/ portal E-Commerce adoption in Pakistan.	+
36	HC 9d: Support industries E-Readiness is significantly positively related to the organisational integrative E-Commerce adoption in Pakistan.	Not tested

7.7.4.2 TECHNOLOGICAL AND PERCEIVED BEHAVIOURAL CONTROL FACTORS MODEL

Sr. No	Hypotheses	Result
1	HD 1a: Perceived Relative Advantage is significantly and positively related to the organisational Non interactive E-Commerce adoption in Pakistan.	+
2	HD 1b: Perceived Relative Advantage is significantly and positively related to the organisational interactive E-Commerce adoption in Pakistan.	+
3	HD 1c: Perceived Relative Advantage is significantly and positively related to the organisational transactive/ portal E-Commerce adoption in Pakistan.	+
4	HD 1d: Perceived Relative Advantage is significantly and positively related to the organisational integrative E-Commerce adoption in Pakistan.	Not tested
5	HD 2a: Perceived Compatibility is significantly and positively related to the organisational non interactive E-Commerce adoption in Pakistan.	+
6	HD 2b: Perceived Compatibility is significantly and positively related to the organisational Interactive E-Commerce adoption in Pakistan.	+
7	HD 2c: Perceived Compatibility is significantly and positively related to the organisational transactive/portal E-Commerce adoption in Pakistan.	-
8	HD 2d: Perceived Compatibility is significantly and positively related to the organisational integrative E-Commerce adoption in Pakistan.	Not tested
9	HD 3a: Perceived Cost Acceptability is significantly and positively related to the organisational non interactive E-Commerce adoption in Pakistan.	+
10	HD 3b: Perceived Cost Acceptability is significantly and positively related to the organisational interactive E-Commerce adoption in Pakistan.	+
11	HD 3c: Perceived Cost Acceptability is significantly and positively related to the organisational transactive/ portal E-Commerce adoption in Pakistan.	+
12	HD 3d: Perceived Cost Acceptability is significantly and positively related to the organisational integrative E-Commerce adoption in Pakistan.	Not tested
13	HD 4a: Perceived Security is significantly and positively related to the organisational non interactive E-Commerce adoption in Pakistan.	-
14	HD 4b: Perceived Security is significantly and positively related to the organisational interactive E-Commerce adoption in Pakistan.	+
15	HD 4c: Perceived Security is significantly and positively related to the organisational transactive/portal E-Commerce adoption in Pakistan.	+

16	HD 4d: Perceived Security is significantly and positively related to the organisational integrative E-Commerce adoption in Pakistan.	Not tested
17	HD 5a: Perceived Ease of Use is significantly and positively related to the organisational non interactive E-Commerce adoption in Pakistan.	+
18	HD 5b: Perceived Ease of Use is significantly and positively related to the organisational interactive E-Commerce adoption in Pakistan.	+
19	HD 5c: Perceived Ease of Use is significantly and positively related to the organisational transactive/portal E-Commerce adoption in Pakistan.	+
20	HD 5d: Perceived Ease of Use is significantly and positively related to the organisational integrative E-Commerce adoption in Pakistan.	Not tested
21	HD 6a: Perceived behavioural control is significantly positively related to the organisational non interactive E-Commerce adoption in Pakistan	+
22	HD 6b: Perceived behavioural control is significantly positively related to the organisational interactive E-Commerce adoption in Pakistan	+
23	HD 6c: Perceived behavioural control is significantly positively related to the organisational transactive/portal E-Commerce adoption in Pakistan	+
24	HD 6d: Perceived behavioural control is significantly positively related to the organisational integrative E-Commerce adoption in Pakistan	Not tested

7.8 SUMMARY

This chapter details the processing and analysis of empirical data and its interpretation. The chapter started with the missing data and outliers handling justification. Then data distribution was assessed, and tests were run to identify any univariate and multivariate outliers. Next, chapter described the scales used to measure latent variables and established reliability and validity of the scales. A good response rate was received from the organisations in both surveys and most of the survey responses were usable. Few cases were deleted where some observable variable scores were missing. Two multivariate techniques were used in the data analysis (1) Partial Least Square Structural Equation Modelling (PLS-SEM) to find answers to research questions 1, 2, 3, and (2) Multinomial Logistic Regression to find the answer to research question 4. PLS-SEM results used the factor scores through internal processing, but for Multinomial Logistic Regression, "Summated Scores" were used. The reliability and validity of the scales were confirmed through confirmatory factors analysis using the robust version of the "Maximum Likelihood Method" of estimation. Empirical data passed the normal distribution tests and tests for outliers. All data points in both datasets clustered nearly together, and all data points were within three standard deviations around the mean. Thus, all data points were retained to ensure the natural variability in the sample. To rule out presence of multicollinearity correlation matrix and variance inflation factors (VIF) were calculated and analysed. Model -A (developed to study E-Readiness Factors and Intention to adopt E-Commerce) explained roughly 41%, 37%, and 52% variation in intention to adopt E-Commerce for complete, private, and public sectors, respectively. With a complete dataset (comprising both public and private sector organisations), all E-Readiness factors except Human Resources and Market Forces were found to be significantly and positively related to the intention to adopt E-Commerce. In the case of the private sector, all E-Readiness factors except Governance, Market Forces and Technology Resources were found to be significantly and positively related to the Intention to Adopt E-Commerce. In public sector, all factors except Business Resources, Human Resources, and Market Forces were found relevant and positively associated. Multigroup analysis algorithm revealed that only the governance path coefficient was significantly different in the two sectors (Governance in the public sector was found to be more strongly related to the intention to adopt E-Commerce). Model -B was developed to study relationship of technological & behavioural control factors with Intention to adopt E-Commerce. The model explained

roughly 30%, 37%, and 39% variation in complete, private, and public sector datasets, respectively. In complete dataset, all factors, except Perceived Cost Acceptability and Perceived Ease of Use, were found to be significantly and positively related to the intention to adopt E-Commerce. In the private sector, all factors except Perceived Ease of Use were found to be significantly and positively related to the intention to adopt E-Commerce. On the other hand, in the public sector, all factors except Perceived Cost Acceptability and Perceived Ease of Use were found positively and significantly related to the intention to adopt E-Commerce. Multigroup analysis algorithm revealed that only two path coefficients (Perceived Cost Acceptability and Relative Advantage) were significantly different in the two sectors. Both factors were more strongly related to the intention to adopt E-Commerce in Private Sector. To investigate relation of E-Readiness, Technological and Behavioural Control factors with different development stages of organisational E-Commerce adoption, Multinomial Logistic Regression was used with E-Commerce adoption stages as dependent variables. The original E-Commerce maturity model had maturity five stages however, the most advanced stage (level 4) was collapsed into level 3 due to just two responses in level 4 category. Level zero or no E-Commerce was made the baseline category. Multinomial Logistic Regression results of model -C (E-Readiness factors) revealed that all E-Readiness factors in levels 1 and 2 except human resources and service industries E-Readiness were discriminating and were positively related. In level three of maturity, only the Human Resource factor was nonsignificant, and the rest of the E-Readiness factors discriminated the reference category. Among Technological and Behavioural Control Factors (Model– D), Perceived Security in level one and Perceived Compatibility in level three of E-Commerce adoption maturity were nonsignificant. In level two of E-Commerce adoption, all Technological and Behavioural Control Factors discriminated against the baseline category. The results will be discussed in detail in the next chapter.

CHAPTER 8 : DISCUSSION AND EXPLANATION OF FINDINGS

8.0 INTRODUCTION

In this chapter, both descriptive and inferential statistics are discussed with an aim to justify the findings and provide a more comprehensive understanding of the results. After presenting the general descriptive statistics, the chapter then discusses and explains each of the four research objectives in relation to the results obtained from the data analysis. The discussion of the results is structured in such a way that it relates to each of the research objectives individually, providing a more detailed and focused analysis of the data. Finally, the chapter concludes with a summary of the key findings and conclusions that can be drawn from the analysis.

8.1 SAMPLE CHARACTERISTICS

The study employed survey questionnaire on a five-point Likert scale to collect data from sample organisations. In addition to constructs, the study also collected demographic data. Two independent samples were used to answer four research questions from the same sampling frame. The "stratified" sampling method was employed to ensure adequate representation of both public and private sectors. The responses received from both sectors were roughly the same in number, with slightly higher respondents from the Private Sector. The study ensured representation of a variety of industry types, thus making it possible to confidently generalise the research findings. However, the study found that male respondents were significantly higher in number than females, indicating that most of the senior leadership positions in organisations are held by men. It is important to note that this gender disparity in leadership positions is not unique to Pakistan. Women across the world face numerous barriers in accessing economic rights compared to their male counterparts (WB, 2022). A Pakistani woman often does not get enough top tier roles typically due to limited social rights, low mobility, gender discrimination, religious beliefs, and the prevalence of the culture of patriarchy (Ahmad, 2001; Shah and Shah, 2012; Raja, 2016). The issue of women being overlooked for senior roles in organisations despite having sufficient relevant work experience appears to be a common challenge faced by women globally. Studies conducted in both developing and developed countries have demonstrated that women have fewer opportunities for promotion to senior positions compared to men, despite having similar work experiences (Blau and Kahn, 2017, Costa Dias et al., 2020, Waqar et al., 2021). Despite Pakistan's commitment to gender equality through signing various international and national agreements, statistics indicate that it remains one of the countries with the lowest rankings in terms of gender equality (UNWomen, 2022). In particular, the female-to-male ratio in technical jobs was just 0.2 in 2016, while in leadership positions, it was a meagre 0.03 (MGI, 2022). The study solicited responses from individuals occupying senior leadership positions within organisations. Given the positive correlation between top-tier positions and factors such as work experience , age and education (Vaughan-Johnston et al., 2021, McQuerrey, 2018, Ng et al., 2005) , a majority of the respondents were between the ages of 40 to 59 years, possessing graduate or postgraduate qualifications. The respondents were requested to mention their E-Commerce adoption level as well mapped on a suggested organisational E-Commerce maturity model. The findings indicated that a majority of the respondent organisations had either level one or level two E-Commerce adoption followed by level three adopters, indicating that very few organisations within our sample were not connected to the internet. Interestingly, there was roughly equal frequency of both "interactive" and "non-interactive" E-Commerce adopters. A substantial number of organisations had a "transactive" (level 3) adoption level of E-Commerce. Level three according to suggested E-Commerce maturity map involves ability of organisations to perform online transactions. Which can be attributed to the availability of affordable hardware and software, IT expertise, and the recent rise in the popularity of digital payment methods in Pakistan (Bhat, 2021, Javed, 2020a). There were very few organisations with no internet connectivity for business purpose. The highest level of E-Commerce adoption in the proposed model was "Integrative". which involves the integration of all functional departments with an E-Commerce

platform, typically requiring an "Enterprise Resource Planning" (ERP) system. However, ERP implementations are considered risky and require substantial investment, expertise, and commitment (Law and Ngai, 2007, Al-Fawaz et al., 2010, Chang et al., 2012), leading organisations to exhibit reluctance towards implementation (Hasheela Miss and Mufeti Dr, 2016). Furthermore, organisations in developing countries face additional barriers in implementing ERP systems (Huang and Palvia, 2001, Ahmed et al., 2017a), which explains the negligible responses we received from level four "integrative" adoption level organisations.

8.2 KEY FINDINGS OF THE RESEARCH

Developing economies have some peculiar common and country specific challenges. Therefore, this study choose to study impact of factors that seem to be more pertinent in Pakistani context (Ernst and Lundvall, 1997b, Khokhar and Serajuddin, 2015a). Numerous previous studies have emphasised the significance of E-Readiness, technological, and behavioural control factors as determinants of E-Commerce adoption in developing countries (Abid and Noreen, 2006, Chen et al., 2013, Fathian et al., 2008, Hanafizadeh et al., 2009, Molla et al., 2010, Oreku et al., 2009, Ågren, Lee et al., 2015, Paul et al., 1988, Rodríguez-Ardura and Meseguer-Artola, 2010, Sayginer and Ercan, 2020, Tushman and Anderson, 1986). Unfortunately, Pakistan is one of the countries with lowest E-Readiness index (UN, 2023a) and lack of E-Readiness could impede organisational E-Commerce adoption because businesses might not be able to fully utilise the available technological resources if they already possess. E-Commerce is still a new technology for majority of the businesses in Pakistan, and the technology specific perceptions about its compatibility, potential benefits and risks can significantly impact the organisational E-Commerce adoption decisions. Perceptions are known to impact the attitudes and behaviours, but sometimes a subject may not behave as required due to lack of control on the actions (Ajzen, 1985, Ajzen and Fishbein, 1980, Davis, 1985). Thus, two different models were developed to measure the perceptions of organisational leader on E-Readiness, technological and behavioural factors.

The project started with the following objectives.

1. To explore impact of E-Readiness factors on E-Commerce adoption in Pakistan's public and private sector organisations.
2. To explore the impact of Technological and Perceived Behavioural Control factors on E-Commerce adoption in Pakistan's public and private sector organisations.
3. To compare impact of E-Readiness, Technological and Perceived Behavioural Control factors, in Pakistan's public and private sector organisations.
4. To identify the discriminating E-Readiness, Technological, and Perceived Behavioural Control factors at different levels of organisational E-Commerce adoption in Pakistan.

Following sections explain how objectives were achieved and what were the findings.

8.2.1 OBJECTIVE 1: IMPACT OF E-READINESS FACTORS ON E-COMMERCE ADOPTION IN PAKISTAN'S PUBLIC AND PRIVATE SECTOR ORGANISATIONS

The project's first phase collected empirical data on E-Readiness factors using previously validated scales (details in Appendix A). The measurement model's validity and reliability in Pakistan were confirmed through robust tests. Constructs were measured on a 5-point Likert scale, with 3 indicating neutrality. Most variables scored between 3 and 3.7, indicating a positive perception. However, the "Governance" factor scored the least in the full dataset. Therefore, the results suggest that IT governance requires attention in Pakistan, particularly in the public sector. Most of the factors had

greater mean in the private sector which indicate more optimistic perceptions about E-Readiness factors in private sector organisations. Among E-Readiness factors internal to organisation, five constructs including Awareness, Business Resources, Technology Resources, Commitment, and Governance were found positively related to the E-Commerce adoption intention, whereas sixth factor, Human Resources also had a positive relationship but statistically insignificant relationship with intention to adopt E-Commerce. Path coefficient analysis indicated that a unit increase in Awareness, Business Resources, Technology Resources, Commitment, and Governance increase in E-Commerce adoption intention by factor of 0.141, 0.093, 0.093, 0.241, and 0.15, respectively, with the highest impact being from Commitment. Molla and Licker's (2005b) study in South Africa found similar results, except for Human Resources, which showed a positive but non-significant effect in this study. The relationships among organisational level E-Readiness factors found in this study seem to agree with previous studies. As posited by Rogers (1995), knowledge and awareness regarding the existence and appropriate usage of technology are crucial for the successful adoption of an innovation. In the absence of such awareness, potential adopters may be less inclined to adopt a particular technology, and even if they do, they may not fully realise the benefits that the innovation has to offer. Consequently, such lack of awareness may impact the attitudes towards and sustained use of the technology, as noted by Raso et al. (2017). Studies have consistently demonstrated a positive correlation between awareness and technology adoption in developing countries. Kashada et al. (2018) found a positive relationship between awareness and Digital Learning Technologies (DLT) adoption in Libya, while Akinnuwesi et al. (2016) discovered a similar connection with biometric adoption. In the context of E-Commerce adoption, Hajli et al. (2014b), Zaied (2012), and Rumanyika and Mashenene (2014) all identified awareness as a crucial driver of E-Commerce adoption in Iran, Egypt, and Tanzania, respectively. Similarly, empirical research conducted in Pakistan also confirmed the positive and significant relationship between awareness and technology adoption in that country (Awan et al., 2021, Khan et al., 2014b, Hussain et al., 2021).

Organisations seeking to establish a dominant market position cannot merely rely on the availability of resources; they must strategically harness their unique, versatile, constant, and inimitable resources (Powell and Dent-Micallef, 1997). Indeed, such resources can be a source of competitive advantage, enabling organisations to respond nimbly to changing market conditions and adopt innovations effectively (Abed, 2020, Cruz-Jesus et al., 2019, Mohtaramzadeh et al., 2018). This study investigated the role of organisational resources E-Readiness in the intention to adopt E-Commerce, by auditing the E-Readiness status of human resources, technological resources, and business resources. Findings revealed that all three resources were positively associated with the intention to adopt E-Commerce. However, it is noteworthy that the relationship between Human Resources and the Intention to adopt E-Commerce was not statistically significant. This result is not consistent with the earlier findings (Ríos-Manríquez, 2021, Rizk, 2004, Molla and Licker, 2005b). However, it is consistent with the findings of Ramayah et al. (2005) in another developed country Malaysia . The observed effect could be explained by the following possible reasons. An increased number of universities in Pakistan are offering higher education on affordable rates and through scholarships (Bari, 2022), and there is a greater trend in the students for technical vocational education. While apparently there seems to be a no shortage of skilled human resource in job market, technical support is also available through expanding network of free lancers in Pakistan (Times, 2021). Moreover, following significant developments in software and hardware (especially integration of Artificial Intelligence) E-Commerce technologies are more user friendly and usually require no specialised skills (Searls, 2004, Nguyen and Mogaji, 2022, Song et al., 2019, Zhang et al., 2021).

The construct of business resources was defined to encompass a range of factors such as financial resources, asset availability, openness, and risk behaviour. The path coefficient of "Business Resources"

was found to be 0.093. This indicates that a unit increase in business resources corresponds to an increase in the intention to adopt E-Commerce by a factor of 0.093, when all other variables held constant. According to a study by Ocloo et al. (2020) in Ghana, financial resource availability was positively related to business-to-business E-Commerce adoption. An organisational culture like openness, teamwork, involvement and communication openness is also found to stimulate innovation adoption and firm performance in general (Aboramadan et al., 2020). Risk-taking propensity has been found to positively influence innovation adoption at the individual (Salem and Nor, 2020, Zeb and Ihsan, 2020) and organisational levels (Al Mamun, 2017). Individual level characteristics are important as they impact the organisational culture and organisational level innovation adoption (García-Granero et al., 2015). While a positive relationship was found (path coefficient 0.069) between Human Resources and Intention to adopt E-Commerce, the relationship was not statistically significant. This result is not consistent with findings of Lian et al. (2014), Awa et al. (2015a), Kevin et al. (2006), Rahayu and Day (2015) and Kurnia et al. (2015a). However, this is worth mentioning that most of the previous studies that related human resources factor with innovation adoption were done in 2015 or before. There is an increasing trend of human resource outsourcing now ; organisations now outsource human resources in both public and private sectors s being (Mansor et al., 2018, Suleman and Ogbette, 2019, Eng'airo and Mate, 2020) to reduce their costs (Bui et al., 2019, Bhushan et al., 2018) . According to an estimate there is a constant increase in Information Technology staff outsourcing, and trend is likely to continue in the future. More and more organisations are now outsourcing the information technology to gain flexibility, agility, cost reduction, and choice to select best of breed (Sekundant, 2021). In the context of E-Commerce adoption, due to recent developments in software and hardware, organisations are able to connect to internet, create business emails, and prepare and host their websites without involving any specialist knowledge (Al-Sakran and Alsudairi, 2021, Anne Truitt 2022, Kvåle and Poulsen, 2018, Ugli et al., 2020) which could explain the why "intention to adopt E-Commerce was not significantly related to Human Resources" in our results. Availability of freelancers for any specialised one-off IT related task on platforms like fivers could be another reason why organisational E-Commerce adoption was not found to be influenced by IT specialist staff within organisation. The results also indicated a positive and significant relationship between Commitment and organisational intention to adopt E-Commerce. In fact, commitment was identified as the factor with the highest influence on intention to adopt E-Commerce, with a path coefficient of 0.241. This means that a unit increase in commitment increases the intention to adopt E-Commerce by a factor of 0.241. The finding highlights the magnitude of the importance of commitment for organisational E-Commerce adoption. The result is not new, in fact, it is consistent with the several previous research. For example, in their study, Mohtaramzadeh et al. (2018) found support and commitment of the country and organisational leadership to be significant contributors to E-Commerce adoption. Same results were echoed in several other studies in where top tier and managerial level commitment to adopt innovations was found to be positively related to E-Commerce/innovation adoption (Hsu et al., 2018, Villa et al., 2018, Salazar et al., 2021, Ober, 2020). Empirical evidence showed a positive and statistically significant correlation between Intention to adopt E-Commerce and Governance, with a path coefficient of 0.15. This means that a unit increase in governance leads to a 0.15 increase in the "Intention to adopt E-Commerce" while controlling for other variables. Past studies have also established a positive link between Governance and E-Commerce adoption, with Governance identified as a discriminating factor between adopters and non-adopters, as well as an enabler for both initial and more advanced stages of adoption in kingdom of Saudi Arabia (Al-Hudhaif and Alkubeyyer, 2011). The research findings indicate that similar positive results have been observed in developing countries such as Iran (Hajli et al., 2014b) and Chile (Kareen et al., 2018) , where Governance has been found to have a significant impact on E-Commerce adoption. Moreover, Governance was found to have a positive impact on the adoption of other information technology based innovations (such as ERP) adoption as well (Fitz-Gerald and Carroll,

2003, Elhasnaoui, 2021). while Governance plays a critical role in the adoption of IT-based innovations, a study conducted in Sri Lanka suggests that Governance also moderates the improvement in business performance after innovation adoption. This implies that while Governance may enable initial adoption, it may not necessarily lead to sustained improvements in business performance in the absence of right Governance frame work (Kuruwitaarachchi, 2020).

Model A used three constructs to audit the external E-Readiness as perceived by decision makers. The findings indicate that among these factors, Government E-Readiness had the highest impact on the "Intention to adopt E-Commerce". followed by support industry E-Readiness. Market forces E-Readiness was found positively related but statistically insignificant to the intention to adopt E-Commerce. The path coefficients reveal that in controlled conditions, a unit increase in Government E-Readiness, Support Industries E-Readiness lead to an increase in intention to adopt E-Commerce by a factor of 0.204, 0.15 increase in the "Intention to adopt E-Commerce" respectively. Notably, all external factors except for Market Forces Readiness were statistically significant. These findings highlight the critical role that external factors play in determining an organisation's readiness to adopt E-Commerce. Specifically, the results suggest that government policies and initiatives aimed at promoting E-Commerce adoption are likely to have the most significant impact, followed by the support of industry players and market forces. By taking these external factors into account, organisations can better understand their E-Readiness and develop strategies to improve their E-Commerce adoption. These findings corroborate earlier research on the subject matter. Government E- Readiness has been positively associated with E-Commerce adoption (Molla et al., 2010). Similarly, in another study (n= 163) on SMEs Hung et al. (2014) found a positive relationship between Government E-Readiness and intention, acceptance, and implementation of the corporate website. The Construct Government E-Readiness also assesses perceptions of cyber-specific legal frameworks along with other support for E-Commerce. Saif-Ur-Rehman (2016) surveyed SMEs in Malaysia and found that the absence of legal, regulatory and internet security was among the top barriers affecting the E-Commerce adoption rate. In another study done in Ghana, respondents reported privacy and security of their data as a barrier to E-Commerce adoption (Tchao et al., 2017). Similarly, in India, Roy and Moorthi (2017) conducted four focus group discussions" and then, through Structural Equation Modelling, found that "privacy concerns" were moderating the "perceived ubiquity" and mobile commerce adoption. Likewise, several studies found a negative correlation between the upsurge of cybercrime and E-Commerce (Apau et al., 2019, Apau and Koranteng, 2019, Fianyi, 2016). The perceived risk associated with E-Commerce adoption can have seriously impeding effect on innovation adoption. Riek et al. (2014) based their study on a cyber security report published by the European Commission in July 2012 and found that the perceived risk of cybercrime mediated the positive relationship between prior cybercrime victimization, media reports and media reports avoidance of adopting e-services. While organisational level commitment is important for E-Commerce adoption and organisations must be committed to adopting E-Commerce, the government must provide an enabling environment through policies, regulations, and infrastructure. Without commitment from government organisations may struggle to realise the benefits of this technology despite having their strong desires and commitments. Importance of government's commitment has been established in many empirical studies like in Taiwan (Thatcher et al., 2006), Ghana (Awiagah et al., 2016), Rwanda (Uwamariya et al., 2015), Saudi Arabia (Al-Hudhaif and Alkubeyyer, 2011) and Tanzania (Kabanda and Brown, 2010).

Organisations need several Support Industries in their implementation and post implementation phases. Support industries provide the necessary infrastructure and services that facilitate E-Commerce adoption, such as payment processing, logistics, and customer support. E-Readiness of Support Industry was measured in Model -A through a single construct and was found to have a path corecipient of 0.185 which means a unit increase in Support Industry increase the intention to adopt E-Commerce by a factor

of 0.185 in controlled environment. The findings support the results of (Molla and Licker, 2005b, Molla et al., 2010, Hung et al., 2014). In addition, several other studies have also highlighted the significance of support industries' presence and compatibility including telecommunication services (Sharma and Gupta, 2003, Lawrence and Tar, 2010, Rumanyika and Mashenene, 2014), financial institutes readiness (Abid and Noreen, 2006, Astuti and Nasution, 2014, Oreku et al., 2009, Al Nahian Riyadh et al., 2009) and IT consultancy (Simpson and Docherty, 2004, Ahmad et al., 2015).

Market forces have traditionally been studied as economy drivers. In the context of E-Commerce adoption market forces referred to suppliers, customers, and competitors' pressure. The construct "Market Forces" in Model-A collectively captures the perceptions about the customer/supplier and competitors' E-Readiness to account for any pressure they exert on organisations to adopt similar technologies. While the mean of the construct was greater than 3 (i.e., skewed positively) and the relationship was positive with "Intention to Adopt E-Commerce, it was not statistically significant. This is in contrast with most of the previous studies that found a positive relationship between customers, suppliers, competitors and technology adoption (Li and Xie, 2012, Abed, 2020, Grandon and Pearson, 2004b, Al-Bakri and Katsioloudes, 2015). While this study's result was contrary to expectations, this result supports the findings of some studies. For example, Alamro and Tarawneh (2011) found a significant positive relationship between customer pressure and E-Commerce adoption and no significant effect on competitors and suppliers. In another Indonesia-based study, Rahayu and Day (2015) found no significant effect of customer, competitor and supplier pressure on E-Commerce adoption. Some studies suggest that the external pressure needs a mediator to impact the E-Commerce adoption decision. For example, Alsaad et al. (2019), in their Jordan-based study, found that resource dependency was acting as a mediating variable in external pressures and E-Commerce adoption decisions. Several organisations, thus, despite strong external pressures, may not adopt E-Commerce because of a lack of relevant organisational controls and resources (Alsaad et al., 2019). It is plausible that mediating variables may exist in the Pakistani context that affect the impact of external pressures on E-Commerce adoption decisions. As such, there is a need for further research to explore the potential moderating, interaction, or mediation variables that may be at play. This will provide a more nuanced understanding of the factors that influence E-Commerce adoption decisions in Pakistan and inform the development of strategies to promote greater adoption of this technology in the country. The results of model-A analysis can be graphically represented as Figure 8-1.

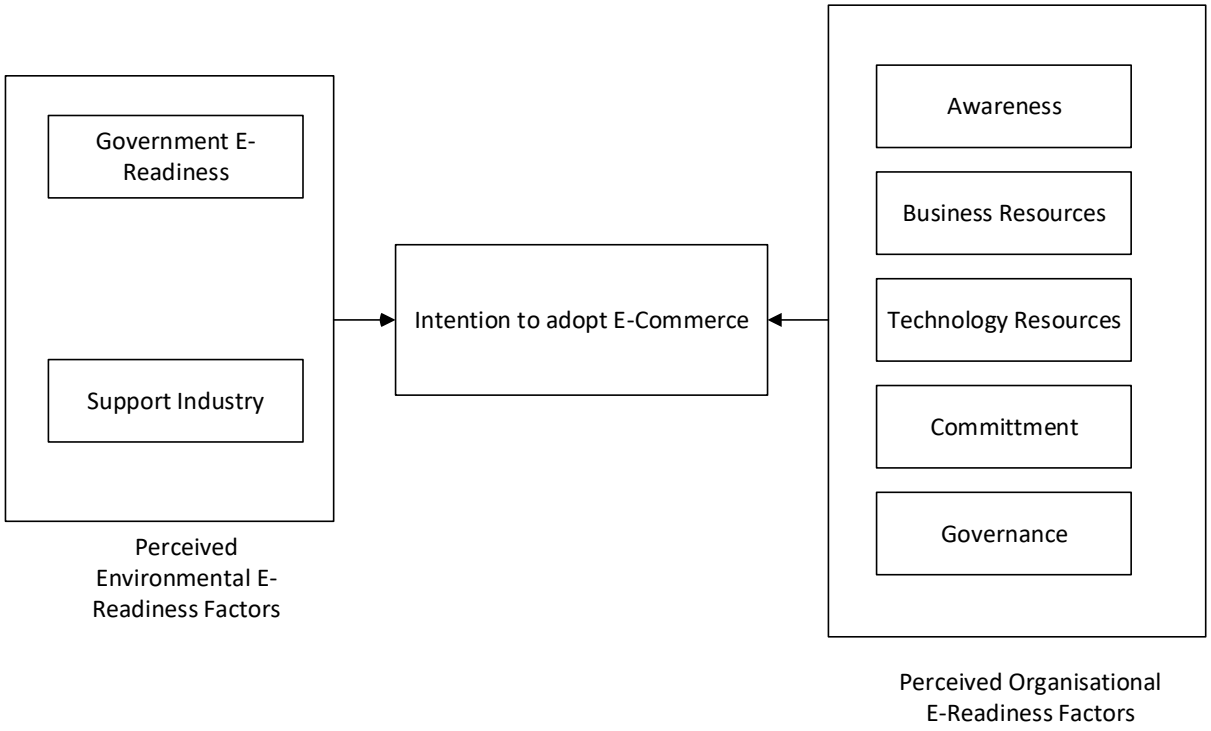


Figure 8-1: Influencing E-Readiness Factors

8.2.2 OBJECTIVE -2: IMPACT OF TECHNOLOGICAL AND PERCEIVED BEHAVIOURAL CONTROL FACTORS ON E-COMMERCE ADOPTION IN PAKISTAN'S PUBLIC AND PRIVATE SECTOR ORGANISATIONS

In model B, effects of “Perceived Compatibility” (PC), “Perceived Behavioural Control” (PB), “Perceived Security” (PS) “, Perceived Cost Acceptability” (CA), “Perceived Relative Advantage” (RA) and “Perceived Ease of Use” (PE) on “Intention to adopt E-Commerce” (IN) were studied using (Partial Least Square Structural Equation Modelling) PLS-SEM. The findings of the study suggest that the construct of Perceived Security (PS) exhibited the strongest positive influence on the intention to adopt E-Commerce, as evidenced by a path coefficient of 0.322. Specifically, a unit increase in PS was associated with a corresponding 0.322 increase in the intention to adopt E-Commerce. These results are consistent with those of prior research by Limthongchai and Speece (2003), who employed Roger's diffusion of innovation framework to demonstrate that security and confidentiality were major concerns among organisations in Thailand. Similarly, Alam et al. (2007)found in a similar study conducted in Malaysia, comprising a survey of 194 organisations, that security concerns had a negative effect on the adoption of electronic commerce. These findings suggest that security concerns continue to pose a significant barrier not only to E-Commerce adoption, but also to other online products such as cloud services, particularly in developing economies (Yeboah-Boateng and Essandoh, 2014). This result is expected, given the significantly high incidence of cybersecurity-related issues in developing economies (Otieno, 2020). The subsequent highest path coefficient was 0.226 for Perceived Compatibility (PC). This indicates that a unit increase in Perceived Compatibility leads to a 22.6% increase in the intention to adopt E-Commerce in model. The relationship between Perceived Compatibility and innovation adoption has been frequently studied in developing economies, with most studies reporting a positive correlation between the two constructs. This is supported by empirical evidence from previous studies conducted in Malaysia by Ahmad et al. (2015), Thailand by Lertwongsatien and Wongpinunwatana (2003), Chile by Grandon and Pearson (2004a), and Bangladesh by Azam and Quadddus (2009). Interestingly, compatibility is also considered a significant factor in organisations' decisions to adopt E-

Commerce in developed economies such as the United States (Shen et al., 2004). The next most influential feature in our model was relative advantage (RA), with a path coefficient of 0.22, which is nearly comparable to Perceived Compatibility (PC). This implies that a unit increase in Perceived Relative Advantage results in a 22% rise in intention to use E-Commerce. Perceived Relative Advantage, like Perceived Compatibility, has been extensively researched in information science research, along with other technological features. The findings are consistent with those of previous research conducted in Malaysia (Sin et al., 2016, Alam et al., 2007), Brunei (Seyal and Rahman, 2003), and Thailand (Limthongchai and Speece, 2003). Perceived Behavioural Control (PB) was found to have a positive correlation with the intention to adopt E-Commerce. The path coefficient of 0.11 implies a 11% increase in the intention to adopt E-Commerce with a unit increase in perceived behavioural control. Prior research has established a positive correlation between behavioural control and the target behaviour. In the context of E-Commerce adoption, our findings align with previous studies conducted in the Kingdom of Saudi Arabia (Sait et al., 2004), Ghana (Awiagah et al., 2016), India (Gangwal and Bansal, 2016) and Egypt (Fawzy and Salam, 2015). Although these results are consistent with most studies, they are not in agreement with findings of Nasco et al. (2008) , they found no significant relationship between perceived behavioural control and E-Commerce adoption in Chile. Similar results were found by Riemenschneider et al. (2003) in the context of IT adoption. While the majority of studies establish a positive relationship between perceived behavioural control and target behaviour, few exceptions may be attributed to the possible conceptual and methodological ambiguity in the construct itself (Armitage and Conner, 2001). Cost Acceptability was found to have a path coefficient of 0.057, but it was statistically insignificant for the complete data set, which included data from both the public and private sectors. While some scholars have noted that the associated costs of E-Commerce adoption are the main barrier to adoption in developing countries (Lawrence and Tar, 2010, Kwadwo et al., 2016, Migiro, 2006), this study's result is consistent with the findings of Al-Somali et al. (2015) in the Kingdom of Saudi Arabia and Sujatha and Sekkizhar (2019), who empirically found that cost concerns were not significant determinants of E-Commerce adoption. Cost concern seems to be a concern of the past and the findings of this study may be explained by the greater penetration of the internet (Kanti Srikantaiah and Xiaoying, 1998, Ein-Dor et al., 1997) and the availability of software and hardware at lower costs following the developments in Information Technology, both generally and specifically in developing economies (Ein-Dor et al., 1997, WTO, 2022). Perceived Ease of Use (PE) was found to have a path coefficient of 0.026, but the result was statistically insignificant. This outcome is in line with the findings of (Shah Alam et al., 2011) in Malaysia. The literature reports mixed findings regarding the relationship between Perceived Ease of Use and E-Commerce adoption. For instance, in the same country, Malaysia, (San Ong et al., 2003) discovered a significant and positive correlation between E-Commerce adoption and Perceived Ease of Use. Similarly, , Aboelmaged (2010) found a significant indirect effect of ease of use on the intention to use e-procurement through attitude and usefulness. Perceived Ease of Use appears to be a crucial factor in IT adoption decisions at the individual level, but organisations do not consider it as a significant factor in their IT implementation decisions. Once firms recognise the importance of technology adoption, they do not regard the complexity of technology usage as a hindrance. The results of model-B analysis can be graphically represented as Figure 8-2.

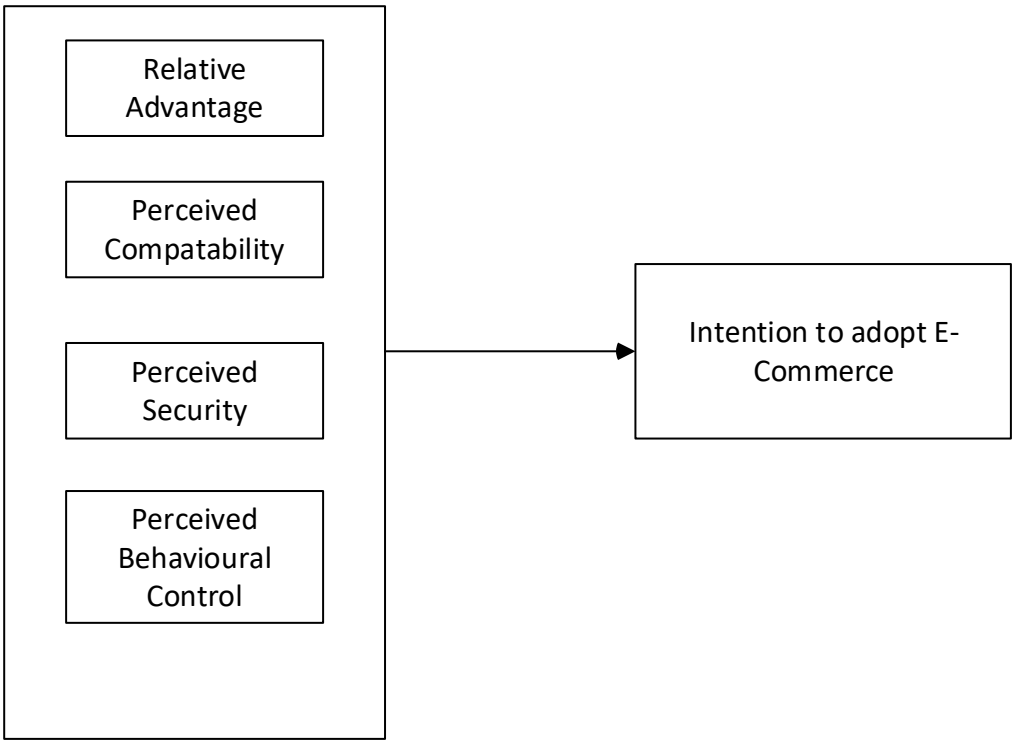


Figure 8-2: Influencing Technological and Behavioural Control Factors.

8.2.3 OBJECTIVE 3- COMPARISON OF E-READINESS, TECHNOLOGICAL AND PERCEIVED BEHAVIOURAL CONTROL FACTORS, AND RESPECTIVE MODELS IN PAKISTAN'S PUBLIC AND PRIVATE SECTOR ORGANISATIONS

The third objective of this project entailed a comparison of E-Commerce adoption in the public and private sectors. To achieve this aim, the study utilised the SMART PLS approach, which facilitates the examination of "multigroup analysis" (MGA) by partitioning the data set into two or more categories and implementing the PLS SEM algorithm on all the resulting sub-datasets. The analysis identifies any statistically significant moderation effects by calculating the differences in parameter estimates among subgroups. The study evaluated both E-Readiness and technological and behavioural control datasets for possible moderation effects resulting from the sector (private or public). The ensuing sections provide a detailed discussion of the findings from each sub-dataset, including the MGA outcomes.

8.2.3.1 E-READINESS FACTORS

A simple comparison of path estimates of two sectors reveals that.

1) Human Resources availability was not significantly related to the Intention to adopt E-Commerce. The result was not a surprise as E-Commerce adoption in this research project ranges from basic level E-Commerce adoption, i.e., being connected to the internet and having a business email, and it does not require specialist knowledge. For more sophisticated E-Commerce adoption levels, it seems that when required, organisations can either recruit employees with relevant skills easily from the market or outsource the business processes. There are more than 177 higher education institutions in Pakistan (HEC, 2022), and successive governments have been making serious efforts to increase the number of industry-ready IT workforce (Saeed, 2021). There seems to be no shortage of IT expertise in the labour market. According to a report, Pakistan is a favourite online/remote destination for IT outsourcing and

is constantly ranked among the top few countries (Erozgaar, 2022). Moreover, there is an increasing trend of outsourcing information technology functions to third parties worldwide. Outsourcing support activities to a third party enables organisations to avoid the high cost associated with maintaining world-class IT departments (Switser, 1997). Result also discussed in section 8.2.1

2) Market forces readiness does not significantly predict Intention to adopt E-Commerce in both sectors. Market forces readiness This result was also expected. A possible explanation of the finding is provided in 8.2.1.

3) Business Resources predict Intention to adopt E-Commerce in the private sector only. Although statistically not significant, this result is interesting as it reflects how a difference in the availability of resources impacts innovation adoption behaviour between the two sectors. While organisations in the developing economies generally face a shortage of financial and business resources, SMEs that contribute significantly to the GDP and makeup 90 per cent of the organisations in the developing economies struggle to grow because of the shortage of resources (W.B., 2022). Thus managers of private organisations usually have more pressure to use resources carefully (Ward and Mitchell, 2004). On the other hand, the public sector in developing countries usually gets finances from government funding that is often received as aid from international donors to improve efficiency and public service delivery (Harrison and Rodríguez-Clare, 2010). Managers and decision-makers in public and private sectors operate in different cultures and constraints; thus, their strategic orientation also differs (Ring and Perry, 1985b). It appears that if an E-Commerce adoption decision has been made in any public sector organisation, relevant business resources are made available by the government.
4) Governance predicts intention to adopt E-Commerce only in the public sector. A possible explanation could be that private sector organisations have to think more strategically before investing. Moreover, private sector organisations generally have good and effective governance mechanisms compared to their public sector counterparts (Sethibe et al., 2007).
5) Multi Group Analysis reveals that only relationship of governance was significantly different in both sectors (public sector organisations had significantly higher Governance path estimates). It appears that managers of public sector organisations with good IT governance show more interest in adopting E-Commerce, and technology decisions in Private Sector organisations are more strongly connected to the overall governance structure in organisations. The findings are summarised in Figure 8-3.

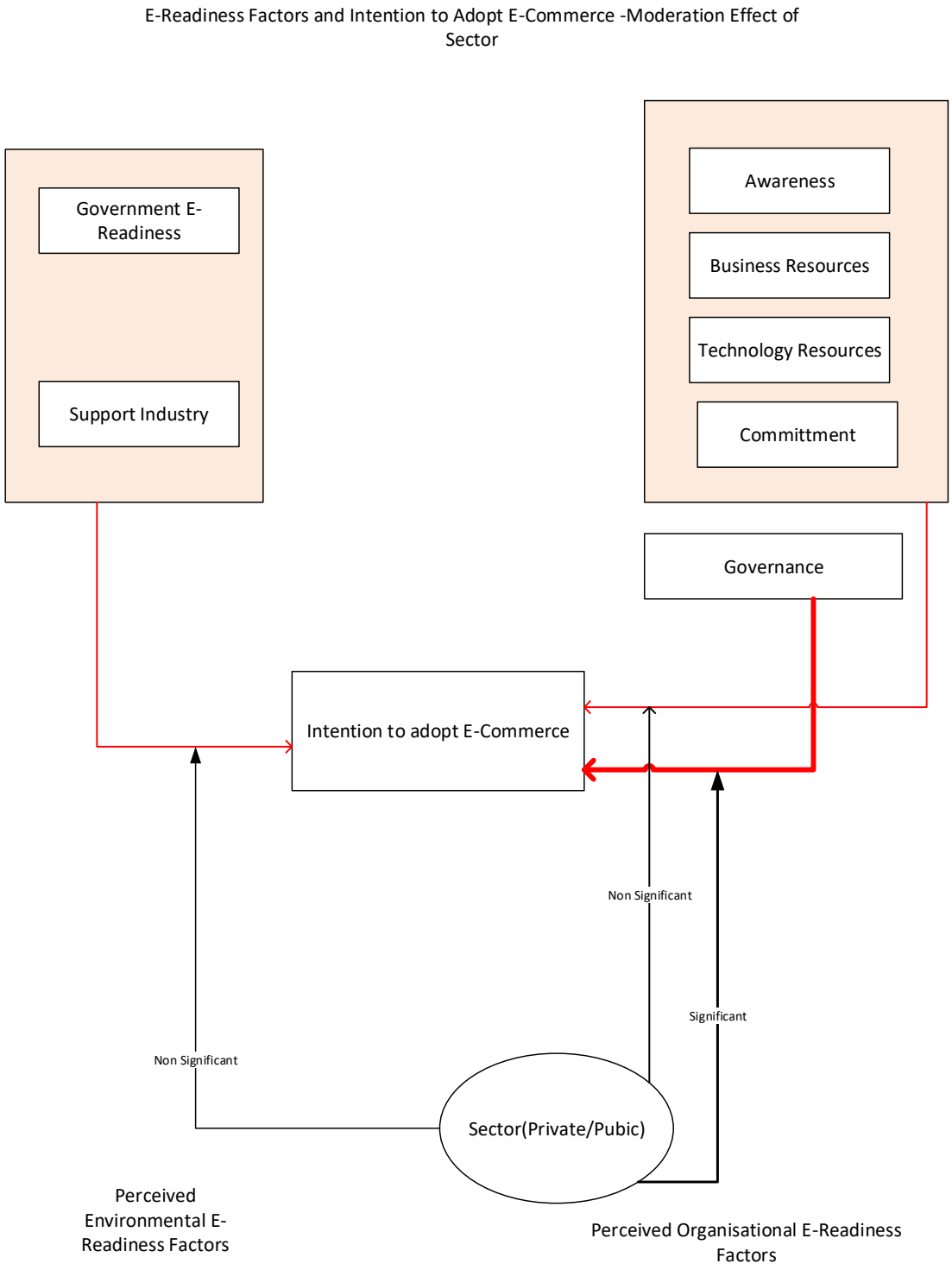


Figure 8-3: E-Readiness factors- moderation effect of sector.

8.2.3.2 TECHNOLOGICAL AND PERCEIVED BEHAVIOURAL CONTROL FACTORS

A comparison of path estimates reveals that.

1) Perceived Ease of Use (PE) is not a predictor of intention to adopt E-Commerce in both sectors. As explained in section 8.3.2, it seems that once organisations establish that E-Commerce is essential, they do not care about the complexity. Similarly, E-Commerce technologies are getting more user-friendly day by day (explained in section8.2.2).
2) Cost Acceptability is predictor only in the private sector. A possible explanation of this result could be that private sector organisations in developing economies have relatively fewer resources and tend to utilise them efficiently (W.B., 2022).
3) Multi Group Analysis (MGA) reveals that Cost and Relative advantage significantly differ in both sectors. Both estimates were higher in the private sector. This also means that these two predictors are more strongly related to the intention to adopt E-Commerce in the private sector than in the public sector. Moreover, cost seemed to be concern of managers of private organisations only. As explained in the earlier section 8.2.2, both sectors have several differences in their working (Rainey et al., 1976). Managers in private sector face increasing pressure to use resources efficiently and effectively in order to fulfil their organisation's goals, and all their policies and decisions are scrutinised strictly compared to their public sector counterparts (Farnham and Horton, 1996). This explains why managers in private sector organisations want to ensure that IT based investment is not only affordable, but also gives some tangible benefits by replacing the existing processes. Results of MGA are summarised as Figure 8-4.

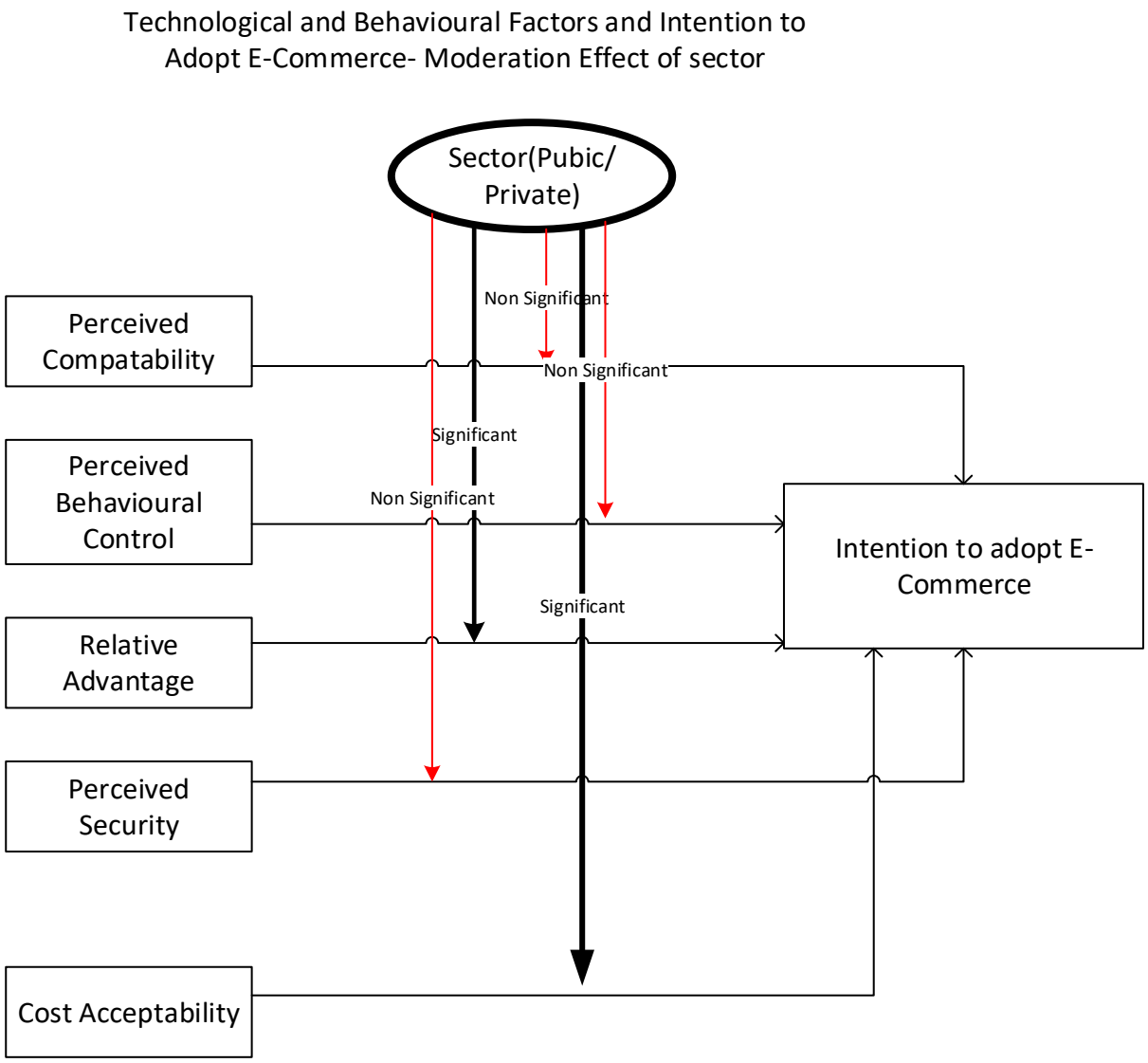


Figure 8-4: Technological and Perceived Behavioural Control factors- Moderation effect of Sector.

8.2.4 OBJECTIVE 4- STUDY OF ASSOCIATION OF FACTORS WITH DIFFERENT MATURITY STAGES OF ORGANISATIONAL E-COMMERCE ADOPTION

One of the objectives of this research project was to determine the association between E-Readiness, Technological and Behavioural Control variables at different stages of E-Commerce adoption as discriminating factor. Previous studies have shown that the determinants of E-Commerce adoption are linked to different maturity levels of organisational E-Commerce maturity in distinctive ways (Molla and Licker, 2005b). Thus, in model C and model D all independent variables of Perceived E-Readiness model (PERM) and the Technological and behavioural model were modelled with four levels of E-Commerce adoption respectively. Following sections discuss the findings of model C and model D.

8.2.4.1 E-READINESS FACTORS

The results of multinominal regression for model D are summarised in Table 8-1. We can see that most of the factors were found related to all maturity levels. Also, parameter values revealed that association of factors with E-Commerce adoption becomes stronger as the E-Commerce maturity level increases. In a similar study but with slightly different research question in Africa Molla and Licker (2005b) found that the discriminating factors from nonadopters to the initial adopters were human resources E-Readiness, business resources E-Readiness, awareness, market forces E-Readiness, and Technical Resources availability. While from initial adoption to institutionalisation, Market Forces, Support Industry, Government Readiness, Governance, and Commitment were influencing variables. The results of this study are consistent with previous results and except for few results of this study echoed the previous findings. The is worth mentioning that while Molla and Licker (2005b) studied "discriminating factors" for different level of E-Commerce adoption, this study examined the discriminating factors and their association with different levels of E-Commerce adoption by predicting their class using Multinomial Regression . While Molla and Licker (2005b) found human resource discrimination factor between E-Commerce non adaptors and adapters , this study did not find association of human resources with any stage of E-Commerce adoption (possible reason explained in section 8.2) . Similarly, support industry was found relevant only at the most sophisticated stages. A possible explanation of the finding could be that E-Commerce technologies, internet and web technologies are increasingly becoming easy to use and as such may not require specialist consultation or input of support industry (Gunasekaran et al., 2002, Yadav et al., 2019) . However, the transactive E-Commerce adoption, where transactions are made online, can require specialist consultations, supporting payment and logistic service providers (Wilinski, 2020, Giuffrida et al., 2021, Aeshah, 2022, Hassan and Lee, 2021).

Table 8-1: E-Readiness discriminating factors (Baseline "non adopters")

Factor	Level		
	1	2	3
AW	✓	✓	✓
HR	×	×	×
BR	✓	✓	✓
TR	✓	✓	✓
GV	✓	✓	✓
MF	✓	✓	✓
GR	✓	✓	✓
SI	×	×	✓
CT	✓	✓	✓

8.2.4.2 TECHNOLOGICAL AND PERCEIVED BEHAVIOURAL CONTROL FACTORS

Analysis results show that most of the factors of model D were relevant in all stages of E-Commerce adoption and were associated more strongly as organisations adopt more advanced E-Commerce technologies. However, there are few findings that need discussion. Multinominal Regression (MNR) results show that Cost Acceptability was associated with all levels of E-Commerce adoption which apparently seem to be conflicting with the findings of model B where cost was found irrelevant. However, it is important to note that even in model B, the cost was found associated with intention to adopt E-Commerce in Private Sectors. It is also worth mentioning that the technique used in model B was different with a different dependent variable to answer a different research question. Structural equation modelling explains the variation in the dependent variable (Hair, 2017), while MNR is used to

predict the membership of a specific category (Fávero and Belfiore, 2019, Weston and Gore Jr, 2006). Results also indicate that security was associated with only level two and three of the E-Commerce adoption. Importance of online security for E-Commerce adoption has already been discussed in section 8.2.1. However, it is important to note that MNR results indicate that as organisations progress from the basic level of internet connectivity to more sophisticated level where they have websites, consumer and products data and perform online transactions, the relationship between perceived online security becomes stronger. This is understandable as modern and sophisticated IT technologies, especially web-based ones, are exposed to more security risks (Akhawe et al., 2010, Huang et al., 2003) than basic IT adoption. Another important result of MNR was association of Perceived Compatibility with different stages of E-Commerce adoption. The importance of Perceived Compatibility has already been discussed in 7.6.2. The MNR results indicated a positive and significant association with the level one and level two, it was just at the border of significance level in level 3 (P value 0.054). While we can argue that organisations tend to establish compatibility at earlier stages of E-Commerce adoption, it is important to note that several scholars have criticised the use of the P value as a significance indicator in social sciences (Goodman, 1999, Rosenthal and Rubin, 2003, Ho et al., 2019) and one of the variables that affect the significance level is the sample size. Larger sample sizes tend to have significant values within recommended ranges (Rosenthal and Rubin, 2003). Since we had fewer observations in the third level of adoption, we cannot say that Perceived Compatibility was irrelevant in level three of E-Commerce adoption.

Table 8-2: Technological and Perceived Behavioural Control factors (Baseline "non-adopters")

** PC close to the border line of significance level)*

Factor	Level		
	1	2	3
PC	✓	✓	✓*
PB	✓	✓	✓
PS	✖	✓	✓
CA	✓	✓	✓
RA	✓	✓	✓
PE	✓	✓	✓

8.3 SUMMARY

This chapter discussed the findings of data analysis and provided possible explanations. The project was intended to investigate the factors that impact of E-Readiness and Technological and Behavioural Control Factors on organisational E-Commerce adoption in. Two sets of constructs were chosen to measure E-Readiness and technological and behavioural factors. To find the answers to research questions, two statistical techniques, PLS-SEM and multinominal regression. The study found that among E-Readiness factors, awareness, business resources, commitment, government readiness, governance and support industry readiness were significantly and positively related to intention to adopt E-Commerce. Except for human resource and market forces it appears that human resources are no more important for intention to adopt E-Commerce as organisations have options to outsource the information technology when required. Moreover, new E-Commerce technologies are increasingly developed with user friendly interface and thus do not require specialised skills. The insignificant result relationship between market forces and intention to adopt E-Commerce requires further investigation

as it is not consistent with results of most of the similar studies. Among technological and behavioural factors, perceived behavioural control, Perceived Security, relative advantage, and Perceived Compatibility were found positively and significantly related to intention to adopt E-Commerce adoption. However, contrary to some studies, cost acceptability and Perceived Ease of Use were not found to be significantly related to the Intention to adopt E-Commerce. E-Commerce technologies are getting cheaper daily, and thus, the cost seems irrelevant in E-Commerce adoption decisions (especially at the basic level of E-Commerce adoption). Moreover, advances in software technology have enabled technology firms to introduce user-friendly and DIY-type E-Commerce products which can explain why Perceived Ease of Use was not found to be significantly related to the intention to adopt E-Commerce. Also, It seems that when firms decide to adopt E-Commerce for business reasons, they do not care about the complexity of the technology. While majority of the research established a positive relationship of two constructs with E-Commerce adoption, findings of this study do align with results of some studies (explained in sections 8.2.1, 8.2.2, 8.2.3 and 8.2.4). The determinants of E-Commerce adoption mostly remain same in both public and private sectors, except for few cases where determinant becomes irrelevant, or their strengths vary significantly. PLS SEM output gave outputs for complete, private, and public sector s. While path coefficients were different in both sectors, statistically significant differences were in the effect of "governance" among E-Readiness factors. Similarly, among technological and behavioural factors path coefficients of only cost acceptability and relative advantage were statistically different. Cost seems to be important only in the Private Sector and while relative advantage was relevant in both public and private sectors, the impact was stronger in the Private Sector. One of the objectives of this study was to examine the discriminating factors/ relationship of influencing factors on different levels of E-Commerce adoption. The technique used to achieve this objective is "Multinominal Regression". The results showed that among E-Readiness factors except for human resources, all factors were associated with all three levels of E-Commerce adoption and were found predicting the membership of a specific level of E-Commerce maturity or sophistication. However, the support industry was found relevant only the most sophisticated level of E-Commerce adoption. It seems that firms do consider the availability of relevant support industries for the most sophisticated E-Commerce adoption. Among technological and behavioural factors, all factors were relevant to predict membership of a specific E-Commerce adoption level except "Perceived Security", which was found relevant only in level two and three of E-Commerce adoption. This study significantly contributes to existing understanding of e-commerce adoption in Pakistan by examining the influence of e-readiness, technological factors, and behavioural control factors. It stands out as the first correlational study that explained variance in organisational E-Commerce adoption though E-Readiness factors. Furthermore, it also revealed the relative importance of E-Readiness, Technological and Behavioural Control Factors for organisational E-Commerce adoption while highlighting significant variations between the public and private sectors. Additionally, it provided insights about the discriminating factors affecting different stages of E-Commerce adoption in firms. To answer the research questions, it was essential to conduct a systematic literature survey of E-Commerce in Pakistan and test measurement scales for the factors involved. This process yielded a systematic survey and validated scales, which also constitutes an addition into existing knowledge.

CHAPTER 9 CONCLUSION

9.0 INTRODUCTION

This final chapter summarises the findings, highlights major theoretical and practical implications that can be inferred from this research, discusses the work's limits, and suggests future research directions. This chapter has 5 sections. Section 9.1 presents a summary of the research findings. Research summary is followed by the discussion on the contribution and implications of this research work in section 9.2. Section 9.3 describes the conceptual and methodological limits of this study. This study is part of large scientific enquiry related to E-Commerce adoption in developing economies and hence to suggest future possible research questions section 9.4 points to the possible research direction. Finally, section 9.5 describes the summary of this chapter.

9.1 SUMMARY OF KEY FINDINGS

The study of organisational E-Commerce adoption has evolved significantly, transitioning from a focus primarily on developed economies to encompassing developing countries as well. Research in this area has revealed distinct challenges faced by firms in developing economies compared to those in developed ones. Moreover, within developing economies, the significance and strength of influencing factors in E-Commerce adoption vary, highlighting the complexity of the adoption process across different contexts. As mentioned in section 1.1 , due to the lack of distinctiveness in the term "developing economies," along with the significant influence of socio-economic factors and the varied social and economic environments within these countries, a more targeted, country-specific approach to studying E-Commerce adoption is necessary. Pakistan, given its unique characteristics, was selected as a case study for examining E-Commerce adoption at the firm level. While a few studies on organisational E-Commerce adoption in Pakistan exist, no comprehensive empirical study was found in literature survey. This research project utilised E-Commerce adoption models that incorporated E-Readiness factors and Technological and Behavioural Control factors that are particularly pertinent to the context of developing economies. Given that organisations in the public and private sectors operate with distinct priorities, objectives, and challenges, the adoption models were tested using datasets from both sectors. This approach aimed to uncover any differences in E-Commerce adoption between the two sectors. The first contribution of the research is through a comprehensive literature survey of E-Commerce research in Pakistani context. Literature survey indicated some serious research gaps as mentioned in the literature survey section. This study investigated possible influence of more relevant factors with firm level E-Commerce adoption in Pakistan. E-Readiness, Technological and Perceived behavioural control factors were studied in two different phases. This study investigated the influence of relevant factors on firm-level E-Commerce adoption in Pakistan, examining E-Readiness, Technological, and Perceived Behavioural Control Factors in two phases of analysis. Among the E-Readiness factors, Awareness, Business Resources, Commitment, Government Readiness, Governance, Support Industry, and Technical Resources were found to significantly affect E-Commerce adoption. The scores for these constructs were generally higher in private sector organisations, indicating that private sector managers have more optimistic perceptions about E-Readiness factors than public sector managers. Data analysis revealed that while the relative strength or association of different E-Readiness factors differed in private and public sector organisations, only the effect of governance was statistically different in both sectors. Technological and Behavioural factors found to influence E-Commerce adoption included Perceived Behavioural Control, Perceived Compatibility, Relative Advantage, and Perceived Security. Cost acceptability and Relative advantage were found to be significantly different in both sectors, with a stronger influence in private sector organisations. Next, the influencing factors in each stage of E-Commerce adoption were identified using Multinomial Regression while keeping "non-adopters" as a baseline. The dependent variable in the model was the E-Commerce adoption level (level0, level1, level2, and level3) based on the E-Commerce maturity model. E-Readiness factors that were found to influence the first, second, and third levels of E-Commerce adoption included Awareness,

Business Resources, Technical Resources, Governance, Market Forces, Government Readiness, and Commitment. Human Resource was found to be non-significant, and Support Industry was found to be relevant only in the third level of E-Commerce adoption. Technological and Behavioural Control factors influencing each stage of E-Commerce adoption included Perceived Compatibility, Perceived Behavioural Control, Perceived Cost Acceptability, Relative Advantage, and Perceived Ease of Use. The mean score for each construct was higher in the subsequent level of E-Commerce adoption, indicating that cluster of organisations in higher levels of E-Commerce adoption had more positive perceptions about E-Readiness, technological/behavioural factors than the previous levels. This is worth mentioning that there are very few Pakistani organisations that have integrated E-Commerce implementation in the organisations as only two responses from level four "Integrative" E-Commerce were received and we had to merge level four into level three of the E-Commerce maturity model. The study also validated the proposed models as they successfully explained (a) variance in "Intention to adopt E-Commerce" and (b) differentiated the clusters of non-adopters from different levels of E-Commerce adoption (level1,2 and 3). Data analysis indicated that commitment is most important factor in the E-Readiness model. Leaders play a crucial in laying out the case for innovation, explaining why it is essential for the future, and communicating the consequences of not innovating (Morgan and Inks, 2001, Venkatesh et al., 2002).Management's commitment can be reflected through their behaviours towards innovation adoption in their personal capacity and their persuasive communication (Leonard-Barton and Deschamps, 1988). Commitment is a known to have three dimensions (a) Affective: significance and importance of innovation adoption (b)Continuance: commitment when planned cost to implement change/innovation fails and Normative: normal commitment to support change (Meyer et al., 2002). While each of the dimension of commitment impacts acceptance of change/innovation (Chen and Wang, 2007, Conway and Monks, 2008) the "affective commitment" has the strongest impact (Abrell-Vogel and Rowold, 2014). So, it is very important that managers and employees understand the likely advantages to innovation adoption over the current practices/procedures. Perceived advantages of innovation adoption over the existing systems are referred to as "relative advantage" (which was found significantly affecting intention to adopt E-Commerce in our second model). So, it is important that managers and employees have awareness about the potential advantages as it forms a dimension "commitment". Managerial and organisational commitment is not enough. For commitment to translate in E-Commerce adoption, government readiness is also necessary (Chen et al., 2013, Oreku et al., 2009). To avail the opportunities that internet offers, it is important that countries have supporting access in the form of infrastructure and services. Once access is available, there needs to be enough capacity in the form of economic, social, legal and policy structure (Choucri et al., 2003) which is normally in the hands of the government, especially in developed countries (Molla and Licker, 2005b). In the 2020 UN E-Government Development Index (EGDI) report, Pakistan was placed 153rd out of 193 nations, a decline in position from the report published in 2018 (148^{th}) (Dawn, 2021). The findings also suggest that organisations consider availability of support industry as an important factor while making E-Commerce adoption decisions especially in the more advanced stages of E-Commerce adoption. Government's commitment and efforts can also influence availability of relevant support industry. While affordable telecommunication infrastructure is important, online line/ remote payment processing facilities are also crucial for E-Commerce. So, government needs to pay attention on this area. Collective commitment from the country and organisation leadership is likely to improve the level of awareness about potential benefits that can be realised by adopting E-Commerce. A good proportion of variance in intention to adopt E-Commerce was explained by governance within organisations. Presence of appropriate Information Technology (IT) governance ensures effective and efficient Information Technology usage by prioritising the IT investments and fundings in efficient way while providing an effective and efficient information technology in compliant environment within organisation to achieve the corporate goals. The mean score for this construct was below the neutral

point (i.e 3) and lowest among all constructs, which suggest that this area requires attention in Pakistani organisations. The study found that culture within an organisation, and previous experience with similar technologies also play an important role in organisational level E-Commerce adoption. Model-A captured certain cultural aspects of organisations through "Business Resources" construct while past experience of digital technologies through "Technology Resources" construct. According to findings of this study organisations that are flexible and responsive to the change having collaborative culture where innovations are encouraged, and failures are tolerated are more likely to adopt E-Commerce. Similarly, organisations' previous knowledge and experience in Information technology related solutions (both hardware and software) was also found significantly related to E-Commerce adoption. These findings highlight importance of creating conducive and collaborative environment within organisations to make them more responsive to the quickly changing business environment and adopt innovation (including E-Commerce technologies) readily. Presence of relevant support industry was also found enabler of E-Commerce adoption. Although E-Commerce technologies are increasingly becoming user friendly and while organisations may not require consultations of experts at very basic level of E-Commerce adoption, at more advanced levels consultation with experts and supporting industries like electronic payment systems and modern logistic services are usually required. We can see that very few organisations had a fully integrated or most advanced E-Commerce adoption level. Statistics indicate that organisations are gradually moving from no connectivity towards fully integrated adoption and presence, or absence of support industry is going to impact the transition rate towards more sophisticated E-Commerce adoption levels. The sector did not appear to moderate the E-Commerce adoption decisions significantly except for the governance. Presence of governance was more strongly related to E-Commerce adoption in the public sector organisation and interestingly, the level of governance in public organisations was perceived lower as compared to private sector organisations. Other interesting findings of the research are that cost of E-Commerce adoption was not found a relevant factor in E-Commerce adoption decision for complete dataset, but it became relevant and significant when only private sector responses were analysed. Possible explanation is provided in chapter 8. Similarly, while organisations considered net benefit of replacing existing practices and business processes both in public and private sector organisation, the association of relative advantage with intention to adopt E-Commerce was stronger in private sector. These results also highlight that private organisations have more scrutiny and checks to ensure best possible IT investments and the fact is also reflected in the mean score of governance in private sector. Organisations do not seem to consider complexity of the E-Commerce technologies as a factor while making E-Commerce adoption decisions. The most important factor that organisations consider was found to be Perceived Security. It is important to provide organisations with secure and risk-free online platforms to foster E-Commerce adoption. Provision of online secure platforms are likely to foster the transitions of organisations from lower to higher levels of E-Commerce adoption as the mean of Perceived Security increased with increase in E-Commerce adoption level.

9.2 RESEARCH CONTRIBUTION AND IMPLICATIONS

Given the importance of E-Commerce adoption in Pakistan for national and global economy and slower than expected firm level E-Commerce adoption rate in Pakistan, it is very important to gain a deeper understanding of the factors that are possibly impeding its adoption by firms. This study provided valuable contribution in the existing body of literature by investigating possible roles of more relevant factors using advanced techniques. Unlike previous studies, it found relevance of different determinants of E-Commerce adoption on different levels of E-Commerce adoption within organisations. Another, great contribution is the comparative study of public and private sectors. Theoretically grounded in Resource Based Theory, Technology-Organisation – Environment model, Diffusion of Innovation Theory, Theory of Reasoned Actions and Theory of planned behaviour, this study

provides important insights for managers, technology consultants, software vendors, and government policy makers. While findings of this research can help stake holders make informed decisions for widespread E-Commerce adoption, it also solid foundation for the future research.

9.2.1 THEORETICAL CONTRIBUTION

This study has made several important theoretical contributions to the field of E-Commerce. The validation ad testing of the E-Readiness model using advanced Partial Least Squares Structural Equation Modelling techniques provides a deeper understanding of the relationship between E-Readiness factors and the intention to adopt E-Commerce. Furthermore, the study of the impact of Technological and Behavioural Control Factors on the intention to adopt E-Commerce provides valuable insights into the role of these factors in the adoption process and highlights the importance of considering these factors in future research. A notable aspect of the study is its examination of how various sets of factors influence each successive stage of E-Commerce adoption, going beyond the basic levels of adoption. The results of this study both contradicted and supported the findings of prior research, providing new insights into the dynamics of E-Commerce adoption. Please refer to section 8.2 for details and how these findings compare with existing literature. The comparison of E-Commerce adoption in the private and public sector in Pakistan provides important insights into the differences in the adoption process between the two sectors and highlights the need for targeted interventions to improve E-Commerce adoption in the public and private sectors. Additionally, the study undertook a comprehensive literature survey and tested measurement scales to reliably measure E-Readiness, Technological, and Behavioural Control Factors, in peculiar context of Pakistan. The study of the impact of a range of factors on E-Commerce adoption contributes to the theory of innovation diffusion, specifically E-Commerce adoption and diffusion in Pakistan. This contribution provides valuable insights into the diffusion of E-Commerce in the country and highlights the need for further research in this area. In conclusion, the present study provides several important theoretical contributions to the field of E-Commerce and sets the stage for future research in the area.

9.2.2 CONTRIBUTION TO PRACTICE

The study of E-Commerce adoption in Pakistan has important implications for practice in several different domains. Firstly, the study provides a comprehensive picture of E-Commerce adoption in both public and private sectors of Pakistan, offering a valuable resource for organisations seeking to better understand E-Commerce and make informed decisions about their own adoption of E-Commerce technologies. Additionally, the findings of the study are expected to be of great interest to government decision-makers, who can use the results to guide their efforts to promote E-Commerce adoption in Pakistan and support the growth of the country's digital economy. International donors and development organisations will also find the study's results of great value, as they can use the insights gained to shape their funding strategies and support E-Commerce adoption in developing countries like Pakistan. Academics and practitioners in the field of E-Commerce will also benefit from the study, as it provides important insights into the factors that facilitate and hinder the adoption of E-Commerce. This knowledge can be used to support industries in adopting E-Commerce technologies, helping to promote economic growth and improve the competitiveness of these organisations. Finally, due to a lack of studies conducted in developing countries, especially in Pakistan, this study brings a new and fresh perspective on the adoption of E-Commerce. The study's findings are expected to contribute to a growing body of knowledge about E-Commerce adoption in developing countries, helping to support further research and development in this area. In conclusion, the study of E-Commerce adoption in Pakistan has important implications for both theory and practice, offering valuable insights into the adoption process and providing a foundation for future research in this area.

9.2.3 IMPLICATIONS FOR MANAGERS

The results of this study have significant implications for organisational management, particularly for those seeking to introduce complex "Type III innovations" such as E-Commerce or expand existing E-Commerce applications to increase revenue. The study aims to assist firms in successfully transitioning from traditional commerce to electronic commerce by identifying the characteristics of early and more advanced E-Commerce adopters. The empirical findings highlight the critical role of management in developing countries in the E-Commerce adoption and diffusion process. To create a supportive environment within organisations that fosters cooperation, collaboration, and innovation, it is essential to have top management commitment. This commitment should be manifested through their actions, policies, and continued support for innovation. Managers who are motivated to innovate and possess favourable attitudes towards technology are more likely to adopt E-Commerce and allocate resources to enhance it. To demonstrate their belief and participation, senior managers can establish support mechanisms like steering committees, working groups, and training programs. It is important to note that achieving the full potential of E-Commerce requires more than just initial financial investment. It also requires technical and organisational support to create an enabling environment and mitigate uncertainties surrounding technical and organisational changes. Furthermore, the study highlights the importance of staying up to date with the latest business trends and promoting innovation within organisations. To facilitate E-Commerce adoption, an appropriate governance structure is critical in both the private and public sector s. Senior organisational leaders must develop a well-defined IT governance structure that encourages innovation. Lastly, companies with extensive technological resources are better positioned to expand the scope and scale of E-Commerce applications. Therefore, managers should pay close attention to their information technology readiness and devise strategies to evaluate the availability of existing IT resources while ensuring alignment between E-Commerce applications and existing IT resources.

9.2.4 IMPLICATIONS FOR TECHNOLOGY CONSULTANTS

This study has substantial practical implications for technology consultants and software suppliers as well. Consultants can play an important role to promote E-Commerce adoption within Pakistan. There appears to be a lot of scope for their services as organisations in Pakistan seem to move towards more sophisticated levels of E-Commerce adoption. It is important that organisations have good experience of initial E-Commerce adoption, because businesses that get a bad first experience from E-Commerce adoption may impact decisions of other organisations by becoming "Influential Negative Opinion Leaders" (Leonard-Barton, 1988). Consultants and vendors thus need to identify potential business, understand their problems, and offer potential solutions for the successful E-Commerce adoption. Technology adoption rate is greatly affected by the awareness about the potential benefits that a technology offers. This study also found that awareness and the perceptions about how E-Commerce technologies would benefit organisations compared to the existing procedures affect E-Commerce adoption decesion. Thus, seminars and presentations that highlight the potential benefits and use cases of E-Commerce technologies along with cost to benefit ratio calculations are likely to create a positive attitude of organisational leadership towards E-Commerce adoption. Several marketing techniques can be used by the consultants to benefit their business and promote E-Commerce adoption in countries as well. In addition to awareness seminars, they can create state of the art interactive websites that not only aware the audiences but also help them create a customised plan for E-Commerce adoption covering financial, technical, and change management aspects. Where possible, they can also offer technology trials, free or discounted post implementation services like maintenance, fine tuning, and training of employees.

9.2.5 IMPLICATIONS FOR GOVERNMENT

This study highlighted the possible significant role of government in fostering firm-level E-Commerce. The government's role becomes more crucial in developing economies like Pakistan as governments' policies and decisions usually impact firm-level decisions more than the market forces (Molla and Licker, 2005b). The government's interest in E-Commerce is likely to pay back the government by helping it gain wider objectives. For example, E-Commerce can help reduce the prevalent poverty by providing economic opportunities to organisations and individuals. People living in remote areas and villages can especially benefit from the greater market reach and low startup costs. A significant proportion of the Pakistani population is female, which remains economically inactive due to cultural reasons. E-Commerce can provide an excellent platform for them to improve their financial health and contribute to the national economy. Pakistan has a great potential for exporting raw materials and intermediaries at competitive rates which foreign companies may attract towards. Increased cross-border E-Commerce exports of goods and services are likely to improve the reduce the trade deficit in Pakistan which is one of the most desirable objectives. Foreign companies may also shift their part operations in Pakistan or outsource some processes in Pakistan which may again benefit both Pakistan and foreign countries. Pakistan is experiencing a severe shortage of foreign currency and could hardly avoid default in the recent past. Given the geo-political factors, E-Commerce trade with developed economies seems to be the only solution for the problem as the current strategy to get bailout packages from the International Monetary Fund and other friendly countries is not a practical and sustainable solution (Cheema, 2004, Looney and CONFLICT, 2002, Khan, 2002, Salman and Ali, 2022, Bhattacharya and Singh, 2022, Rana, 2023).

E-Commerce adoption in the public sector is likely to benefit the public by giving them easy access to government services and may benefit the government by saving cash spent for delivering those services in far-flung areas of Pakistan using traditional methods. According to an estimate majority of Pakistani citizens, especially in rural areas do not have easy and affordable access to health services (Khan, 2019). E-Commerce can help Pakistani citizens access health facilities through remote access. Another, important use case of internet technologies is the provision of education services to distant areas using online services. The world has recently seen how education sector throughout the world transformed in pandemic. Online education will be especially beneficial for female segment of the Pakistani population. Females in Pakistan usually have low literacy rate as compared to the male segment due to several socio-cultural reasons (Siraj et al., 2022, Abbas and Husssain, 2021). One of the most stated education barriers for females is the conservative atmosphere, where sociocultural issues prevent most females from receiving even a basic education. Women are not permitted to attend universities or schools in many parts of Pakistan due to local norms. Female students could benefit from online learning by receiving their education at home. In fact, societal and cultural hurdles to female engagement with men appear to hinder every attempt to boost female involvement rates in the Pakistani economy. For example, gender segregation in public or social venues is another Pakistani cultural norm stemming from perceived Islamic tradition that may limit women's roles in management (and this explains the lower female ratio in our surveys as well). However, for the benefits to be realised, the government must create an enabling climate within the country. The government must strengthen general infrastructure by giving access to better and more affordable telecommunications services, as well as improved roads and rail networks. Although there has been a noticeable growth in internet users recently, a sizable portion of society still cannot afford internet access or gear. The government needs to expand mobile networks because mobile internet on mobile devices currently accounts for most of the internet traffic. Furthermore, wireless internet can provide online access to persons living in remote places without incurring excessive costs associated with physical line-based internet. In Pakistan, the internet is heavily taxed, which is ultimately passed on to the customer. Tax incentives for

the private sector telecommunication companies can help reduce the internet connectivity costs. Government needs to ensure that firms and individuals feel safe online. This study also highlighted importance of online security in firm level E-Commerce adoption decisions. A limited number of financial institutions support online transactions but they tend to rely on old security mechanisms (Javed, 2020b, Anjum and Chai, 2020). Other payment gateways like PayPal also need to be present in the country for cross border trade especially. Pakistan is among the top countries that offer freelancing services; however, service providers are unable to open their accounts on market leader platforms like fiver etc due to absence of appropriate payment solution in Pakistan. However, reportedly PayPal refused to start operation in Pakistan due to concerns about financial regulations and money laundering (Barrech et al., 2023, Qasim and Mahmood, 2021). The government needs to establish financial regulatory authority that ensures all banks have a dedicated section to monitor the transactions possibly using state of the art artificial intelligence and machine learning technologies to flag any suspicious transactions. Strict monitoring of financial transactions is also important to flag any money laundering activity. Similarly, strict data protection regulations should be in place that make sure that sensitive information is only kept on servers when necessary and for the shortest duration on secure servers. Such measures are likely to win the trust of big online payments service providers like PayPal. Another measure that can win the trust of both sellers and buyers is introduction of relevant laws and policies that address concerns on online trading. As mentioned earlier, currently, general trading laws apply on online trade as well. While we see frequent announcements of government projects aimed at promoting E-Commerce and online trade, proportionate effect is not seen. It is important that successive governments adopt consistent, focused, and targeted approach to promote E-Commerce. It is also important that previous projects related to E-Commerce promotion be audited. How many of them were successful, how many were partially successful and how many failed? The lesson learnt should be documented for potential future projects to increase their success rate. Government and policy makers of both public and private sectors can use the findings of this research for more targeted efforts to promote E-Commerce.

9.3 STUDY LIMITATIONS

This research project attempted to provide valuable insights on the E-Commerce adoption processes in Pakistani organisations comprehensively, however, since this research was first of its kind in Pakistan, further empirical work is needed to validate the findings of this study. The project was based on strong theoretical framework and used constructs used already in several peer reviewed research, all scales were tested for validity and reliability using robust versions of statistical techniques. An appropriate method of sampling was used to make sure that results can be genialised. However, like with any such research study, it is important to understand the limitations of the study as well. The study adopted a cross sectional approach and thus gives snapshot of facts at a specific point in time. However, diffusion of innovation process has a time element in it (Rogers, 1995), and as such we cannot importance of time factor in process of innovation diffusion. So, a longitudinal study would perhaps be a better choice for studying processes that are function of time. However, longitudinal studies tend to be expensive and cannot cover large sample sizes. To get a more understanding of the topic, the author originally planned to adopt a mix method approach involving interviews and processing of qualitative data as well, however, due to pandemic emergencies top management was not available for telephonic interview. Also, travel restrictions prevented author to travel physically to Pakistan. Similarly, the author wanted to study the cross-border E-Commerce trade for Pakistan as well but could not do that because of shortage of time and non-cooperation concerned Pakistani trade representatives in high commission of Pakistan in UK. While the study adopted approach of multiple respondents from single organisation to minimise the bias effect, the data collected was self-reported which is often criticised, especially in the context of innovation as people normally have limited information about the subject,

attention lapses and bounded realities (Devaraj and Kohli 2003). However, this is a very common practice in information systems research and further replications of the study can validate the findings. Because the information was gathered as perceptions from key informants at each firm, this study had several limitations. The appropriateness of self-reported measurements of innovation usage is criticised by innovation adoption academics. Devaraj and Kohli (2003) claim that self-reported measures of innovation usage have various drawbacks and may not be an adequate proxy for actual usage due to individuals' lack of information, attention lapses, and restricted rationality. Nonetheless, this is a frequent practise in information sciences research, and only replications may validate the measurements utilised in the study conclusions. To make item variables more understandable in this study context, the author made some minor adjustments to their wording. Future research must thus use the original scales from the source and make any necessary revisions if their study designs permit. It is also important to mention that the study was done in pandemic time and businesses were not operating in normal circumstances. This can have potential impact on the data that was collected.

9.4 FUTURE DIRECTIONS

The findings of the present study, along with its limitations, hold implications for future research avenues. To obtain a more comprehensive understanding of E-Commerce adoption, it is recommended to conduct high-quality qualitative research using appropriate data processing tools. Such studies can offer deeper insights into the decision-making process of organisational E-Commerce adoption and potentially validate the findings of this study. Additionally, developing new E-Readiness scales that encompass both internal and external E-Readiness with fewer constructs can allow for the incorporation of other technological, behavioural, and cultural factors into a single, integrated model. This approach can enable researchers to analyse the relative importance of constructs from diverse domains in explaining variations in E-Commerce adoption, as well as explore the mediating and moderating roles of potential candidate constructs, such as organisational size or industry types. The moderating or mediating role of “Perceived Behavioural Control” especially deserves attention as a statistically significant positive relationship with E-Commerce adoption was found in this study. While this project examined the relationship between predictor variables and different stages of E-Commerce adoption, future studies can utilise techniques such as discriminant analysis to identify the discriminating variables as organisations transition between stages. Moreover, E-Commerce adoption promises to enhance organisational revenue and performance, but it remains unclear if such benefits are actually being realised by firms who adopted E-Commerce. Hence, a longitudinal study that compares the pre- and post-E-Commerce adoption stages using a tool like balanced scorecard can provide valuable insights in this regard. Despite the Pakistani government's apparent enthusiasm towards promoting E-Commerce, it is unclear whether the information technology projects, policies, and procedures have delivered the desired objectives. Thus, an intriguing research project would be to investigate any resistance to E-Commerce adoption, particularly in the public sector. This study can identify the factors underlying the resistance, including whether decision-makers and managers are genuinely interested in digitising their operations or offering public services online.

The author of this study wishes to recommend a few useful tips for future research in Pakistan. Since most organisations were reluctant to participate in research projects, having a coordinator with industry connections can be beneficial for any future research. Moreover, researchers must continuously follow up with respondents to boost response rates. Private sector owners and CEOs often expect their employees and subordinates to fill out questionnaires in their free time, which can result in lower response rates. In contrast, public sector employees may be hesitant to respond due to political

reasons. To ensure better response rates, the author recommends using a printed questionnaire pack and a return postage-paid envelope.

9.5 SUMMARY

Despite certain limitations, this research project significantly enhanced the understanding of organisational E-Commerce adoption in Pakistan. The study successfully developed and tested four statistical models to explain the “Intention to adopt E-Commerce” in organisations. It also proposed an E-Commerce maturity model, based on existing literature, to map the levels of E-Commerce adoption within organisations. The insights gained from this study could be instrumental for both organisational and national leadership in the acquisition of E-Commerce technologies. The research's key findings suggest that organisational leadership generally holds positive perceptions about E-Readiness, Technological, and Behavioural Control Factors, with the exception of the "Governance" construct. Factors such as awareness about technology, openness, IT governance, and an innovative organisational culture were found to promote E-Commerce adoption. Furthermore, the government can play a pivotal role by providing the necessary infrastructure and implementing visible measures to foster a secure and conducive environment for E-Commerce. Organisations evaluate the potential benefits of adopting E-Commerce technologies and their compatibility with existing operations. However, they do not take into account the complexity of these technologies or whether their partners or competitors have already adopted them. Their primary focus is on the tangible advantages over existing practices and procedures. Interestingly, the study also revealed that the cost and availability of human resources within the organisation do not appear to influence the decision to adopt E-Commerce. Most of the predictors of E-Commerce adoption relate to every stage of E-Commerce adoption, and they become more strongly related in each successive stage. Although the study adopted robust research methods, it has certain limitations that are typical of such projects. Nevertheless, the findings of this research can benefit organisational and national leadership. The limitations and findings of this study suggest further possible research topics using qualitative, quantitative, or mixed method research. The author suggests developing new E-Readiness scales and some integrated models that capture more aspects of E-Commerce adoption. However, the author believes that this study has fulfilled its goals and expectations and has answered all research questions initially set at the beginning of the study. The findings are beneficial to innovation literature, practitioners, and policy makers.

References

AARONS, G. A., HURLBURT, M. & HORWITZ, S. M. 2011. Advancing a conceptual model of evidence-based practice implementation in public service sectors. *Administration and Policy in Mental Health and Mental Health Services Research,* 38**,** 4-23.

ABBAS, A., ABDULLAH, S. H. & SAAD, R. M. 2018. Affecting factors to intentions to adoption of E-Commerce Technologies in SMEs of Pakistan. *The Journal of Social Sciences Research***,** 147-155: 4.

ABBAS, M. & HUSSSAIN, S. 2021. Low literacy rate at primary level: identification of causes and impacts. *Pakistan Social Sciences Review,* 5**,** 492-506.

ABBASI, S., KAMRAN, S. & AKHTAR, C. 2017. Factors Affecting Customers' Adoption of Internet Banking in Pakistan. *Pakistan Administrative Review,* 1**,** 115-129.

ABDELKARIM, A. & NASEREDDIN, H. 2010. Mobile commerce. *Journal of Mathematics and Technology,* 4**,** 51-56.

ABDULHAKEEM, I., EDWARDS, H. & MCDONALD, S. 2017. E-commerce adoption in developing countries SMEs: what do the prevailing theoretical models offer Us?

ABED, S. S. 2020. Social commerce adoption using TOE framework: An empirical investigation of Saudi Arabian SMEs. *International Journal of Information Management,* 53**,** 102118.

ABID, H. & NOREEN, U. 2006. Ready to E-bank: An exploratory research on adoption of e-banking and e-readiness in customers among commercial banks in Pakistan. *Spider,* 31**,** 1-31.

ABOELMAGED, M. G. 2010. Predicting e-procurement adoption in a developing country: An empirical integration of technology acceptance model and theory of planned behaviour. *Industrial Management & Data Systems*.

ABORAMADAN, M., ALBASHITI, B., ALHARAZIN, H. & ZAIDOUNE, S. 2020. Organizational culture, innovation and performance: a study from a non-western context. *Journal of Management Development*.

ABRELL-VOGEL, C. & ROWOLD, J. 2014. Leaders' commitment to change and their effectiveness in change–a multilevel investigation. *Journal of organizational change management*.

ACCA 2014. How e-business transforms public sector services in the UK. *In:* RIPLEY, H. (ed.). London UK: The Association of Chartered Certified Accountants.

ACCENTURE. 2014. Digital Government Pathways to Delivering Public Services for the Future. Available: https://www.accenture.com/in-en/~/media/accenture/conversion-assets/dotcom/documents/global/pdf/industries_7/accenture-digital-government-pathways-to-delivering-public-services-for-the-future.pdf [Accessed 19/11/2020].

ACUNA, E. & RODRIGUEZ, C. 2004. The treatment of missing values and its effect on classifier accuracy. *Classification, clustering, and data mining applications.* Springer.

ADEJOH, V. A. 2018. Role of E-Commerce in the Economic Development of Nigeria (Konga a case study)‖. *Texila International Journal of Management,* 4**,** 1-5.

ADNAN, H. 2014. An analysis of the factors affecting online purchasing behavior of Pakistani consumers. *International Journal of Marketing Studies,* 6**,** 133.

ADP & ESCAP. 2018. Embracing E-commerce - Revolution. [Accessed 05/10/2020].

ADWOK, J. 2015. Probability Sampling-A Guideline for Quantitative Health Care Research. *Annals of African Surgery,* 12.

AESHAH, A. N. A. A. 2022. Artificial intelligence application in the adoption of e-commerce in small and medium enterprises in Libya. *Journal of University Studies for Inclusive Research,* 6**,** 8309-3826.

AFRASIABI RAD, A. & BENYOUCEF, M. 2011. A model for understanding social commerce. *Journal of Information Systems Applied Research,* 4**,** 63.

AFREEN, M. I. Impact of e-governance on the economy of Pakistan. The revolutionary plan. Nineteenth Annual General Meeting of Pakistan Society of Development Economists, held on, 2004. 13-15.

AFUAH, A. & TUCCI, C. L. 2003. *Internet business models and strategies: Text and cases*, McGraw-Hill New York.

AGARWAL, R. & PRASAD, J. 1999. Are individual differences germane to the acceptance of new information technologies? *Decision sciences,* 30**,** 361-391.

ÅGREN, E. S. Exploring technological and social barriers hindering growth of e-commerce in Pakistan.

AGREN, E. S. & BARBUTIU, S. M. 2018. Barriers In The Adoption Of E-Commerce In Pakistan With The Focus On Gender. *International Journal of Scientific and Technology Research,* 7.

AGRESTI, A. 2003. *Categorical data analysis*, John Wiley & Sons.

AGWU, P. E. 2012. A Qualitative Study of the Problems and Prospects of Online Banking in Developing Economies–Case of Nigeria. *Available at SSRN 3112130*.

AGWU, P. E. & MURRAY, P. J. 2014. Drivers and inhibitors to e-Commerce adoption among SMEs in Nigeria. *Journal of Emerging Trends in Computing and Information Sciences,* 5.

AHERN, D. M., CLOUSE, A. & TURNER, R. 2004. *CMMI distilled: a practical introduction to integrated process improvement*, Addison-Wesley Professional.

AHMAD, M. & SIRAJ, S. 2018. A systematic review and analysis of determinants impacting adoption and assimilation of e-commerce in small and medium enterprises. *International Journal of Electronic Business,* 14**,** 326-351.

AHMAD, M. O., MARKKULA, J. & OIVO, M. 2013. Factors affecting e-government adoption in Pakistan: a citizen's perspective. *Transforming Government: People, Process and Policy*.

AHMAD, S. Z., ABU BAKAR, A. R., FAZIHARUDEAN, T. M. & MOHAMAD ZAKI, K. A. 2015. An empirical study of factors affecting e-commerce adoption among small-and medium-sized enterprises in a developing country: Evidence from Malaysia. *Information Technology for Development,* 21**,** 555-572.

AHMED, N., SHAIKH, A. & SARIM, M. 2017a. Critical success factors plays a vital role in ERP implementation in developing countries: An exploratory study in Pakistan. *International Journal of Advanced Computer Science and Applications,* 8**,** 21-29.

AHMED, R. R., GHAURI, S. P., VVEINHARDT, J. & STREIMIKIENE, D. 2018. An empirical analysis of export, import, and inflation: a case of Pakistan. *Romanian journal of economic forecasting,* 21**,** 117-130.

AHMED, V., ABBAS, A. & AHMED, S. 2013. Public infrastructure and economic growth in Pakistan.

AHMED, Z., SU, L., RAFIQUE, K., KHAN, S. Z. & JAMIL, S. 2017b. A study on the factors affecting consumer buying behavior towards online shopping in Pakistan. *Journal of Asian Business Strategy,* 7**,** 44-56.

AHMED, Z., SU, L., RAFIQUE, K., KHAN, S. Z. & JAMIL, S. 2017c. A study on the factors affecting consumer buying behavior towards online shopping in Pakistan. *Journal of Asian Business Strategy,* 7**,** 44.

AJZEN, I. 1985. From intentions to actions: A theory of planned behavior. *In:* KUHL, J. & BECKMAN, J. (eds.) *Action-control: From cognition to behavior.* Heidelberg: Springer.

AJZEN, I. 2002. Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior 1. *Journal of applied social psychology,* 32**,** 665-683.

AJZEN, I. 2011. The theory of planned behaviour: Reactions and reflections. Taylor & Francis.

AJZEN, I. 2020. The theory of planned behavior: Frequently asked questions. *Human Behavior and Emerging Technologies,* 2**,** 314-324.

AJZEN, I. & FISHBEIN, M. 1972. Attitudes and normative beliefs as factors influencing behavioral intentions. *Journal of personality and social psychology,* 21**,** 1.

AJZEN, I. & FISHBEIN, M. 1980. *Understanding attitudes and predicting social behavior,* Englewood Cliffs, NJ, Prentice-Hall.

AKÇA, Y. & ÖZER, G. 2014. Diffusion of innovation theory and an implementation on enterprise resource planning systems.

AKHAWE, D., BARTH, A., LAM, P. E., MITCHELL, J. & SONG, D. Towards a formal foundation of web security. 2010 23rd IEEE Computer Security Foundations Symposium, 2010. IEEE, 290-304.

AKINNUWESI, B. A., UZOKA, F.-M. E., OKWUNDU, O. S. & FASHOTO, G. 2016. Exploring biometric technology adoption in a developing country context using the modified UTAUT. *International Journal of Business Information Systems,* 23**,** 482-521.

AL-BAKRI, A. A. & KATSIOLOUDES, M. I. 2015. The factors affecting e-commerce adoption by Jordanian SMEs. *Management Research Review*.

AL-EMRAN, M., MEZHUYEV, V. & KAMALUDIN, A. 2018. Technology Acceptance Model in M-learning context: A systematic review. *Computers & Education,* 125**,** 389-412.

AL-EMRAN, M., MEZHUYEV, V. & KAMALUDIN, A. PLS-SEM in information systems research: a comprehensive methodological reference. Proceedings of the International Conference on Advanced Intelligent Systems and Informatics 2018 4, 2019. Springer, 644-653.

AL-FAWAZ, K., ELDABI, T. & NASEER, A. 2010. Challenges and influential factors in ERP adoption and implementation.

AL-HUDHAIF, S. & ALKUBEYYER, A. 2011. E-commerce adoption factors in Saudi Arabia. *International Journal of Business and Management,* 6**,** 122.

AL-QIRIM, N. 2006. The role of the government and e-commerce adoption in small businesses in New Zealand. *International Journal of Internet and Enterprise Management,* 4**,** 293-313.

AL-SAKRAN, H. O. & ALSUDAIRI, M. A. 2021. Usability and Accessibility Assessment of Saudi Arabia Mobile E-Government Websites. *IEEE Access,* 9**,** 48254-48275.

AL-SOMALI, S., GHOLAMI, R. & CLEGG, B. An investigation into the adoption of electronic business in Saudi Arabia using the technology-organisation-environment framework. UK Academy for Information Systems Conference proceedings, paper, 2010.

AL-SOMALI, S. A., GHOLAMI, R. & CLEGG, B. 2015. A stage-oriented model (SOM) for e-commerce adoption: a study of Saudi Arabian organisations. *Journal of Manufacturing Technology Management*.

AL-QIRIM, N. 2005. An empirical investigation of an e-commerce adoption-capability model in small businesses in New Zealand. *Electronic Markets,* 15**,** 418-437.

AL MAMUN, A. 2017. Diffusion of innovation among Malaysian manufacturing SMEs. *European Journal of Innovation Management*.

AL NAHIAN RIYADH, M., AKTER, S. & ISLAM, N. 2009. The adoption of e-banking in developing countries: A theoretical model for SMEs. *International review of business research papers,* 5**,** 212-230.

ALAM, S. S., KHATIBI, A., AHMAD, M. I. S. & ISMAIL, H. B. 2007. Factors affecting e-commerce adoption in the electronic manufacturing companies in Malaysia. *International Journal of Commerce and Management*.

ALAMRO, S. & TARAWNEH, S. A. 2011. Factors affecting e-commerce adoption in Jordanian SMEs. *European journal of scientific research,* 64**,** 497-506.

ALGHAMDI, R., DREW, S. & AL-GHAITH, W. 2011. Factors Influencing e-commerce Adoption by Retailers in Saudi Arabia: a qualitative analysis. *The Electronic Journal of Information Systems in Developing Countries,* 47**,** 1-23.

ALHASSAN, M. D., ADAM, I. O. & NANGPIIRE, C. 2020. Drivers of Global Social Network Adoption: A Technology-Organisation-Environment Perspective. *International Journal of E-Services and Mobile Applications (IJESMA),* 12**,** 1-23.

ALHUJRAN, O. 2009. Determinants of e-government services adoption in developing countries: a field survey and a case study.

ALI, S. M. & ISHAQ, A. 2019. Prospects and Challenges of Adopting E-Commerce System in Pakistan–An Empirical Research. *International Journal of Computer Applications,* 975**,** 8887.

ALIN, A. 2010. Multicollinearity. *Wiley Interdisciplinary Reviews: Computational Statistics,* 2**,** 370-374.

ALLEN, J. P. 2000. Information systems as technological innovation. *Information Technology & People*.

ALLEN, M. P. 1997. Regression analysis with dummy variables. *Understanding Regression Analysis.* Boston, MA: Springer US.

ALLISON, P. D. 2001. *Missing data*, Sage publications.

ALRAJA, M. N. & AREF, M. 2015. Customer acceptance of e-commerce: Integrating Perceived Risk with TAM. *International Journal of Applied Business and Economic Research,* 13**,** 913-921.

ALROUSAN, M. K. & JONES, E. 2016. A conceptual model of factors affecting e-commerce adoption by SME owner/managers in Jordan. *International Journal of Business Information Systems,* 21**,** 269-308.

ALSAAD, A., MOHAMAD, R. & ISMAIL, N. A. 2017. The moderating role of trust in business to business electronic commerce (B2B EC) adoption. *Computers in Human Behavior,* 68**,** 157-169.

ALSAAD, A., MOHAMAD, R. & ISMAIL, N. A. 2019. The contingent role of dependency in predicting the intention to adopt B2B e-commerce. *Information Technology for Development,* 25**,** 686-714.

ALSADI, A. K., ALASKAR, T. H. & MEZGHANI, K. 2021. Adoption of Big Data Analytics in Supply Chain Management: Combining Organizational Factors With Supply Chain Connectivity. *International Journal of Information Systems and Supply Chain Management (IJISSCM),* 14**,** 88-107.

ALSHEHRI, M. & DREW, S. Implementation of e-government: advantages and challenges. International Association for Scientific Knowledge (IASK), 2010. .

ALYOUBI, A. A. 2015. E-commerce in developing countries and how to develop them during the introduction of modern systems. *Procedia Computer Science,* 65**,** 479-483.

ALZAHRANI, L., AL-KARAGHOULI, W. & WEERAKKODY, V. 2017. Analysing the critical factors influencing trust in e-government adoption from citizens' perspective: A systematic review and a conceptual framework. *International business review,* 26**,** 164-175.

ANJUM, S. & CHAI, J. 2020. Drivers of cash-on-delivery method of payment in e-commerce shopping: evidence from Pakistan. *Sage Open,* 10**,** 2158244020917392.

ANNE TRUITT , L. 2022. Build an Ecommerce Website That Keeps Up With Evolving Customer Expectations. Available: https://www.bigcommerce.co.uk/blog/build-an-ecommerce-website/#conclusion [Accessed 19/05/2022].

ANSARI, S., PANHWAR, A. H. & MAHESAR, G. A. 2016. Mixed methods research: Ontological, epistemological and methodological underpinnings. *ARIEL-An International Research Journal of English Language and Literature,* 27.

APAU, R. & KORANTENG, F. N. 2019. Impact of Cybercrime and Trust on the Use of E-Commerce Technologies: An Application of the Theory of Planned Behavior. *International Journal of Cyber Criminology,* 13.

APAU, R., KORANTENG, F. N. & GYAMFI, S. A. 2019. Cyber-crime and its effects on E-commerce technologies. *Journal of Information,* 5**,** 39-59.

ARDIANSAH, M., CHARIRI, A., RAHARDJA, S. & UDIN, U. 2020. The effect of electronic payments security on e-commerce consumer perception: An extended model of technology acceptance. *Management Science Letters,* 10**,** 1473-1480.

ARFEEN, M. I., IQBAL, J. & MUSHTAQ, M. J. Model for e-Government implementation in Pakistan. Proceedings of the 10th International Conference on Theory and Practice of Electronic Governance, 2017. 57-61.

ARFEEN, M. I. & KHAN, N. 2009. Public sector innovation: Case study of e-government projects in Pakistan. *The Pakistan Development Review***,** 439-457.

ARFEEN, M. I. & KHAN, N. Factors influencing e-Governance in Pakistan: case study of e-Governance projects in Balochistan. Proceedings of the 13th Annual International Conference on Digital Government Research, 2012. 192-199.

ARIFEEN, M. 2017. Top 10 Telecommunication Compnies of Pakistan. *Pakistan & Gulf Economist.* Pakistan & Gulf Economist.

ARMITAGE, C. J. & CONNER, M. 1999. Distinguishing perceptions of control from self-efficacy: Predicting consumption of a low-fat diet using the theory of planned behavior 1. *Journal of applied social psychology,* 29**,** 72-90.

ARMITAGE, C. J. & CONNER, M. 2001. Efficacy of the theory of planned behaviour: A meta-analytic review. *British journal of social psychology,* 40**,** 471-499.

ARRFAT, Y. 2019. Aligning the global value chains of China and Pakistan in the context of the Belt and Road Initiative, and China Pakistan Economic Corridor. *China's Belt and Road Initiative in a Global Context: Volume II: The China Pakistan Economic Corridor and its Implications for Business.* Springer.

ARSHAD, M. & ZAIDI, S. S. Z. 2020. Role of electronic commerce (E-commerce) in Pakistan: Consumer behavior, growth prospects, and challenges. *Int. J. Manag.(IJM),* 11**,** 264-278.

ASHRAF, A. R., THONGPAPANL, N. & AUH, S. 2014. The application of the technology acceptance model under different cultural contexts: The case of online shopping adoption. *Journal of International Marketing,* 22**,** 68-93.

ASLAM, W., HAM, M. & ARIF, I. 2017. Consumer behavioral intentions towards mobile payment services: An empirical analysis in Pakistan. *Market-Tržište,* 29**,** 161-176.

ASTUTI, N. C. & NASUTION, R. A. 2014. Technology readiness and e-commerce adoption among entrepreneurs of SMEs in Bandung City, Indonesia. *Gadjah Mada International Journal of Business,* 16**,** 69-88.

ATIF, R. M., HAIYUN, L. & MAHMOOD, H. 2017. Pakistan's agricultural exports, determinants and its potential: an application of stochastic frontier gravity model. *The Journal of International Trade & Economic Development,* 26**,** 257-276.

AU, Y. A. & KAUFFMAN, R. J. 2001. Should we wait? Network externalities, compatibility, and electronic billing adoption. *Journal of Management Information Systems,* 18**,** 47-63.

AULKEMEIER, F., PARAMARTHA, M. A., IACOB, M.-E. & VAN HILLEGERSBERG, J. 2016. A pluggable service platform architecture for e-commerce. *Information systems and e-business management,* 14**,** 469-489.

AUSAT, A. M. A. & SUHERLAN, S. 2021. Obstacles and solutions of MSMEs in electronic commerce during covid-19 pandemic: evidence from Indonesia. *BASKARA: Journal of Business and Entrepreneurship,* 4**,** 11-19.

AVGEROU, C. 2002. *Information Systems and Global Diversity,* NY, Oxford University Press.

AWA, H. O. & OJIABO, O. U. 2016. A model of adoption determinants of ERP within TOE framework. *Information Technology & People*.

AWA, H. O., OJIABO, O. U. & EMECHETA, B. C. 2015a. Integrating TAM, TPB and TOE frameworks and expanding their characteristic constructs for e-commerce adoption by SMEs. *Journal of Science & Technology Policy Management*.

AWA, H. O., OJIABO, O. U. & EMECHETA, B. C. 2015b. Integrating TAM, TPB and TOE frameworks and expanding their characteristic constructs for e-commerce adoption by SMEs. *Journal of Science and Technology Policy Management,* 6**,** 76-94.

AWA, H. O., UKO, J. P. & UKOHA, O. 2016. An Empirical Study of Some Critical Adoption Factors of ERP Software. *International Journal of Human–Computer Interaction,* 33**,** 609-622.

AWAN, M., ULLAH, N., ALI, S., ABBASI, I. A., HASSAN, M. S., KHATTAK, H. & HUANG, J. 2021. An empirical investigation of the challenges of cloud-based ERP adoption in Pakistani SMEs. *Scientific Programming,* 2021.

AWANG, Z. 2012. *Research methodology and data analysis second edition*, UiTM Press.

AWIAGAH, R., KANG, J. & LIM, J. I. 2016. Factors affecting e-commerce adoption among SMEs in Ghana. *Information Development,* 32**,** 815-836.

AYO, C., ADEWOYE, J. & ONI, A. A. 2011. Business-to-consumer e-commerce in Nigeria: Prospects and challenges. *African Journal of Business Management,* 5**,** 5109-5117.

AYOB, A. H., YAKOB, N. A. & JA'AFAR, R. 2021. E-commerce adoption in ASEAN: testing on individual and country-level drivers. *International Journal of Business Environment,* 12**,** 18-36.

AZAM, M. S. & QUADDDUS, M. Adoption of b2b e-commerce by the SMEs in Bangladesh: an empirical analysis. Proceedings of Asian Business Research Conference, 2009. Citeseer, 11-12.

AZEEM, M. M., OZARI, A., MARSAP, P., ARHAB, P. & JILANI, A. H. 2015. Impact of E-Commerce on Organization Performance; Evidence from Banking Sector of Pakistan.

BABBIE, E. 1990. The essential wisdom of sociology. *Teaching Sociology,* 18**,** 526-530.

BABBIE, E. R. 2020. *The practice of social research*, Cengage learning.

BAGOZZI, R. 2007. The Legacy of the Technology Acceptance Model and a Proposal for a Paradigm Shift. *J. AIS,* 8.

BAIG, M. K., RAZA, H. & FAROOQ, U. 2011. *E-commerce adoption: a comparative study of Sweden and Pakistan*.

BAJAJ, A. & LEONARD, L. 2004a. The CPT Framework: Understanding the Roles of Culture, Policy and Technology in Promoting Ecommerce Readiness. *Problems and Perspectives in Management,* 2.

BAJAJ, A. & LEONARD, L. N. 2004b. The CPT framework: understanding the roles of culture, policy and technology in promoting ecommerce readiness. *Problems and Perspectives in Management***,** 242-252.

BANDURA, A., FREEMAN, W. & LIGHTSEY, R. 1999. Self-efficacy: The exercise of control. Springer.

BARHAM, H., DABIC, M., DAIM, T. & SHIFRER, D. 2020. The role of management support for the implementation of open innovation practices in firms. *Technology in Society,* 63**,** 101282.

BARI, F. 2022. More Universities *The Dawn*, 01/04/2022.

BARNEY, J. 1991. Firm resources and sustained competitive advantage. *Journal of management,* 17**,** 99-120.

BARRECH, D. M., ASLAM, A., MANZOOR, R. & AHMED, M. 2023. E-commerce in Pakistan: Prospects and Challenges. *Al-Qantara,* 9.

BARUCH, Y. & HOLTOM, B. C. 2008. Survey response rate levels and trends in organizational research. *Human relations,* 61**,** 1139-1160.

BASK, A., LIPPONEN, M. & TINNILÄ, M. 2012. E-commerce logistics: a literature research review and topics for future research. *International Journal of E-Services and Mobile Applications (IJESMA),* 4**,** 1-22.

BASSILI, J. N. 1993. RESPONSE LATENCY VERSUS CERTAINTY AS INDEXES OF THE STRENGTH OF VOTING INTENTIONS IN A CATI SURVEY JOHN N. BASSILI. *Public Opinion Quarterly,* 57**,** 61.

BASU, S. 2004. E-government and developing countries: an overview. *International Review of Law, Computers & Technology,* 18**,** 109-132.

BAUEROVÁ, R. & KLEPEK, M. 2018. Technology acceptance as a determinant of online grocery shopping adoption. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis,* 66**,** 737-746.

BAYAGA, A. 2010. Multinomial Logistic Regression: Usage and Application in Risk Analysis. *Journal of applied quantitative methods,* 5.

BECKER, J.-M., RAI, A. & RIGDON, E. 2013. Predictive validity and formative measurement in structural equation modeling: Embracing practical relevance.

BEERTEN, R., LYNN, P., LAIHO, J. & MARTIN, J. 2000. Response rates as a measure of survey quality.

BEHRMAN, D. N. & PERREAULT JR, W. D. 1982. Measuring the performance of industrial salespersons. *Journal of Business Research,* 10**,** 355-370.

BELANGER, F. & HILLER, J. S. 2006. A framework for e-government: privacy implications. *Business process management journal*.

BELL, E., BRYMAN, A. & HARLEY, B. 2018. *Business research methods*, Oxford university press.

BENTLER, P. M. & BONETT, D. G. 1980. Significance tests and goodness of fit in the analysis of covariance structures. *Psychological bulletin,* 88**,** 588.

BERTHON, P., PITT, L., CYR, D. & CAMPBELL, C. 2008. E-readiness and trust: macro and micro dualities for e-commerce in a global environment. *International Marketing Review*.

BHANDARI, P. 2020. *What Is Quantitative Research? | Definition, Uses and Methods* [Online]. Scribber. Available: https://www.scribbr.com/methodology/quantitative-research/ [Accessed 16/01/2021 2022].

BHANDARI, P. 2021. How to Find Outliers | 4 Ways with Examples & Explanation. Available: https://www.scribbr.com/statistics/outliers/ [Accessed 06/03/2022].

BHAT, D. 2021. Majority of MENA, Pakistan consumers prefer digital payment methods for ecommerce: report. Available: https://gulfbusiness.com/majority-of-mena-pakistan-consumers-prefer-digital-payment-methods-for-ecommerce-report/ [Accessed 13/05/2021].

BHATTACHARYA, S. & SINGH, R. 2022. Debt ridden and deficit afflicted economic turmoil of Pakistan. *International Journal of Research in Engineering, Science and Management,* 5**,** 186-189.

BHATTI, A. & REHMAN, S. U. 2019. Impact of Social risk, Government and Psychological Factors with Moderator Cultural Factors on Online Shopping Behavior in Pakistan. *Pakistan Journal of Humanities and Social Sciences,* 7**,** 31-44.

BHUSHAN, U., GUJARATHI, R. & KAUR, J. 2018. Analysis of human resource outsourcing with regards to competitiveness of organizations. *Open Access Journal of Science,* 2**,** 265-272.

BISHOP, N. 1999. Telecommunications service providers as payment facilitators. *European Business Review*.

BLAIKIE, N. 2010. Designing Social Research, Malden. *MA: Polity Press.[Google Scholar]*.

BLAIKIE, N. & PRIEST, J. 2019. *Designing social research: The logic of anticipation*, John Wiley & Sons.

BLAND, J. 1997. Altman DG Cronbach's alpha. *BMJ,* 314**,** 572.

BLAU, F. D. & KAHN, L. M. 2017. The gender wage gap: Extent, trends, and explanations. *Journal of economic literature,* 55**,** 789-865.

BLOOMENTHAL, A. 2020. *Electronic Commerce (e-commerce)* [Online]. Investopedia. Available: https://www.investopedia.com/terms/e/ecommerce.asp [Accessed 04/02/2021 2021].

BOATENG, R., MOLLA, A. & HEEKS, R. 2009. E-Commerce in developing economies: a review of theoretical frameworks and approaches. *Emerging markets and e-commerce in developing economies.* IGI Global.

BOER, H. & DURING, W. E. 2001. Innovation, what innovation? A comparison between product, process and organisational innovation. *International Journal of Technology Management,* 22**,** 83-107.

BOLLEN, K. A. 1989. *Structural equations with latent variables*, John Wiley & Sons.

BORGES, R. 2013. Are public officials really less satisfied than private sector workers? A comparative study in Brazil. *Revista de Administração Pública,* 47**,** 1477-1496.

BORREGO, M., FROYD, J. E. & HALL, T. S. 2010. Diffusion of engineering education innovations: A survey of awareness and adoption rates in US engineering departments. *Journal of Engineering Education,* 99**,** 185-207.

BRABHAM, D. C. & GUTH, K. L. 2017. The deliberative politics of the consultative layer: Participation hopes and communication as design values of civic tech founders. *Journal of Communication,* 67**,** 445-475.

BRINGULA, R. P., MORAGA, S. D., CATACUTAN, A. E., JAMIS, M. N. & MANGAO, D. F. 2018. Factors influencing online purchase intention of smartphones: A hierarchical regression analysis. *Cogent Business & Management,* 5**,** 1496612.

BRITANNICA, E. 2020. World Wide Web. Encyclopædia Britannica.

BROWN, D. H. & THOMPSON, S. 2011. Priorities, policies and practice of e-government in a developing country context: ICT infrastructure and diffusion in Jamaica. *European Journal of Information Systems,* 20**,** 329-342.

BROWN, T. A. 2015. *Confirmatory factor analysis for applied research*, Guilford publications.

BRYMAN, A. 2016. *Social research methods*, Oxford university press.

BRYNJOLFSSON, E., HITT, L. & YANG, S. 1998. Intangible Assets How the Interaction of Computers and Organizational Structure Affects Stock Market Valuations. *ICIS 1998 Proceedings***,** 3.

BUELENS, M. & VAN DEN BROECK, H. 2007. An analysis of differences in work motivation between public and private sector organizations. *Public administration review,* 67**,** 65-74.

BUENO, E., ARAGÓN, J. A., PAZ SALMADOR, M. & GARCÍA, V. J. 2010. Tangible slack versus intangible resources: the influence of technology slack and tacit knowledge on the capability of organisational learning to generate innovation and performance. *International Journal of Technology Management,* 49**,** 314-337.

BUI, Q. N., LEO, E. & ADELAKUN, O. 2019. Exploring complexity and contradiction in information technology outsourcing: A set-theoretical approach. *The Journal of Strategic Information Systems,* 28**,** 330-355.

BURNS, R. B. 2000. Introduction to research methods . Frenchs Forest. NSW: Longman.

BYNNER, J., OPPENHEIM, A. N. & HAMMERSLEY, M. 1979. *Data collection procedures*, Open University Press.

CABLE.CO.UK. 2020. *Worldwide mobile data pricing: The cost of 1GB of mobile data in 228 countries* [Online]. Available: https://www.cable.co.uk/mobiles/worldwide-data-pricing/ [Accessed 30/11/2020 2020].

CAIN, M. K., ZHANG, Z. & YUAN, K.-H. 2017. Univariate and multivariate skewness and kurtosis for measuring nonnormality: Prevalence, influence and estimation. *Behavior research methods,* 49**,** 1716-1735.

CAMPBELL, M. K. & DONNER, A. 1989. Classification Efficiency of Multinomial Logistic Regression Relative to Ordinal Logistic Regression. *Journal of the American Statistical Association,* 84**,** 587-591.

CAO, J. & EVERARD, A. 2008. User attitude towards instant messaging: The effect of espoused national cultural values on awareness and privacy. *Journal of Global Information Technology Management,* 11**,** 30-57.

CARLSON, J. R., CARLSON, D. S., ZIVNUSKA, S., HARRIS, R. B. & HARRIS, K. J. 2017. Applying the job demands resources model to understand technology as a predictor of turnover intentions. *Computers in Human Behavior,* 77**,** 317-325.

CARLSSON, C., WALDEN, P. & BOUWMAN, H. 2006. Adoption of 3G+ services in Finland. *International Journal of Mobile Communications,* 4**,** 369-385.

CARR, N. G. & CARR, N. G. 2004. *Does IT matter?: information technology and the corrosion of competitive advantage*, Harvard Business Press.

CARRINGTON, M. J., NEVILLE, B. A. & WHITWELL, G. J. 2010. Why ethical consumers don't walk their talk: Towards a framework for understanding the gap between the ethical purchase intentions and actual buying behaviour of ethically minded consumers. *Journal of business ethics,* 97**,** 139-158.

CATS-BARIL, W. & THOMPSON, R. 1995. Managing information technology projects in the public sector. *Public administration review***,** 559-566.

CHAFFEY, D. 2007. *E-business and E-commerce Management: Strategy, Implementation and Practice*, Pearson Education.

CHAFFEY, D. 2009. *E-business and e-commerce management : strategy, implementation and practice,* Harlow, England

New York, Harlow, England

New York : FT Prentice Hall.

CHAI, L. & PAVLOU, P. A. 2004. From "ancient" to "modern": a cross-cultural investigation of electronic commerce adoption in Greece and the United States. *Journal of Enterprise Information Management*.

CHAKRABARTY, A. 2019. Is India poised for M-commerce in the cashless milieu. *M-Commerce: Experiencing the Phygital Retail***,** 205-216.

CHAN, C. & SWATMAN, P. M. 1999a. *B2B e-commerce implementation: The case of BHP steel*, Deakin University School of Information Systems.

CHAN, C. & SWATMAN, P. M. 1999b. *E-commerce implementation in Australia: A case study approach*, Deakin University School of Management Information Systems.

CHAN, D. K. S. & FISHBEIN, M. 1993. Determinants of College Women's Intentions to Tell Their Partners to Use Condoms 1. *Journal of Applied Social Psychology,* 23**,** 1455-1470.

CHANDIO, A. R., HAIDER, Z., AHMED, S., ALI, M. & AMEEN, I. 2018. E–GOVERNMENT IN PAKISTAN: FRAMEWORK OF OPPORTUNITIESANDCHALLENGES. *GSJ,* 6.

CHANG, S.-I., HUNG, S.-Y., YEN, D. & LEE, P.-J. 2012. Critical factors of ERP adoption for small-and medium-sized enterprises: An empirical study. *International Comparisons of Information Communication Technologies: Advancing Applications.* IGI Global.

CHAO, C.-M. 2019. Factors determining the behavioral intention to use mobile learning: An application and extension of the UTAUT model. *Frontiers in psychology,* 10**,** 1652.

CHATTERJEE, E. & SENNOTT, C. 2020. Fertility intentions and maternal health behaviour during and after pregnancy. *Population studies,* 74**,** 55-74.

CHATTERJEE, R. A. & ELIASHBERG, J. 1990. The innovation diffusion process in a heterogeneous population: A micromodeling approach. *Management science,* 36**,** 1057-1079.

CHAU, P. Y. 1996. An empirical assessment of a modified technology acceptance model. *Journal of management information systems,* 13**,** 185-204.

CHAUDHARY, S. & SHARMA, G. 2014. A Study on Mobile-Commerce. *Advances in Computer Science and Information Technology (ACSIT)***,** 4.

CHEEMA, F. 2004. Macroeconomic stability of Pakistan: the role of the IMF and World Bank (1997-2003). *ACDIS Occasional Paper*.

CHEGE, S. M. & WANG, D. 2020. Information technology innovation and its impact on job creation by SMEs in developing countries: an analysis of the literature review. *Technology Analysis & Strategic Management,* 32**,** 256-271.

CHEN, J.-Y., DIMITROV, S. & PUN, H. 2019a. The impact of government subsidy on supply Chains' sustainability innovation. *Omega,* 86**,** 42-58.

CHEN, J. & WANG, L. 2007. Locus of control and the three components of commitment to change. *Personality and individual differences,* 42**,** 503-512.

CHEN, J. K., WINDASARI, N. A. & PAI, R. Exploring E-readiness on E-commerce adoption of SMEs: Case study South-East Asia. 2013 IEEE International Conference on Industrial Engineering and Engineering Management, 2013. IEEE, 1382-1386.

CHEN, W., MRKAIC, M. & NABAR, M. 2019b. The Global Economic Recovery 10 Years After the 2008 Financial Crisis. *IMF Working Paper* [Online]. Available: https://www.imf.org/en/Publications/WP/Issues/2019/04/26/The-Global-Economic-Recovery-10-Years-After-the-2008-Financial-Crisis-46711.

CHEN, Y.-C. & PERRY, J. 2003. Outsourcing for e-government: Managing for success. *Public Performance & Management Review,* 26**,** 404-421.

CHIKODILI, N. B., ABDULMALIK, M. D., ABISOYE, O. A. & BASHIR, S. A. Outlier Detection in Multivariate Time Series Data Using a Fusion of K-Medoid, Standardized Euclidean Distance and Z-Score. Information and Communication Technology and Applications: Third International Conference, ICTA 2020, Minna, Nigeria, November 24–27, 2020, Revised Selected Papers 3, 2021. Springer, 259-271.

CHIN, W., CHEAH, J.-H., LIU, Y., TING, H., LIM, X.-J. & CHAM, T. H. 2020. Demystifying the role of causal-predictive modeling using partial least squares structural equation modeling in information systems research. *Industrial Management & Data Systems,* 120**,** 2161-2209.

CHIN, W. W. 1998. The partial least squares approach to structural equation modeling. *Modern methods for business research,* 295**,** 295-336.

CHIPEMBELE, M. & BWALYA, K. J. 2016. Assessing e-readiness of the Copperbelt University, Zambia: case study. *The International Journal of Information and Learning Technology,* 33**,** 315-332.

CHIRCU, A. M. & KAUFFMAN, R. J. 2000. Limits to value in electronic commerce-related IT investments. *Journal of Management Information Systems,* 17**,** 59-80.

CHIU, Y. C. & LIAW, Y. C. 2009. Organizational slack: is more or less better? *Journal of Organizational Change Management,* 22**,** 321-342.

CHO, Y. 2017. A consumer satisfaction model based on the integration of EDT and TAM. *Asia Pacific Journal of Marketing and Logistics*.

CHOHAN, S. R., HU, G., SI, W. & PASHA, A. T. 2020. Synthesizing e-government maturity model: a public value paradigm towards digital Pakistan. *Transforming Government: People, Process and Policy*.

CHONG, A. Y.-L., CHAN, F. T. S. & OOI, K.-B. 2012. Predicting consumer decisions to adopt mobile commerce: Cross country empirical examination between China and Malaysia. *Decision Support Systems,* 53**,** 34-43.

CHOOPRAYOON, V., FUNG, C. C. & DEPICKERE, A. A. TECTAM, A modified technology acceptance model to assess E-commerce technologies adoption by Thai SME. TENCON 2007-2007 IEEE Region 10 Conference, 2007. IEEE, 1-4.

CHOSHIN, M. & GHAFFARI, A. 2017. An investigation of the impact of effective factors on the success of e-commerce in small-and medium-sized companies. *Computers in Human Behavior,* 66**,** 67-74.

CHOUCRI, N., MAUGIS, V., MADNICK, S., SIEGEL, M., GILLET, S., O'DONNEL, S., BEST, M., ZHU, H. & HAGHSETA, F. 2003. Global e-readiness-for what. *Center for eBusiness at MIT*.

CHUA, C. E. H., STRAUB, D. W., KHOO, H. M. & KADIYALA, S. 2005. The evolution of e-commerce research: A stakeholder perspective. *Journal of Electronic Commerce Research,* 6.

CHWELOS, P., BENBASAT, I. & DEXTER, A. S. 2001. Empirical test of an EDI adoption model. *Information systems research,* 12**,** 304-321.

CIA.GOV. 2021. *The World Fact Book* [Online]. CIA. Available: https://www.cia.gov/the-world-factbook/countries/pakistan/ [Accessed 2021].

CISCO. 2002. Transforming the purpose, practice, and performance of Government. Available: https://www.cisco.com/c/dam/en_us/about/ac79/docs/wp/eGovPages-press.pdf [Accessed 19/11/2020].

CLEAVER, T. 2011. *Economics The Basics*, Routledge.

CLOETE, E., COURTNEY, S. & FINTZ, J. 2002. Small Businesses' Acceptance and Adoption of e-Commerce in the Western-Cape Province of South-Africa. *The Electronic Journal of Information Systems in Developing Countries,* 10**,** 1-13.

CODY-ALLEN, E. & KISHORE, R. An extension of the UTAUT model with e-quality, trust, and satisfaction constructs. Proceedings of the 2006 ACM SIGMIS CPR conference on computer personnel research: Forty four years of computer personnel research: achievements, challenges & the future, 2006. 82-89.

COHEN, L., MANION, L. & MORRISON, K. 2002. *Research methods in education*, routledge.

COLLINS, J. & HUSSEY, R. 2003. Business Research: a practical guide for undergraduate and postgraduate students. *New York: Paigrave Macmillan*.

CONNELLY, N. A., BROWN, T. L. & DECKER, D. J. 2003. Factors Affecting Response Rates to Natural Resource - Focused Mail Surveys: Empirical Evidence of Declining Rates Over Time. *Society & Natural Resources,* 16**,** 541-549.

CONNER, M., SHEERAN, P., NORMAN, P. & ARMITAGE, C. J. 2000. Temporal stability as a moderator of relationships in the theory of planned behaviour. *British Journal of Social Psychology,* 39**,** 469-493.

CONWAY, E. & MONKS, K. 2008. HR practices and commitment to change: an employee-level analysis. *Human Resource Management Journal,* 18**,** 72-89.

CORRAL, L., SILLITTI, A., SUCCI, G., GARIBBO, A. & RAMELLA, P. Evolution of mobile software development from platform-specific to web-based multiplatform paradigm. Proceedings of the 10th SIGPLAN symposium on New ideas, new paradigms, and reflections on programming and software, 2012. 181-183.

COSTA DIAS, M., JOYCE, R. & PARODI, F. 2020. The gender pay gap in the UK: children and experience in work. *Oxford Review of Economic Policy,* 36**,** 855-881.

COURSARIS, C. & HASSANEIN, K. 2002. Understanding m-commerce: a consumer-centric model. *Quarterly journal of electronic commerce,* 3**,** 247-272.

COX, D. R. 1972. Regression models and life-tables. *Journal of the Royal Statistical Society: Series B (Methodological),* 34**,** 187-202.

CRAIG, C. S. & DOUGLAS, S. P. 2006. Beyond national culture: implications of cultural dynamics for consumer research. *International Marketing Review,* 23**,** 322-342.

CRESWELL, J. W. 2011. Controversies in mixed methods research. *The Sage handbook of qualitative research,* 4**,** 269-284.

CRESWELL, J. W. 2019. *Criteria for Selecting a Research Approach* [Online]. online: Sage Publishing. Available: https://www.methodspace.com/criteria-for-selecting-a-research-approach/ [Accessed 05/05/2021 2021].

CRESWELL, J. W. & CLARK, V. L. P. 2017. *Designing and conducting mixed methods research*, Sage publications.

CRR. n.d. *Mobile Retailing* [Online]. Available: https://www.retailresearch.org/mobile-retailing.html [Accessed 07/02/2021 2021].

CRR. n.d. *Mobile Retailing* [Online]. Available: https://www.retailresearch.org/mobile-retailing.html [Accessed 07/02/2021 2021].

CRUZ-JESUS, F., PINHEIRO, A. & OLIVEIRA, T. 2019. Understanding CRM adoption stages: empirical analysis building on the TOE framework. *Computers in Industry,* 109**,** 1-13.

CURTIS, L., EDWARDS, C., FRASER, K. L., GUDELSKY, S., HOLMQUIST, J., THORNTON, K. & SWEETSER, K. D. 2010. Adoption of social media for public relations by nonprofit organizations. *Public Relations Review,* 36**,** 90-92.

DA. 2020. *Debit and Credit Card Usage in Asia* [Online]. Available: http://www.demystifyasia.com/creditdebit-card-adoption-asia/ [Accessed 02/12/2020 2020].

DADA, D. 2006. E-Readiness for Developing Countries: Moving the focus from the environment to the users. *The Electronic Journal of Information Systems in Developing Countries,* 27**,** 1-14.

DAI, H. & PALVI, P. C. 2009. Mobile commerce adoption in China and the United States: a cross-cultural study. *ACM SIGMIS Database: the DATABASE for Advances in Information Systems,* 40**,** 43-61.

DAMANPOUR, F. & SCHNEIDER, M. 2006. Phases of the adoption of innovation in organizations: effects of environment, organization and top managers 1. *British journal of Management,* 17**,** 215-236.

DANIEL, E. & WILSON, H. 2002. Adoption intentions and benefits realised: a study of e-commerce in UK SMEs. *Journal of Small Business and Enterprise Development*.

DARLINGTON, R. 1990. *Regression and linear models*, New York: McGraw-Hill.

DAVERN, M. 2013. Nonresponse rates are a problematic indicator of nonresponse bias in survey research. *Health services research,* 48**,** 905.

DAVEY, A. 2009. *Statistical power analysis with missing data: A structural equation modeling approach*, Routledge.

DAVIES, J., FOXALL, G. R. & PALLISTER, J. 2002. Beyond the intention–behaviour mythology: an integrated model of recycling. *Marketing theory,* 2**,** 29-113.

DAVIS, F. 1985. *A Technology Acceptance Model for Empirically Testing New End-User Information Systems.* MIT Sloan School of Management, Cambbridge ,M.A.

DAVIS, F. D. 1989. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly,* 13**,** 319-340.

DAVIS, F. D., BAGOZZI, R. P. & WARSHAW, P. R. 1989. User Acceptance Of Computer Technology: A Comparison Of Two theortical models. 35**,** 982-1003.

DAVIS, F. D. & VENKATESH, V. 1996. A critical assessment of potential measurement biases in the technology acceptance model: three experiments. *International journal of human-computer studies,* 45**,** 19-45.

DAWN. 2021. Pakistan stands 153rd in E-Govt Development Index. Available: https://www.dawn.com/news/1641418 [Accessed 09/09/2022].

DAWOOD, A. 2019. All you wanted to know about Pakistan's e-commerce scene (but didn't know who to ask). Available: https://profit.pakistantoday.com.pk/2019/01/14/all-you-wanted-to-know-about-pakistans-e-commerce-scene-but-didnt-know-who-to-ask-part-1/ [Accessed 04/12/2020].

DE VAUS, D. & DE VAUS, D. 2013. *Surveys in social research*, Routledge.

DECOSTER, J. 1998. Overview of factor analysis. Tuscaloosa, AL.

DEMAIO, T. J. 1980. Refusals: Who, where and why. *Public Opinion Quarterly,* 44**,** 223-233.

DEMPSTER, A. P., LAIRD, N. M. & RUBIN, D. B. 1977. Maximum likelihood from incomplete data via the EM algorithm. *Journal of the Royal Statistical Society: Series B (Methodological),* 39**,** 1-22.

DENIS, D. J. 2021. *Applied Univariate, Bivariate, and Multivariate Statistics: Understanding Statistics for Social and Natural Scientists, With Applications in SPSS and R*, John Wiley & Sons.

DESHMUKH, S. P., DESHMUKH, P. & THAMPI, G. 2013. Transformation from E-commerce to M-commerce in Indian Context. *International Journal of Computer Science Issues (IJCSI),* 10**,** 55.

DEVARAJ, S. & KOHLI, R. 2003. Performance impacts of information technology: Is actual usage the missing link? *Management science,* 49**,** 273-289.

DEVELLIS, R. F. & THORPE, C. T. 2021. *Scale development: Theory and applications*, Sage publications.

DO MONTE, P. A. 2017. Public versus private sector: Do workers' behave differently? *EconomiA,* 18**,** 229-243.

DOMÍNGUEZ-ALMENDROS, S., BENÍTEZ-PAREJO, N. & GONZALEZ-RAMIREZ, A. R. 2011. Logistic regression models. *Allergologia et immunopathologia,* 39**,** 295-305.

DONDERS, A. R. T., VAN DER HEIJDEN, G. J., STIJNEN, T. & MOONS, K. G. 2006. A gentle introduction to imputation of missing values. *Journal of clinical epidemiology,* 59**,** 1087-1091.

DONG, L., NEUFELD, D. & HIGGINS, C. 2009. Top management support of enterprise systems implementations. *Journal of Information technology,* 24**,** 55-80.

DONNER, A. 1982. The relative effectiveness of procedures commonly used in multiple regression analysis for dealing with missing values. *The American Statistician,* 36**,** 378-381.

DREW, M. A. & J, S. 2011. E-government principles: implementation, advantages and challenges. *International Journal of Electronic Business,* 9**,** 255-270.

DTI 2000. Business in Information Age-International Bench Marking Study 2000. Department of Trade and Industry.

DUDOVSKIY, J. 2021. *Survey Method* [Online]. Available: https://research-methodology.net/research-methods/survey-method/ [Accessed 06/05/2021 2021].

DUTTA, S., LANVIN, B. & PAUA, F. 2004. *The global information technology report 2003-2004: Towards an equitable information society*, Oxford University Press, USA.

DWIVEDI, Y. K., PAPAZAFEIROPOULO, A., PARKER, C. M. & CASTLEMAN, T. 2009a. Small firm e-business adoption: a critical analysis of theory. *Journal of enterprise information management*.

DWIVEDI, Y. K., PAPAZAFEIROPOULO, A. & SCUPOLA, A. 2009b. SMEs'e-commerce adoption: perspectives from Denmark and Australia. *Journal of Enterprise Information Management*.

DWIVEDI, Y. K., RANA, N. P., JEYARAJ, A., CLEMENT, M. & WILLIAMS, M. D. 2019. Re-examining the Unified Theory of Acceptance and Use of Technology (UTAUT): Towards a Revised Theoretical Model. *Information Systems Frontiers,* 21**,** 719-734.

E-MARKETER. 2019. Global Ecommerce 2019. Available: https://www.emarketer.com/content/global-ecommerce-2019 [Accessed 28/10/2020].

EASTERBY-SMITH, M., THORPE, R. & JACKSON, P. R. 2012. *Management research*, Sage.

ECKHARDT, A., LAUMER, S. & WEITZEL, T. 2009. Who Influences Whom? Analyzing Workplace Referents' Social Influence on it Adoption and Non-Adoption. *Journal of Information Technology,* 24**,** 11-24.

EDEN, S., HOYER , A.-L., NIEMEIER, D. & PETERS, L. 2020. eCommerce in Pakistan 2020. *E-Commerce DB Country Reports.* online: Ststista.

EFFENDI, M. I., SUGANDINI, D. & ISTANTO, Y. 2020. Social media adoption in SMEs impacted by COVID-19: The TOE Model. *The Journal of Asian Finance, Economics, and Business,* 7**,** 915-925.

EIN-DOR, P., MYERS, M. D. & RAMAN, K. 1997. Information technology in three small developed countries. *Journal of Management Information Systems,* 13**,** 61-89.

EJIAKU, S. A. 2014. Technology adoption: Issues and challenges in information technology adoption in emerging economies. *Journal of International Technology and Information Management,* 23**,** 5.

ELHASNAOUI, S. 2021. Analysis of the role of IT Governance on ERP Systems implementation. *International Journal of Web-Based Learning and Teaching Technologies (IJWLTT),* 16**,** 18-26.

ELIA, S., GIUFFRIDA, M., MARIANI, M. M. & BRESCIANI, S. 2021. Resources and digital export: An RBV perspective on the role of digital technologies and capabilities in cross-border e-commerce. *Journal of Business Research,* 132**,** 158-169.

EMMITT, S. 1997. *The diffusion of innovations in the building industry.* University of Manchester.

ENACHE, M. C. 2018. E-commerce Trends *Economics and Applied Informatics,* 24**,** 67-71.

ENDERS, C. K. 2001. The impact of nonnormality on full information maximum-likelihood estimation for structural equation models with missing data. *Psychological methods,* 6**,** 352.

ENG'AIRO, P. & MATE, M. E. 2020. BUSINESS IMPROVEMENT MOTIVE OF HUMAN RESOURCE OUTSOURCING AND PERFORMANCE OUTCOMES AMONG MOBILE TELECOMMUNICATION FIRMS IN KENYA. *African Journal of Emerging Issues,* 2**,** 41-53.

ENGEL, J. 1988. Polytomous logistic regression. *Statistica Neerlandica,* 42**,** 233-252.

ERNST, D. & LUNDVALL, B.-Å. 1997a. Information technology in the learning economy-challenges for developing countries. *Globalization, Economic Development and Inequality***,** 258.

ERNST, D. & LUNDVALL, B.-Å. 1997b. Information technology in the learning economy-challenges for developing countries. *Globalization, Economic Development and Inequality,* 258.

EROZGAAR. 2022. *Pakistan 4th most popular country for freelancing* [Online]. Available: https://www.erozgaar.pitb.gov.pk/Pakistan-4th-freelancing-country#:~:text=Pakistan%20is%20ranked%20as%20the,growth%20of%20the%20IT%20sector. [Accessed 22/08/2022 2022].

ESTEVES, J. & JOSEPH, R. C. 2008. A comprehensive framework for the assessment of eGovernment projects. *Government information quarterly,* 25**,** 118-132.

ETHRIDGE, D. 2004. *Research methodology in applied economics: organizing, planning, and conducting economic research*, Blackwell publishing.

FAGERBERG, J. Innovation: A guide to the literature. 2004. Georgia Institute of Technology.

FAN, W. & YAN, Z. 2010. Factors affecting response rates of the web survey: A systematic review. *Computers in human behavior,* 26**,** 132-139.

FARNHAM, D. & HORTON, S. 1996. Public managers and private managers: Towards a professional synthesis? *New public managers in Europe: Public servants in transition***,** 26-52.

FATHIAN, M., AKHAVAN, P. & HOORALI, M. 2008. E-readiness assessment of non-profit ICT SMEs in a developing country: The case of Iran. *Technovation,* 28**,** 578-590.

FATOKUN, B. O. 2023. *Customers' Affective Responses Towards the Key Factors Influencing E-Commerce Adoption: Extended Technology Acceptance Model (TAM) Approach.* Liverpool john Moores University, UK.

FAULKNER, A. 2016. Opening the gateways to market and adoption of regenerative medicine? The UK case in context. *Regenerative medicine,* 11**,** 321-330.

FÁVERO, L. P. & BELFIORE, P. 2019. Chapter 14 - Binary and Multinomial Logistic Regression Models. *In:* FÁVERO, L. P. & BELFIORE, P. (eds.) *Data Science for Business and Decision Making.* Academic Press.

FAWZY, S. F. & SALAM, E. M. A. 2015. M-Commerce adoption in Egypt: An extension to theory of reasoned action. *The Business & Management Review,* 6**,** 123.

FAYAD, R. & PAPER, D. 2015. The technology acceptance model e-commerce extension: a conceptual framework. *Procedia economics and finance,* 26**,** 1000-1006.

FERKETICH, S., PHILLIPS, L. & VERRAN, J. 1993. Development and administration of a survey instrument for cross-cultural research. *Research in nursing & health,* 16**,** 227-230.

FERRARI, R. 2015. Writing narrative style literature reviews. *Medical writing,* 24**,** 230-235.

FEYERABEND, P. 1985. *Problems of Empiricism: Volume 2: Philosophical Papers*, Cambridge University Press.

FIANYI, I. 2016. Curbing cyber-crime and Enhancing e-commerce security with Digital Forensics. *arXiv preprint arXiv:1610.08369*.

FICHMAN, R. G. & KEMERER, C. F. 1993. Adoption of software engineering process innovations: The case of object orientation. *Sloan management review,* 34**,** 7-7.

FIELD, A. 2013a. *Discovering statistics using IBM SPSS statistics*, sage.

FIELD, A. 2013b. Logistic Regression. *Discovering statistics using IBM SPSS statistics*

sage.

FILZMOSER, P. 2004. *A multivariate outlier detection method*, Citeseer.

FISHBEIN, M. A. & AJZEN, I. 1975. *Belief, attitude, intention and behavior : an introduction to theory andresearch,* Addison-wesley, Addison-wesley.

FITZ-GERALD, L. & CARROLL, J. The role of governance in ERP system implementation. Proceedings of the 14th Australasian conference on information systems, 2003. Citeseer.

FLOM, P. L. 2010. Multinomial and ordinal logistic regression using PROC LOGISTIC. *NESUG. Baltimore*.

FODDY, W. & FODDY, W. H. 1994. *Constructing questions for interviews and questionnaires: Theory and practice in social research*, Cambridge university press.

FORNELL, C. & BOOKSTEIN, F. L. 1982. Two structural equation models: LISREL and PLS applied to consumer exit-voice theory. *Journal of Marketing research,* 19**,** 440-452.

FORSLUND, H. 2007. Measuring information quality in the order fulfilment process. *International Journal of Quality & Reliability Management*.

FOSTER, L., DIAMOND, I. & BANTON, J. 2014. *Beginning statistics: An introduction for social scientists*, Sage.

FOWLER JR, F. J. 2013. *Survey research methods*, Sage publications.

FRANK, L. 2004. Architecture for integration of distributed ERP systems and e-commerce systems. *Industrial Management & Data Systems*.

FRASER, P., MOULTRIE, J. & GREGORY, M. The use of maturity models/grids as a tool in assessing product development capability. IEEE international engineering management conference, 2002. IEEE, 244-249.

FREEZE, R. & RASCHKE, R. L. 2007. An assessment of formative and reflective constructs in IS research.

FULLER, M. A., SERVA, M. A. & BAROUDI, J. 2009. Clarifying the integration of trust and TAM in e-commerce environments: implications for systems design and management. *IEEE Transactions on Engineering Management,* 57**,** 380-393.

GALLIERS, R. D., MADON, S. & RASHID, R. 1998. Information systems and culture: Applying 'stages of growth'concepts to development administration. *Information technology for Development,* 8**,** 89-100.

GANGWAL, N. & BANSAL, V. Application of decomposed theory of planned behavior for m-commerce adoption in India. International Conference on Enterprise Information Systems, 2016. Scitepress, 357-367.

GANGWAR, H., DATE, H. & RAMASWAMY, R. 2015. Understanding determinants of cloud computing adoption using an integrated TAM-TOE model. *Journal of enterprise information management*.

GAO, S., KROGSTIE, J. & SIAU, K. 2011. Developing an instrument to measure the adoption of mobile services. *Mobile information systems,* 7**,** 45-67.

GARCÍA-GRANERO, A., LLOPIS, Ó., FERNÁNDEZ-MESA, A. & ALEGRE, J. 2015. Unraveling the link between managerial risk-taking and innovation: The mediating role of a risk-taking climate. *Journal of Business Research,* 68**,** 1094-1104.

GARCÍA-SÁNCHEZ, E., OSBORNE, D., WILLIS, G. B. & RODRÍGUEZ-BAILÓN, R. 2020. Attitudes towards redistribution and the interplay between perceptions and beliefs about inequality. *British Journal of Social Psychology,* 59**,** 111-136.

GARLAND, A. F., BICKMAN, L. & CHORPITA, B. F. 2010. Change what? Identifying quality improvement targets by investigating usual mental health care. *Administration and Policy in Mental Health and Mental Health Services Research,* 37**,** 15-26.

GATIGNON, H. 2014. Confirmatory factor analysis. *Statistical analysis of management data.* Springer.

GEFEN, D. 2000. Lessons learnt from the successful adoption of an ERP: The central role of trust. *Decision making: Recent developments and worldwide applications.* Springer.

GEFEN, D., KARAHANNA, E. & STRAUB, D. W. 2003. Trust and TAM in online shopping: An integrated model. *MIS quarterly,* 27**,** 51-90.

GEFEN, D. & STRAUB, D. 2000a. The relative importance of perceived ease of use in IS adoption: A study of e-commerce adoption. *Journal of the association for Information Systems,* 1**,** 1-30.

GEFEN, D. & STRAUB, D. W. 2000b. The relative importance of perceived ease of use in IS adoption: A study of e-commerce adoption. *Journal of the association for Information Systems,* 1**,** 8.

GHOBAKHLOO, M., ARIAS-ARANDA, D. & BENITEZ-AMADO, J. 2011. Adoption of e-commerce applications in SMEs. *Industrial Management & Data Systems*.

GHOURI, M. W. A., HUSSAIN, M. A., KANWAL, T., AFZAL, B. & RASHEED, M. 2018. Influence of E-Commerce on Business Growth in Pakistan: An Approach to Analyze Privacy, Threats and Consumer Trust in Business. *International Journal of Computer Science Issues (IJCSI),* 15**,** 27-35.

GIAMPIETRI, E. & TRESTINI, S. 2020. Analysing farmers' intention to adopt web marketing under a technology-organisation-environment perspective: A case study in Italy. *Agricultural Economics,* 66**,** 226-233.

GIBREEL, O., ALOTAIBI, D. A. & ALTMANN, J. 2018. Social commerce development in emerging markets. *Electronic Commerce Research and Applications,* 27**,** 152-162.

GIL-GARCÍA, J. R. 2007. Exploring e-government benefits and success factors. *Encyclopedia of digital government.* IGI Global.

GIL-GARCIA, J. R., DAWES, S. S. & PARDO, T. A. 2018. Digital government and public management research: finding the crossroads. Taylor & Francis.

GIL-GARCÍA, J. R. & PARDO, T. A. 2005. E-government success factors: Mapping practical tools to theoretical foundations. *Government information quarterly,* 22**,** 187-216.

GILLEY, O. W. & LEONE, R. P. 1991. A two-stage imputation procedure for item nonresponse in surveys. *Journal of Business Research,* 22**,** 281-291.

GIUFFRIDA, M., JIANG, H. & MANGIARACINA, R. 2021. Investigating the relationships between uncertainty types and risk management strategies in cross-border e-commerce logistics. *The International Journal of Logistics Management,* 32**,** 1406-1433.

GOLDSTEIN, A. & O'CONNOR, D. 2000. E-commerce for development: prospects and policy issues.

GOLES, T. & HIRSCHHEIM, R. 2000. The paradigm is dead, the paradigm is dead… long live the paradigm: the legacy of Burrell and Morgan. *Omega,* 28**,** 249-268.

GOODMAN, S. N. 1999. Toward evidence-based medical statistics. 1: The P value fallacy. *Annals of internal medicine,* 130**,** 995-1004.

GOP 2018. Digital Pakistan Policy *In:* MOITT (ed.). Government of Pakistan.

GOP 2019a. E- Commerce Policy Framework of Pakistan. *In:* TEXTILE, M. O. C. (ed.). Islamabad, Pakistan: Government of Pakistan.

GOP 2019b. E-COMMERCE POLICY FRAMEWORK OF PAKISTAN. Islamabad, Pakistan.

GOP 2019c. e-COMMERCE POLICY OF PAKISTAN *In:* DIVISION, C. (ed.). Pakistan: Government of Pakistan.

GRAF, T. A. 2020. Unity in the face of threat? Exploring the empirical relationship between strategic threat perceptions and public support for a common European army in Germany. *European Security,* 29**,** 55-73.

GRAHAM, J. W., CUMSILLE, P. E. & SHEVOCK, A. E. 2013. Methods for handling missing data.

GRANDÓN, E. & PEARSON, J. 2004. E-Commerce Adoption: Perceptions of Managers/Owners of Small and Medium Sized Firms in Chile. *Communications of the Association for Information Systems,* 13**,** 81-102.

GRANDON, E. & PEARSON, J. M. 2003. Strategic value and adoption of electronic commerce: an empirical study of Chilean small and medium businesses. *Journal of Global Information Technology Management,* 6**,** 22-43.

GRANDON, E. & PEARSON, J. M. 2004a. E-commerce adoption: perceptions of managers/owners of small and medium sized firms in Chile. *Communications of the association for information systems,* 13**,** 8.

GRANDÓN, E. E., NASCO, S. A. & MYKYTYN JR, P. P. 2011. Comparing theories to explain e-commerce adoption. *Journal of Business Research,* 64**,** 292-298.

GRANDON, E. E. & PEARSON, J. M. 2004b. Electronic commerce adoption: an empirical study of small and medium US businesses. *Information & management,* 42**,** 197-216.

GREENHALGH, T., ROBERT, G., MACFARLANE, F., BATE, P. & KYRIAKIDOU, O. 2004. Diffusion of innovations in service organizations: systematic review and recommendations. *The milbank quarterly,* 82**,** 581-629.

GREGORY, G. D., NGO, L. V. & KARAVDIC, M. 2019. Developing e-commerce marketing capabilities and efficiencies for enhanced performance in business-to-business export ventures. *Industrial Marketing Management,* 78**,** 146-157.

GRIFFIN, M. M. & STEINBRECHER, T. D. 2013. Chapter Four - Large-Scale Datasets in Special Education Research. *In:* URBANO, R. C. (ed.) *International Review of Research in Developmental Disabilities.* Academic Press.

GRIMNES, S. & MARTINSEN, Ø. G. 2015. Chapter 9 - Data and Models. *In:* GRIMNES, S. & MARTINSEN, Ø. G. (eds.) *Bioimpedance and Bioelectricity Basics (Third Edition).* Oxford: Academic Press.

GROVER, V. 1993. An empirically derived model for the adoption of customer-based interorganizational systems. *Decision sciences,* 24**,** 603-640.

GSMA. 2015. Digital inclusion and mobile sector taxation in Pakistan. Available: https://www.gsma.com/publicpolicy/wp-content/uploads/2015/02/GSMA2015_Report_DigitalInclusionAndMobileSectorTaxationInPakistan.pdf [Accessed 30/11/2020].

GSMA. 2016. Country overview: Pakistan. Available: https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2016/12/Country-Overview_Pakistan_Digital-Future.pdf [Accessed 30/11/2020].

GSMA. 2019. The power of mobile to accelerate digital transformation in Pakistan. Available: https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2019/10/The-Power-of-Mobile-to-Accelerate-Digital-Transformation-in-Pakistan-2019.pdf [Accessed 30/11/2020].

GSMA 2020. Pakistan: progressing towards a fully fledged digital economy. London, UK: GSMA.

GUADAGNOLI, E. & VELICER, W. F. 1988. Relation of sample size to the stability of component patterns. *Psychological bulletin,* 103**,** 265.

GUNASEKARAN, A., MARRI, H., MCGAUGHEY, R. & NEBHWANI, M. 2002. E-commerce and its impact on operations management. *International journal of production economics,* 75**,** 185-197.

GURARA, D., KLYUEV, M. V., MWASE, M., PRESBITERO, A., XU, X. C. & BANNISTER, M. G. J. 2017. *Trends and challenges in infrastructure investment in low-income developing countries*, International Monetary Fund.

HADI, A. S., IMON, A. R. & WERNER, M. 2009. Detection of outliers. *Wiley Interdisciplinary Reviews: Computational Statistics,* 1**,** 57-70.

HADIDI, R. 2003. The Status of E-finance in Developing Countries. *The Electronic Journal of Information Systems in Developing Countries,* 11**,** 1-5.

HAGGER, M. S. & CHATZISARANTIS, N. L. 2009. Integrating the theory of planned behaviour and self-determination theory in health behaviour: A meta-analysis. *British journal of health psychology,* 14**,** 275-302.

HAIDER, A. & NASIR, N. 2016. Factors affecting online shopping behavior of consumers in Lahore, Pakistan. *Journal of Management Engineering and Information Technology,* 3**,** 9-14.

HAIR, J. F. 1992. *Multivariate data analysis with readings,* New York : Toronto : New York, New York : Macmillan

Toronto : Maxwell Macmillan Canada

New York : Maxwell Macmillan International.

HAIR, J. F. 2017. *A primer on partial least squares structural equation modeling (PLS-SEM)*, Thousand Oaks, California : SAGE Publications, Inc.

HAIR, J. F., BLACK, W. C., BABIN, B. J., ANDERSON, R. E. & TATHAM, R. L. 2006. Multivariate data analysis 6th Edition. New Jersey: Prentice Hall.

HAIR, J. F., HENSELER, J., DIJKSTRA, T. K. & SARSTEDT, M. 2014. Common beliefs and reality about partial least squares: comments on Rönkkö and Evermann.

HAIR, J. F., HULT, G. T. M., RINGLE, C. M., SARSTEDT, M. & THIELE, K. O. 2017. Mirror, mirror on the wall: a comparative evaluation of composite-based structural equation modeling methods. *Journal of the academy of marketing science,* 45**,** 616-632.

HAIR, J. F., RINGLE, C. M. & SARSTEDT, M. 2011. PLS-SEM: Indeed a silver bullet. *Journal of Marketing theory and Practice,* 19**,** 139-152.

HAIR, J. F., RISHER, J. J., SARSTEDT, M. & RINGLE, C. M. 2019. When to use and how to report the results of PLS-SEM. *European business review*.

HAIR JR, J. F., HULT, G. T. M., RINGLE, C. & SARSTEDT, M. 2016. *A primer on partial least squares structural equation modeling (PLS-SEM)*, Sage publications.

HAIR JR, J. F., MATTHEWS, L. M., MATTHEWS, R. L. & SARSTEDT, M. 2017. PLS-SEM or CB-SEM: updated guidelines on which method to use. *International Journal of Multivariate Data Analysis,* 1**,** 107-123.

HAJLI, M. 2013. A research framework for social commerce adoption. *Information Management & Computer Security*.

HAJLI, N., SIMS, J. & SHANMUGAM, M. 2014a. A practical model for e-commerce adoption in Iran. *Journal of Enterprise Information Management,* 27**,** 719-730.

HAJLI, N., SIMS, J. & SHANMUGAM, M. 2014b. A practical model for e-commerce adoption in Iran. *Journal of Enterprise Information Management*.

HAKIM, C. 2000. *Research design: Successful designs for social and economic research*, Psychology Press.

HALLIKAINEN, H. & LAUKKANEN, T. 2018. National culture and consumer trust in e-commerce. *International Journal of Information Management,* 38**,** 97-106.

HANAFIAH, M. H. 2020. Formative vs. reflective measurement model: Guidelines for structural equation modeling research. *International Journal of Analysis and Applications,* 18**,** 876-889.

HANAFIZADEH, P., HANAFIZADEH, M. R. & KHODABAKHSHI, M. 2009. Taxonomy of e-readiness assessment measures. *International Journal of Information Management,* 29**,** 189-195.

HANIF, M. S., YUNFEI, S. & HANIF, M. 2017. Growth prospects, market challenges and policy measures: Evolution of mobile broadband in Pakistan. *Digital Policy, Regulation and Governance,* 20**,** 00-00.

HARDY, S. E., ALLORE, H. & STUDENSKI, S. A. 2009. Missing data: a special challenge in aging research. *Journal of the American Geriatrics Society,* 57**,** 722-729.

HARRISON, A. & RODRÍGUEZ-CLARE, A. 2010. Chapter 63 - Trade, Foreign Investment, and Industrial Policy for Developing Countries*. *In:* RODRIK, D. & ROSENZWEIG, M. (eds.) *Handbook of Development Economics.* Elsevier.

HARTMAN, A., KADOR, J. & SIFONIS, J. G. 2001. *Net Ready: Strategies for Success in the E-conomy*, McGraw-Hill, Inc.

HASAN, M. M. 2019. *Difference Between Positivism and Realism* [Online]. EPEDIAA. Available: https://pediaa.com/difference-between-positivism-and-realism/#:~:text=The%20main%20difference%20between%20positivism,world%20exists%20independent%20of%20our [Accessed 01/05/2021 2021].

HASBULLAH, N. A., OSMAN, A., ABDULLAH, S., SALAHUDDIN, S. N., RAMLEE, N. F. & SOHA, H. M. 2016. The relationship of attitude, subjective norm and website usability on consumer intention to purchase online: An evidence of Malaysian youth. *Procedia Economics and Finance,* 35**,** 493-502.

HASHEELA MISS, V. T. & MUFETI DR, T. K. 2016. An investigation of factors leading to the reluctance of SaaS ERP adoption in Namibian SMEs. *The African Journal of Information Systems,* 8**,** 1.

HASHIM, S., SADDOZAI, A. K., JAMIL, S. & SADDOZAI, F. K. 2013. Role of E-commerce in Foreign Trade Promotion: Some Evidence from Pakistan. *European Journal of Business and Management*.

HASSAN, M., IQBAL, Z. & KHANUM, B. 2018. The role of trust and social presence in social commerce purchase intention. *Pakistan Journal of Commerce and Social Sciences (PJCSS),* 12**,** 111-135.

HASSAN, M. M. & LEE, G. 2021. Online Payment Options And Consumer Trust: Determinants Of E-Commerce In Africa: Reference: Hassan, M., & Lee, G.(2021). Online payment options and consumer trust: determinants of e-commerce in Africa. International Journal of Entrepreneurial Knowledge, 9 (2), 1-13. *International Journal of Entrepreneurial Knowledge,* 9**,** 1-13.

HASSAN, Z. A., SCHATTNER, P. & MAZZA, D. 2006. Doing a pilot study: why is it essential? *Malaysian family physician: the official journal of the Academy of Family Physicians of Malaysia,* 1**,** 70.

HAWKINS, D. M. 1980. *Identification of outliers*, Springer.

HEC. 2022. *Universities* [Online]. Higher Education Commission Available: https://www.hec.gov.pk/english/universities/pages/recognised.aspx [Accessed 22/08/2022 2022].

HENDRICKS, S. & MWAPWELE, S. D. 2023. A systematic literature review on the factors influencing e-commerce adoption in developing countries. *Data and Information Management***,** 100045.

HENSELER, J., DIJKSTRA, T. K., SARSTEDT, M., RINGLE, C. M., DIAMANTOPOULOS, A., STRAUB, D. W., KETCHEN JR, D. J., HAIR, J. F., HULT, G. T. M. & CALANTONE, R. J. 2014. Common beliefs and reality about PLS: Comments on Rönkkö and Evermann (2013). *Organizational research methods,* 17**,** 182-209.

HENSELER, J., HUBONA, G. & RAY, P. 2016. Using PLS Path Modeling in New Technology Research: Updated Guidelines. *Industrial Management &amp Data Systems,* 116**,** 2-20.

HENSELER, J., RINGLE, C. M. & SARSTEDT, M. 2015. A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the academy of marketing science,* 43**,** 115-135.

HERON, J. 1996. *Co-operative inquiry: Research into the human condition*, Sage.

HESTERBRINK, C. 1999. e-Business and ERP: Bringing two Paradigms together. *PriceWaterhouse Coopers, Sept*.

HO, J., TUMKAYA, T., ARYAL, S., CHOI, H. & CLARIDGE-CHANG, A. 2019. Moving beyond P values: data analysis with estimation graphics. *Nature methods,* 16**,** 565-566.

HODGE, V. & AUSTIN, J. 2004. A survey of outlier detection methodologies. *Artificial intelligence review,* 22**,** 85-126.

HONG, W. & ZHU, K. 2006. Migrating to internet-based e-commerce: Factors affecting e-commerce adoption and migration at the firm level. *Information & Management,* 43**,** 204-221.

HOQUE, M. & BOATENG, R. 2017. Adoption of B2B e-commerce in developing countries: evidence from ready made garment (RMG) industry in Bangladesh. *Pacific Asia Journal of the Association for Information Systems,* 9**,** 4.

HOQUE, R. & SORWAR, G. 2017. Understanding factors influencing the adoption of mHealth by the elderly: An extension of the UTAUT model. *International journal of medical informatics,* 101**,** 75-84.

HOSMER, D. W., LEMESHOW, S. & COOK, E. 2000a. Applied logistic regression 2nd edition. *New York: Jhon Wiley and Sons Inc*.

HOSMER, D. W., LEMESHOW, S. & STURDIVANT, R. X. 2000b. *Applied logistic regression*, Wiley New York.

HOX, J. J. & BECHGER, T. M. 1998. An introduction to structural equation modeling.

HRISOS, S., ECCLES, M. P., FRANCIS, J. J., DICKINSON, H. O., KANER, E. F., BEYER, F. & JOHNSTON, M. 2009. Are there valid proxy measures of clinical behaviour? A systematic review. *Implementation Science,* 4**,** 1-20.

HSIEH, P.-H., HUANG, C. & YEN, D. C. 2013. Assessing web services of emerging economies in an Eastern country—Taiwan's e-government. *Government Information Quarterly,* 30**,** 267-276.

HSU, H.-Y., LIU, F.-H., TSOU, H.-T. & CHEN, L.-J. 2018. Openness of technology adoption, top management support and service innovation: a social innovation perspective. *Journal of Business & Industrial Marketing*.

HU, L.-T. & BENTLER, P. M. 1998. Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. *Psychological methods,* 3**,** 424.

HU, L.-T., BENTLER, P. M. & KANO, Y. 1992. Can test statistics in covariance structure analysis be trusted? *Psychological bulletin,* 112**,** 351.

HU, L. T. & BENTLER, P. M. 1999. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural equation modeling: a multidisciplinary journal,* 6**,** 1-55.

HUA, C., CHOI, Y.-J. & SHI, Q. 2021. *Multinomial Logistic Regression* [Online]. Available: https://bookdown.org/chua/ber642_advanced_regression/multinomial-logistic-regression.html [Accessed 26/11/2021 2021].

HUANG, H., GARTNER, G., KRISP, J. M., RAUBAL, M. & VAN DE WEGHE, N. 2018. Location based services: ongoing evolution and research agenda. *Journal of Location Based Services,* 12**,** 63-93.

HUANG, Y.-W., HUANG, S.-K., LIN, T.-P. & TSAI, C.-H. Web application security assessment by fault injection and behavior monitoring. Proceedings of the 12th international conference on World Wide Web, 2003. 148-159.

HUANG, Z. & PALVIA, P. 2001. ERP implementation issues in advanced and developing countries. *Business process management journal*.

HULLAND, J., CHOW, Y. H. & LAM, S. 1996. Use of causal models in marketing research: A review. *International journal of research in marketing,* 13**,** 181-197.

HUMPHREY, J., MANSELL, R., PARE, D. & SCHMITZ, H. 2003a. The Reality of E-commerce with Developing Countries. London: London School of Economics.

HUMPHREY, J., MANSELL, R., PARÉ, D. & SCHMITZ, H. 2003b. Reality of e-commerce with developing countries.

HUMPHRIES, M. 2013. Missing Data & How to Deal: An overview of missing data. *Population Research Center. University of Texas. Recuperado de: http://www. google. com/url***,** 39-41.

HUNG, W.-H., CHANG, L.-M., LIN, C.-P. & HSIAO, C.-H. 2014. E-readiness of website acceptance and implementation in SMEs. *Computers in Human Behavior,* 40**,** 44-55.

HUNT, S. D., SPARKMAN JR, R. D. & WILCOX, J. B. 1982. The pretest in survey research: Issues and preliminary findings. *Journal of marketing research,* 19**,** 269-273.

HUSSAIN, A., SHAHZAD, A. & HASSAN, R. 2020. Organizational and environmental factors with the mediating role of e-commerce and SME performance. *Journal of Open Innovation: Technology, Market, and Complexity,* 6**,** 196.

HUSSAIN, A., SHAHZAD, A., HASSAN, R. & DOSKI, S. A. 2021. COVID-19 impact on B2B e-commerce: A multi-group analysis of sports and surgical SME's. *Pakistan Journal of Commerce and Social Sciences (PJCSS),* 15**,** 166-195.

HUSSAIN, J., RABBANI, I., ASLAM, S. & AHMAD, H. 2015. An overview of poultry industry in Pakistan. *World's poultry science journal,* 71**,** 689-700.

HYÖTYLÄINEN, R. 1998. *Implementation of technical change as organizational problem-solving process: management and user activities*, VTT Technical Research Centre of Finland.

IACOBUCCI, D. 2009. Everything you always wanted to know about SEM (structural equations modeling) but were afraid to ask. *Journal of Consumer Psychology,* 19**,** 673-680.

IACOBUCCI, D. & CHURCHILL, G. A. 2010. Marketing research. *Methodological foundations,* 10.

IAN. 2011. Normality tests don't do what you think they do. Available: https://www.r-bloggers.com/2011/10/normality-tests-don%E2%80%99t-do-what-you-think-they-do/ [Accessed 11/02/2022].

IBM. 2003. How e-government are you? Available: https://www-07.ibm.com/services/pdf/bcs_egovernment.pdf [Accessed 19/11/2020].

IBM. 2020. Pairwise vs. Listwise deletion: What are they and when should I use them? Available: https://www.ibm.com/support/pages/pairwise-vs-listwise-deletion-what-are-they-and-when-should-i-use-them [Accessed 08/03/2022].

IBM. 2021. Multinomial Logistic Regression. Available: https://www.ibm.com/docs/en/spss-statistics/27.0.0?topic=regression-multinomial-logistic [Accessed 18/02/2023].

IBM. 2022. Adjusted R Squared. Available: https://www.ibm.com/docs/en/cognos-analytics/11.1.0?topic=terms-adjusted-r-squared [Accessed 30/03/2022].

IBRAHIM, J. C. H. 2007. Fundamental of Development Administration. Selangor: Scholar Press.

IDREES, S., VIGNALI, G. & GILL, S. 2020. Technological Advancement in Fashion Online Retailing: A Comparative Study of Pakistan and UK Fashion E-Commerce. *International Journal of Economics and Management Engineering,* 14**,** 318-333.

IFINEDO, P. & SINGH, M. 2011. Determinants of eGovernment maturity in the transition economies of Central and Eastern Europe. *Electronic Journal of e-government,* 9**,** 166.

IGBARIA, M., GUIMARAES, T. & DAVIS, G. B. 1995. Testing the determinants of microcomputer usage via a structural equation model. *Journal of management information systems,* 11**,** 87-114.

IMF. 2024. *WORLD ECONOMIC OUTLOOK* [Online]. International Monetory Fund. Available: https://www.imf.org/external/datamapper/profile/PAK [Accessed 08/03/2024 2024].

IMTIAZ, S., ALI, S. H. & KIM, D. J. 2020. E-Commerce Growth in Pakistan: Privacy, Security, and Trust as Potential Issues. *Culinary Science & Hospitality Research,* 26**,** 10-18.

INDRASTRA. 2018. A brief note on degital payment systems in Pakistan. Available: https://zenodo.org/record/1217840/files/indrastra.com-A%20Brief%20Note%20on%20Digital%20Payment%20Systems%20in%20Pakistan.pdf.

INTERNET WORLD STATS 2020. Internet Usage in Asia. Internet World Stats.

ISAAC, O., ABDULLAH, Z., ALDHOLAY, A. H. & AMEEN, A. A. 2019. Antecedents and outcomes of internet usage within organisations in Yemen: An extension of the Unified Theory of Acceptance and Use of Technology (UTAUT) model. *Asia Pacific Management Review,* 24**,** 335-354.

ISPAK. 2020. *History of Internet in Pakistan* [Online]. Internet Service Providers Association of Pakistan. Available: https://ispak.pk/history-of-internet-in-pakistan/#:~:text=The%20Internet%20industry%20in%20Pakistan,%2DNet%20in%201992%2

D93.&text=In%201995%2C%20Digicom%2C%20an%20entrepreneurial,of%20Internet%20industry%20in%20Pakistan. [Accessed 10/10/2020 2020].

ITGOVERNANCE. 2021. *IT governance* [Online]. it governance. Available: https://www.itgovernance.co.uk/it_governance [Accessed 08/04/2021 2021].

JACKSON, S. L. 2015. *Research methods and statistics: A critical thinking approach*, Cengage Learning.

JAJJA, S. 2018. As Alibaba buys Daraz, many ask: what next? Available: https://www.dawn.com/news/1406501 [Accessed 29/11/2020].

JAMIESON, L. F. & BASS, F. M. 1989. Adjusting stated intention measures to predict trial purchase of new products: A comparison of models and methods. *Journal of Marketing Research,* 26**,** 336-345.

JAMSHIDIAN, M. 2004. Strategies for analysis of missing data. *Handbook of Data Analysis. Sage Publication***,** 113-130.

JANOWSKI, A. & BEDNARCZYK, M. Considerations on Indoor Navigation Based on Cheap Mobile Devices. 2016 Baltic Geodetic Congress (BGC Geomatics), 2016. IEEE, 78-84.

JARRELL, M. G. 1992. A comparison of two procedures, the Mahalanobis distance and the Andrews-Pregibon statistic, for identifying multivariate outliers.

JAVED, A. 2020a. Prospects and Problems for E-commerce in Pakistan. *Asian Journal of Economics, Finance and Management***,** 131-139.

JAVED, A. 2020b. Prospects and Problems for E-commerce in Pakistan. *Asian Journal of Economics, Finance and Management***,** 295-303.

JAZZ. 2020a. *4G devices* [Online]. Mobilink Pakistan. Available: https://jazz.com.pk/4gdevices/ [Accessed 30/11/2020 2020].

JAZZ. 2020b. *4G Devices* [Online]. Jazz. Available: https://jazz.com.pk/4gdevices [Accessed 13/10/2020].

JENTZSCH, R. & MINIOTAS, A. The Application of E-commerce to a SME. 1999. Proc. 10th Australasian Conference

JOHANNESSON, P. & PERJONS, E. 2014. *An introduction to design science*, Springer.

JOHAR, M. G. M. & AWALLUDDIN, J. A. A. 2011. The role of technology acceptance model in explaining effect on e-commerce application system. *International Journal of Managing Information Technology,* 3**,** 1-14.

JOHN, R. 2018. *Ecommerce business models* [Online]. medium.com. Available: https://medium.com/@riyajohn9495/ecommerce-business-models-e531f572dc6a [Accessed 06/02/2021 2021].

JOHNSON, B. & CHRISTENSEN, L. 2000. *Educational research: Quantitative and qualitative approaches*, Allyn & Bacon.

JOHNSON, D. & TURNER, C. 2010. *International business: Themes and issues in the modern global economy*, Routledge.

JOSEPH, R. C. 2013. A structured analysis of e-government studies: Trends and opportunities. *Government Information Quarterly,* 30**,** 435-440.

JUDD, C. M., MCCLELLAND, G. H. & RYAN, C. S. 2011. *Data analysis: A model comparison approach*, Routledge.

KABANDA, S. & BROWN, I. Factors that affect e-commerce adoption in Tanzanian SMEs. International Conference on Information Management and Evaluation, 2010. Academic Conferences International Limited, 153.

KABANDA, S. & BROWN, I. 2017. A structuration analysis of Small and Medium Enterprise (SME) adoption of E-Commerce: The case of Tanzania. *Telematics and Informatics,* 34**,** 118-132.

KABANDA, S. K. & BROWN, I. 2015. E-commerce enablers and barriers in Tanzanian small and medium enterprises. *The Electronic Journal of Information Systems in Developing Countries,* 67**,** 1-24.

KAHN, R. & DENNIS, M. A. 2020. Internet. Encyclopædia Britannica.

KALAKOTA, R. 1997. *Electronic commerce : a manager's guide,* Reading, Mass., Reading, Mass. : Addison-Wesley.

KAMEL, S. & ASSEM, A. 2003. Assessing the Introduction of Electronic Banking in Egypt Using the Technology Acceptance Model. *Annals of Cases on Information Technology,* 5**,** 1-25.

KAMEL, S. & HUSSEIN, M. 2004. King hotel goes online: The case of a medium enterprise in using eCommerce. *Journal of Electronic Commerce in Organizations (JECO),* 2**,** 102-116.

KAN, M. P. H. & FABRIGAR, L. R. 2017. Theory of Planned Behavior. *In:* ZEIGLER-HILL, V. & SHACKELFORD, T. K. (eds.) *Encyclopedia of Personality and Individual Differences.* Cham: Springer International Publishing.

KANTI SRIKANTAIAH, T. & XIAOYING, D. 1998. The Internet and its impact on developing countries: examples from China and India. *Asian Libraries,* 7**,** 199-209.

KAREEN, P., PURWANDARI, B., WILARSO, I. & PRATAMA, M. O. E-commerce adoption in SME: A systematic review. 2018 6th International conference on cyber and IT service management (CITSM), 2018. IEEE, 1-7.

KARIA, N. & SOLIMAN, M. 2017. Factors affecting enterprise resource planning (ERP) systems adoption among higher education institutions in Egypt. *Int. J. Adv. Appl. Sci,* 4**,** 144-151.

KASHADA, A., LI, H. & KOSHADAH, O. 2018. Analysis Approach to Identify Factors Influence Digital Learning Technology Adoption and Utilization in Developing Countries. *International Journal of Emerging Technologies in Learning,* 13.

KAUSHIK, V. & WALSH, C. A. 2019. Pragmatism as a research paradigm and its implications for social work research. *Social Sciences,* 8**,** 255.

KEIL, M., BERANEK, P. M. & KONSYNSKI, B. R. 1995. Usefulness and ease of use: field study evidence regarding task considerations. *Decision support systems,* 13**,** 75-91.

KEMAL, A. R. 1998. Electronic commerce and international trade of Pakistan. *The Pakistan Development Review***,** 849-859.

KEVIN, Z., KRAEMER, K. & XU, S. 2006. The Process of Innovation Assimilation by Firms in Different Countries: A Technology Diffusion Perspective on E-Business. *Management Science,* 52**,** 1557-1576.

KHALID, K. & SIDDIQUI, D. A. 2019. Branding with Vlogs, Factor Affecting Their Success. *Khalid, K. and Siddiqui, DA (2019). Branding with Vlogs, Factor Affecting Their Success. Business and Management Horizons,* 7**,** 49-77.

KHAN, A. U. 2016. E-Commerce potential in Pakistan economy. Available: https://pakobserver.net/e-commerce-potential-in-pakistan-economy/ [Accessed November 23].

KHAN, F., KHAN, S. & ZHANG, B. E-government challenges in developing countries: a case study of Pakistan. 2010 International Conference on Management of e-Commerce and e-Government, 2010. IEEE, 200-203.

KHAN, M. 2018. One wallet to rule them all? *Dawn*.

KHAN, M. A., ZUBAIR, S. S. & MALIK, M. 2019. An assessment of e-service quality, e-satisfaction and e-loyalty: Case of online shopping in Pakistan. *South Asian Journal of Business Studies,* 8**,** 283-302.

KHAN, M. D., KHAN, F. & KHAN, M. E. 2014a. Growing Importance of E-Commerce in Global Market. *Information and Knowledge Management* 4.

KHAN, M. H. 2002. When is economic growth pro-poor? Experiences in Malaysia and Pakistan.

KHAN, S. 2019. Situation analysis of health care system of Pakistan: post 18 amendments. *Health Care Current Reviews,* 7**,** 244.

KHAN, S. A., LIANG, Y. & SHAHZAD, S. 2014b. Adoption of electronic supply chain management and e-commerce by small and medium enterprises and their performance: A survey of SMEs in Pakistan. *American Journal of Industrial and Business Management,* 2014.

KHAN, S. H. & ARSHAD, M. Z. 2010. Why e-commerce remains unsuccessful in Pakistan.

KHAN, Z. A. 2011. Military operations in FATA and PATA. *Strategic Studies,* 31**,** 129-146.

KHASKHELI, A. & JUN, Y. 2016. A Review on the Importance of E-Commerce for SMEs in Pakistan. *RISUS-Journal on Innovation and Sustainability,* 7.

KHOKHAR, T. & SERAJUDDIN, U. 2015a. Should we continue to use the term “developing world”? *World Bank Blogs* [Online]. Available: https://blogs.worldbank.org/opendata/should-we-continue-use-term-developing-world.

KHOKHAR, T. & SERAJUDDIN, U. 2015b. Should we continue to use the term “developing world”? *World Bank Blogs*.

KHOO, V., AHMI, A. & SAAD, R. A.-J. A comprehensive review on e-commerce research. AIP Conference Proceedings, 2018. AIP Publishing LLC, 020069.

KIANI, K. 2013. Poor infrastructure a major hurdle to growth. *The Dawn*, 23/09/2013.

KILLAM, L. 2013. *Research terminology simplified: Paradigms, axiology, ontology, epistemology and methodology*, Laura Killam.

KIMBERLY, J. R. & EVANISKO, M. J. 1981. Organizational innovation: The influence of individual, organizational, and contextual factors on hospital adoption of technological and administrative innovations. *Academy of management journal,* 24**,** 689-713.

KING, J. E. 2011. Binary Logistic Regression *In:* OSBORNE, J. (ed.) *Best practices in quantitative methods.* Sage.

KLOPPING, I. M. & MCKINNEY, E. 2004. Extending the technology acceptance model and the task-technology fit model to consumer e-commerce. *Information Technology, Learning & Performance Journal,* 22.

KOIVUMÄKI, T., RISTOLA, A. & KESTI, M. 2008. The perceptions towards mobile services: an empirical analysis of the role of use facilitators. *Personal and Ubiquitous Computing,* 12**,** 67-75.

KOR, K. & MULLAN, B. A. 2011. Sleep hygiene behaviours: An application of the theory of planned behaviour and the investigation of perceived autonomy support, past behaviour and response inhibition. *Psychology & health,* 26**,** 1208-1224.

KOU, Y., LU, C.-T. & DOS SANTOS, R. F. Spatial outlier detection: a graph-based approach. 19th IEEE International Conference on Tools with Artificial Intelligence (ICTAI 2007), 2007. IEEE, 281-288.

KOUROUTHANASSIS, P. E. & GIAGLIS, G. M. 2012. Introduction to the special issue mobile commerce: the past, present, and future of mobile commerce research. *International Journal of Electronic Commerce,* 16**,** 5-18.

KOZAK, M. & PIEPHO, H. P. 2018. What's normal anyway? Residual plots are more telling than significance tests when checking ANOVA assumptions. *Journal of agronomy and crop science,* 204**,** 86-98.

KRAEMER, K. L., DEDRICK, J., MELVILLE, N. P. & ZHU, K. 2006. *Global e-commerce: Impacts of National Environment and Policy,* Cambridge, Cambridge: Cambridge University Press.

KSHETRI, N. & DHOLAKIA, N. 2005. E-commerce patterns in South Asia: a look beyond economics. *Journal of Asia-Pacific Business,* 6**,** 63-79.

KUAN, K. K. & CHAU, P. Y. 2001. A perception-based model for EDI adoption in small businesses using a technology–organization–environment framework. *Information & management,* 38**,** 507-521.

KURNIA, S., CHOUDRIE, J., MAHBUBUR, R. M. & ALZOUGOOL, B. 2015a. E-commerce technology adoption: A Malaysian grocery SME retail sector study. *Journal of Business Research,* 68**,** 1906-1918.

KURNIA, S., KARNALI, R. J. & RAHIM, M. M. 2015b. A qualitative study of business-to-business electronic commerce adoption within the Indonesian grocery industry: A multi-theory perspective. *Information & Management,* 52**,** 518-536.

KURUWITAARACHCHI, N. 2020. Structural Equation Modeling Approach to Analyze the IT Governance Moderation in the Relationship of E-Commerce Adoption to Organizational Performance in Sri Lanka. *Global Journal of Computer Science and Technology*.

KUZIC, J., FISHER, J. & SCOLLARY, A. 2002. Electronic commerce benefits, challenges and success factors in the Australian banking and finance industry. *ECIS 2002 Proceedings***,** 60.

KVÅLE, G. & POULSEN, S. V. 2018. The Templatized Aesthetics of Wix: A Social Semiotic Technology Approach to Web Design. *Multimodality and Aesthetics.* Routledge.

KWADWO, M., MARTINSON, A., EVANS, T. & ESTHER, A. 2016. Barriers to e-commerce adoption and implementation strategy: empirical review of small and medium-sized enterprises in Ghana. *British Journal of Economics, Management & Trade,* 13**,** 1-13.

KWAK, C. & CLAYTON-MATTHEWS, A. 2002. Multinomial logistic regression. *Nursing research,* 51**,** 404-410.

KWUN, O., NICKELS, D., ALIJANI, G. S. & OMAR, A. 2010. THE PERCEIVED STRATEGIC VALUE OF ECOMMERCE IN THE FACE OF NATURAL DISASTER: E-COMMERCE ADOPTION BY SMALL BUSINESSES IN POST-KATRINA NEW ORLEANS. *International Journal of Entrepreneurship,* 14**,** 71-84.

LAI, V. S. & GUYNES, J. L. 1997. An assessment of the influence of organizational characteristics on information technology adoption decision: a discriminative approach. *IEEE Transactions on Engineering Management,* 44**,** 146-157.

LALANI, A. 2020. *Top 5 courier companies for COD in Pakistan 2020* [Online]. Available: http://www.internetretailer.pk/2020/04/03/top-5-courier-companies-for-cod-in-pakistan/ [Accessed 02/12/2020 2020].

LARSEN, G. D. 2011. Understanding the early stages of the innovation diffusion process: awareness, influence and communication networks. *Construction Management and Economics,* 29**,** 987-1002.

LAUDON, K. C. & TRAVER, C. G. 2014. *E-commerce Essentials*, Pearson.

LAUDON, K. C. & TRAVER, C. G. 2016. *E-commerce: business, technology, society*.

LAW, C. C. & NGAI, E. W. 2007. ERP systems adoption: An exploratory study of the organizational factors and impacts of ERP success. *Information & Management,* 44**,** 418-432.

LAWRENCE, E., CORBITT, B., TIDEWELL, A., FISHER, J. & LAWRENCE, J. 1998. *Internet commerce: Digital Modals for business,* Sydney, John Wiley & Sons.

LAWRENCE, J. E. & TAR, U. A. 2010. Barriers to e-commerce in developing countries. *Information, society and justice journal,* 3**,** 23-35.

LAYNE, K. & LEE, J. 2001. Developing fully functional E-government: A four stage model. *Government information quarterly,* 18**,** 122-136.

LE, T. T. & KOH, A. C. 2002. A managerial perspective on electronic commerce development in Malaysia. *Electronic commerce research,* 2**,** 7-29.

LEE, D., PARK, J. & AHN, J.-H. 2001. On the explanation of factors affecting e-commerce adoption. *ICIS 2001 Proceedings***,** 14.

LEE, S.-J., AHN, C., SONG, K. M. & AHN, H. 2018. Trust and Distrust in E-Commerce. *Sustainability (Basel, Switzerland),* 10**,** 1015.

LEE, S. L., AININ, S., DEZDAR, S. & MALLASI, H. 2015. Electronic data interchange adoption from technological, organisational and environmental perspectives. *International Journal of Business Information Systems,* 18**,** 299-320.

LEE, Y., KOZAR, K. A. & LARSEN, K. R. 2003. The technology acceptance model: Past, present, and future. *Communications of the Association for information systems,* 12**,** 50.

LEGRIS, P., INGHAM, J. & COLLERETTE, P. 2003. Why do people use information technology? A critical review of the technology acceptance model. *Information & management,* 40**,** 191-204.

LEONARD-BARTON, D. & DESCHAMPS, I. 1988. Managerial influence in the implementation of new technology. *Management science,* 34**,** 1252-1265.

LERTWONGSATIEN, C. & WONGPINUNWATANA, N. 2003. E-Commerce Adoption in Thailand: An Empirical Study of Small and Medium Enterprises (SMEs). *Journal of Global Information Technology Management,* 6**,** 67-83.

LESTARI, D. 2019. Measuring e-commerce adoption behaviour among gen-Z in Jakarta, Indonesia. *Economic Analysis and Policy,* 64**,** 103-115.

LEWIS-BECK, M., BRYMAN, A. E. & LIAO, T. F. 2003. *The Sage encyclopedia of social science research methods*, Sage Publications.

LI, J. 2020. Blockchain Technology Adoption: Examining the Fundamental Drivers. *Proceedings of the 2020 2nd International Conference on Management Science and Industrial Engineering.* Osaka, Japan: Association for Computing Machinery.

LI, P. & XIE, W. 2012. A strategic framework for determining e-commerce adoption. *Journal of Technology Management in China*.

LIAN, J.-W., YEN, D. C. & WANG, Y.-T. 2014. An exploratory study to understand the critical factors affecting the decision to adopt cloud computing in Taiwan hospital. *International Journal of Information Management,* 34**,** 28-36.

LIANG, T.-P. & TURBAN, E. 2011. Introduction to the special issue social commerce: a research framework for social commerce. *International Journal of electronic commerce,* 16**,** 5-14.

LIANG, T.-P. & WEI, C.-P. 2004. Introduction to the special issue: Mobile commerce applications. *International journal of electronic commerce,* 8**,** 7-17.

LIEBOWITZ, S. J. & MARGOLIS, S. E. 1995. Are network externalities a new source of market failure. *Research in Law and Economics,* 17**,** 1-22.

LIEN, A. S. Y. & JIANG, Y. D. 2017. Integration of diffusion of innovation theory into diabetes care. *Journal of diabetes investigation,* 8**,** 259.

LIGHTNER, N. J., YENISEY, M. M., OZOK, A. A. & SALVENDY, G. 2002. Shopping behaviour and preferences in e-commerce of Turkish and American university students: implications from cross-cultural design. *Behaviour & Information Technology,* 21**,** 373-385.

LIMPANITGUL, T., ROBSON, M. & SOREZE, F. 2009. Methodological considerations in a quantitative study examining the relationship between job attitudes and citizenship behaviours. *18th EDAMBA Summer Academy, Soreze, France*.

LIMTHONGCHAI, P. & SPEECE, M. The effect of perceived characteristics of innovation on e-commerce adoption by SMEs in Thailand. Proceedings of the Seventh International Conference on Global Business and Economic Development, Bangkok, Thailand, 2003.

LIN, C.-P. & ANOL, B. 2008. Learning online social support: an investigation of network information technology based on UTAUT. *CyberPsychology & behavior,* 11**,** 268-272.

LIN, H.-F. & LIN, S.-M. 2008. Determinants of e-business diffusion: A test of the technology diffusion perspective. *Technovation,* 28**,** 135-145.

LIN, H. F. & LEE, G. G. 2005. Impact of organizational learning and knowledge management factors on e-business adoption. *Management Decision*.

LIP-SAM, T. & HOCK-EAM, L. 2011. Estimating the determinants of B2B e-commerce adoption among small & medium enterprises. *International Journal of Business & Society,* 12.

LIPSMAN, A., MUDD, G., RICH, M. & BRUICH, S. 2012. The power of "like": How brands reach (and influence) fans through social-media marketing. *Journal of Advertising research,* 52**,** 40-52.

LITTLE, R. J. & RUBIN, D. B. 1989. The analysis of social science data with missing values. *Sociological Methods & Research,* 18**,** 292-326.

LIU, S. M. & YUAN, Q. 2015. The evolution of information and communication technology in public administration. *Public Administration and Development,* 35**,** 140-151.

LLANES, R. P. 2020. E-commerce as a tool to boost the development of Cuban agribusiness companies. *Scientia et technica,* 25**,** 120-126.

LONG, J. S. 1997. Regression models for categorical and limited dependent variables: Advanced quantitative techniques in the Social Sciences Series.

LOOI, H. C. 2005. E-commerce adoption in Brunei Darussalam: A quantitative analysis of factors influencing its adoption. *Communications of the association for information Systems,* 15**,** 3.

LOONEY, R. & CONFLICT, N. P. S. M. C. C. F. C. 2002. IMF Stabilization Programs and the War on Terrorism: Conflicting or Complementary Objectives in Pakistan? *Strategic Insights. Center for Contemporary Conflict (CCC)*.

LU, J. 2003. A model for evaluating e-commerce based on cost/benefit and customer satisfaction. *Information Systems Frontiers,* 5**,** 265-277.

LUARN, P. & LIN, H.-H. 2005. Toward an understanding of the behavioral intention to use mobile banking. *Computers in human behavior,* 21**,** 873-891.

LUNDBLAD, J. P. 2003. A review and critique of Rogers' diffusion of innovation theory as it applies to organizations. *Organization Development Journal,* 21**,** 50.

LUTTIGHUIS, P. O. & BIEMANS, F. 2000. ERP in the E-Commerce Era. *Netherlands: Telematic Institute*.

LYONS, S. T., DUXBURY, L. E. & HIGGINS, C. A. 2006. A comparison of the values and commitment of private sector, public sector, and parapublic sector employees. *Public administration review,* 66**,** 605-618.

MACCALLUM, R. C., WIDAMAN, K. F., ZHANG, S. & HONG, S. 1999. Sample size in factor analysis. *Psychological methods,* 4**,** 84.

MACGREGOR, R. C. & VRAZALIC, L. 2005. A basic model of electronic commerce adoption barriers: A study of regional small businesses in Sweden and Australia. *Journal of small business and enterprise development*.

MACGREGOR, R. C. & VRAZALIC, L. 2006. E-commerce adoption barriers in small business and the differential effects of gender. *Journal of Electronic Commerce in Organizations (JECO),* 4**,** 1-24.

MACIONIS, J. J. & GERBER, L. M. 2011. *Sociology*, Pearson Education Canada.

MACVAUGH, J. & SCHIAVONE, F. 2010. Limits to the diffusion of innovation: A literature review and integrative model. *European journal of innovation management,* 13**,** 197-221.

MADUKU, D. K., MPINGANJIRA, M. & DUH, H. 2016. Understanding mobile marketing adoption intention by South African SMEs: A multi-perspective framework. *International Journal of Information Management,* 36**,** 711-723.

MAHALANOBIS, P. C. On the generalised distance in statistics. Proceedings of the national Institute of Science of India, 1936. 49-55.

MALHOTRA, N. K., NUNAN, D. & BIRKS, D. F. 2017. *Marketing research: An applied approach*, Pearson Education Limited.

MALOUF, R. A comparison of algorithms for maximum entropy parameter estimation. COLING-02: The 6th Conference on Natural Language Learning 2002 (CoNLL-2002), 2002.

MANOVICH, L. 2009. The practice of everyday (media) life: From mass consumption to mass cultural production? *Critical Inquiry,* 35**,** 319-331.

MANSOR, M. F., ABU, N. H., ABASHAH, A. N. & MOHD KASSIM, M. A. Cost reduction and business strategy matters to human resource outsourcing? a validation by HR experts from Government Link Companies (GLC's). MATEC Web of Conferences, 2018. EDP Sciences, 1-7.

MANZOOR, A. 2010. *E-commerce: an introduction*, Amir Manzoor.

MARCATI, A., GUIDO, G. & PELUSO, A. M. 2008. The role of SME entrepreneurs' innovativeness and personality in the adoption of innovations. *Research policy,* 37**,** 1579-1590.

MARINO, K. E. & LANGE, D. R. 1983. Measuring organizational slack: a note on the convergence and divergence of alternative operational definitions. *Journal of Management,* 9**,** 81-92.

MARTÍNEZ-DOMÍNGUEZ, M. & MORA-RIVERA, J. 2020. Internet adoption and usage patterns in rural Mexico. *Technology in society,* 60**,** 101226.

MATSINHE, F. & KABANDA, S. E-Commerce Institutionalisation in Mozambique: Enablers and Barriers. International Conference on Social Implications of Computers in Developing Countries, 2019. Springer, 140-151.

MAZHAR, F., JAM, F. A. & ANWAR, F. 2012. Consumer trust in e-commerce: A study of consumer perceptions in Pakistan. *African Journal of Business Management,* 6**,** 2516-2528.

MCCLURE, D. L. 2000. Electronic Government: Federal Initiatives Are Evolving Rapidly But They Face Significant Challenges. *In:* (GAO), G. A. O. (ed.).

MCCOMBES, S. 2019. An introduction to sampling methods. Available: https://www.scribbr.com/methodology/sampling-methods/ [Accessed 03/06/2021].

MCCOMBES, S. 2020. How to do survey research. Available: https://www.scribbr.com/methodology/survey-research/ [Accessed 06/05/2021].
MCKAY, J. & MARSHALL, P. 2004. *Strategic Management of E-Business,* Brisbane, John Wiley & Sons.
MCKAY, J., MARSHALL, P. & PRANANTO, A. 2000. Stages of maturity for e-business: The SOG-e model. *PACIS 2000 proceedings***,** 3.
MCKNIGHT, D. H., CHOUDHURY, V. & KACMAR, C. 2002. Developing and validating trust measures for e-commerce: An integrative typology. *Information systems research,* 13**,** 334-359.
MCQUERREY, L. 2018. What Are the Qualifications to Be a Senior Level Manager or CEO of a Company? Available: https://work.chron.com/qualifications-senior-level-manager-ceo-company-5265.html [Accessed 13/05/2022].
MEHMOOD, N., SHAH, F., AZHAR, M. & RASHEED, A. 2014. The factors effecting e-banking usage in Pakistan. *Journal of Management Information System and E-commerce,* 1**,** 57-94.
MENARD, S. 2002. *Applied logistic regression analysis*, Sage.
MENSAH, O., BAHTA, A. & MHLANGA, S. E-commerce challenges in Africa: Issues, constraints, opportunities. 2005 Tunis, Tunsinia. World Summit on the Information Society.
METTLER, T., ROHNER, P. & WINTER, R. 2010. Towards a classification of maturity models in information systems. *Management of the interconnected world.* Springer.
MEXMONOV, S. 2020. Actual issues of electronic commerce development in the republic of Uzbekistan. *Архив научных исследований,* 33.
MEYER, A. D. & GOES, J. B. 1988. Organizational assimilation of innovations: A multilevel contextual analysis. *Academy of management journal,* 31**,** 897-923.
MEYER, J. P., STANLEY, D. J., HERSCOVITCH, L. & TOPOLNYTSKY, L. 2002. Affective, continuance, and normative commitment to the organization: A meta-analysis of antecedents, correlates, and consequences. *Journal of vocational behavior,* 61**,** 20-52.
MGI 2022. THE POWER OF PARITY: ADVANCING WOMEN'S EQUALITY IN ASIA PACIFIC. McKinsey Global Institute.
MIDDLETON, F. 2022. Reliability vs Validity in Research | Differences, Types and Examples. Available: https://www.scribbr.com/methodology/reliability-vs-validity/#:~:text=Reliability%20and%20validity%20are%20concepts,the%20accuracy%20of%20a%20measure.
MIGIRO, S. O. 2006. Diffusion of ICTs and E-commerce adoption in manufacturing SMEs in Kenya. *South African Journal of Libraries and Information Science,* 72**,** 35-44.
MILLER, S. J. 2017. The method of least squares. *The Probability Lifesaver.* Princeton University Press.
MINITABEXPRESS. 2019. *Interpret the key results for Binary Logistic Regression* [Online]. Minitab. Available: https://support.minitab.com/en-us/minitab-express/1/help-and-how-to/modeling-statistics/regression/how-to/binary-logistic-regression/interpret-the-results/key-results/ [Accessed 26/11/2021 2021].
MISHRA, P., PANDEY, C. M., SINGH, U., GUPTA, A., SAHU, C. & KESHRI, A. 2019. Descriptive statistics and normality tests for statistical data. *Annals of cardiac anaesthesia,* 22**,** 67.
MISHRA, S. 1970. Adoption of m-commerce in India: Applying theory of planned behaviour model. *The Journal of Internet Banking and Commerce,* 19**,** 1-17.
MOC. 2019. E-COMMERCE POLICY OF PAKISTAN. Available: http://www.commerce.gov.pk/wp-content/uploads/2019/11/e-Commerce_Policy_of_Pakistan_Print.pdf [Accessed 29/11/2020].
MOHR, L. B. 1969. Determinants of innovation in organizations. *American political science review,* 63**,** 111-126.
MOHTARAMZADEH, M., RAMAYAH, T. & JUN-HWA, C. 2018. B2B e-commerce adoption in Iranian manufacturing companies: Analyzing the moderating role of organizational culture. *International Journal of Human–Computer Interaction,* 34**,** 621-639.
MOKSONY, F. & HEGED, R. 1990. Small is beautiful. The use and interpretation of R2 in social research. *Szociológiai Szemle, Special issue***,** 130-138.

MOLLA, A. & HEEKS, R. 2007. Exploring e-commerce benefits for businesses in a developing country. *The Information Society,* 23**,** 95-108.

MOLLA, A. & LICKER, P. S. 2001. E-commerce systems success: An attempt to extend and respecify the Delone and MacLean model of IS success. *J. Electron. Commerce Res.,* 2**,** 131-141.

MOLLA, A. & LICKER, P. S. 2004. Maturation stage of ecommerce in developing countries: A survey of South African companies. *Information Technologies & International Development,* 2**,** pp. 89-98.

MOLLA, A. & LICKER, P. S. 2005a. eCommerce adoption in developing countries: a model and instrument. *Information & Management,* 42**,** 877-899.

MOLLA, A. & LICKER, P. S. 2005b. Perceived E-Readiness Factors in E-Commerce Adoption: An Empirical Investigation in a Developing Country. *International Journal of Electronic Commerce,* 10**,** 83-110.

MOLLA, A., PESZYNSKI, K. & PITTAYACHAWAN, S. 2010. The use of e-business in agribusiness: Investigating the influence of e-readiness and OTE factors. *Journal of Global Information Technology Management,* 13**,** 56-78.

MON, C. Predicting VR adoption on e-commerce platforms using TAM and porter five forces. Understanding Digital Industry: Proceedings of the Conference on Managing Digital Industry, Technology and Entrepreneurship (CoMDITE 2019), July 10-11, 2019, Bandung, Indonesia, 2020. Routledge, 176.

MONTEALEGRE, R. 1996. Implications of electronic commerce for managers in less-developed countries. *Information Technology for Development,* 7**,** 145-152.

MONTEALEGRE, R. 1998. Managing information technology in modernizingagainst the odds': Lessons from an organization in a less-developed country. *Information & Management,* 34**,** 103-116.

MONTEALEGRE, R. 1999a. A case for more case study research in the implementation of Information Technology in less-developed countries. *Information Technology for Development,* 8**,** 199-207.

MONTEALEGRE, R. 1999b. A temporal model of institutional interventions for information technology adoption in less-developed countries. *Journal of Management Information Systems,* 16**,** 207-232.

MOODLEY, S. 2003. E-Commerce and export markets: small furniture producers in South Africa. *Journal of Small Business Management,* 41**,** 317-324.

MOON, K. & BLACKMAN, D. 2014. A guide to understanding social science research for natural scientists. *Conservation Biology,* 28**,** 1167-1177.

MOORE, G. C. & BENBASAT, I. 1991. Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information systems research,* 2**,** 192-222.

MORGAN, A. J. & INKS, S. A. 2001. Technology and the sales force: Increasing acceptance of sales force automation. *Industrial marketing management,* 30**,** 463-472.

MORRIS, T. & WOOD, S. 1991. Testing the survey method: continuity and change in British industrial relations. *Work, Employment and Society,* 5**,** 259-282.

MORTON, A. 1996. Philosophy in practice: an introduction to the main questions.

MORWITZ, V. G., STECKEL, J. H. & GUPTA, A. 2007. When do purchase intentions predict sales? *International Journal of Forecasting,* 23**,** 347-364.

MOUGAYAR, W. 1998. E-commerce? E-business? Who E-cares? *Computerworld,* 32**,** 33.

MUELLER, R. A. 2000. *Emergent E-commerce in Agriculture*, University of California, Agricultural Issues Center.

MURAD, H., FLEISCHMAN, A., SADETZKI, S., GEYER, O. & FREEDMAN, L. S. 2003. Small samples and ordered logistic regression: does it help to collapse categories of outcome? *The American Statistician,* 57**,** 155-160.

MUSTAFA, S., ARSHAD, M. & MOIN, N. 2018. The potential of ICT SMEs in Pakistan. *Archives of Business Research,* 6.

MUSTONEN-OLLILA, E. & LYYTINEN, K. 2003. Why organizations adopt information system process innovations: a longitudinal study using Diffusion of Innovation theory. *Information Systems Journal,* 13**,** 275-297.

NACHMIAS, C. F. & NACHMIAS, D. 2008. Research methods in the social sciences. London: St. Martin Press, Inc.

NAJIB, M. & FAHMA, F. 2020. Investigating the adoption of digital payment system through an extended technology acceptance model: An insight from the Indonesian small and medium enterprises. *International Journal on Advanced Science, Engineering and Information Technology,* 10**,** 1702-1708.

NASCO, S. A., TOLEDO, E. G. & MYKYTYN, P. P. 2008. Predicting electronic commerce adoption in Chilean SMEs. *Journal of Business Research,* 61**,** 697-705.

NASEEM, M. H., YANG, J. & XIANG, Z. 2021a. Prioritizing the solutions to reverse logistics barriers for the e-commerce industry in pakistan based on a fuzzy ahp-topsis approach. *Sustainability,* 13**,** 12743.

NASEEM, M. H., YANG, J. & XIANG, Z. 2021b. Selection of Logistics Service Provider for the E-Commerce Companies in Pakistan Based on Integrated GRA-TOPSIS Approach. *Axioms,* 10**,** 208.

NASIMI, A. N., NASIMI, R. N. & BASIT, R. A. 2018. Factors affecting e-commerce customer loyalty in Pakistan. *Journal of Marketing and Consumer Research,* 49**,** 17-30.

NAWAZ, S. 2016. Countering Militancy and Terrorism in Pakistan. *United States Institute of Peace Special Report,* 393.

NAZIR, M. 2019. *Factors affecting e-commerce adoption among SMEs: a case study investigation of a developing economy-Pakistan.* Teesside University.

NAZIR, M. & ZHU, X. E-Commerce adoption factors affecting the SMEs: A Case study investigation of a developing economy-Pakistan. British Academy of Management Conference September 2018, 2018.

NDOU, V. 2004a. E-government for developing countries: Opportunities and challenges. *Electron. J. Inf. Syst. Dev. Ctries.,* 18**,** 1-24.

NDOU, V. 2004b. E–Government for developing countries: opportunities and challenges. *The electronic journal of information systems in developing countries,* 18**,** 1-24.

NEMAT, R. 2011. Taking a look at different types of e-commerce. *World Applied Programming,* 1**,** 100-104.

NEWMAN, D. A. 2014. Missing data: Five practical guidelines. *Organizational Research Methods,* 17**,** 372-411.

NEWMAN, D. A., LANCE, C. & VANDENBERG, R. 2009. Missing data techniques and low response rates. *Statistical and methodological myths and urban legends***,** 7-36.

NG, T. W., EBY, L. T., SORENSEN, K. L. & FELDMAN, D. C. 2005. Predictors of objective and subjective career success: A meta-analysis. *Personnel psychology,* 58**,** 367-408.

NGAI, E. W. & WAT, F. K. T. 2005. Fuzzy decision support system for risk analysis in e-commerce development. *Decis. Support Syst.,* 40**,** 235-255.

NGUYEN, N. P. & MOGAJI, E. 2022. Redefining banking service delivery: Information technology adoption by UK banks amid the COVID-19 pandemic. *Management and Information Technology in the Digital Era.* Emerald Publishing Limited.

NINJAOUTREACH. 2020. *Top Fashion Instagram Influencers in Pakistan* [Online]. Available: https://ninjaoutreach.com/fashion-influencers-pk [Accessed 12/12/2020 2020].

NIRANJANAMURTHY, M. & CHAHAR, D. 2013. The study of e-commerce security issues and solutions. *International Journal of Advanced Research in Computer and Communication Engineering,* 2**,** 2885-2895.

NORRIS, G., HURLEY, J. R., HARTLEY, K. M., DUNLEAVY, J. R. & BALLS, J. D. 2000. *E-business and ERP: Transforming the Enterprise*, John Wiley & Sons New York, NY.

NSANZUMUHIRE, S. U. & GROOT, W. 2020. Context perspective on University-Industry Collaboration processes: A systematic review of literature. *Journal of cleaner production,* 258**,** 120861.

NUNNALLY, J. C. 1994. *Psychometric theory 3E*, Tata McGraw-hill education.

O'CONNOR, G. C. & O'KEEFE, B. 1997. Viewing the Web as a marketplace: the case of small companies. *Decision Support Systems,* 21**,** 171-183.

O'REGAN, N. & ABBY, G. 2005. Innovation in SMEs: the impact of strategic orientation and environmental perceptions. *International Journal of Productivity and Performance Management,* 54**,** 81-97.

O'SULLIVAN, A. & SHEFFRIN, S. M. 2003. *Economics: Principles in action*.

O'CONNOR, R. J., HECKMAN, B. W., ADKISON, S. E., REES, V. W., HATSUKAMI, D. K., BICKEL, W. K. & CUMMINGS, K. M. 2016. Persistence and amplitude of cigarette demand in relation to quit intentions and attempts. *Psychopharmacology,* 233**,** 2365-2371.

OAKLEY, A. 1999. Paradigm wars: some thoughts on a personal and public trajectory. *International Journal of Social Research Methodology,* 2**,** 247-254.

OBER, J. 2020. Innovation adoption: empirical analysis on the example of selected factors of organizational culture in the IT industry in Poland. *Sustainability,* 12**,** 8630.

OCLOO, C. E., XUHUA, H., AKABA, S., ADDAI, M., WORWUI-BROWN, D. K. & SPIO-KWOFIE, A. 2018. B2B E-commerce Adoption amongst manufacturing SMEs: An Evidence from Ghana. *Australian Journal of Economics and Management Sciences,* 8.

ODEDRA-STRAUB, M. 2003. "E-Commerce and Development": Whose development? *The Electronic Journal of Information Systems in Developing Countries,* 11**,** 1-5.

OECD 2013. INTERCONNECTED ECONOMIES: BENEFITING FROM GLOBAL VALUE CHAINS

OKOLI, C. & MBARIKA, V. 2003. A Framework for Assessing E-Commerce in Sub-Saharan Africa. *Journal of Global Information Technology Management,* 6**,** 44-66.

OLIVEIRA, T. & MARTINS , M. F. 2011. Literature Review of Information Technology Adoption Models at Firm Level. *The Electronic Journal Information Systems Evaluation,* 14**,** 110-121.

OREKU, G. S., LI, J., KIMELI, K. & MTENZI, F. J. 2009. State of Tanzania e-readiness and e-commerce: Overview.

ORR, J. M., SACKETT, P. R. & DUBOIS, C. L. 1991. Outlier detection and treatment in I/O psychology: A survey of researcher beliefs and an empirical illustration. *Personnel Psychology,* 44**,** 473-486.

OSBORNE, J. W. & OVERBAY, A. 2004. The power of outliers (and why researchers should always check for them). *Practical Assessment, Research, and Evaluation,* 9**,** 6.

OTIENO, D. 2020. *Cyber security challenges: The Case of Developing Countries*.

OXLEY, J. E. & YEUNG, B. 2001. E-commerce readiness: Institutional environment and international competitiveness. *Journal of International Business Studies,* 32**,** 705-723.

ÖZTUNA, D., ELHAN, A. H. & TÜCCAR, E. 2006. Investigation of four different normality tests in terms of type 1 error rate and power under different distributions. *Turkish Journal of Medical Sciences,* 36**,** 171-176.

PADGETT, R. N. & MORGAN, G. B. 2021. Multilevel CFA with ordered categorical data: A simulation study comparing fit indices across robust estimation methods. *Structural Equation Modeling: A Multidisciplinary Journal,* 28**,** 51-68.

PALACIOS, J. J. 2003. The development of e-commerce in Mexico: A business-led passing boom or a step toward the emergence of a digital economy? *The information society,* 19**,** 69-79.

PALLANT, J. 2020. *SPSS survival manual: A step by step guide to data analysis using IBM SPSS*, Routledge.

PAN, M.-J. & JANG, W.-Y. 2008. Determinants of the adoption of enterprise resource planning within the technology-organization-environment framework: Taiwan's communications industry. *Journal of Computer information systems,* 48**,** 94-102.

PAN, Q., WEI, J. & AL-HAKIM, L. 2020. The Effect of Organizational Slack on Innovation Performance: An Empirical Study of High-Tech Industry in China. *Disruptive Technology: Concepts, Methodologies, Tools, and Applications.* IGI Global.

PANJAITAN, M., NAPITUPULU, J., MASLAN, J. & NORMI, S. Examining generation X experiences on using e-commerce: integrating the technology acceptance model and perceived risks. Journal of Physics: Conference Series, 2019. IOP Publishing, 012029.

PANSIRI, J. 2005. Pragmatism: A methodological approach to researching strategic alliances in tourism. *Tourism and Hospitality Planning & Development,* 2**,** 191-206.

PARK, J., LEE, D. & AHN, J. 2004. Risk-focused e-commerce adoption model: A cross-country study. *Journal of Global Information Technology Management,* 7**,** 6-30.

PARSONS, V. L. 2014. Stratified sampling. *Wiley StatsRef: Statistics Reference Online***,** 1-11.

PATRICIAN, P. A. 2002. Multiple imputation for missing data. *Research in nursing & health,* 25**,** 76-84.

PAUL, D. C., JERALD, H. & FRANK, M. H. 1988. Organizational and Technological Predictors of Change in Automaticity. *Academy of Management journal,* 31**,** 512-543.

PAULK, M. C., CURTIS, B., CHRISSIS, M. B. & WEBER, C. V. 1993. Capability maturity model, version 1.1. *IEEE software,* 10**,** 18-27.

PAVLOU, P. A. & FYGENSON, M. 2006. Understanding and predicting electronic commerce adoption: An extension of the theory of planned behavior. *MIS quarterly***,** 115-143.

PAYNE, G. & PAYNE, J. 2004. Key Concepts in Social Research. London: SAGE Publications, Ltd.

PAYONEER. 2019. The Golbal Gig Economy Index. Available: https://pubs.payoneer.com/images/q2_global_freelancing_index.pdf [Accessed 11/12/2020].

PEDHAZUR, E. J. & SCHMELKIN, L. P. 2013. *Measurement, design, and analysis: An integrated approach*, psychology press.

PELET, J.-É. & PAPADOPOULOU, P. 2015. Social media and m-commerce. *International Journal of Internet Marketing and Advertising,* 9.

PENG, L. & LEI, L. 2005. A review of missing data treatment methods. *Intell. Inf. Manag. Syst. Technol,* 1**,** 412-419.

PEREIRA, G. V., LUCIANO, E. M., MACADAR, M. A. & DANIEL, V. M. Information technology governance practices adoption through an institutional perspective: the perception of Brazilian and American CIOs. Proceedings of 46th Hawaiian International Conference on System Sciences, 2013, Estados Unidos., 2013.

PERES, R., MULLER, E. & MAHAJAN, V. 2010. Innovation diffusion and new product growth models: A critical review and research directions. *International journal of research in marketing,* 27**,** 91-106.

PETRUCCI, C. J. 2009. A primer for social worker researchers on how to conduct a multinomial logistic regression. *Journal of social service research,* 35**,** 193-205.

PHAM, L., PHAM, L. N. & NGUYEN, D. T. T. 2011. DETERMINANTS OF E-COMMERCE ADOPTION IN VIETNAMESE SMALL AND MEDIUM SIZED ENTERPRISES. *International Journal of Entrepreneurship,* 15**,** 45-72.

PICKARD, A. J. 2013. *Research methods in information*, Facet publishing.

PIERCY, N. F., CRAVENS, D. W. & MORGAN, N. A. 1999. Relationships between sales management control, territory design, salesforce performance and sales organization effectiveness. *British Journal of Management,* 10**,** 95-111.

PIETERS, R. G. & VERPLANKEN, B. 1995. Intention-behaviour consistency: Effects of consideration set size, involvement and need for cognition. *European Journal of Social Psychology,* 25**,** 531-543.

PIPITWANICHAKARN, T. & WONGTADA, N. 2019. Leveraging the technology acceptance model for mobile commerce adoption under distinct stages of adoption. *Asia Pacific Journal of Marketing and Logistics*.

PITUCH, K. & STEVENS, J. 2016. Applied Multivariate Statistics for the Social Sciences. 6th edn. New York and London. Routledge/Taylor & Francis Group.

POLIT, D. F. 2013. *Statistics and Data Analysis for Nursing Research: Pearson New International Edition*, Pearson Higher Ed.

POLUHINA, E. 2015. INTEGRATING QUALITATIVE AND QUANTITATIVE METHODS: A PRAGMATIC APPROACH. MEZHDUNARODNAYA KNIGA 39 DIMITROVA UL., MOSCOW, 113095, RUSSIA.

PONTO, J. 2015. Understanding and evaluating survey research. *Journal of the advanced practitioner in oncology,* 6**,** 168.

POWELL, T. C. & DENT-MICALLEF, A. 1997. Information technology as competitive advantage: The role of human, business, and technology resources. *Strategic management journal,* 18**,** 375-405.

PRANANTO, A., MCKAY, J. & MARSHALL, P. 2003. A study of the progression of e-business maturity in Australian SMEs: Some evidence of the applicability of the stages of growth for e-business model. *PACIS 2003 Proceedings***,** 5.

PRESSER, S. & BLAIR, J. 1994. Survey pretesting: Do different methods produce different results? *Sociological methodology***,** 73-104.

PTA. 2020. *Telecom Indicators* [Online]. PTA, Government of Pakistan. Available: https://www.pta.gov.pk/en/telecom-indicators/7 [Accessed 29/11/2020 2020].

PTCL. 2020. *High Speed Internet with Unlimited Downloads* [Online]. Available: https://www.ptcl.com.pk/Home/PageDetail?ItemId=122&linkId=710 [Accessed 13/10/2020].

PUKELSHEIM, F. 1994. The three sigma rule. *The American Statistician,* 48**,** 88-91.

PURCELL, F. & TOLAND, J. 2004. Electronic commerce for the South Pacific: A review of e-readiness. *electronic commerce research,* 4**,** 241-262.

QAISAR, N. & KHAN, H. G. A. 2010. E-Government challenges in public sector: A case study of Pakistan. *International Journal of Computer Science Issues (IJCSI),* 7**,** 310.

QASIM, Y. & MAHMOOD, Z. 2021. Why Is Technopreneurship Developing Slowly in Pakistan? *Abasyn University Journal of Social Sciences,* 14.

QIN, Z. 2009. *Introduction to e-commerce / [internet resource],* Berlin

London, Berlin

London : Springer.

QIU, L. & LI, D. 2008. Applying TAM in B2C E-commerce research: An extended model. *Tsinghua Science and Technology,* 13**,** 265-272.

QUAYLE, M. 2002. E-commerce: the challenge for UK SMEs in the twenty-first century. *International Journal of Operations & Production Management*.

QUIMBA, F. M. A. & CALIZO, S. C. 2019. Determinants of E-Commerce Adoption of Philippine Businesses. Philippine Institute for Development Studies.

QURESHI, O. 2019. Will PayPal never come to Pakistan? *The Express Tribune*

RAAIJMAKERS, Q. A. 1999. Effectiveness of different missing data treatments in surveys with Likert-type data: Introducing the relative mean substitution approach. *Educational and Psychological Measurement,* 59**,** 725-748.

RABURU, C. O. A. D. G. & ONDITI, S. L. D. L. A. 2017. Infrastructure A Major Barrier to Ecommerce Development and Adoption.

RADTKE, T., KAKLAMANOU, D., SCHOLZ, U., HORNUNG, R. & ARMITAGE, C. J. 2014. Are diet-specific compensatory health beliefs predictive of dieting intentions and behaviour? *Appetite,* 76**,** 36-43.

RAHAYU, R. & DAY, J. 2015. Determinant factors of e-commerce adoption by SMEs in developing country: evidence from Indonesia. *Procedia-social and behavioral sciences,* 195**,** 142-150.

RAHAYU, R. & DAY, J. 2017. E-commerce adoption by SMEs in developing countries: evidence from Indonesia. *Eurasian Business Review,* 7**,** 25-41.

RAHI, S., GHANI, M. A. & NGAH, A. H. 2019. Integration of unified theory of acceptance and use of technology in internet banking adoption setting: Evidence from Pakistan. *Technology in Society,* 58**,** 101120.

RAHMAN, M. M. 2013. Barriers to M-commerce adoption in developing countries–a qualitative study among the stakeholders of Bangladesh. *The International Technology Management Review,* 3**,** 80-91.

RAINEY, H. G., BACKOFF, R. W. & LEVINE, C. H. 1976. Comparing Public and Private Organizations. *Public Administration Review,* 36**,** 233.

RAITOHARJU, R. When acceptance is not enough-taking TAM-model into healthcare. Proceedings of the 38th Annual Hawaii International Conference on System Sciences, 2005. IEEE, 150c-150c.

RAMANATHAN, R., RAMANATHAN, U. & KO, L. W. L. 2014. Adoption of RFID technologies in UK logistics: Moderating roles of size, barcode experience and government support. *Expert Systems with Applications,* 41**,** 230-236.

RAMAYAH, T., YAN, L. C. & SULAIMAN, M. 2005. SME e-readiness in Malaysia: Implications for Planning and Implementation. *Sasin Journal of Management,* 11**,** 103-120.

RANA, S. 2023. Pakistan's Existential Economic Crisis. Available: https://www.usip.org/publications/2023/04/pakistans-existential-economic-crisis [Accessed 01/09/2023].

RANDALL, D. M. & WOLFF, J. A. 1994. The time interval in the intention-behaviour relationship: Meta-analysis. *British Journal of Social Psychology,* 33**,** 405-418.

RAO, S. S., METTS, G. & MONGE, C. A. M. 2003. Electronic commerce development in small and medium sized enterprises: A stage model and its implications. *Business Process Management Journal,* 9**,** 11-32.

RASO, D., TUNGKUNANAN, P. & ANUKULWECH, A. 2017. Factors Supporting an Information Technology Management: Teachers in Primary Schools in Thailand. *International Journal of Emerging Technologies in Learning,* 12.

RAY, S. 2011. Emerging trend of e-commerce in India: Some crucial issues, prospects and challenges. *Computer Engineering and Intelligent Systems,* 2**,** 17-35.

RAYMOND, L., UWIZEYEMUNGU, S. & BERGERON, F. 2006. Motivations to implement ERP in e-government: an analysis from success stories. *Electronic Government, an International Journal,* 3**,** 225-240.

RAZA, S. A. & KHAN, K. A. 2021. Corona fear and e-commerce adoption in an emerging economy: paradigm shift of consumer intention. *foresight*.

READ, A. 2000. Determinants of successful organisational innovation: a review of current research. *Journal of management practice,* 3**,** 95-119.

REFFAT, R. 2003. Developing a successful e-government. *Proc. Sympos. e-Government: Opportunities and Challenge, Muscat Municipality, Oman, IV1–IV13*.

REHMAN, M., ESICHAIKUL, V. & KAMAL, M. 2012. Factors influencing e-government adoption in Pakistan. *Transforming Government: People, Process and Policy*.

REHMAN, S. U., BHATTI, A., MOHAMED, R. & AYOUP, H. 2019. The moderating role of trust and commitment between consumer purchase intention and online shopping behavior in the context of Pakistan. *Journal of Global Entrepreneurship Research,* 9**,** 43.

RIANTINI, R. E. Adoption of E-Commerce Online to Offline with Technology Acceptance Model (TAM) Approach. 2018 4th International Conference on Computer and Information Sciences (ICCOINS), 2018. IEEE, 1-6.

RIEK, M., BÖHME, R. & MOORE, T. Understanding the influence of cybercrime risk on the e-service adoption of European Internet users. 13th Workshop on the Economics of Information Security, 2014. Citeseer.

RIEMENSCHNEIDER, C. K., HARRISON, D. A. & MYKYTYN JR, P. P. 2003. Understanding IT adoption decisions in small business: integrating current theories. *Information & management,* 40**,** 269-285.

RIGDON, E. E. 2012. Rethinking partial least squares path modeling: In praise of simple methods. *Long range planning,* 45**,** 341-358.

RIND, M., HYDER, M., SAAND, A. S., ALZABI, T., NAWAZ, H. & UJAN, I. 2017a. Impact Investigation of perceived cost and perceived risk in mobile commerce: analytical study of Pakistan. *Int. J. Comput. Sci. Netw. Secur,* 17**,** 124-130.

RIND, M., HYDER, M., SAAND, A. S., ALZABI, T., NAWAZ, H. & UJAN, I. 2017b. Impact Investigation of perceived cost and perceived risk in mobile commerce: analytical study of Pakistan. *International Journal of Computer Science and Network Security,* 17**,** 124-130.

RING, P. S. & PERRY, J. L. 1985a. Strategic management in public and private organizations: Implications of distinctive contexts and constraints. *Academy of management review,* 10**,** 276-286.

RING, P. S. & PERRY, J. L. 1985b. Strategic Management in Public and Private Organizations: Implications of Distinctive Contexts and Constraints. *The Academy of Management Review,* 10**,** 276-286.

RINGLE, C. M., SARSTEDT, M. & STRAUB, D. W. 2012. Editor's comments: a critical look at the use of PLS-SEM in" MIS Quarterly". *MIS quarterly***,** iii-xiv.

RÍOS-MANRÍQUEZ, M. 2021. Human capital and its influence on the e-readiness of the company: an empirical case. *International Journal of Innovation,* 9**,** 79-107.

RIZK, N. 2004. E-readiness assessment of small and medium enterprises in Egypt: A micro study. *Topics in Middle Eastern and North African Economies,* 6.

RLTSQUARE. 2020. *E-Commerce In Pakistan: Potential To Fast-Track The Economy?* [Online]. Available: https://www.rltsquare.com/blog/e-commerce-in-pakistan/ [Accessed 29/11/2020 2020].

ROBERTS, N. & THATCHER, J. 2009. Conceptualizing and testing formative constructs: Tutorial and annotated example. *ACM sigmis database: The database for Advances in Information Systems,* 40**,** 9-39.

ROBEY, D., GUPTA, S. & RODRIGUES-DIAZ, A. 1990. *Implementing information systems in developing countries: organizational and cultural considerations,* North - Holland, Amsterdam.

ROBSON, C. & MCCARTAN, K. 2016. *Real world research*, John Wiley & Sons.

RODRÍGUEZ-ARDURA, I. & MESEGUER-ARTOLA, A. 2010. Toward a longitudinal model of e-commerce: Environmental, technological, and organizational drivers of B2C adoption. *The Information Society,* 26**,** 209-227.

RODRÍGUEZ, G. 2007. Lecture Notes on Generalized Linear Models. Available: https://data.princeton.edu/wws509/notes/.

ROGELBERG, S. G. & STANTON, J. M. 2007. Introduction: Understanding and dealing with organizational survey nonresponse. Sage Publications Sage CA: Los Angeles, CA.

ROGERS, E. M. 1962. *Diffusion of Innovations*, Free Press of Glencoe, Macmillan Company.

ROGERS, E. M. 1995. *Diffusion of Innovations,* NY, The Free Press.

ROGERS, E. M. 2010. *Diffusion of innovations*, Simon and Schuster.

ROGERS, E. M. & MARSHALL, L. R. 2003. *Diffusion of Innovations, 5th Edition*, Free Press.

ROGERS, E. M., SINGHAL, A. & QUINLAN, M. M. 2014. Diffusion of innovations. *An integrated approach to communication theory and research.* Routledge.

ROGERS, R. W. & PRENTICE-DUNN, S. 1997. Protection motivation theory.

ROGERS, S. 2019. *Ranked: Best Online Shopping Websites in Pakistan (2020)* [Online]. Available: https://medium.com/@samiyajutt.wbm/ranked-best-online-shopping-websites-in-pakistan-2020-d99c2eff4f73 [Accessed 29/11/2020 2020].

ROHRBACH, L. A., GRAHAM, J. W. & HANSEN, W. B. 1993. Diffusion of a school-based substance abuse prevention program: Predictors of program implementation. *Preventive medicine,* 22**,** 237-260.

ROSENTHAL, R. & RUBIN, D. B. 2003. requivalent: A simple effect size indicator. *Psychological methods,* 8**,** 492.

ROTH, P. L. & BEVIER, C. A. 1998. Response rates in HRM. *OB survey research*.

ROWE, F., TRUEX, D. & HUYNH, M. Q. 2012. An empirical study of determinants of e-commerce adoption in SMEs in Vietnam: An economy in transition. *Journal of Global Information Management (JGIM),* 20**,** 23-54.

ROY, S. & MOORTHI, Y. 2017. Technology readiness, perceived ubiquity and M-commerce adoption: The moderating role of privacy. *Journal of Research in Interactive Marketing*.

RUMANYIKA, J. D. & MASHENENE, R. G. 2014. Impediments of E-commerce Adoption among Small and Medium Enterprises in Tanzania: A review.

RYAN, G. W. & BERNARD, H. R. 2003. Techniques to Identify Themes. *Field Methods,* 15**,** 85-109.

RYU, E. 2011. Effects of skewness and kurtosis on normal-theory based maximum likelihood test statistic in multilevel structural equation modeling. *Behavior Research Methods,* 43**,** 1066-1074.

SAEED, B. 2021. Strengthening IT skills. *DAWN*.

SAEED, S., WAHAB, F., CHEEMA, S. A. & ASHRAF, S. 2013. Role of usability in e-government and e-commerce portals: an empirical study of Pakistan. *Life Science Journal,* 10**,** 8-13.

SAFFU, K., DEBERRY-SPENCE, B., WALKER, J. H. & HINSON, R. 2008. Strategic value and electronic commerce adoption among small and medium-sized enterprises in a transitional economy. *Journal of Business & Industrial Marketing,* 23**,** 395-404.

SAHA, G. K. & KUMAR, S. 2014. E-Commerce Implementation Issues.

SAHLQVIST, S., SONG, Y., BULL, F., ADAMS, E., PRESTON, J. & OGILVIE, D. 2011. Effect of questionnaire length, personalisation and reminder type on response rate to a complex postal survey: randomised controlled trial. *BMC medical research methodology,* 11**,** 1-8.

SAIF-UR-REHMAN, R. A. 2016. A study of barriers to e-commerce adoption among SMEs in Malaysia. *University of Modern Sciences,* 1**,** 45-58.

SAIR, S. A. & DANISH, R. Q. 2018. Effect of performance expectancy and effort expectancy on the mobile commerce adoption intention through personal innovativeness among Pakistani consumers. *Pakistan Journal of Commerce and Social Sciences (PJCSS),* 12**,** 501-520.

SAIT, S., AL-TAWIL, K. & HUSSAIN, S. 2004. E-commerce in Saudi Arabia: Adoption and perspectives. *Australasian Journal of Information Systems,* 12.

SALAZAR, R., RAUNIAR, R. & BLODGETT, J. 2021. Determinants of technology adoption in US oil and gas industry. *International Journal of Technology, Policy and Management,* 21**,** 104-127.

SALEEM, F. 2015. OPINIONFamous Internet Service Providers in Pakistan: A Review. Available: https://pakwired.com/famous-internet-service-providers-pakistan-review/ [Accessed 10/10/2020].

SALEM, M. A. & NOR, K. M. 2020. The effect of COVID-19 on consumer behaviour in Saudi Arabia: Switching from brick and mortar stores to E-Commerce. *International Journal of Scientific & Technology Research,* 9**,** 15-28.

SALMAN, A. & ALI, B. 2022. The IMF Stabilization Program and Macroeconomic Analysis for Pakistan. *IPRI policy paper*.

SAN ONG, T., TEH, B. H., KASBUN, N. F., MAHROEIAN, H. & IMTIAZ, M. 2003. Electronic commerce adoption among Malaysian SMEs. *Small*.

SANCHEZ, G. 2013. PLS Path Modeling with R. Available: https://www.gastonsanchez.com/PLS_Path_Modeling_with_R.pdf [Accessed 04/04/2022].

SANDILANDS, D. 2014a. Bivariate Analysis. *In:* MICHALOS, A. C. (ed.) *Encyclopedia of Quality of Life and Well-Being Research.* Dordrecht: Springer Netherlands.

SANDILANDS, D. 2014b. Univariate Analysis. *In:* MICHALOS, A. C. (ed.) *Encyclopedia of Quality of Life and Well-Being Research.* Dordrecht: Springer Netherlands.

SARDJONO, W., SELVIYANTI, E., MUKHLIS, M. & TOHIR, M. Global issues: utilization of e-commerce and increased use of mobile commerce application as a result of the covid-19 pandemic. Journal of Physics: Conference Series, 2021. IOP Publishing, 012024.

SARFRAZ, H. 2020. Shopping online: the rise of digital payments. *Dawn*.

SARSTEDT, M., HAIR, J. F., RINGLE, C. M., THIELE, K. O. & GUDERGAN, S. P. 2016. Estimation issues with PLS and CBSEM: Where the bias lies! *Journal of Business Research,* 69**,** 3998-4010.

SARSTEDT, M., RINGLE, C. M. & HAIR, J. F. 2017. Partial least squares structural equation modeling. *Handbook of market research,* 26**,** 1-40.

SAUNDERS, M., LEWIS, P. & THORNHILL, A. 2009. *Research methods for business students*, Pearson education.

SAYGINER, C. & ERCAN, T. 2020. Understanding determinants of cloud computing adoption using an integrated diffusion of innovation (Doi)-technological, organizational and environmental (TOE) model. *Humanities & Social Sciences Reviews,* 8**,** 91-102.

SBP n.d. THE PAKISTAN INFRASTRUCTURE REPORT. online.

SCHOLL, H. J., BARZILAI-NAHON, K., ANN, J.-H., POPOVA, O. H. & RE, B. E-Commerce and e-Government: How do they Compare? what can they Learn from each Other? 2009 42nd Hawaii International Conference on System Sciences, 2009. IEEE, 1-10.

SCHOLZ, U., SCHÜZ, B., ZIEGELMANN, J. P., LIPPKE, S. & SCHWARZER, R. 2008. Beyond behavioural intentions: Planning mediates between intentions and physical activity. *British journal of health psychology,* 13**,** 479-494.

SCHREIBER, J. B., NORA, A., STAGE, F. K., BARLOW, E. A. & KING, J. 2006. Reporting structural equation modeling and confirmatory factor analysis results: A review. *The Journal of educational research,* 99**,** 323-338.

SCHREURS, B., CUYPER, N. D., EMMERIK, I., NOTELAERS, G. & WITTE, H. D. 2011. Job demands and resources and their associations with early retirement intentions through recovery need and work enjoyment. *SA Journal of Industrial Psychology,* 37**,** 63-73.

SCHUMACKER, R. E. & LOMAX, R. G. 2004. *A beginner's guide to structural equation modeling*, psychology press.

SCHUPPAN, T. 2009. E-Government in developing countries: Experiences from sub-Saharan Africa. *Government information quarterly,* 26**,** 118-127.

SCHWAB, J. A. 2002. Multinomial logistic regression: Basic relationships and complete problems.

SCHWARZER, R. 2002. Health action process approach (HAPA). *Gesundheitspsychologie von A bis Z***,** 241-245.

SCIBILIA, B. 2015. Why You Should Use Non-parametric Tests when Analyzing Data with Outliers. Available: https://blog.minitab.com/en/applying-statistics-in-quality-projects/why-you-should-use-non-parametric-tests-when-analyzing-data-with-outliers [Accessed 06/03/2022].

SCOTT, M., DELONE, W. H. & GOLDEN, W. 2009. Understanding net benefits: a citizen-based perspective on eGovernment success. *ICIS 2009 proceedings***,** 86.

SEARATES. 2020. *Sea Ports of Pakistan* [Online]. Available: https://www.searates.com/maritime/pakistan.html [Accessed 02/02/2021 2021].

SEARLS, D. 2004. DIY-IT: How Linux and open source are bringing do-it-yourself to information technology. *Linux Journal,* 2004**,** 4.

SEDYASTUTI, K., SUWARNI, E., RAHADI, D. R. & HANDAYANI, M. A. Human Resources Competency at Micro, Small and Medium Enterprises in Palembang Songket Industry. 2nd Annual Conference on Social Science and Humanities (ANCOSH 2020), 2021. Atlantis Press, 248-251.

SEKARAN, U. & BOUGIE, R. 2016. *Research methods for business: A skill building approach*, John Wiley & Sons.

SEKUNDANT, O. 2021. IT Outsourcing Trends 2021: the Bottom Line and Key Insights. Available: https://fulcrum.rocks/blog/it-outsourcing-trends/ [Accessed 19/05/2022].

SENAVIRATNA, N. & COORAY, T. 2019. Diagnosing multicollinearity of logistic regression model. *Asian Journal of Probability and Statistics,* 5**,** 1-9.

SERIC, A. & TONG, Y. S. 2019. *What are global value chains and why do they matter?* [Online]. IAP, UNIDO. Available: https://iap.unido.org/articles/what-are-global-value-chains-and-why-do-they-matter [Accessed 31/01/2021 2021].

SETHIBE, T., CAMPBELL, J. & MCDONALD, C. 2007. IT governance in public and private sector organisations: examining the differences and defining future research directions. *ACIS 2007 Proceedings***,** 118.

SETYOWATI, W., WIDAYANTI, R. & SUPRIYANTI, D. 2021. Implementation Of E-Business Information System In Indonesia: Prospects And Challenges. *International Journal of Cyber and IT Service Management,* 1**,** 180-188.

SEYAL, A. H., AWAIS, M. M., SHAMAIL, S. & ABBAS, A. 2004. Determinants of electronic commerce in Pakistan: Preliminary evidence from small and medium enterprises. *Electronic Markets,* 14**,** 372-387.

SEYAL, A. H. & RAHMAN, M. N. A. 2003. A preliminary investigation of e-commerce adoption in small & medium enterprises in Brunei. *Journal of Global Information Technology Management,* 6**,** 6-26.

SHACHAK, A., KUZIEMSKY, C. & PETERSEN, C. 2019. Beyond TAM and UTAUT: Future directions for HIT implementation research. *Journal of biomedical informatics,* 100**,** 103315.

SHAFIQUE, F. & MAHMOOD, K. 2008. Indicators of the emerging information society in Pakistan. *Information Development,* 24**,** 66-78.

SHAH ALAM, S., ALI, M. Y. & MOHD. JANI, M. F. 2011. An empirical study of factors affecting electronic commerce adoption among SMEs in Malaysia. *Journal of business economics and management,* 12**,** 375-399.

SHAH, R. & GOLDSTEIN, S. M. 2006. Use of structural equation modeling in operations management research: Looking back and forward. *Journal of Operations management,* 24**,** 148-169.

SHAHID, J. 2019. Etisalat eager to resolve $800m payment issue. *DAWN*.

SHARMA, A. & CITURS, A. 2005. Radio frquency identification (RFID) adoption drivers: A radical innovation adoption perspective. *AMCIS 2005 Proceedings***,** 211.

SHARMA, G. 2017. Pros and cons of different sampling techniques. *International journal of applied research,* 3**,** 749-752.

SHARMA, S. K. & GUPTA, J. N. 2003. Socio-economic influences of e-commerce adoption. *Journal of Global Information Technology Management,* 6**,** 3-21.

SHEHZAD, R., ASLAM, Z., AHMAD, N. & IQBAL, M. W. 2017. Web Usability and User Trust on E-commerce Websites in Pakistan. *International Journal of Advanced Computer Science and Applications,* 8.

SHEN, L., HAWLEY, J. & DICKERSON, K. 2004. E-commerce adoption for supply chain management in US apparel manufacturers. *Journal of Textile and apparel, technology and management,* 4**,** 1-11.

SHEPPARD, B. H., HARTWICK, J. & WARSHAW, P. R. 1988. The theory of reasoned action: A meta-analysis of past research with recommendations for modifications and future research. *Journal of consumer research,* 15**,** 325-343.

SHI, F. 2019. Learn About Multinomial Logit Regression in R With Data From the General Social Survey (2016). London.

SHIH, Y.-Y. & CHEN, C.-Y. 2013. The study of behavioral intention for mobile commerce: via integrated model of TAM and TTF. *Quality & Quantity,* 47**,** 1009-1020.

SIAU, K., LIM, E.-P. & SHEN, Z. 2001. Mobile commerce: Promises, challenges and research agenda. *Journal of Database Management (JDM),* 12**,** 4-13.

SIDDIQUI, Z. H. n.d. Telecom Sector Liberalization & Deregulation in Pakistan:

Economic and Social Benefits. Available: https://www.wto.org/english/tratop_e/serv_e/telecom_e/sym_feb08_e/siddiqui_e.pdf [Accessed 08/02/2021].

SIM, C. H., GAN, F. F. & CHANG, T. C. 2005. Outlier Labeling With Boxplot Procedures. *Journal of the American Statistical Association,* 100**,** 642-652.

SIMPSON, M. & DOCHERTY, A. J. 2004. E-commerce adoption support and advice for UK SMEs. *Journal of small business and enterprise development*.

SIN, K. Y., OSMAN, A., SALAHUDDIN, S. N., ABDULLAH, S., LIM, Y. J. & SIM, C. L. 2016. Relative advantage and competitive pressure towards implementation of e-commerce: Overview of small and medium enterprises (SMEs). *Procedia Economics and Finance,* 35**,** 434-443.

SINDAKIS, S. & AGGARWAL, S. 2022. E-business Adoption by Small Businesses: Benefits and Drawbacks. *Small Business Management and Control of the Uncertain External Environment.* Emerald Publishing Limited.

SINGH, H., DAS, A. & JOSEPH, D. 2007. Country-level determinants of e-government maturity. *Communications of the Association for Information Systems,* 20**,** 40.

SINGH, J. & GILCHRIST, S. M. 2002. Three layers of the electronic commerce network: challenges for the developed and developing worlds. *info*.

SINGH, T., JAYASHANKAR, J. V. & SINGH, J. 2001. E-Commerce in the US and Europe--Is Europe Ready to Compete? *Business Horizons,* 44**,** 6-6.

SIRAJ, M., AHMAD, K. & KHAN, S. K. 2022. Socio cultural causes of low literacy among female in southern Punjab, district Dera Ghazi Khan. *Pakistan Journal of International Affairs,* 5.

SLEVITCH, L. 2011. Qualitative and quantitative methodologies compared: Ontological and epistemological perspectives. *Journal of Quality Assurance in Hospitality & Tourism,* 12**,** 73-81.

SMITH, B. R., CHATFIELD, V. & UEMURA, O. 2001. IBM e server iSeries e-business Handbook

A V5R1 Technology and Product Reference

Available: https://www.redbooks.ibm.com/redbooks/pdfs/sg246711.pdf [Accessed 18/10/2020].

SOHAIB, O. & KANG, K. 2014. Cultural aspects of business-to-consumer (B2C) e-commerce: A comparative analysis of Pakistan and Australia. *EJISDC: The Electronic Journal on Information Systems in Developing Countries***,** 3.

SONG, X., YANG, S., HUANG, Z. & HUANG, T. The application of artificial intelligence in electronic commerce. Journal of Physics: Conference Series, 2019. IOP Publishing, 032030.

SORCE, J. & ISSA, R. R. 2021. Extended Technology Acceptance Model (TAM) for adoption of Information and Communications Technology (ICT) in the US Construction Industry. *Journal of Information Technology in Construction,* 26.

SPACEY, J. 2018. *7 types of market forces* [Online]. Available: https://simplicable.com/new/market-forces [Accessed 10/04/2021 2021].

SPEEDTEST. 2020. *Speedtest Global Index* [Online]. Speed Test. Available: https://www.speedtest.net/global-index/pakistan#fixed [Accessed 30/11/2020 2020].

SPINDLER, G. & BÖRNER, F. 2013. *E-Commerce Law in Europe and the USA*, Springer Science & Business Media.

STANDING, C. & LIN, C. 2007. Organizational evaluation of the benefits, constraints, and satisfaction of business-to-business electronic commerce. *International Journal of electronic commerce,* 11**,** 107-134.

STARKWEATHER, J. & MOSKE, A. K. 2011. Multinomial logistic regression.

STARNINI, M., BOGUÑÁ, M. & SERRANO, M. Á. 2019. The interconnected wealth of nations: Shock propagation on global trade-investment multiplex networks. *Scientific Reports,* 9**,** 13079.

STATISTA 2020a. E-Commerce Report 2020. *Statista Digital Market Outlook – Market Report.* online.

STATISTA. 2020b. *Forecast of the credit card penetration in India from 2010 to 2025* [Online]. Available: https://www.statista.com/forecasts/1149902/credit-card-penetration-forecast-in-india [Accessed 02/12/2020].

STATISTA. 2020c. *Forecast of the credit card penetration in Pakistan from 2010 to 2025* [Online]. Statista. Available: https://www.statista.com/forecasts/1149896/credit-card-penetration-forecast-in-pakistan [Accessed 02/12/2020 2020].

STATISTA 2020d. Pakistan.

STATISTA. 2021. *Forecast of the number of mobile internet users in Pakistan from 2010 to 2025 (in millions)* [Online]. Available: https://www.statista.com/forecasts/1146711/mobile-internet-users-in-pakistan [Accessed 04/02/2021 2021].

STEVEN, M. K. 2004. *Business statistics demystified*, McGraw-hill.

STEVENS, J. P. 1984. Outliers and influential data points in regression analysis. *Psychological bulletin,* 95**,** 334.

STEVENS, J. P. 2012. *Applied multivariate statistics for the social sciences*, Routledge.

STEWART, K. A. & SEGARS, A. H. 2002. An empirical examination of the concern for information privacy instrument. *Information systems research,* 13**,** 36-49.

STINE, R. & FOSTER, D. 2011. *Statistics for Business: Decision Making and*, Addison-Wesley.

STOCKDALE, R. & STANDING, C. 2004. Benefits and barriers of electronic marketplace participation: an SME perspective. *Journal of Enterprise Information Management*.

STOKES, G. 1998. Popper: Philosophy, politics and scientific method.

STOWERS, G. N. 2001. Commerce comes to government on the desktop: E-commerce applications in the public sector. *E-Government* [Online]. Available: http://www.businessofgovernment.org/sites/default/files/StowersReport.pdf [Accessed 10/03/2021].

STOWERS, G. N. L. 2002. Commerce Comes to Government on Desktop: E Commerce Applications in Public Sector. *In:* ABRAMSON, M. A. & MEANS, G. E. (eds.) *E-Government 2001.* Oxford: Rowman and Littelfield Publishers.

STRAITS, B. C. 2005. *Approaches to social research*, Oxford University Press.

STRAUB, D., KEIL, M. & BRENNER, W. 1997. Testing the technology acceptance model across cultures: A three country study. *Information & management,* 33**,** 1-11.

STRECHER, V. J. & ROSENSTOCK, I. M. 1997. The health belief model. *Cambridge handbook of psychology, health and medicine,* 113**,** 117.

SUBRAMANIAN, G. H. & NOSEK, J. T. 2001. An Empirical Study of the Measurement and Instrument Validation of Perceived Strategy Value of Information Systems. *Journal of Computer Information Systems,* 41**,** 64-69.

SUHR, D. D. 2006. Exploratory or confirmatory factor analysis?

SUJATHA, R. & SEKKIZHAR, J. 2019. Determinants of M-Commerce Adoption in India Using Technology Acceptance Model Infused with Innovation Diffusion Theory. *Journal of Management Research,* 19**,** 193-204.

SUKHODOLOV, A. P. 2018. *Internet Economy vs Classic Economy: Struggle of Contradictions [internet resource]*, Cham : Springer International Publishing.

SULEMAN, A. O. & OGBETTE, A. S. 2019. Human resource management: Implications of outsourcing in public organisations in Nigeria. *Human Resource Management,* 9**,** 27-31.

SWILLEY, E. 2016. *Mobile commerce: how it contrasts, challenges and enhances electronic commerce,* New York, New York (222 East 46th Street, New York, NY 10017), New York, New York (222 East 46th Street, New York, NY 10017): Business Expert Press.

SWITSER, J. 1997. Trends in human resources outsourcing. *Strategic Finance,* 79**,** 22.

SYARIFUDIN, G., ABBAS, B. S. & HERIYATI, P. TAM Approach On E-Commerce of Aircraft Ticket Sales On Consumer Purchase Intention. 2018 6th International Conference on Cyber and IT Service Management (CITSM), 2018. IEEE, 1-6.

SYED, A. & SHAIKH, F. M. 2012. Barriers in implementation of e-business technologies in small and medium enterprises (SMEs) in Pakistan. *Romanian Statistical Review,* 60**,** 65-72.

SYMONDS, M. 2000. Government and the internet: no gain without pain. *The Economist,* 355**,** S9-S14.

TABACHNICK, B. G., FIDELL, L. S. & ULLMAN, J. B. 2013. *Using multivariate statistics*, pearson Boston, MA.

TAHERDOOST, H. 2018. A review of technology acceptance and adoption models and theories. *Procedia Manufacturing,* 22**,** 960-967.

TAN, M. & TEO, T. S. 2000. Factors influencing the adoption of Internet banking. *Journal of the Association for information Systems,* 1**,** 5.

TANVEER, M. 2021. Analytical Approach on Small and Medium Pakistani Businesses Based on E-Commerce Ethics with Effect on Customer Repurchase Objectives and Loyalty. *Journal of Legal, Ethical and Regulatory Issues,* 24**,** 1-20.

TARKA, P. 2018. An overview of structural equation modeling: its beginnings, historical development, usefulness and controversies in the social sciences. *Quality & quantity,* 52**,** 313-354.

TASHAKKORI, A. & TEDDLIE, C. 2010. *Sage handbook of mixed methods in social & behavioral research*, sage.

TAYLOR, S. & TODD, P. A. 1995. Understanding information technology usage: A test of competing models. *Information systems research,* 6**,** 144-176.

TCHAO, E. T., DIAWUO, K., AGGOR, C. S. & KOTEY, S. D. 2017. Ghanaian Consumers Online Privacy Concerns: Causes and its Effects on E-Commerce Adoption. *arXiv preprint arXiv:1801.01086*.

TELENOR. 2020. *UpGrade to Telenor 4G speed* [Online]. Available: https://www.telenor.com.pk/devices/mobile-broadband/ [Accessed 13/10/2020].

TEO, T. S. & TAN, M. 1998. An empirical study of adoptors and non-adopters of the Internet in Singapore. *Information & management,* 34**,** 339-345.

THATCHER, S. M., FOSTER, W. & ZHU, L. 2006. B2B e-commerce adoption decisions in Taiwan: The interaction of cultural and other institutional factors. *Electronic Commerce Research and Applications,* 5**,** 92-104.

THE NATIONAL AUDIT OFFICE. 2002. Government on the Web II. Available: https://www.nao.org.uk/wp-content/uploads/2002/04/0102764.pdf.

THE NEWS. 2020. UK relaxes travel guidelines for Pakistan citing improved security. *The News*, 24/01/2020.

THODE, H. C. 2002. *Testing for normality*, CRC press.

THOMAS, L. 2020a. What is a cross-sectional study? Available: https://www.scribbr.com/methodology/cross-sectional-study/ [Accessed 07/05/2021].

THOMAS, L. 2020b. What is a longitudinal study? Available: https://www.scribbr.com/methodology/longitudinal-study/ [Accessed 07/05/2021].

THOMAS, M. R., KAVYA, V. & MONICA, M. 2018. Online website cues influencing the purchase intention of generation z mediated by trust. *Indian Journal of Commerce and Management Studies,* 9**,** 13-23.

THOMPSON, C. 1999. If you could just provide me with a sample: examining sampling in qualitative and quantitative research papers. *Evidence-Based Nursing,* 2**,** 68-70.

TIMES 2021. Pakistan becomes the 4th fastest growing freelance market across the world. online: The Times.

TIMMERS, P. 1999. Eletronic commerce: strategies and models for business-to-business trading.

TIWARI, R., BUSE, S. & HERSTATT, C. 2006. The mobile commerce technologies: Generations, standards and protocols. *Technology and Innovation Managment (University of Hamburg) Working Paper*.

TOH, T. W., GOVINDAN, M., CHONG, A. Y.-L., KENG-BOON, O. & SEETHARAM, A. 2009. What drives Malaysian m-commerce adoption? An empirical analysis. *Industrial Management & Data Systems,* 109**,** 370-388.

TORNATZKY, G., FLEISCHER, M. & DRAZIN, R. 1991. The Process of Technological Innovation. *Journal of Technology Transfer - J TECHNOL TRANSFER,* 16**,** 45-46.

TORNATZKY, L. G. & KLEIN, K. J. 1982. Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings. *IEEE Transactions on engineering management***,** 28-45.

TRAFIMOW, D., SHEERAN, P., CONNER, M. & FINLAY, K. A. 2002. Evidence that perceived behavioural control is a multidimensional construct: Perceived control and perceived difficulty. *British journal of social psychology,* 41**,** 101-121.

TRAVICA, B. 2002. Diffusion of Electronic Commerce in Developing Countries: The Case of Costa Rica. *Journal of Global Information Technology Management,* 5**,** 4-24.

TSIKRIKTSIS, N. 2005. A review of techniques for treating missing data in OM survey research. *Journal of operations management,* 24**,** 53-62.

TU, Y. & SHANGGUAN, J. Z. 2018. Cross-border e-commerce: a new driver of global trade. *Emerging Issues in Global Marketing.* Springer.

TURBAN, E., LEE, J., KING, D. & CHUNG, H. 1999. *Electronic Commerce: A Managerial Perspective,* NJ, Prentice-Hall.

TUSHMAN, M. L. & ANDERSON, P. 1986. Technological discontinuities and organizational environments. *Administrative science quarterly***,** 439-465.

UCLA. 2021. *MULTINOMIAL LOGISTIC REGRESSION | SAS DATA ANALYSIS EXAMPLES* [Online]. Institute for Digital Reserach & Education Available: https://stats.idre.ucla.edu/sas/dae/multinomiallogistic-regression/ [Accessed 26/11/2021 2021].

UGLI, K. S. F., UGLI, I. B. I. & UGLI, A. D. A. 2020. Website Development with New Technology. *International Journal of Human Computing Studies,* 2**,** 1-7.

UK CABINET OFFICE. 1999. e-commerce@its.best.uk. A Performance and Innovation Unit Report. Available: https://ntouk.files.wordpress.com/2015/06/ecommerce-at-its-best-1999-body.pdf.

UN 2012. *United Nations E-Government Survey 2012*.

UN. 2023a. *EGOVKB | United Nations > Data > Country Information* [Online]. online: United Nations. Available: https://publicadministration.un.org/egovkb/en-us/Data/Country-Information/id/128-Pakistan [Accessed 19/02/2023 2023].

UN, K. 2023b. *UN-E- Government Knowledgebase* [Online]. online: United Nations. Available: https://publicadministration.un.org/egovkb/en-us/data-center [Accessed 05/02/2023 2023].

UNCTAD 2017a. Information Economy Report. *DIGITALIZATION, TRADE AND DEVELOPMENT.* 2017 ed.: UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT.

UNCTAD 2017b. UNCTAD B2C E-COMMERCE INDEX 2017. *UNCTAD Technical Notes on ICT for Development.*

UNCTAD 2020. Global e-Commerce hits $25.6 trillion – latest UNCTAD estimates. Geneva, Switzerland: UNCTAD.

UNPAN. Benchmarking E-government: A Global Perspective. 2002.

UNWOMEN. 2022. *Asia and the Pacific* [Online]. United Nations. Available: https://asiapacific.unwomen.org/en/countries/pakistan [Accessed 13/05/2022 2022].

UR RAHMAN, S., KHAN, M. A. & IQBAL, N. 2018. Motivations and barriers to purchasing online: understanding consumer responses. *South Asian Journal of Business Studies*.

US DEPARTMENT OF COMMERCE 2000. DIGITAL ECONOMY 2000 *In:* COMMERCE, U. S. D. O. (ed.). Secretariat on Electronic Commerce, U. S. Department of Commerce.

UWAMARIYA, M., CREMER, S. & LOEBBECKE, C. ICT for economic development in Rwanda: Fostering E-commerce adoption in tourism SMEs. SIG GlobalDev Annual Workshop, 2015.

UZOKA, F. M. E., SHEMI, A. P. & SELEKA, G. G. 2007. Behavioral Influences on E-Commerce Adoption in a Developing Country Context. *The Electronic Journal of Information Systems in Developing Countries,* 31**,** 1-15.

VAITHIANATHAN, S. 2010. A review of e-commerce literature on India and research agenda for the future. *Electronic Commerce Research,* 10**,** 83-97.

VALAREZO, Á., PÉREZ-AMARAL, T., GARÍN-MUÑOZ, T., GARCÍA, I. H. & LÓPEZ, R. 2018. Drivers and barriers to cross-border e-commerce: Evidence from Spanish individual behavior. *Telecommunications Policy,* 42**,** 464-473.

VALLE-CRUZ, D. 2019. Public value of e-government services through emerging technologies. *International Journal of Public Sector Management,* 32**,** 530-545.

VAN RAAIJ, E. M. & SCHEPERS, J. J. L. 2008. The acceptance and use of a virtual learning environment in China. *Computers & Education,* 50**,** 838-852.

VAN TEIJLINGEN, E. R. & HUNDLEY, V. 2001. The importance of pilot studies.

VĂRZARU, A. A., BOCEAN, C. G., ROTEA, C. C. & BUDICĂ-IACOB, A.-F. 2021. Assessing antecedents of behavioral intention to use mobile technologies in e-commerce. *Electronics,* 10**,** 2231.

VAUGHAN-JOHNSTON, T., IMTIAZ, F., LEE, A. & JI, L.-J. 2021. Age Differences in Leadership Positions Across Cultures. *Frontiers in psychology,* 12**,** 703831-703831.

VEERANJANEYULU, S. 2016. ROLE OF MOBILE COMMERCE IN PROMOTING NEW ENTERPRISES IN INDIA: AN OVERVIEW G. Rajendra Prasad1. *RESPONSIBLE MARKETING FOR SUSTAINABLE BUSINESS*, 33.

VENKATESH, V., BROWN, S. A., MARUPING, L. M. & BALA, H. 2008. Predicting different conceptualizations of system use: the competing roles of behavioral intention, facilitating conditions, and behavioral expectation. *MIS quarterly*, 483-502.

VENKATESH, V., MORRIS, M. G., DAVIS, G. B. & DAVIS, F. D. 2003. User acceptance of information technology: Toward a unified view. *MIS quarterly*, 425-478.

VENKATESH, V., SPEIER, C. & MORRIS, M. G. 2002. User acceptance enablers in individual decision making about technology: Toward an integrated model. *Decision sciences,* 33, 297-316.

VENKATRAMAN, N. 1989. Strategic Orientation Of Business Enterprises: The Construc. *Management Science,* 35, 942-962.

VERHOEVEN, J. C., HEERWEGH, D. & DE WIT, K. 2010. Information and communication technologies in the life of university freshmen: An analysis of change. *Computers & Education,* 55, 53-66.

VICENTE, P. & REIS, E. 2010. Using questionnaire design to fight nonresponse bias in web surveys. *Social science computer review,* 28, 251-267.

VIJVERBERG, W. P. 2011. Testing for IIA with the Hausman-McFadden test. IZA Discussion Papers.

VILLA, E., RUIZ, L., VALENCIA, A. & PICÓN, E. 2018. Electronic commerce: factors involved in its adoption from a bibliometric analysis. *Journal of theoretical and applied electronic commerce research,* 13, 39-70.

VLADIMIR, Z. 1996. Electronic commerce: structures and issues. *International journal of electronic commerce,* 1, 3-23.

VLOSKY, R. P. 1999. eBusiness in the Forest Products Industry. *Forest Products Journal,* 49.

VOM BROCKE, J., SIMONS, A., RIEMER, K., NIEHAVES, B., PLATTFAUT, R. & CLEVEN, A. 2015. Standing on the shoulders of giants: Challenges and recommendations of literature search in information systems research. *Communications of the association for information systems,* 37, 9.

W.B. 2022. Small and Medium Enterprises (SMEs) Finance. Available: https://www.worldbank.org/en/topic/smefinance [Accessed 28/08/2022].

W.F. 2010. *Multinationals target developing countries* [Online]. World Finance. Available: https://www.worldfinance.com/news/multinationals-target-developing-countries [Accessed 31/01/2021 2021].

WALLSTON, K. 2001. Control Beliefs: Health Perspectives. *In:* SMELSER, N. J. & BALTES, P. B. (eds.) *International Encyclopedia of the Social & Behavioral Sciences.* Oxford: Pergamon.

WANG, S. & CHEUNG, W. 2004. E-business adoption by travel agencies: prime candidates for mobile e-business. *International Journal of Electronic Commerce,* 8, 43-63.

WANG, Y. & AHMED, P. K. 2009. The moderating effect of the business strategic orientation on eCommerce adoption: Evidence from UK family run SMEs. *The Journal of Strategic Information Systems,* 18, 16-30.

WANG, Y., JIA, F., SCHOENHERR, T., GONG, Y. & CHEN, L. 2020. Cross-border e-commerce firms as supply chain integrators: The management of three flows. *Industrial Marketing Management,* 89, 72-88.

WANG, Y. S. 2008. Assessing e-commerce systems success: a respecification and validation of the DeLone and McLean model of IS success. *Information systems journal,* 18, 529-557.

WANG, Y. S., WU, M. C. & WANG, H. Y. 2009. Investigating the determinants and age and gender differences in the acceptance of mobile learning. *British journal of educational technology,* 40, 92-118.

WANYOIKE, D. M., MUKULU, E. & WAITITU, A. G. 2012. ICT attributes as determinants of e-commerce adoption by formal small enterprises in urban Kenya. *International Journal of Business and Social Science,* 3.

WAQAR, S., HANIF, R. & LOH, J. 2021. Invisibility not invincibility: Pakistani women and the lack of career ascendance. *Gender in Management: An International Journal,* 36**,** 731-744.

WARD, M. A. & MITCHELL, S. 2004. A comparison of the strategic priorities of public and private sector information resource management executives. *Government Information Quarterly,* 21**,** 284-304.

WATSON, R. T. & MUNDY, B. 2001. A strategic perspective of electronic democracy. *Communications of the ACM,* 44**,** 27-30.

WATTOO, M. U. & IQBAL, S. M. J. 2022. Unhiding Nexus Between Service Quality, Customer Satisfaction, Complaints, and Loyalty in Online Shopping Environment in Pakistan. *SAGE Open,* 12**,** 21582440221097920.

WB. 2002. THE E-GOVERNMENT HANDBOOK FOR DEVELOPING COUNTRIES. Available: http://documents1.worldbank.org/curated/en/317081468164642250/pdf/320450egovhandbook01public12002111114.pdf [Accessed 19/11/2020].

WB. 2022. *Women, Business and the Law* [Online]. The World Bank. Available: https://wbl.worldbank.org/en/wbl [Accessed 13/05/2022 2022].

WEBB, T. L. & SHEERAN, P. 2006. Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychological bulletin,* 132**,** 249.

WEI, T. T., MARTHANDAN, G., CHONG, A. Y. L., OOI, K. B. & ARUMUGAM, S. 2009. What drives Malaysian m-commerce adoption? An empirical analysis. *Industrial management & data systems*.

WEI, Z., LEE, M.-Y. & SHEN, H. 2018. What drives consumers in China to buy clothing online? Application of the technology acceptance model. *Journal of Textiles and Fibrous Materials,* 1**,** 2515221118756791.

WESCOTT, C. G. 2001. E-Government in the Asia-pacific region. *Asian Journal of Political Science,* 9**,** 1-24.

WESTON, R. & GORE JR, P. A. 2006. A brief guide to structural equation modeling. *The counseling psychologist,* 34**,** 719-751.

WILINSKI, K. 2020. Roles of logistics service provider in e-commerce: an example of raben company. *Kasetsart Applied Business Journal,* 14**,** 33-50.

WILLCOCKS, L. & GRIFFITHS, C. 1997. Management and risk in major information technology projects. *Managing IT as a Strategic Resource, McGraw-Hill, London***,** 203-237.

WINKENBACH, M. & JANJEVIC, M. 2018. Classification of Last-Mile Delivery Models for e-Commerce Distribution: A Global Perspective. *City Logistics 1: New Opportunities and Challenges***,** 209-229.

WITRIBE. 2020. *business internet* [Online]. Available: http://wi-tribe.pk/enterprise-solutions/business-internet/ [Accessed 31/11/2020 2020].

WOLCOTT, P., PRESS, L., MCHENRY, W., GOODMAN, S. E. & FOSTER, W. 2001. A framework for assessing the global diffusion of the Internet. *Journal of the Association for Information Systems,* 2.

WORZALA, E. M., MCCARTHY, A. M., DIXON, T. & MARSTON, A. 2002. E-commerce and retail property in the UK and USA. *Journal of Property Investment & Finance*.

WTO. 2013. e-commerce in developing countries. Available: https://www.wto.org/english/res_e/booksp_e/ecom_brochure_e.pdf [Accessed 10/03/2021].

WTO. 2022. Computer and related services. Available: https://www.wto.org/english/tratop_e/serv_e/computer_e/computer_e.htm [Accessed 14/06/2022].

WU, J. & GUO, D. 2015. Measuring E-government performance of provincial government website in China with slacks-based efficiency measurement. *Technological forecasting and social change,* 96**,** 25-31.

WYMER, S. A. & REGAN, E. A. 2005. Factors influencing e-commerce adoption and use by small and medium businesses. *Electronic markets,* 15**,** 438-453.

XU, M., FERRAND, B. & ROBERTS, M. 2008. The last mile of e-commerce–unattended delivery from the consumers and eTailers' perspectives. *International Journal of Electronic Marketing and Retailing,* 2**,** 20-38.

YADAV, N., RAJPOOT, D. S. & DHAKAD, S. K. LARAVEL: a PHP framework for e-commerce website. 2019 Fifth International Conference on Image Information Processing (ICIIP), 2019. IEEE, 503-508.

YANG, K. C. 2005. Exploring factors affecting the adoption of mobile commerce in Singapore. *Telematics and informatics,* 22**,** 257-277.

YAP, C. S. & HII, J. W. H. 2009. Factors Affecting the Adoption of Mobile Commerce in Malaysia. *IUP Journal of Information Technology,* 5.

YASIR, M. 2018. Half of the World's Unbanked Population Belongs to Pakistan and 6 Other Countries. Available: https://propakistani.pk/2018/05/25/half-of-the-worlds-unbanked-population-belongs-to-pakistan-and-6-other-countries/ [Accessed 24/02/2021].

YEBOAH-BOATENG, E. O. & ESSANDOH, K. A. 2014. Factors influencing the adoption of cloud computing by small and medium enterprises in developing economies. *International Journal of Emerging Science and Engineering,* 2**,** 13-20.

YEFIMOV, V. 2004. On pragmatist institutional economics.

YIGITBASIOGLU, O. M. 2015. The role of institutional pressures and top management support in the intention to adopt cloud computing solutions. *Journal of Enterprise Information Management*.

YILDIZ, M. 2007. E-government research: Reviewing the literature, limitations, and ways forward. *Government information quarterly,* 24**,** 646-665.

YIN, R. K. & HOLLWECK, T. 2015. Case Study Research Design and Methods . Thousand Oaks, CA: Sage. 282 pages. *Canadian Journal of Program Evaluation,* 30.

YIP, R. & RAMAKRISHNAN, U. 2002. Experiences and challenges in developing countries. *The Journal of nutrition,* 132**,** 827S-830S.

YOO, W., MAYBERRY, R., BAE, S., SINGH, K., HE, Q. P. & LILLARD JR, J. W. 2014. A study of effects of multicollinearity in the multivariable analysis. *International journal of applied science and technology,* 4**,** 9.

YOUNG, G. J., CHARNS, M. P. & SHORTELL, S. M. 2001. Top manager and network effects on the adoption of innovative management practices: A study of TQM in a public hospital system. *Strategic management journal,* 22**,** 935-951.

YOUNG, R. & JORDAN, E. 2008. Top management support: Mantra or necessity? *International journal of project management,* 26**,** 713-725.

YOUSAFZAI, S. Y., FOXALL, G. R. & PALLISTER, J. G. 2010. Explaining internet banking behavior: theory of reasoned action, theory of planned behavior, or technology acceptance model? *Journal of applied social psychology,* 40**,** 1172-1202.

YUAN, K. H., CHAN, W. & BENTLER, P. M. 2000. Robust transformation with applications to structural equation modelling. *British Journal of Mathematical and Statistical Psychology,* 53**,** 31-50.

ZAFAR, F., KAMRAN, A., SALMAN, S. & REHMAN, S. U. Influence of E-commerce and Emerging Innovative Technological Advancements in the Banking Sector in Pakistan. *In:* XU, J., ALTIPARMAK, F., HASSAN, M. H. A., GARCÍA MÁRQUEZ, F. P. & HAJIYEV, A., eds. Proceedings of the Sixteenth International Conference on Management Science and Engineering Management – Volume 1, 2022// 2022 Cham. Springer International Publishing, 193-206.

ZAIED, A. N. H. 2012. Barriers to e-commerce adoption in Egyptian SMEs. *International Journal of Information Engineering and Electronic Business,* 4**,** 9.

ZAKI, W., TAYYAB, A., HASSAN, A. & JAVED, A. 2019. Factors Affecting Customer Experience of E-Commerce in Pakistan.

ZEB, A. & IHSAN, A. Innovation and the entrepreneurial performance in women-owned small and medium-sized enterprises in Pakistan. Women's Studies International Forum, 2020. Elsevier, 102342.

ZHANG, D., PEE, L. & CUI, L. 2021. Artificial intelligence in E-commerce fulfillment: A case study of resource orchestration at Alibaba's Smart Warehouse. *International Journal of Information Management,* 57**,** 102304.

ZHANG, J. & YUAN, Y. 2002. M-commerce versus internet-based E-commerce: the key differences. *AMCIS 2002 Proceedings***,** 261.

ZHANG, X., YU, P., YAN, J. & SPIL, I. T. A. 2015. Using diffusion of innovation theory to understand the factors impacting patient acceptance and use of consumer e-health innovations: a case study in a primary care clinic. *BMC health services research,* 15**,** 1-15.

ZHONG, S., GIANNIKAS, V., MERINO, J., MCFARLANE, D., CHENG, J. & SHAO, W. 2022. Evaluating the benefits of picking and packing planning integration in e-commerce warehouses. *European Journal of Operational Research,* 301**,** 67-81.

ZHU, K., DONG, S., XU, S. X. & KRAEMER, K. L. 2006a. Innovation diffusion in global contexts: determinants of post-adoption digital transformation of European companies. *European journal of information systems,* 15**,** 601-616.

ZHU, K. & KRAEMER, K. L. 2005. Post-adoption variations in usage and value of e-business by organizations: cross-country evidence from the retail industry. *Information systems research,* 16**,** 61-84.

ZHU, K., XU, S., KRAEMER, K., KORTE, W. & SELHOFER, H. 2006b. Contingency effects in innovation diffusion: why does the same technology attract firms differently. *Grameen Communications Is a Leading IT Solutions Provider in Bangladesh, Concentrated in Software Development & Implementation, Hardware Support, Training Etc. with the Leadership & Direction of Nobel Laureate Prof. Dr. Muhammad Yunus, the Organisation Gained Traction Serving More Than,* 90.

ZHUANG, Y. 1999. Electronic Commerce: A Resource-Based View.

ZHUANG, Y. & LEDERER, A. L. 2003. An instrument for measuring the business benefits of e-commerce retailing. *International Journal of Electronic Commerce,* 7**,** 65-99.

ZIA, M. M. D., SAJID, M. M. & SIDDIQUE, M. 2022. E-commerce in Pakistan: A new horizon for pakistani products in european markets. *Journal of European Studies (JES),* 38**,** 67-86.

ZONG. 2020. *Broad Band Devices* [Online]. Available: https://www.zong.com.pk/devices/zong-4g-wifi-huawei [Accessed 13/10/2020].

ZWASS, V. 2003. Electronic commerce and organizational innovation: Aspects and opportunities. *International Journal of Electronic Commerce,* 7**,** 7-37.

ZWASS, V. 2019. E-Commerce. Encyclopedia Britanica.

Appendix -A

Questionnaire 1

Exploring E-Commerce in Pakistan (PERM)

Thank you very much for taking the time to participate in this investigation. Please select and encircle the option that best describes your perceptions/ status. For privacy and ethical policies please refer to the relevant accompanying documents.

This study is regarding E-Commerce derivers and barriers in Pakistan. For this study, we define E-Commerce as the exchange of information and/or goods online using computer/ cell phone/ mobile device, internet, and web technologies or E-mail, whether or not it involves the financial transaction.

Please note you can fill this questionnaire online as well on the secure online platform- The link has been shared with the focal person of your organisation. You can call 00923034393776 should you have any questions or concerns about the survey.

Part-I

About your Organisation

We have defined four levels of E-Commerce adoption status within organisations based on the level of sophistication. Please refer to the following table before answering question 1. Please select level-0 if your organisation is not connected to the internet/does not has a website and you do not have a business email.

Level Name	Private Sector- Characteristics	Public sector - Characteristics
1	Your organisation has a business e-mail and/or Static website but with no two-way communication and/or you have downloadable information from the website	Your organisation has official e-mails of different relevant functional departments and/ or Single E-mail for communication with citizens and/or with businesses and/ or with other governmental organisations and/or your organisation has a static website with no two-way communication. Downloadable forms from the website
2	In addition to level 1 features, your organisation has a Web site with two-way communication capability and/or Online query submission/ online forms submission and/or online ordering but no financial transaction facility and/or Your organisation's web pages dynamically generate/refresh the page content	In addition to level 1 features, your organisation has a website with two-way communication capability and/or Online query submission/ online form submission and/or Online ordering of services or products but no financial transaction facility and/or your organisation's web pages dynamically generate/refresh the page content
3	In addition to level 2 features, your organisation has websites/ portals that allow financial transactions and/or the website/portal allows a customer to make a personalised account with your organisation. you have online Communities	In addition to level 2 features, Your organisation has websites/ portals that allow financial transactions (paying bills online, renewing licences etc) and/or the website/portal allows a customer to make a personalised account with the organisation and/or Online Communities

4	In addition to level three features, all relevant functional departments/ business processes are integrated	In addition to level 3 features, all relevant functional departments within the organisation and business processes are integrated and/or web portal/ website is integrated with other relevant departments/ organisations of the Public sector .

1. **What is your organisation's current level of E-Commerce adoption? (Please refer to the above table)?**
    a. Level-0
    b. Level-1
    c. Level-2
    d. Level-3
    e. Level-4

2. **What is your Sector?**

    a. Private
    b. Government/ Public
    c. Semi Government

3. **What best describes your sector?**
    a. Construction and Building
    b. Insurance and financial services
    c. Computer and electronic products manufacturing
    d. Electrical materials and accessories
    e. Food and Beverages
    f. Motor and Autos
    g. Medical Care/Hospitals
    h. Textile and Clothing
    i. Transportation
    j. Tourism and Hospitality
    k. Training and consultancy
    l. Utility Provider
    m. Publication and Printing
    n. Education / University/School/Collage
    o. Telecom
    p. Public service delivery
    q. Other (Please mention) _____

Part-II

About Yourself

4. **What is your position in your organisation? (Please encircle the appropriate)**
    a. President/Managing Director/Chief Executive Officer
    b. Deputy Managing Director/ Senior General Manager/ General Manager
    c. Line Manager / Information Manager/ Chief Information Officer
    d. Upper Middle Management
    e. Middle Management

5. **How would you describe your Gender?**
    a. Female

b. Male
c. Prefer not to say.

6. What is your age?

a. 21-29
b. 30-39
c. 49-49
d. 50-59
e. 60 or older

7. What is your highest qualification?

a. Nil
b. Primary
c. High School
d. Trade Qualification/ Diploma/FSc/ FA or equivalent
e. Graduate
f. Postgraduate

Part-III

Please encircle the number that best describes your thoughts (1=strongly disagree and 5=strongly agree).

AW1- Our organisation is aware of E-Commerce implementations of our partner organisations.

Strongly Agree	5	4	3	2	1	Strongly Disagree

AW2- Our organisation is aware of our competitors' E-Commerce and E-Business implementations.

Strongly Agree	5	4	3	2	1	Strongly Disagree

AW3- Our business recognizes the opportunities and threats enabled by E-Commerce.

Strongly Agree	5	4	3	2	1	Strongly Disagree

AW4 - Our organisation understands E-Commerce business models that can be applicable to our business.

Strongly Agree	5	4	3	2	1	Strongly Disagree

AW5- We understand the potential benefits of E-Commerce to our business.

Strongly Agree	5	4	3	2	1	Strongly Disagree

AW6- Our organisation has thought about whether or not E-Commerce has impacts on the way business is to be conducted in our industry.

Strongly Agree	5	4	3	2	1	Strongly Disagree

AW7- Our organisation has considered whether or not businesses in our industry that fail to adopt E-Commerce and E-Business would be at a competitive disadvantage.

Strongly Agree	5	4	3	2	1	Strongly Disagree

HR1-Most of our employees are computer literate.

Strongly Agree	5	4	3	2	1	Strongly Disagree

HR2-Most of our employees have unrestricted access to computers.

Strongly Agree	5	4	3	2	1	Strongly Disagree

BR1-Our people are open and trusting with one another.

Strongly Agree	5	4	3	2	1	Strongly Disagree

BR2-Communication is very open in our organisation.

Strongly Agree	5	4	3	2	1	Strongly Disagree

BR3-Our organisation exhibits a culture of enterprise-wide information sharing.

Strongly Agree	5	4	3	2	1	Strongly Disagree

BR4-We have a policy that encourages grass roots E-Commerce (or IT) initiatives.

Strongly Agree	5	4	3	2	1	Strongly Disagree

BR5-Failure can be tolerated in our organisation.

Strongly Agree	5	4	3	2	1	Strongly Disagree

BR6-Our organisation is capable of dealing with rapid changes.

Strongly Agree	5	4	3	2	1	Strongly Disagree

TR1-We have sufficient experience with network-based applications.

Strongly Agree	5	4	3	2	1	Strongly Disagree

TR2-We have sufficient business resources to implement E-Commerce.

Strongly Agree	5	4	3	2	1	Strongly Disagree

TR3-Our organisation is well computerized with LAN and WAN (LAN is a network of locally connected computers and WAN is network of computers placed locally or distant places).

Strongly Agree	5	4	3	2	1	Strongly Disagree

TR4-We have high bandwidth connectivity to the Internet.

Strongly Agree	5	4	3	2	1	Strongly Disagree

TR5-Our existing systems are flexible.

Strongly Agree	5	4	3	2	1	Strongly Disagree

TR6-Our existing systems are customisable to our customers' needs.

Strongly Agree	5	4	3	2	1	Strongly Disagree

CT1-Our business has a clear vision on E-Commerce (or IT).

Strongly Agree	5	4	3	2	1	Strongly Disagree

CT2-Our vision of E-Commerce (or IT) activities is widely communicated and understood throughout our company.

Strongly Agree	5	4	3	2	1	Strongly Disagree

CT3-Our E-Commerce (or IT) implementations are strategy-led.

Strongly Agree	5	4	3	2	1	Strongly Disagree

CT4-All our E-Commerce (or IT) initiatives have champions.

Strongly Agree	5	4	3	2	1	Strongly Disagree

CT5-Senior management champions our E-Commerce (or IT)initiatives and implementations.

Strongly Agree	5	4	3	2	1	Strongly Disagree

GV1-Roles, responsibilities and accountability are clearly defined within each E-Commerce (or IT) initiative.

Strongly Agree	5	4	3	2	1	Strongly Disagree

GV2-E-Commerce (or IT) accountability is extracted via on-going responsibility.

Strongly Agree	5	4	3	2	1	Strongly Disagree

GV3-Decision-making authority has been clearly assigned for all E-Commerce (or IT) initiatives.

Strongly Agree	5	4	3	2	1	Strongly Disagree

GV4-We thoroughly analyse the possible changes to be caused in our organisation, suppliers, partners, and customers as a result of each E-Commerce (or IT) implementation.

Strongly Agree	5	4	3	2	1	Strongly Disagree

GV5-We follow a systematic process for managing change issues as a result of E-Commerce (or IT) implementations.

Strongly Agree	5	4	3	2	1	Strongly Disagree

GV6-We define a business case for each E-Commerce (or IT) implementation or initiative.

Strongly Agree	5	4	3	2	1	Strongly Disagree

GV7-We have clearly defined metrics for assessing the impact of our E-Commerce (or IT) initiatives.

Strongly Agree	5	4	3	2	1	Strongly Disagree

GV8-Our employees at all levels support our E-Commerce(or IT) initiatives.

Strongly Agree	5	4	3	2	1	Strongly Disagree

MF1-We believe that our customers are ready to do business on the Internet.

Strongly Agree	5	4	3	2	1	Strongly Disagree

MF2-We believe that our business partners are ready to conduct business on the Internet.

Strongly Agree	5	4	3	2	1	Strongly Disagree

GR1-We believe that there are effective laws to protect consumer privacy.

Strongly Agree	5	4	3	2	1	Strongly Disagree

GR2-We believe that there are effective laws to combat cybercrime.

Strongly Agree	5	4	3	2	1	Strongly Disagree

GR3-We believe that the legal environment is conducive to conduct business on the Internet.

Strongly Agree	5	4	3	2	1	Strongly Disagree

GR4-The government demonstrates strong commitment to promote E-Commerce.

Strongly Agree	5	4	3	2	1	Strongly Disagree

SI1-The telecommunication infrastructure is reliable and efficient to support E-Commerce and eBusiness.

Strongly Agree	5	4	3	2	1	Strongly Disagree

SI2-The technology infrastructure of commercial and financial institutions is capable of supporting E-Commerce transactions.

Strongly Agree	5	4	3	2	1	Strongly Disagree

SI3-We feel that there is efficient and affordable support from the local IT industry to support our move on the Internet.

Strongly Agree	5	4	3	2	1	Strongly Disagree

SI4-Secure Electronic Transaction (SET) and/or Secure Electronic Commerce Environment (SCCE) services are easily available and affordable.

Strongly Agree	5	4	3	2	1	Strongly Disagree

IN1-Assuming I have the access to resources, and I have authority, I intend to adopt E-Commerce for my organisation.

Strongly Agree	5	4	3	2	1	Strongly Disagree

IN2-Given that I have all the resources and required support, I would adopt E-Commerce for my company.

Strongly Agree	5	4	3	2	1	Strongly Disagree

Thank you very much once again for your time. Please put your response in the accompanying prepaid envelop and post.

Questionnaire 2

Exploring E-Commerce in Pakistan- TECHPB

Thank you very much for taking the time to participate in this investigation. Please select and encircle the option that best describes your perceptions/ status. For privacy and ethical policies please refer to the relevant accompanying documents.

This study is regarding E-Commerce derivers and barriers in Pakistan. For this study, we define E-Commerce as the exchange of information and/or goods online using computer/ cell phone/ mobile device, internet, and web technologies or E-mail, whether or not it involves the financial transaction.

Please note you can fill this questionnaire online as well on the secure online platform- The link has been shared with the focal person of your organisation. You can call 00923034393776 should you have any questions or concerns about the survey.

Part-I

About your Organisation

We have defined four levels of E-Commerce adoption status within organisations based on the level of sophistication. Please refer to the following table before answering question 1. Please select level-0 if your organisation is not connected to the internet/does not has a website and you do not have a business email.

Level Name	Private Sector- Characteristics	Public sector - Characteristics
1	Your organisation has a business e-mail and/or Static website but with no two-way communication and/or you have downloadable information from the website	Your organisation has official e-mails of different relevant functional departments and/ or Single E-mail for communication with citizens and/or with businesses and/ or with other governmental organisations and/or your organisation has a static website with no two-way communication. Downloadable forms from the website
2	In addition to level 1 features, your organisation has a Web site with two-way communication capability and/or Online query submission/ online forms submission and/or online ordering but no financial transaction facility and/or Your organisation's web pages dynamically generate/refresh the page content	In addition to level 1 features, your organisation has a website with two-way communication capability and/or Online query submission/ online form submission and/or Online ordering of services or products but no financial transaction facility and/or your organisation's web pages dynamically generate/refresh the page content
3	In addition to level 2 features, your organisation has websites/ portals that allow financial transactions and/or the website/portal allows a customer to make a personalised account with your organisation. you have online Communities	In addition to level 2 features, Your organisation has websites/ portals that allow financial transactions (paying bills online, renewing licences etc) and/or the website/portal allows a customer to make a personalised account with the organisation and/or Online Communities

4	In addition to level three features, all relevant functional departments/ business processes are integrated	In addition to level 3 features, all relevant functional departments within the organisation and business processes are integrated and/or web portal/ website is integrated with other relevant departments/ organisations of the public sector.

1. **What is your organisation's current level of E-Commerce adoption? (Please refer to the above table)?**
    a. Level-0
    b. Level-1
    c. Level-2
    d. Level-3
    e. Level-4

2. **What is your Sector?**

    a. Private
    b. Government/ Public
    c. Semi Government

3. **What best describes your sector?**
    a. Construction and Building
    b. Insurance and financial services
    c. Computer and electronic products manufacturing
    d. Electrical materials and accessories
    e. Food and Beverages
    f. Motor and Autos
    g. Medical Care/Hospitals
    h. Textile and Clothing
    i. Transportation
    j. Tourism and Hospitality
    k. Training and consultancy
    l. Utility Provider
    m. Publication and Printing
    n. Education / University/School/Collage
    o. Telecom
    p. Public service delivery
    q. Other (Please mention) _____

Part-II

About Yourself

4. **What is your position in your organisation? (Please encircle the appropriate)**
    a. President/Managing Director/Chief Executive Officer
    b. Deputy Managing Director/ Senior General Manager/ General Manager
    c. Line Manager / Information Manager/ Chief Information Officer
    d. Upper Middle Management
    e. Middle Management

5. **How would you describe your Gender?**
    a. Female

b. Male
c. Prefer not to say.

6. **What is your age?**
   a. 21-29
   b. 30-39
   c. 49-49
   d. 50-59
   e. 60 or older
7. **What is your highest qualification?**
   a. Nil
   b. Primary
   c. High School
   d. Trade Qualification/ Diploma/FSc/ FA or equivalent
   e. Graduate
   f. Postgraduate

Part-III

Please encircle the number that best describes your thoughts (1=strongly disagree and 5=strongly agree).

RA1- The degree to which you expect E-Commerce can help increase sales/ better public service delievery.

Strongly Agree	**5**	**4**	**3**	**2**	**1**	**Strongly Disagree**

RA2-The degree to which you expect E-Commerce can help decrease cost.

Strongly Agree	**5**	**4**	**3**	**2**	**1**	**Strongly Disagree**

PC1-Degree to which you think E-Commerce is compatible with your company's current selling/ public delievery process.

Strongly Agree	**5**	**4**	**3**	**2**	**1**	**Strongly Disagree**

PC2-Degree to which buying over the internet is compatible with your company's current procurement process.

Strongly Agree	**5**	**4**	**3**	**2**	**1**	**Strongly Disagree**

PC-3-Degree to which conducting transactions over the internet is compatible with existing distribution channels.

Strongly Agree	**5**	**4**	**3**	**2**	**1**	**Strongly Disagree**

PC4-Degree to which doing business through E-Commerce is compatible with your company's corporate culture and value system.

Strongly Agree	**5**	**4**	**3**	**2**	**1**	**Strongly Disagree**

PE1-My interaction with the E-Commerce technologies is /would clear and understandable.

Strongly Agree	**5**	**4**	**3**	**2**	**1**	**Strongly Disagree**

PE2-I believe it would be easy to get the E-Commerce technologies to do what I want it to do.

Strongly Agree	**5**	**4**	**3**	**2**	**1**	**Strongly Disagree**

PE3-Overall, I believe the E-Commerce technologies would be easy to use.

Strongly Agree	**5**	**4**	**3**	**2**	**1**	**Strongly Disagree**

PE4-Learning to use the E-Commerce technologies would be easy for me.

Strongly Agree	**5**	**4**	**3**	**2**	**1**	**Strongly Disagree**

CA1-The cost of implementing internet based online *sales* (including hardware, software, training, organisational restructuring, business process reengineering is acceptable.

Strongly Agree	**5**	**4**	**3**	**2**	**1**	**Strongly Disagree**

CA2-Costs of implementing internet based online ***procurement*** (including hardware, software, training, organisational restructuring, business process reengineering is acceptable.

Strongly Agree	**5**	**4**	**3**	**2**	**1**	**Strongly Disagree**

PS1-I think on internet data and transactions are safe.

Strongly Agree	**5**	**4**	**3**	**2**	**1**	**Strongly Disagree**

PS2-Our customers believe that the data and transactions over the internet are secure.

Strongly Agree	**5**	**4**	**3**	**2**	**1**	**Strongly Disagree**

PB1-I will be able to adopt E-Commerce.

Strongly Agree	**5**	**4**	**3**	**2**	**1**	**Strongly Disagree**

PB2-Adoption of E-Commerce is entirely under my control.

Strongly Agree	**5**	**4**	**3**	**2**	**1**	**Strongly Disagree**

PB3-I have resources and the knowledge and ability to adopt E-Commerce.

Strongly Agree	**5**	**4**	**3**	**2**	**1**	**Strongly Disagree**

IN1-Assuming I have the access to resources, and I have authority, I intend to adopt E-Commerce for my organisation.

Strongly Agree	**5**	**4**	**3**	**2**	**1**	**Strongly Disagree**

IN2-Given that I have all the resources and required support, I would adopt E-Commerce for my company.

Strongly Agree	**5**	**4**	**3**	**2**	**1**	**Strongly Disagree**

Thankyou very much for your time. Please send your response back to us using the accompanying prepaid postage envelop.

ROBUST CFA

Appendix B , Robust Confirmatory Analysis Results

Perceived E-Readiness model

lavaan 0.6-8 ended normally after 72 iterations

Estimator	ML
Optimization method	NLMINB
Number of model parameters	137
Number of observations	448

Model Test User Model:

	Standard	Robust
Test Statistic	1501.001	1489.639
Degrees of freedom	944	944
P-value (Chi-square)	0.000	0.000
Scaling correction factor		1.008
Satorra-Bentler correction		

Parameter Estimates:

Standard errors	Robust.sem
Information	Expected
Information saturated (h1) model	Structured

Latent Variables:

	Estimate	Std.Err	z-value	P(>|z|)	Std.lv	Std.all
AW =~						
aw1	1.000				0.940	0.798
aw2	1.070	0.047	22.777	0.000	1.006	0.826
aw3	0.970	0.050	19.240	0.000	0.912	0.758
aw4	1.022	0.046	22.382	0.000	0.961	0.816
aw5	1.061	0.046	23.066	0.000	0.997	0.815
aw6	1.008	0.044	22.800	0.000	0.947	0.805
aw7	1.022	0.049	20.968	0.000	0.961	0.808
HR =~						
hr1	1.000				1.034	0.886
hr2	0.807	0.079	10.160	0.000	0.835	0.754
BR =~						
br1	1.000				0.972	0.856
br2	0.885	0.043	20.783	0.000	0.860	0.760
br3	1.033	0.044	23.696	0.000	1.004	0.834
br4	1.038	0.041	25.362	0.000	1.008	0.842
br5	0.877	0.044	19.832	0.000	0.852	0.717
br6	0.867	0.041	21.299	0.000	0.843	0.745
TR =~						
tr1	1.000				0.951	0.805
tr2	1.002	0.046	21.770	0.000	0.953	0.812
tr3	1.012	0.046	21.953	0.000	0.962	0.839
tr4	1.024	0.049	20.689	0.000	0.974	0.814
tr5	0.887	0.048	18.515	0.000	0.844	0.754
tr6	0.894	0.044	20.106	0.000	0.850	0.756
CT =~						
ct1	1.000				0.959	0.808
ct2	0.957	0.048	20.031	0.000	0.918	0.769
ct3	0.997	0.047	21.378	0.000	0.956	0.814
ct4	1.067	0.047	22.746	0.000	1.024	0.831
ct5	1.041	0.050	20.707	0.000	0.999	0.820
GV =~						

gv1	1.000			0.929	0.811	
gv2	0.954	0.044	21.677	0.000	0.886	0.761
gv3	1.056	0.050	21.186	0.000	0.981	0.811
gv4	1.064	0.049	21.909	0.000	0.988	0.802
gv5	0.973	0.047	20.592	0.000	0.903	0.787
gv6	0.971	0.052	18.771	0.000	0.902	0.764
gv7	0.986	0.053	18.756	0.000	0.916	0.739
gv8	0.819	0.042	19.512	0.000	0.761	0.743
MF =~						
mf1	1.000			0.837	0.691	
mf2	1.336	0.191	7.000	0.000	1.118	0.934
GR =~						
gr1	1.000			0.758	0.698	
gr2	1.020	0.074	13.759	0.000	0.774	0.719
gr3	1.161	0.075	15.414	0.000	0.881	0.809
gr4	1.110	0.075	14.837	0.000	0.842	0.784
SI =~						
si1	1.000			0.771	0.712	
si2	1.125	0.070	16.127	0.000	0.868	0.814
si3	0.997	0.062	16.212	0.000	0.769	0.758
si4	1.038	0.069	15.101	0.000	0.801	0.741
IN =~						
in1	1.000			0.943	0.841	
in2	0.908	0.057	15.963	0.000	0.856	0.784

Technological and Behavioural Control Model

lavaan 0.6-8 ended normally after 54 iterations

Estimator	ML
Optimization method	NLMINB
Number of model parameters	59
Number of observations	347

Model Test User Model:

	Standard	Robust
Test Statistic	129.295	127.291
Degrees of freedom	131	131
P-value (Chi-square)	0.526	0.575
Scaling correction factor		1.016
Satorra-Bentler correction		

Parameter Estimates:

Standard errors	Robust.sem
Information	Expected
Information saturated (h1) model	Structured

Latent Variables:

	Estimate	Std.Err	z-value	P(>|z|)	Std.lv	Std.all
PC =~						
pc1	1.000				0.820	0.728
pc2	1.033	0.076	13.556	0.000	0.847	0.736
pc3	1.014	0.075	13.501	0.000	0.831	0.722
pc4	1.064	0.077	13.776	0.000	0.872	0.787
CA =~						
ca1	1.000				0.733	0.701
ca2	1.362	0.244	5.581	0.000	0.998	0.901

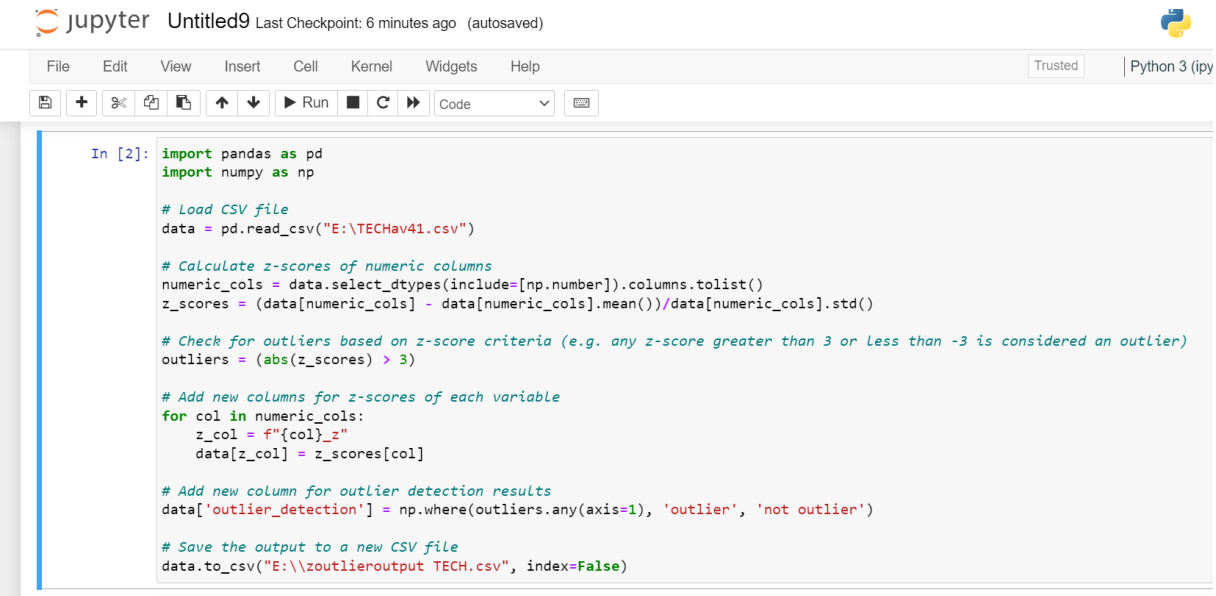
PS =~						
ps1	1.000			0.865	0.814	
ps2	0.840	0.123	6.839	0.000	0.726	0.660
PB =~						
pb1	1.000			0.983	0.837	
pb2	0.853	0.063	13.471	0.000	0.839	0.739
pb3	0.858	0.063	13.549	0.000	0.844	0.741
PE =~						
pe1	1.000			0.834	0.789	
pe2	1.026	0.060	17.106	0.000	0.856	0.819
pe3	1.033	0.067	15.499	0.000	0.862	0.801
pe4	0.903	0.072	12.486	0.000	0.754	0.699
RA =~						
ra1	1.000			0.898	0.761	
ra2	1.064	0.147	7.256	0.000	0.955	0.848
IN =~						
in1	1.000			0.952	0.890	
in2	0.805	0.078	10.356	0.000	0.766	0.706

Appendix-C

Z-Score

Annex- Z Score Outliers detection script and results

Python script to flag outliers



PERM Z-SCORE OUTLIER TEST

AW_z	HR_z	BR_z	TR_z	GV_z	MF_z	GR_z	IN_z	SI_z	CT_z	outlier_detection
-0.73	0.09	1.00	0.48	-1.45	-0.02	-2.42	-1.67	-0.10	-0.94	not outlier
-2.16	-1.36	-0.72	-1.77	-1.84	0.44	1.24	-1.17	0.18	-0.75	not outlier
-0.87	-0.88	-0.89	-2.45	-1.58	-0.93	-1.01	-1.17	-0.39	-2.31	not outlier
-1.02	-1.36	-1.24	-0.73	-1.71	-0.93	0.68	-0.68	-2.10	-1.53	not outlier
-0.44	-2.32	-2.27	-0.21	-1.84	-0.02	0.96	-1.67	0.18	-1.14	not outlier
-0.30	-0.40	-1.41	-1.25	-0.13	-0.93	-1.29	-2.16	1.04	-1.73	not outlier
-0.87	-1.36	-0.89	-1.77	-0.52	-0.93	1.24	-2.16	-0.10	-0.94	not outlier
-2.30	-2.32	0.49	-1.59	-1.58	0.44	-1.29	-2.66	-0.96	-0.94	not outlier
-1.73	-1.36	-0.20	-1.42	-0.39	-0.93	0.39	-0.68	1.61	-1.14	not outlier
-1.30	-0.40	-1.93	-1.59	-1.05	0.44	-0.17	-2.16	0.18	-1.34	not outlier
-1.30	-1.36	-1.58	-1.08	-0.92	0.90	0.11	-0.68	0.75	-1.34	not outlier
-0.87	0.09	-2.10	-1.25	-1.84	-0.02	-0.45	-2.16	-0.39	-1.14	not outlier
-1.59	-0.88	-1.93	-0.90	-1.58	-0.47	0.68	-0.18	0.18	-0.16	not outlier
-1.02	-0.40	-0.89	-1.08	-0.79	0.90	-0.45	-1.17	0.18	-1.53	not outlier
-1.59	-0.88	-1.58	-1.08	-0.26	-0.47	-0.17	-1.67	0.75	-1.92	not outlier
-0.44	-0.40	-2.10	-1.77	-0.65	-0.93	-1.86	-2.66	0.47	-2.12	not outlier
-0.16	1.05	-1.24	-1.42	-1.98	0.90	-0.17	-1.17	-0.68	-1.92	not outlier
-1.87	0.57	-1.06	-1.25	-1.84	-1.39	1.24	-2.66	-0.39	-1.53	not outlier
-1.73	-1.36	-1.24	-1.42	-0.79	-0.93	-1.29	-1.67	-0.10	-2.12	not outlier
-0.16	-0.40	-0.72	-2.11	-0.92	-2.30	-0.17	-0.68	-0.68	-0.94	not outlier
0.41	0.09	-0.20	0.82	-1.84	0.44	0.68	-0.18	-0.68	-0.94	not outlier

-0.44	-0.40	-0.38	-0.73	-0.92	-0.93	-0.45	-1.67	-0.96	-1.53	not outlier
-1.73	-1.36	-2.10	-0.04	-1.05	0.44	-1.57	-2.16	-1.82	-1.92	not outlier
-0.87	1.05	-0.20	-0.90	-0.13	-0.02	-1.29	-0.68	-0.96	-2.12	not outlier
-0.87	0.57	-0.38	-1.25	-1.84	-1.39	-1.01	-1.67	-0.10	-2.12	not outlier
-0.59	-0.88	0.14	-1.08	-0.39	0.44	-1.01	0.31	-0.39	-0.16	not outlier
-1.30	-1.36	-1.24	-1.08	-1.98	-2.30	1.52	-1.67	-0.68	-0.36	not outlier
-0.16	-0.40	-0.72	-0.56	-2.11	-0.93	-1.29	-1.67	-0.96	-1.73	not outlier
-0.16	0.09	0.66	-1.42	1.33	-1.85	1.52	0.31	-0.68	-2.31	not outlier
-2.02	-1.36	-0.55	-1.77	-1.58	0.44	1.52	-0.18	-2.39	-0.75	not outlier
-0.59	1.05	-2.10	-0.56	-0.52	-0.93	-0.17	-0.68	-1.53	-1.14	not outlier
-0.02	-1.84	-1.93	-1.77	-0.79	1.36	1.52	0.31	0.18	-0.36	not outlier
-1.45	-1.36	-2.10	-2.11	0.40	-0.02	0.11	-2.16	-0.39	-0.75	not outlier
0.27	0.57	-1.24	-0.21	-1.32	-0.47	-2.14	-0.68	-0.68	-0.16	not outlier
-2.45	-1.84	-1.41	-1.42	-0.52	0.90	0.96	-1.17	-0.68	-1.73	not outlier
-2.45	-1.36	-1.06	-1.94	0.67	-1.39	0.11	-1.67	-1.25	-1.73	not outlier
-2.45	-0.88	0.14	-1.25	-1.84	0.90	-1.57	-2.66	-0.10	-2.12	not outlier
-0.59	0.09	-1.24	-1.08	-1.98	-1.85	0.68	0.31	1.61	-1.34	not outlier
-2.30	0.57	-1.06	-0.39	-1.45	0.44	-0.17	0.81	-0.96	-0.55	not outlier
-2.02	-0.88	-0.72	-1.08	-1.98	-0.02	-0.45	-2.16	-1.25	-2.12	not outlier
-1.16	-2.32	-1.24	-0.73	-1.98	-0.47	0.39	-1.67	-2.10	0.23	not outlier
-1.73	0.09	-0.38	-1.25	-1.84	-0.47	0.96	-0.68	1.32	-1.14	not outlier
0.41	0.09	-1.93	-0.73	0.93	-2.30	-0.17	-0.18	0.47	-1.34	not outlier
-1.02	1.05	-1.24	-1.59	1.59	-0.93	0.68	1.30	1.04	1.01	not outlier
-0.87	0.57	-0.20	-1.08	0.67	1.36	1.52	-1.17	-0.68	-1.34	not outlier
-0.73	0.57	-0.72	0.30	0.27	0.44	1.52	1.30	1.61	1.01	not outlier
-0.44	-0.40	-0.03	-0.90	0.67	-0.47	1.24	1.30	-1.25	0.03	not outlier
0.13	0.09	-0.72	0.65	-1.32	0.44	1.24	0.31	-1.25	-0.36	not outlier
-1.16	-2.32	0.83	0.65	0.54	1.36	-1.29	-0.18	0.75	1.21	not outlier
-1.30	-1.36	-1.24	-0.73	-0.79	-0.93	0.39	0.81	1.32	0.03	not outlier
0.70	-1.84	-0.55	0.30	-1.18	-0.47	-1.29	-0.68	1.32	0.03	not outlier
0.13	-0.40	-0.03	-0.90	-1.32	-0.02	-1.01	-0.68	-0.39	1.21	not outlier
1.56	-1.36	-1.58	-0.56	1.99	-0.93	0.68	0.81	-1.53	0.23	not outlier
-0.59	-0.88	-0.20	-0.90	0.93	0.44	0.96	1.30	0.47	0.03	not outlier
-1.45	-1.84	-0.89	-0.21	-0.26	0.44	0.11	0.31	-0.10	1.40	not outlier
0.13	0.09	-1.06	0.82	0.14	-1.85	0.68	1.30	-0.10	1.01	not outlier
0.70	-1.36	-0.72	-0.73	1.46	0.44	-0.73	0.81	0.47	0.43	not outlier
-0.02	-2.32	-0.03	-1.94	-0.39	1.36	1.24	1.30	-0.39	0.43	not outlier
-0.30	0.09	0.14	-0.56	0.67	-0.93	0.68	0.81	-0.39	-1.14	not outlier
-0.30	-1.36	-0.55	-0.39	1.33	1.36	0.68	1.30	1.04	-0.94	not outlier
-0.02	-0.88	0.14	0.13	-0.92	-0.47	-2.14	-0.68	-0.96	0.03	not outlier
0.84	-1.36	0.31	-0.04	0.40	0.44	0.68	1.30	0.75	1.01	not outlier
-1.16	-0.40	-0.20	-0.21	-0.65	-0.02	0.39	-0.18	1.04	-1.14	not outlier
-1.02	0.09	-0.55	0.13	1.06	1.36	-0.17	-0.18	-0.96	0.82	not outlier
-0.16	-0.88	1.00	-0.04	1.20	-1.85	0.96	1.30	0.47	-0.55	not outlier
-0.87	-1.84	-1.24	-0.56	-0.79	-1.85	-0.17	-1.67	-1.53	-1.34	not outlier
-0.73	-0.88	-1.24	0.48	1.99	0.44	-0.45	0.81	0.18	-1.34	not outlier
-0.02	1.05	0.14	1.17	0.54	-1.85	0.39	1.30	0.47	-0.16	not outlier
0.13	1.05	0.49	0.30	0.27	-1.39	-0.45	1.30	1.04	0.03	not outlier

-0.02	0.09	0.66	-0.56	0.54	-0.93	0.39	-1.17	-0.39	0.82	not outlier
-0.16	-0.88	-0.03	-0.04	0.54	-1.85	-1.86	-0.18	1.04	0.62	not outlier
-1.16	-0.88	-0.38	1.17	1.20	-0.47	0.96	0.81	0.47	-0.75	not outlier
0.13	0.57	-0.89	0.65	1.33	-0.02	0.96	0.81	-1.82	0.43	not outlier
-0.44	-1.36	-1.06	-1.42	-0.13	1.36	-0.17	1.30	-0.39	0.62	not outlier
-1.59	-0.88	-1.24	-1.59	0.27	-0.93	-0.45	-0.68	1.04	-0.16	not outlier
-0.87	-0.88	-1.75	-0.04	-1.45	-0.47	-0.17	-1.67	-0.68	-1.92	not outlier
-0.02	-0.40	-1.75	-0.21	0.14	-0.47	-0.17	0.81	0.75	0.82	not outlier
-1.16	-0.40	0.49	-0.90	-0.26	-1.85	0.68	-1.17	1.04	-0.94	not outlier
0.84	-0.40	-1.24	-0.39	0.27	0.44	1.52	0.31	1.04	0.03	not outlier
-0.73	1.05	-1.06	1.34	0.40	-0.02	-0.73	-1.17	-1.53	-1.73	not outlier
-1.30	-0.40	1.17	-0.21	0.27	-0.47	0.39	0.81	0.47	1.21	not outlier
-1.30	-1.84	-0.20	-0.04	0.40	0.44	0.11	1.30	-1.25	1.40	not outlier
-0.73	-0.40	-0.55	-1.08	0.14	-0.47	-0.17	-0.18	0.47	-0.94	not outlier
0.27	0.09	-1.24	-0.73	0.40	0.44	0.11	-1.17	-2.10	0.43	not outlier
0.70	-1.36	-0.55	-0.73	0.80	1.36	0.96	1.30	-0.68	-0.36	not outlier
-0.02	-0.88	-2.10	-1.25	-0.39	-1.85	-0.17	0.81	0.75	1.21	not outlier
-0.87	0.09	-0.03	-0.73	-0.26	-1.39	0.68	-0.18	1.04	-1.73	not outlier
0.70	-1.36	-0.38	-0.04	0.27	-0.02	1.24	0.31	-0.10	0.43	not outlier
1.13	-1.36	-0.20	-1.42	-1.18	0.90	-0.17	-1.17	-1.53	1.21	not outlier
-1.59	-0.40	-1.24	0.48	-0.39	0.44	0.39	0.81	0.47	0.82	not outlier
-1.73	-1.84	0.31	0.13	-0.13	-0.47	0.96	0.31	-0.10	-1.14	not outlier
-0.16	-1.36	-0.55	0.48	0.40	-2.30	0.96	1.30	0.75	1.21	not outlier
-1.59	-0.40	-0.72	-1.59	1.59	0.90	-1.29	1.30	-0.96	1.40	not outlier
0.27	-0.40	0.14	0.30	0.14	-0.93	0.39	0.81	0.47	0.82	not outlier
-0.16	-0.40	-1.75	-1.08	0.80	-0.47	-0.17	-1.67	-0.10	0.03	not outlier
0.99	0.57	-1.41	-0.56	-1.05	1.36	1.24	1.30	-0.68	0.43	not outlier
-2.16	-1.84	-0.38	-1.94	0.14	-1.39	0.68	-0.18	0.18	1.21	not outlier
1.27	-0.88	-0.55	0.48	1.46	-0.02	1.24	1.30	-1.53	1.01	not outlier
-0.16	0.09	0.31	-1.08	1.59	-0.93	-1.01	-0.18	1.32	-1.73	not outlier
0.41	-1.36	-1.41	0.30	-0.26	0.44	1.24	0.81	-0.39	-0.36	not outlier
-0.44	-1.84	0.31	-2.11	1.33	-0.47	-0.17	-0.18	1.04	-0.75	not outlier
-0.59	-0.40	0.14	-1.08	0.67	-0.47	-1.86	-1.17	0.18	0.03	not outlier
-0.59	-1.36	-1.58	0.48	0.40	-0.02	0.39	1.30	1.32	-0.36	not outlier
-0.16	-1.36	0.49	-1.42	-0.52	-0.93	0.68	-2.16	-2.67	-0.75	not outlier
0.56	-0.88	0.66	1.34	-0.39	0.90	0.11	1.30	0.18	0.62	not outlier
-1.30	-0.88	-1.58	-1.94	0.14	-1.39	0.68	-1.67	-0.96	-1.34	not outlier
0.13	0.09	-1.41	-0.21	1.20	-0.02	-0.17	1.30	0.47	0.03	not outlier
0.27	-1.36	-0.20	0.48	1.72	-0.93	-0.17	0.31	0.47	1.40	not outlier
0.27	0.09	-0.72	-0.90	-1.45	-1.39	-1.86	-0.18	-0.68	-1.34	not outlier
0.70	-0.40	-1.06	-1.25	1.86	1.36	-1.29	0.31	0.75	0.03	not outlier
-1.16	0.09	-0.38	1.68	1.46	-0.02	0.96	0.81	-0.39	0.23	not outlier
-1.73	-1.36	0.14	-0.39	-1.45	0.44	-0.45	0.31	0.75	0.23	not outlier
-1.30	-2.32	-0.20	-0.56	-0.13	-1.85	-0.73	0.31	0.18	-0.55	not outlier
0.13	1.05	-1.24	-1.08	0.54	-0.47	0.96	1.30	0.47	-0.36	not outlier
-1.87	-0.40	0.31	-2.11	-0.39	-0.47	-1.86	-0.68	0.47	-0.75	not outlier
0.56	-0.88	0.83	-0.21	1.72	-0.47	0.68	1.30	-0.39	0.82	not outlier
-1.73	-1.84	-1.24	-0.90	-0.26	-2.30	-0.17	-1.67	0.75	-1.53	not outlier

-0.02	-0.88	-0.72	-0.39	0.40	-0.93	-0.17	0.81	1.32	1.21	not outlier
-0.30	-0.88	-0.55	0.48	-0.39	-0.47	-1.57	-1.17	-0.39	0.23	not outlier
0.56	-1.36	-0.89	1.17	-0.39	-0.47	0.11	1.30	-1.25	-0.75	not outlier
0.84	-1.84	-0.55	-1.08	0.14	-0.93	0.11	0.81	-1.53	1.01	not outlier
-0.59	0.09	-0.89	-1.77	-1.98	0.90	0.11	-0.68	-1.25	0.82	not outlier
-0.44	-0.88	-1.24	0.30	0.01	-0.02	-0.17	-0.18	1.04	1.40	not outlier
0.56	-0.40	0.14	1.34	-0.26	0.44	1.52	0.81	-0.68	0.03	not outlier
-1.45	-0.88	-1.06	-0.73	0.54	-0.93	-0.17	0.31	0.18	-1.34	not outlier
-0.87	0.57	-0.03	0.82	1.46	-0.47	1.24	1.30	-0.68	-0.36	not outlier
-1.30	-0.40	0.31	-0.90	-1.58	0.44	1.52	0.31	-2.67	-0.16	not outlier
0.27	1.53	1.17	-1.25	1.06	-2.30	0.96	1.30	-0.39	1.60	not outlier
0.41	1.53	0.31	0.30	0.27	0.44	0.96	-0.68	1.32	-0.55	not outlier
0.99	-0.88	-2.10	-1.08	-0.52	1.36	0.39	1.30	0.75	-0.16	not outlier
-0.59	0.57	0.66	-1.08	-0.26	1.36	0.39	0.81	1.32	0.23	not outlier
0.27	-0.40	1.52	-1.59	0.67	0.90	1.24	-0.68	-0.10	-1.92	not outlier
0.13	1.05	-1.06	-0.04	-0.79	0.90	-0.45	0.31	-0.10	0.62	not outlier
1.13	1.05	0.14	-1.25	0.14	-1.85	0.96	0.81	1.61	-1.14	not outlier
-0.16	1.05	0.66	-0.90	-0.26	-0.02	-0.73	0.81	0.47	0.82	not outlier
0.27	1.53	0.31	1.68	-0.13	-0.02	-0.17	0.31	1.61	0.43	not outlier
1.27	1.53	-1.58	-0.56	1.86	1.36	-0.45	0.31	-1.25	-0.75	not outlier
0.41	1.05	1.17	0.48	0.27	1.36	-1.29	0.81	-0.96	-0.55	not outlier
1.42	1.53	1.35	-0.21	-1.45	0.44	-1.86	1.30	0.18	1.01	not outlier
1.13	1.05	1.69	0.30	0.27	-0.47	1.24	0.81	-1.25	-0.36	not outlier
1.13	1.05	1.35	1.51	0.01	1.36	-1.01	0.81	-0.39	0.43	not outlier
0.70	1.53	-0.38	-0.56	0.54	1.36	0.39	0.81	1.04	-0.75	not outlier
0.13	-0.40	0.83	-1.08	-0.26	0.90	-2.42	0.81	1.04	1.01	not outlier
1.13	0.09	0.83	0.99	0.40	0.44	0.96	0.81	0.18	0.82	not outlier
1.27	1.05	1.52	0.13	0.01	1.36	0.96	0.81	1.32	0.62	not outlier
0.70	-0.40	0.31	0.13	-0.39	1.36	0.96	-0.18	1.61	-0.94	not outlier
-0.44	-1.36	-0.55	-1.08	-0.26	-0.02	-0.45	-1.17	0.75	-0.94	not outlier
-0.30	1.53	1.69	-0.56	1.20	-0.02	0.39	1.30	0.47	-1.14	not outlier
-0.30	1.05	1.52	-0.90	-0.65	1.36	0.96	1.30	-0.96	0.43	not outlier
1.56	-0.40	1.52	1.17	-1.71	0.44	0.11	1.30	0.75	-0.94	not outlier
0.27	-1.36	1.00	0.13	0.67	-0.02	-0.45	-0.18	1.61	1.01	not outlier
-0.87	0.57	0.83	0.65	2.12	1.36	1.52	1.30	0.75	1.60	not outlier
-0.16	0.09	-0.38	1.17	-0.13	0.90	0.39	0.31	1.04	-1.53	not outlier
1.13	1.05	1.69	-0.39	1.86	1.36	0.11	0.81	1.61	0.23	not outlier
-1.59	0.57	0.31	-0.39	-0.65	-0.93	1.24	-0.68	1.04	-0.55	not outlier
1.13	-1.36	0.83	-0.21	-1.18	-0.93	1.52	-0.18	0.18	-0.55	not outlier
0.41	-0.88	-0.38	0.99	-0.39	-0.02	0.39	-0.18	0.75	-1.14	not outlier
-0.59	0.09	-1.24	-1.25	0.54	1.36	-0.73	-0.68	1.04	0.43	not outlier
0.41	-0.88	0.49	-0.21	-1.05	-0.02	1.24	0.81	1.04	-0.75	not outlier
-0.02	-0.88	0.49	-1.08	1.99	0.44	-1.01	-0.18	0.18	0.23	not outlier
1.42	1.53	-1.58	-1.08	0.93	-0.93	0.68	0.81	1.32	0.43	not outlier
-0.02	-0.40	-0.20	-1.25	-0.92	0.90	1.24	0.81	1.61	0.03	not outlier
-0.59	1.05	-0.20	-1.77	-0.26	1.36	0.96	-0.18	1.61	-0.36	not outlier
0.27	0.09	0.83	0.13	0.14	0.44	-0.17	0.31	-1.82	0.62	not outlier
-1.45	-1.36	1.35	-0.56	1.86	0.90	0.68	1.30	-0.10	-2.12	not outlier

0.70	1.05	1.00	-0.56	-1.32	-0.93	-0.45	0.31	1.32	-0.75	not outlier
-0.16	1.53	1.35	0.99	0.14	-1.39	0.96	-0.68	1.04	-0.16	not outlier
-1.30	1.05	0.49	0.48	1.06	-0.02	0.39	0.81	0.75	1.40	not outlier
-0.16	-0.40	0.31	0.30	1.20	-0.02	0.39	1.30	0.47	1.01	not outlier
0.41	1.53	0.66	1.68	1.46	0.90	0.96	0.81	1.04	-1.34	not outlier
0.27	-0.40	1.17	0.99	1.59	1.36	-1.29	1.30	-0.39	-0.36	not outlier
-1.87	1.05	0.14	-0.56	1.20	1.36	1.52	-0.18	0.18	0.03	not outlier
-1.73	0.57	1.00	0.48	1.20	0.44	0.11	-0.68	-2.39	-0.75	not outlier
-0.73	1.05	-0.38	0.13	-0.65	0.44	0.11	0.31	0.47	1.01	not outlier
1.42	1.05	1.52	-0.39	-0.79	1.36	0.96	0.81	-0.96	0.23	not outlier
0.84	0.09	0.31	0.65	0.01	-1.85	1.24	1.30	1.32	1.40	not outlier
0.84	1.05	1.00	-0.04	-1.58	-0.02	-0.73	0.81	0.18	1.21	not outlier
0.13	1.05	0.31	-0.04	-0.65	1.36	1.24	0.81	-0.96	1.60	not outlier
1.42	1.05	1.17	0.82	0.40	1.36	1.52	1.30	-1.82	1.21	not outlier
-0.30	-0.40	1.52	0.30	0.40	1.36	1.52	0.81	-0.68	0.82	not outlier
0.41	1.05	1.35	0.13	0.27	0.90	1.52	1.30	1.32	-0.36	not outlier
1.13	-1.36	1.17	-0.73	0.67	1.36	0.11	0.31	1.32	-0.94	not outlier
-1.16	-0.40	0.66	-0.73	-1.58	-0.02	0.11	-1.17	0.18	-2.12	not outlier
-0.30	-0.40	-1.06	-0.90	-0.13	1.36	-2.70	0.31	1.32	1.01	not outlier
1.27	1.53	1.52	0.48	0.80	-0.47	1.52	-0.68	0.75	1.01	not outlier
-0.30	1.05	-0.20	1.51	-0.52	1.36	1.52	-0.18	-0.96	0.03	not outlier
1.13	1.05	0.83	0.65	1.06	1.36	0.68	0.31	0.75	-0.75	not outlier
-0.44	1.05	0.14	1.51	0.40	-1.39	1.52	1.30	1.61	1.60	not outlier
1.13	0.57	1.69	0.65	-0.92	1.36	1.52	1.30	1.04	0.82	not outlier
0.27	1.05	0.49	0.48	0.80	-0.02	-0.45	-0.18	-2.10	0.23	not outlier
-0.59	1.05	1.52	0.13	0.01	1.36	0.68	-0.68	0.18	1.21	not outlier
1.42	1.05	0.83	0.13	0.93	-0.02	0.96	0.31	1.61	1.01	not outlier
1.56	-0.40	0.49	1.34	-0.13	1.36	-1.29	1.30	0.75	1.60	not outlier
1.56	-0.88	1.69	0.99	-0.13	0.90	-0.73	1.30	0.18	0.82	not outlier
0.27	-0.88	1.52	1.17	-1.32	0.44	1.24	0.31	1.61	1.60	not outlier
0.27	-1.36	1.69	1.51	0.93	1.36	1.52	-0.68	1.61	1.21	not outlier
1.13	1.05	0.83	1.34	0.67	1.36	0.39	1.30	0.75	-0.55	not outlier
0.27	0.57	1.69	0.48	1.72	-0.47	0.96	0.81	-0.39	1.01	not outlier
-0.02	1.05	1.69	1.68	0.80	0.90	1.24	0.31	1.61	0.82	not outlier
-0.16	1.05	1.00	0.99	1.06	-0.47	0.68	1.30	0.47	1.60	not outlier
1.13	0.09	-1.06	0.99	0.14	1.36	1.52	-0.68	-0.39	0.23	not outlier
0.70	-0.40	-0.03	1.51	-0.26	1.36	0.11	0.31	1.32	0.23	not outlier
-0.16	0.57	-0.72	1.34	2.12	-0.47	0.96	1.30	-0.10	1.40	not outlier
-0.16	1.53	0.83	-0.21	0.01	1.36	1.52	1.30	1.32	1.40	not outlier
1.27	1.53	-0.03	0.48	0.01	1.36	0.96	1.30	-0.96	-0.36	not outlier
1.27	-0.40	1.35	1.68	0.80	0.44	0.39	-0.18	-0.68	-0.55	not outlier
-1.02	-2.32	0.66	-0.90	-0.79	-0.93	-0.45	-1.67	0.18	-1.92	not outlier
-2.30	-0.88	1.00	0.65	-2.11	-0.93	-2.98	-1.17	-0.10	-0.75	not outlier
0.13	0.09	-0.55	-1.59	-0.92	-1.39	-0.73	1.30	1.32	0.82	not outlier
0.27	0.57	-1.41	-1.59	-0.26	-0.02	-2.70	-0.18	-1.25	0.62	not outlier
-0.73	-0.40	-0.20	0.48	0.54	-1.85	0.39	0.31	-0.10	0.23	not outlier
-1.30	0.57	-0.72	0.48	-1.05	-2.30	-1.86	-0.18	-0.10	-0.36	not outlier
-1.59	-0.88	-0.89	-1.77	-1.98	-0.02	-0.45	-0.18	-0.96	-0.75	not outlier

-0.30	1.05	-1.06	-1.25	0.14	1.36	-1.86	0.31	-1.53	-0.16	not outlier
-1.45	-0.40	-2.27	-0.39	-0.13	-1.85	-0.17	-0.18	0.47	-0.55	not outlier
0.41	-0.88	-0.89	0.13	-1.18	-1.85	-0.45	0.81	1.04	-0.36	not outlier
-1.87	0.09	-0.89	0.48	-1.32	-0.47	0.96	0.31	-1.82	-0.36	not outlier
0.70	0.57	1.00	-1.25	-1.32	-1.39	-1.57	0.81	-1.25	0.43	not outlier
-1.59	0.09	0.31	0.13	-0.65	-1.39	0.39	0.31	-0.10	-0.36	not outlier
-2.30	0.09	0.66	-0.90	-1.05	-1.39	-0.17	0.31	-0.68	-0.55	not outlier
-0.16	-0.88	-1.06	-1.08	-0.13	0.44	-0.17	-2.16	0.47	-2.12	not outlier
-1.02	0.09	-1.93	-1.42	0.40	-2.30	-1.01	-1.67	-2.39	-2.31	not outlier
-0.02	-1.84	0.31	-0.39	-1.58	-0.02	-0.45	-0.68	-1.53	-1.14	not outlier
-2.16	-0.40	-1.24	-1.94	-2.11	0.44	-0.17	-1.17	1.04	-1.34	not outlier
-0.59	-0.88	-0.38	-0.56	-0.13	-0.47	-1.86	-0.68	1.04	0.03	not outlier
-1.59	-1.36	-1.41	-1.25	-0.65	-0.47	-0.17	-2.16	-0.96	-0.16	not outlier
-0.30	-0.40	0.31	-0.56	0.14	-0.47	-0.17	-0.18	-0.68	-1.92	not outlier
0.99	0.09	1.35	-0.39	-1.84	-0.02	-0.45	0.31	1.04	-0.94	not outlier
-0.73	-1.36	-1.24	-0.56	-0.39	-2.30	-0.17	-1.17	0.18	-0.55	not outlier
0.56	0.57	-1.06	-1.42	-0.39	-1.39	-0.73	-0.68	0.18	-1.73	not outlier
0.41	-1.84	-0.20	-0.21	-1.05	-1.39	-1.01	-0.68	-0.68	-0.94	not outlier
0.70	-0.88	-2.44	-2.45	0.01	-0.93	0.68	-1.67	0.75	-1.73	not outlier
-1.16	-2.32	-0.38	-2.11	-0.39	-1.85	0.11	-1.17	-0.10	-1.53	not outlier
1.42	0.57	0.14	-1.25	-0.39	-1.39	0.96	0.81	-2.10	0.43	not outlier
-0.87	0.57	-0.72	-0.56	-1.18	-2.30	-0.17	0.81	-1.25	0.03	not outlier
-2.30	-2.32	-1.58	-1.94	-1.05	-0.93	-0.45	-2.66	-0.68	-1.14	not outlier
-0.59	0.09	-0.20	0.82	0.14	-1.85	-1.01	0.31	-0.10	-0.55	not outlier
-0.59	-1.36	-0.20	0.13	-0.79	-1.39	0.96	0.31	0.75	0.62	not outlier
-0.44	-1.84	-0.72	0.82	-1.45	-2.30	0.39	-0.18	1.32	0.62	not outlier
-1.59	1.05	-0.20	-0.56	0.27	-2.30	-1.29	-1.17	0.18	-0.75	not outlier
-0.73	-0.40	-0.20	-1.08	0.54	0.44	0.11	-0.18	-1.82	-0.75	not outlier
-0.44	0.57	-1.06	-0.21	-0.52	-0.02	-1.86	-0.18	-0.10	-0.36	not outlier
0.13	-0.88	-1.24	-1.94	-0.65	-0.02	-1.29	-0.18	0.75	0.43	not outlier
-1.87	0.09	-1.06	-0.21	-0.65	-0.47	-1.57	-0.68	-0.39	-1.92	not outlier
-0.44	0.09	-0.38	0.65	-1.05	-1.39	-1.57	-0.68	-0.39	-1.73	not outlier
-1.30	-1.36	-1.58	1.34	-1.45	-0.93	-0.17	-1.67	-0.39	-0.75	not outlier
-0.73	-2.32	0.31	-0.73	-1.18	-1.85	0.39	-0.68	-0.68	-0.16	not outlier
-0.44	0.57	0.31	0.65	-1.18	-0.93	-0.45	1.30	0.47	-0.36	not outlier
-1.59	0.57	-1.06	-1.59	0.80	-1.85	-0.73	-0.18	0.75	-0.55	not outlier
-1.45	1.53	1.00	0.13	-0.79	-1.85	-1.86	0.31	-0.10	1.40	not outlier
-1.59	-1.36	-0.89	-0.56	-0.65	-1.85	0.96	-1.67	-0.68	-0.16	not outlier
1.27	-0.88	-0.20	1.17	-0.92	-0.93	0.11	-1.17	-1.53	0.43	not outlier
0.41	0.57	1.17	-0.04	1.99	0.44	1.24	-0.68	-0.68	0.62	not outlier
1.27	-0.40	-0.72	0.65	1.86	-0.02	-0.45	0.81	0.47	0.03	not outlier
0.27	-1.36	1.17	0.13	-0.92	0.44	0.11	-0.68	-0.96	1.01	not outlier
-1.73	-0.40	0.49	0.30	0.40	0.90	1.24	-0.68	-0.96	0.62	not outlier
-0.59	1.53	0.66	0.48	1.59	0.90	-1.29	-0.18	-1.82	1.60	not outlier
1.42	0.09	0.66	0.48	0.67	-0.47	-1.86	-0.18	0.18	1.01	not outlier
0.27	1.05	1.52	0.99	1.72	0.44	0.39	-0.18	-1.53	1.01	not outlier
1.13	1.05	0.49	1.17	0.27	-0.93	-0.73	-0.68	-0.68	-0.75	not outlier
0.13	-0.40	-1.06	-0.73	0.01	1.36	-0.45	-2.66	0.47	0.23	not outlier

0.99	0.57	0.14	1.17	1.20	1.36	-0.73	0.31	-0.10	-0.75	not outlier
0.70	-0.40	1.52	-0.04	1.33	0.44	0.11	0.31	0.75	0.82	not outlier
0.70	-0.88	1.69	0.99	0.93	-0.47	0.11	0.31	0.47	0.82	not outlier
0.56	-0.88	0.49	1.17	-0.39	-0.47	-0.73	-0.18	-0.10	-1.34	not outlier
0.70	0.57	-1.24	-0.39	0.27	-0.02	0.39	-1.17	0.75	-1.53	not outlier
0.84	0.09	-0.89	-1.08	-0.26	1.36	0.11	0.31	-0.39	-0.16	not outlier
1.27	1.05	0.31	-0.21	1.46	0.90	1.24	0.81	-0.68	1.40	not outlier
-1.73	-0.40	-1.93	0.13	-1.05	0.44	0.68	-0.68	-2.10	-0.75	not outlier
0.56	0.09	1.69	-0.39	-0.26	-0.02	-1.29	-0.18	-0.10	-0.36	not outlier
0.70	1.53	0.14	-0.56	0.54	1.36	0.11	-1.17	-1.53	-0.36	not outlier
-0.44	0.09	0.14	-1.08	1.86	-1.39	0.39	0.81	1.61	1.60	not outlier
-0.87	0.57	1.00	0.65	1.33	0.44	-0.45	0.31	0.18	0.62	not outlier
0.99	-0.88	0.49	1.51	-0.13	0.90	-0.17	0.31	-0.39	-0.16	not outlier
0.99	0.57	-0.72	0.82	-1.84	-0.93	-1.57	-1.67	-1.82	-0.36	not outlier
1.56	0.57	0.49	0.65	0.40	1.36	0.68	1.30	1.61	0.03	not outlier
1.42	0.57	1.00	1.51	-0.13	0.90	0.39	0.31	-0.39	0.82	not outlier
0.27	1.53	1.00	0.30	0.93	-1.39	-1.86	0.31	0.75	1.21	not outlier
0.70	0.57	0.31	0.48	0.14	-0.02	-1.57	0.31	0.47	-1.53	not outlier
-0.02	-0.40	-1.06	0.48	-0.39	-0.02	-1.57	-1.17	-0.39	0.03	not outlier
0.13	0.09	-1.06	0.30	-0.92	-0.47	-0.45	-0.18	0.75	1.40	not outlier
0.84	1.53	-0.03	0.30	0.80	1.36	1.52	0.31	-0.96	-0.94	not outlier
-0.16	-0.40	-0.20	-1.59	0.27	-0.02	-0.17	0.31	1.61	0.43	not outlier
0.84	-0.88	1.69	1.68	0.54	-0.02	-2.14	0.81	0.47	0.03	not outlier
-0.02	1.05	-0.03	0.99	0.54	1.36	-0.17	0.81	1.04	0.82	not outlier
-1.16	-0.40	-0.20	0.48	0.27	-0.02	0.96	-0.18	-0.68	-0.36	not outlier
1.42	-0.40	1.35	-0.56	0.54	-0.02	-0.45	-0.18	-1.53	1.60	not outlier
0.70	-0.40	0.31	0.48	-0.26	0.44	0.39	-0.18	-1.53	1.01	not outlier
0.84	-0.40	0.31	1.17	0.80	1.36	-0.17	0.31	-0.68	1.01	not outlier
-1.30	1.05	0.83	1.34	-0.52	-0.47	0.11	-0.68	0.18	0.43	not outlier
0.70	-1.36	-0.72	0.65	-1.32	-1.39	0.11	-1.17	0.47	1.60	not outlier
-0.59	1.53	0.66	0.48	0.27	0.44	-1.01	-1.67	0.47	1.40	not outlier
-0.87	0.09	-0.72	1.34	0.01	-0.93	0.11	-0.18	1.04	-0.55	not outlier
-1.30	0.09	0.49	0.48	0.54	-1.85	1.52	-1.17	-1.53	-1.92	not outlier
0.13	0.57	1.52	0.30	-0.26	0.90	1.52	0.81	-0.68	1.40	not outlier
-0.30	0.57	-0.20	0.30	1.59	-0.47	0.96	0.31	1.61	0.03	not outlier
0.70	-0.40	-1.24	0.30	1.72	-0.93	-0.45	-1.17	0.47	1.01	not outlier
0.84	1.05	0.14	-1.25	1.46	0.44	0.39	-0.68	-0.39	1.21	not outlier
1.56	0.09	-0.20	-1.59	1.33	-0.02	0.68	0.31	0.47	0.03	not outlier
-0.73	0.57	1.52	0.13	0.01	0.44	0.11	0.81	-0.39	1.60	not outlier
1.13	-0.40	-0.89	1.68	-1.18	-0.93	-1.86	-0.68	-2.10	-0.36	not outlier
1.13	1.05	-0.72	0.99	0.01	0.44	1.52	-0.18	-0.10	1.21	not outlier
-1.02	1.05	-0.55	1.17	-1.84	-0.02	1.24	-0.68	1.04	0.03	not outlier
1.13	-0.40	-0.20	1.34	-1.32	-0.93	0.39	0.31	0.47	1.21	not outlier
1.56	0.09	0.83	0.48	-0.39	0.90	0.68	1.30	-0.39	0.23	not outlier
-1.02	0.57	0.66	-0.56	-1.05	0.44	-1.29	-1.17	-0.68	0.23	not outlier
-0.30	0.09	-0.03	0.99	0.14	0.44	-0.73	-0.18	-1.25	-0.94	not outlier
-0.02	1.05	1.35	0.99	0.80	0.44	-1.01	-0.18	-0.39	0.03	not outlier
0.84	0.57	0.31	-0.21	-0.26	0.44	-0.45	-1.67	-2.10	-0.55	not outlier

-1.02	-0.88	0.83	1.68	-1.32	-0.02	-2.14	0.31	1.04	0.23	not outlier
-0.16	-0.40	-1.24	-0.21	0.14	0.44	-0.45	-2.16	-1.53	-2.31	not outlier
0.56	0.09	-1.06	0.13	-0.13	0.90	-1.29	0.31	-0.39	0.23	not outlier
-1.02	-0.40	0.14	-1.42	1.46	-0.02	0.96	0.31	-0.10	0.62	not outlier
-0.44	0.57	-0.38	0.30	0.93	1.36	0.39	0.31	0.75	-0.16	not outlier
-0.16	0.09	1.69	0.30	0.27	-0.93	0.68	-1.17	-0.10	-0.16	not outlier
0.84	0.09	0.49	-0.39	0.80	-0.02	1.24	-0.18	-1.82	0.62	not outlier
-0.16	-0.88	1.00	1.68	-1.45	-0.93	-2.70	-2.16	-0.39	-0.94	not outlier
1.42	0.57	-0.72	-0.73	0.80	-0.47	-1.01	-0.68	-0.39	1.01	not outlier
1.13	1.05	-0.03	0.30	0.67	0.90	0.39	-0.68	-1.82	-0.94	not outlier
0.13	0.57	-0.20	1.17	1.06	-0.93	-0.45	0.81	-0.96	1.40	not outlier
0.41	-2.32	0.66	1.51	0.01	-1.39	-2.14	-0.18	-1.82	1.21	not outlier
0.99	0.57	-0.89	-0.21	0.80	-0.93	-1.29	-1.17	-0.96	0.62	not outlier
-0.73	-0.40	-0.72	0.48	1.46	0.44	0.68	0.81	-0.10	0.23	not outlier
-0.02	0.57	0.83	-0.73	-0.39	-1.39	-0.17	0.31	-1.25	-0.75	not outlier
-1.02	0.57	0.83	0.82	0.01	-1.39	-0.45	-0.68	-1.82	1.01	not outlier
1.42	0.57	0.49	0.13	0.80	-0.93	-0.17	1.30	0.18	-0.16	not outlier
1.56	0.57	-0.72	-0.56	-0.65	-0.02	-1.01	0.81	0.47	1.40	not outlier
0.70	-1.36	1.35	1.68	0.14	0.44	-0.17	0.31	-1.25	-0.55	not outlier
0.13	-0.40	0.66	0.30	-0.39	-0.02	1.52	-0.68	0.47	0.23	not outlier
-0.16	0.09	1.52	-0.04	0.40	-0.47	0.68	0.81	1.04	-1.14	not outlier
-0.59	-1.84	0.83	-0.56	-1.71	0.44	-1.01	-1.17	-0.10	0.82	not outlier
0.56	1.05	1.35	0.30	-0.79	-0.47	0.11	-1.17	-0.96	-0.36	not outlier
0.41	1.53	0.14	1.34	0.40	0.44	0.96	0.81	-1.53	-0.36	not outlier
0.84	1.53	0.83	0.99	-0.52	-0.02	0.68	0.31	-0.96	0.03	not outlier
0.84	-1.36	-0.38	0.48	-0.52	-0.02	-0.45	-1.67	0.18	0.82	not outlier
-0.16	1.05	0.31	-0.21	1.33	-0.93	0.68	0.81	-0.10	-0.16	not outlier
-0.16	1.05	1.69	0.48	1.59	0.44	-0.45	-0.68	-1.53	-0.16	not outlier
-0.02	-0.88	0.14	1.68	0.14	1.36	-1.57	0.31	-0.39	0.23	not outlier
-0.87	1.05	-0.89	-0.21	-0.26	-1.39	-1.01	-1.67	-0.68	-0.36	not outlier
1.13	1.05	1.00	1.51	-1.05	-0.47	-0.73	1.30	1.04	1.40	not outlier
-0.02	0.57	0.66	0.48	0.14	0.44	0.11	-0.68	-0.39	-0.94	not outlier
0.27	1.53	0.83	1.34	1.20	-0.02	0.68	1.30	-0.10	-0.16	not outlier
0.70	1.05	0.83	0.99	0.54	1.36	0.39	1.30	0.18	1.01	not outlier
0.99	1.05	1.69	0.13	1.72	0.90	-1.29	1.30	-0.39	-0.55	not outlier
0.84	0.57	-1.41	0.99	-0.39	0.90	0.39	-0.68	1.32	-0.94	not outlier
1.13	0.09	1.52	1.34	0.93	1.36	-1.29	0.31	-0.10	-0.36	not outlier
0.13	1.53	-1.06	1.17	0.93	0.44	-1.86	-0.18	-0.96	1.21	not outlier
-0.30	0.57	1.35	0.82	-0.13	-0.47	0.11	-1.17	-0.96	0.82	not outlier
0.84	0.09	-0.03	0.48	1.06	-0.47	0.11	0.31	0.18	0.62	not outlier
1.56	0.57	-1.24	1.34	1.59	0.90	0.96	0.81	0.75	-0.16	not outlier
0.70	0.57	0.14	0.13	-1.32	-0.47	-0.45	-0.68	0.75	-0.16	not outlier
0.84	-0.88	0.14	1.34	-0.26	1.36	-0.45	0.31	0.18	-0.94	not outlier
1.27	-0.40	-0.55	1.34	1.59	0.90	-0.45	1.30	-0.96	1.60	not outlier
1.42	0.57	-0.72	-0.04	0.14	0.90	0.68	0.81	0.18	1.60	not outlier
1.56	1.53	-0.72	-0.39	1.06	0.44	0.96	0.31	-0.10	-0.36	not outlier
0.27	1.05	1.35	0.99	1.46	0.90	-0.73	-0.18	0.47	-0.75	not outlier
0.84	-0.40	-1.58	-0.56	-1.32	-0.93	1.24	-0.18	-0.68	1.01	not outlier

0.99	1.05	1.52	0.82	1.59	-0.47	-1.86	-1.17	-1.25	0.23	not outlier
1.42	-0.40	0.66	-1.94	-0.26	-0.02	-0.45	-2.16	-2.67	-0.94	not outlier
1.13	1.53	1.35	0.65	0.67	-0.47	1.24	1.30	-1.25	-0.55	not outlier
-0.02	1.53	0.83	-0.04	0.01	1.36	0.11	0.31	-0.68	0.62	not outlier
-0.16	1.05	-1.06	1.34	0.67	0.44	-1.86	-0.68	0.18	-0.75	not outlier
0.13	-1.36	1.35	0.30	0.27	-0.47	-0.45	-0.18	-0.96	1.40	not outlier
1.42	1.05	1.52	1.34	0.80	1.36	1.24	1.30	0.75	1.40	not outlier
-0.44	-0.40	-0.03	0.13	0.67	-0.47	-2.42	-2.16	0.47	0.43	not outlier
0.84	0.09	0.31	1.17	1.33	0.90	-0.45	-0.18	-1.25	1.21	not outlier
1.56	1.53	-0.72	-0.39	0.67	0.90	0.96	0.31	-0.96	1.60	not outlier
1.27	0.09	0.31	0.65	0.80	0.90	-0.17	-0.18	-0.10	1.40	not outlier
1.13	1.53	-0.89	0.99	0.80	-0.02	1.52	-0.68	-0.39	-1.14	not outlier
1.13	-0.40	1.17	0.48	-0.79	-0.93	0.68	-0.18	0.18	0.23	not outlier
0.84	-0.40	0.83	0.13	-0.79	-0.02	-0.73	-0.68	-0.96	0.03	not outlier
-0.59	1.53	0.83	-1.25	0.40	-0.02	-0.45	-0.18	1.61	-1.73	not outlier
-1.73	-0.88	-0.89	0.48	1.20	1.36	-1.01	-0.18	1.61	1.60	not outlier
0.56	0.09	1.00	-0.39	0.93	-0.47	-0.73	-1.17	-0.68	1.01	not outlier
1.56	-0.88	-0.03	1.34	-0.79	-0.47	0.11	-0.68	-0.96	1.21	not outlier
-1.87	1.53	0.66	0.48	0.01	1.36	1.52	-0.18	-0.10	0.43	not outlier
1.13	1.53	1.00	0.82	1.59	0.90	1.52	0.81	-0.10	0.62	not outlier
-0.44	0.57	-0.89	1.17	1.59	-1.39	-0.17	-0.18	-1.25	0.43	not outlier
0.41	1.53	0.49	0.82	-0.92	1.36	-0.45	0.31	0.75	1.01	not outlier
1.42	0.09	-0.20	-0.39	1.06	1.36	-0.17	-0.68	-0.96	-0.55	not outlier
0.70	-0.40	1.69	-0.39	-0.79	-0.93	-0.17	-0.68	-0.39	-0.94	not outlier
0.70	-0.40	0.49	0.82	0.40	0.90	0.39	-0.18	0.75	0.62	not outlier
-0.59	1.53	0.31	1.68	1.20	-0.47	-1.86	0.81	1.61	0.62	not outlier
0.27	1.53	0.49	-0.73	-0.79	-0.93	-1.86	-0.68	1.32	1.21	not outlier
-0.44	-0.40	1.00	1.68	-1.84	0.90	0.11	-0.18	1.32	0.82	not outlier
1.42	1.53	1.69	0.65	1.33	-0.02	-0.17	0.81	0.75	0.43	not outlier
-0.44	-0.40	0.66	0.13	-0.79	0.90	-1.57	0.31	-0.10	1.60	not outlier
0.56	-0.88	-0.89	-1.59	0.27	1.36	0.68	-0.68	-0.96	1.40	not outlier
1.27	-0.40	1.35	-1.25	-1.18	1.36	-0.73	1.30	1.04	-0.16	not outlier
-0.44	0.09	0.14	-1.25	0.14	0.44	-1.01	1.30	-1.53	1.21	not outlier
0.13	-0.40	-0.03	-0.04	-1.05	1.36	1.52	-0.18	0.18	1.21	not outlier
0.41	1.05	-0.03	-0.90	0.27	-0.02	-0.17	-0.68	-0.10	0.03	not outlier
1.13	1.05	0.49	0.99	-0.52	-0.02	0.39	0.31	0.18	0.82	not outlier
0.27	1.05	1.52	0.99	0.27	0.44	0.39	0.81	-0.68	0.23	not outlier
1.56	0.57	-0.55	-0.73	-1.32	-0.47	0.39	-0.18	0.47	0.62	not outlier
1.42	0.09	0.66	1.17	0.67	-0.93	-1.57	-0.68	0.47	0.62	not outlier
-0.02	1.05	1.52	-1.42	-0.13	0.90	0.11	-0.18	0.18	0.03	not outlier
0.84	0.57	0.31	1.68	0.40	0.44	0.96	1.30	1.04	1.40	not outlier
1.56	1.05	-0.72	1.51	-0.39	1.36	-0.45	0.81	-0.39	0.82	not outlier
0.27	-1.36	-1.58	-0.21	0.27	-0.02	0.68	-0.18	-0.39	0.62	not outlier
1.27	1.05	0.49	0.30	1.33	0.44	-2.70	-0.18	0.18	1.40	not outlier
0.13	1.53	0.14	1.17	1.20	0.44	-1.01	0.31	-0.10	1.21	not outlier
1.27	-0.40	1.00	0.48	-0.65	-0.93	-0.45	-0.18	-0.10	-0.36	not outlier
1.42	1.05	-1.24	0.30	0.54	1.36	-0.73	-0.18	0.75	-0.55	not outlier
0.70	1.05	0.31	1.51	-0.13	0.90	-0.73	-1.17	0.75	0.82	not outlier

0.41	-0.40	0.14	-0.90	-1.98	0.90	0.68	-1.17	-0.10	0.62	not outlier
1.27	1.53	0.49	-0.39	-0.65	1.36	0.68	1.30	-1.53	0.62	not outlier
0.70	-0.40	1.52	-0.04	-0.92	-0.47	0.96	-0.18	1.04	0.23	not outlier
1.56	0.57	0.14	-0.73	-0.13	-0.02	0.68	1.30	1.04	-0.55	not outlier
0.41	0.57	0.14	1.17	0.27	-0.02	0.11	0.81	1.04	0.62	not outlier
0.27	1.05	0.14	0.82	0.67	-0.02	0.68	-0.68	0.75	0.03	not outlier
-0.02	1.53	-0.20	1.51	-0.92	0.44	0.96	0.31	0.47	0.03	not outlier
0.56	1.05	-0.03	0.13	0.14	1.36	0.68	0.81	1.32	0.82	not outlier
-0.87	0.57	0.31	0.65	0.27	-0.02	0.39	-0.18	0.47	1.21	not outlier
-1.02	0.09	1.35	1.68	0.67	0.44	0.11	0.81	1.32	1.21	not outlier
0.84	0.09	0.49	0.99	1.20	1.36	-0.17	0.81	-0.68	1.01	not outlier
0.99	1.05	0.14	0.65	0.40	-0.02	0.96	-0.18	1.04	-1.34	not outlier
1.13	0.57	-0.55	0.13	0.01	-0.02	0.39	0.81	0.18	0.23	not outlier
-1.16	-0.88	-0.03	0.99	-0.13	-0.02	-1.29	-1.67	1.32	-0.55	not outlier
0.13	0.57	1.17	1.68	-1.05	1.36	1.52	1.30	1.04	0.62	not outlier
0.70	1.05	-0.38	1.51	0.93	1.36	1.52	1.30	1.32	0.82	not outlier
-0.16	-0.40	-1.58	0.48	1.06	-0.47	0.96	1.30	0.47	0.82	not outlier
0.99	1.05	0.31	-0.56	0.54	0.44	-0.45	0.31	0.18	-1.14	not outlier
0.84	0.09	1.52	0.82	-0.79	0.90	-0.17	0.81	0.47	1.60	not outlier
0.13	0.57	-0.55	0.82	0.01	0.90	0.11	0.81	0.47	1.01	not outlier
1.13	0.09	1.35	1.68	1.72	0.44	1.24	0.81	0.75	0.43	not outlier
0.27	0.09	1.00	-0.39	1.59	0.44	0.96	0.81	1.61	0.43	not outlier
0.56	0.09	0.31	0.30	1.33	0.90	-0.73	0.31	1.32	-0.36	not outlier
-0.02	0.09	1.69	0.48	-0.92	0.90	-0.73	0.81	-0.68	-0.55	not outlier
1.13	0.09	0.66	0.30	-0.39	-0.47	0.11	0.31	1.32	0.03	not outlier
1.42	0.57	-0.20	0.99	0.40	1.36	-0.17	1.30	1.32	-0.16	not outlier
0.41	0.09	-0.38	1.51	0.93	0.44	1.24	0.31	1.32	0.03	not outlier
0.41	0.09	-0.55	0.30	0.27	0.44	0.68	0.81	-0.10	1.40	not outlier
1.56	0.57	1.69	1.51	-0.13	1.36	0.11	1.30	1.04	1.40	not outlier
1.42	0.57	0.14	0.65	-1.45	0.44	0.96	1.30	1.32	-1.53	not outlier
1.42	1.53	1.69	0.48	-0.65	-0.02	0.11	1.30	1.61	0.43	not outlier
-0.02	1.53	1.52	1.51	-1.18	0.90	0.11	1.30	1.32	0.82	not outlier
-0.73	-0.40	1.69	0.48	-0.52	1.36	0.96	0.81	0.18	1.01	not outlier
-0.59	1.05	1.52	1.51	-1.71	0.44	1.24	0.81	-1.25	0.23	not outlier
0.70	0.09	-0.20	0.99	0.54	0.44	-0.17	0.81	1.32	0.03	not outlier
1.13	1.53	-0.89	0.65	-0.26	0.90	-1.01	0.81	1.32	0.82	not outlier
-0.87	0.57	1.17	0.65	-0.39	-0.47	-1.01	0.31	0.18	0.03	not outlier
0.99	1.53	-0.38	0.30	-0.39	0.90	-0.45	0.81	1.61	0.43	not outlier
-0.87	1.53	0.31	-0.21	0.14	0.90	-0.17	-0.18	0.75	0.03	not outlier
-1.59	1.05	0.49	0.82	0.14	0.90	-0.45	0.81	0.18	0.23	not outlier
1.42	1.05	0.49	1.34	1.46	-0.93	-0.45	0.81	1.04	0.03	not outlier
1.42	0.57	1.69	1.51	1.72	1.36	0.39	1.30	0.47	1.40	not outlier
1.13	-1.36	-0.72	0.99	0.40	-0.47	-0.17	1.30	-0.68	-1.14	not outlier

Technological and Behavioural Factors

PC_z	PB_z	IN_z	PS_z	CA_z	RA_z	PE_z	outlier_detection

-1.133	-0.413	-0.148	-1.341	-1.782	-0.226	0.108	not outlier
-1.944	-1.090	-1.689	-0.288	-0.755	-1.180	-1.291	not outlier
-1.133	-1.090	-0.662	0.238	0.786	-2.135	-0.731	not outlier
-0.863	-1.768	-0.662	-1.341	-2.295	-1.658	-1.291	not outlier
-1.674	-0.752	-0.662	-2.394	-1.268	-0.703	-0.731	not outlier
-2.215	-0.752	-1.689	-1.868	-2.295	-1.658	-1.011	not outlier
-2.485	-1.768	-0.148	-1.341	-0.241	0.252	-0.452	not outlier
0.759	-1.090	-0.148	-1.868	-1.268	-2.135	-2.131	not outlier
0.488	-1.429	-0.148	-0.815	-1.782	-1.658	-1.291	not outlier
0.488	-2.107	-0.662	-1.341	0.272	-0.226	-0.452	not outlier
0.488	-2.445	-0.662	0.238	-1.268	-0.226	-1.011	not outlier
-0.593	-1.090	1.393	-0.815	-0.241	0.252	-1.291	not outlier
-1.944	-1.090	-1.689	0.238	-0.755	0.729	-2.411	not outlier
-1.944	-2.107	-1.175	0.238	-1.268	-0.226	0.388	not outlier
-1.404	-0.074	-1.689	-1.341	-1.268	-0.703	0.668	not outlier
-0.593	-1.429	-0.148	1.291	-2.295	-1.180	-1.291	not outlier
-0.593	-2.107	1.393	0.238	-0.241	0.729	0.668	not outlier
-1.944	-0.752	-1.175	-0.288	-1.268	-1.658	-0.731	not outlier
-1.404	-1.768	-1.175	-1.341	-2.295	-0.703	-1.011	not outlier
-0.322	-1.768	1.393	0.238	-1.782	-0.226	-1.011	not outlier
0.488	-0.413	0.366	0.765	-0.241	-1.658	0.388	not outlier
0.218	-0.752	0.366	0.238	-1.782	-1.180	-1.571	not outlier
0.488	-1.768	-0.662	-1.868	-1.268	-0.703	-1.291	not outlier
-2.485	-0.752	-0.662	-1.868	-0.241	-0.226	-1.291	not outlier
-2.215	-1.429	-1.689	0.765	-0.755	0.252	-1.571	not outlier
-0.863	-0.752	-1.175	-0.815	-1.268	-1.658	-1.011	not outlier
-0.052	-1.768	-0.662	-1.341	0.786	-0.703	-1.011	not outlier
0.488	-1.768	-0.662	-0.815	-2.295	0.252	0.108	not outlier
0.218	0.603	1.393	-0.288	-0.755	-1.658	-1.851	not outlier
1.029	1.281	1.393	0.238	-0.241	0.252	-0.172	not outlier
-1.944	-1.090	-1.175	-1.868	0.272	-0.226	-1.011	not outlier
0.759	-0.413	-0.662	0.238	-0.755	-1.180	-0.172	not outlier
0.218	-0.413	1.393	0.238	-0.241	0.252	0.108	not outlier
-1.404	-1.768	-0.662	0.238	0.272	1.206	-1.291	not outlier
1.299	-0.074	1.393	0.238	0.272	1.206	-1.571	not outlier
-1.404	-0.752	-0.148	-1.341	-0.755	0.252	-2.411	not outlier
-1.674	-0.074	0.366	0.238	-0.241	0.252	-0.452	not outlier
-0.593	-2.107	-1.175	-0.815	0.786	-0.226	-1.011	not outlier
-0.322	-0.413	0.879	0.238	0.786	-0.226	-0.172	not outlier
-1.404	-0.752	-0.148	-0.815	0.272	-1.180	1.507	not outlier
-1.133	-0.752	-0.662	-0.815	1.299	0.252	0.108	not outlier
-0.593	-1.768	0.366	0.765	-1.268	0.252	0.668	not outlier
-0.593	-0.752	-0.148	-0.815	-0.755	-0.703	0.388	not outlier
-0.593	0.265	0.366	0.765	-0.241	1.206	0.108	not outlier
1.570	-0.074	0.366	0.765	-0.241	1.206	0.668	not outlier
-0.052	-0.752	0.366	0.238	-0.241	0.252	-1.851	not outlier

0.218	-1.429	0.366	-2.394	0.272	-0.703	0.108	not outlier
0.759	-0.752	1.393	0.238	1.299	-0.703	1.227	not outlier
-0.593	-1.429	-0.662	-0.288	0.272	-0.226	-0.731	not outlier
-2.755	-0.074	-1.175	0.238	-0.755	-0.226	-1.291	not outlier
-0.863	-0.752	0.366	0.765	0.272	-1.180	-0.452	not outlier
-1.404	-2.445	-0.148	0.765	-0.755	0.252	0.388	not outlier
0.488	-0.074	0.366	-0.288	-0.755	-1.658	-1.571	not outlier
0.488	-0.752	0.879	0.238	-0.755	0.729	-0.452	not outlier
-0.322	-2.107	0.366	0.238	0.272	-0.703	-0.452	not outlier
-1.404	-1.768	-0.148	0.765	-0.241	-0.226	-0.452	not outlier
1.029	-1.768	1.393	-0.815	-0.241	1.684	0.948	not outlier
1.029	-2.107	0.366	-0.815	-1.268	0.729	-0.452	not outlier
-0.593	-0.074	-0.662	0.238	-0.755	-2.135	-0.731	not outlier
-1.133	-1.429	-0.662	0.765	0.272	0.729	-0.731	not outlier
-1.674	-0.413	-1.689	-0.815	-0.755	-1.180	-0.172	not outlier
1.029	0.942	0.366	-0.815	-1.268	-1.658	1.227	not outlier
-0.322	-0.413	-0.662	-0.815	-0.755	0.729	-0.172	not outlier
-0.593	-1.090	-0.662	-0.815	-0.241	-0.703	1.227	not outlier
-1.404	0.265	-0.662	0.765	-0.241	-0.226	-1.291	not outlier
1.570	0.603	0.879	0.238	-1.268	-1.180	-0.172	not outlier
-0.863	0.265	0.366	0.765	-0.755	-0.703	-1.291	not outlier
0.218	0.265	0.879	-0.288	1.299	-1.180	0.668	not outlier
-1.404	0.265	0.879	-0.815	-1.268	-1.180	-0.452	not outlier
-1.404	-0.413	0.879	0.765	0.272	-0.703	-0.172	not outlier
0.218	-0.752	0.879	0.238	0.272	0.252	0.668	not outlier
0.759	-0.752	-0.148	0.765	-0.241	-0.703	-2.411	not outlier
0.488	-1.768	-0.148	-0.815	-0.241	1.206	-1.571	not outlier
-0.593	-2.445	1.393	0.765	-0.241	0.729	0.108	not outlier
-1.674	-0.752	-2.717	-0.815	0.272	-1.658	0.108	not outlier
-0.322	-1.090	-0.148	-2.394	0.786	0.729	0.388	not outlier
0.218	0.942	0.879	0.765	-1.268	-1.658	0.948	not outlier
-0.052	-1.090	1.393	0.238	-0.755	1.206	-1.011	not outlier
-0.863	-0.074	1.393	1.291	-0.755	-1.658	-1.291	not outlier
-0.593	-1.429	-0.148	-0.815	0.272	0.252	-0.452	not outlier
-0.593	0.603	0.879	1.291	-0.241	-1.180	-1.011	not outlier
0.488	-0.413	0.366	-0.288	-0.241	0.252	1.507	not outlier
-0.322	-0.752	0.366	1.291	1.299	0.252	-2.131	not outlier
-0.322	0.265	0.366	-0.815	0.786	-1.658	0.108	not outlier
1.299	-0.413	1.393	0.238	0.272	-0.703	0.948	not outlier
-1.133	0.603	0.879	1.291	-1.782	1.206	1.507	not outlier
1.570	0.942	1.393	1.291	-0.755	0.252	0.108	not outlier
1.029	0.603	0.879	0.238	-1.268	-1.180	0.388	not outlier
-1.133	1.620	0.879	1.291	1.299	-1.180	1.507	not outlier
0.759	-0.413	-0.662	0.765	1.299	0.729	0.388	not outlier
1.299	-0.074	-0.148	-1.868	0.272	-0.703	0.388	not outlier
-0.322	-0.074	-0.148	1.291	0.786	-0.703	-0.172	not outlier

-0.863	-0.413	-0.148	0.238	-0.755	1.206	1.227	not outlier
0.218	-0.074	-0.148	1.291	-0.755	-0.703	-1.291	not outlier
0.218	1.281	-0.662	-1.868	-1.268	-0.226	-1.291	not outlier
1.299	-0.752	0.879	0.765	0.786	1.684	-1.851	not outlier
-1.674	-0.752	0.879	1.291	0.272	1.206	-0.172	not outlier
-0.322	1.620	1.393	-1.341	0.786	0.252	0.108	not outlier
0.218	-0.413	1.393	0.238	-0.755	1.206	0.948	not outlier
1.299	1.620	1.393	0.765	0.272	-0.226	1.227	not outlier
-0.593	-0.074	-0.148	-1.341	1.299	0.252	0.388	not outlier
-0.052	0.265	1.393	0.238	0.272	1.206	0.388	not outlier
-2.755	1.281	-2.203	0.765	0.786	-1.180	-0.172	not outlier
0.488	0.265	1.393	1.291	0.272	-0.703	0.108	not outlier
-2.215	-1.090	-0.148	0.765	0.786	0.252	0.108	not outlier
-0.322	0.603	0.366	1.291	0.786	0.252	-0.172	not outlier
0.759	0.265	0.879	1.291	-0.755	-0.703	-1.291	not outlier
0.218	0.603	-0.148	0.765	0.272	-0.703	-1.011	not outlier
0.759	1.281	0.879	0.765	1.299	1.206	0.388	not outlier
0.218	1.620	1.393	0.238	0.272	-0.703	-1.571	not outlier
-1.404	0.603	0.879	0.765	0.786	1.684	1.227	not outlier
-1.404	-0.074	0.879	-0.815	-1.268	-0.703	-0.452	not outlier
-0.593	-0.074	0.366	0.765	0.786	-0.703	-1.011	not outlier
0.759	-0.074	-0.662	0.238	1.299	1.684	-1.291	not outlier
0.218	0.603	-2.203	-1.341	0.272	0.252	0.108	not outlier
-1.133	0.265	1.393	1.291	0.272	0.252	-0.731	not outlier
-0.593	0.603	0.366	1.291	-0.241	-0.226	-0.172	not outlier
-0.322	-0.074	0.366	0.765	1.299	-1.658	0.388	not outlier
0.759	0.603	0.366	0.765	1.299	-1.180	-1.571	not outlier
1.299	-0.752	1.393	0.238	1.299	-0.226	0.108	not outlier
-0.593	0.265	0.366	-0.815	-2.295	-0.226	-1.291	not outlier
-0.052	-0.413	1.393	0.238	-0.241	0.252	0.668	not outlier
0.218	-1.429	0.366	1.291	0.786	0.729	-0.731	not outlier
0.759	-0.413	1.393	1.291	0.272	-1.180	0.668	not outlier
-0.322	0.942	-1.689	-0.815	1.299	0.729	-0.172	not outlier
-0.863	1.620	1.393	0.238	-0.241	1.206	-0.172	not outlier
-0.863	-0.752	0.879	1.291	1.299	-1.658	-0.172	not outlier
0.218	1.620	0.879	0.765	-0.755	0.729	0.108	not outlier
1.029	1.620	0.879	-1.341	1.299	1.684	1.507	not outlier
1.029	0.942	0.366	0.238	0.272	-0.226	-1.011	not outlier
-0.322	0.603	-1.175	0.765	-1.268	1.206	0.948	not outlier
1.299	-0.413	1.393	1.291	-0.241	0.252	0.948	not outlier
-0.863	1.620	0.366	-0.288	1.299	-0.703	-0.452	not outlier
0.218	0.603	-0.662	0.765	0.272	-0.703	0.948	not outlier
-0.322	1.281	1.393	0.765	0.786	0.252	-0.172	not outlier
0.759	-1.429	-0.148	1.291	0.272	0.252	0.668	not outlier
0.218	1.620	0.366	-0.288	0.272	0.252	0.948	not outlier
-0.052	-0.074	-0.148	0.765	1.299	0.729	0.948	not outlier

-0.593	-1.090	0.879	0.765	-2.808	0.252	-0.452	not outlier
0.759	0.603	1.393	1.291	-0.241	1.206	0.948	not outlier
0.759	0.603	1.393	-0.288	0.786	1.684	-1.291	not outlier
-0.052	0.603	1.393	1.291	-0.755	-0.226	0.108	not outlier
-0.863	0.603	1.393	0.765	1.299	0.252	-1.011	not outlier
1.029	-0.413	-0.148	-0.288	-0.241	-1.658	0.388	not outlier
0.759	-0.752	-0.148	0.765	0.786	0.729	-2.131	not outlier
1.299	0.942	1.393	1.291	-0.755	1.206	0.108	not outlier
0.218	-1.429	-0.148	0.765	0.272	0.252	1.227	not outlier
1.570	1.281	1.393	1.291	0.272	-0.226	0.668	not outlier
0.488	0.603	1.393	0.238	1.299	1.684	0.108	not outlier
0.488	-0.413	0.366	-0.288	0.272	-0.226	0.108	not outlier
1.029	0.265	0.879	0.238	-0.241	0.729	1.507	not outlier
-0.052	-0.752	-0.662	-0.815	1.299	0.729	-0.452	not outlier
1.299	1.281	0.879	1.291	0.272	-0.703	0.108	not outlier
-0.322	0.265	0.366	0.765	0.272	0.729	1.507	not outlier
-0.052	1.620	0.366	0.765	-1.782	1.684	0.108	not outlier
1.029	0.265	-1.175	-0.288	-1.268	-1.658	-1.011	not outlier
0.488	1.281	0.366	1.291	-1.782	-0.703	-0.452	not outlier
-0.322	0.265	0.366	-0.288	-0.241	-0.703	-0.172	not outlier
1.299	-1.429	-0.662	-0.288	-0.241	-1.180	-1.011	not outlier
0.218	-1.090	-1.175	-0.288	0.786	-0.703	-2.131	not outlier
-0.322	-1.768	-0.148	-0.815	-0.241	-1.180	-1.291	not outlier
-0.593	-0.752	-1.175	-0.815	-1.268	-1.180	-1.571	not outlier
-0.322	-0.074	-2.203	-0.815	-2.295	-2.135	1.227	not outlier
-0.052	-0.413	-1.689	-0.288	-0.241	-0.226	0.108	not outlier
0.759	0.603	-0.662	-1.341	-0.241	-0.703	-1.011	not outlier
-1.404	0.265	-1.689	-1.341	-0.755	-0.703	-0.452	not outlier
-0.052	0.603	1.393	0.765	0.272	0.252	0.108	not outlier
1.299	-1.090	-1.689	1.291	0.272	-1.658	0.108	not outlier
0.218	-0.074	-1.175	-0.815	-1.782	-2.135	0.948	not outlier
1.570	-0.074	1.393	0.238	0.272	-0.226	0.108	not outlier
-0.593	-1.768	-0.662	0.238	0.786	0.729	-1.571	not outlier
-0.593	-0.413	-0.662	0.238	1.299	-1.180	-0.452	not outlier
-1.133	0.942	1.393	1.291	0.272	0.252	-1.851	not outlier
-1.133	0.265	-1.689	-2.394	-0.241	-1.180	-1.011	not outlier
-0.593	-0.074	-0.148	0.765	0.272	1.206	-1.571	not outlier
-0.593	-1.090	1.393	0.765	1.299	0.252	-1.571	not outlier
-0.593	-0.752	0.366	0.238	-2.295	1.206	-1.571	not outlier
-1.404	-0.074	-0.662	0.238	-2.808	-0.226	-1.571	not outlier
-1.404	-1.768	-1.175	-1.341	-0.241	-1.658	0.948	not outlier
-0.593	-0.413	-1.175	1.291	0.272	-0.226	-0.731	not outlier
-0.863	-2.107	-1.689	1.291	-0.241	-1.658	0.388	not outlier
-1.133	-0.074	-1.689	-0.288	-1.268	0.729	-1.011	not outlier
-1.674	0.265	-1.175	-2.394	-2.295	-0.703	-2.131	not outlier
-1.404	-2.107	-0.662	0.238	-0.755	-0.703	-0.731	not outlier

-1.133	-1.090	-1.689	-0.815	1.299	-1.180	0.948	not outlier
-1.133	0.265	0.879	1.291	-0.241	-0.703	-0.172	not outlier
0.218	-0.413	-1.175	0.765	0.786	0.252	0.108	not outlier
-1.404	-0.413	-2.203	0.238	-0.241	-1.180	-1.011	not outlier
-0.052	-0.074	1.393	0.238	1.299	0.729	-0.452	not outlier
-0.052	-0.074	0.879	-0.815	0.272	1.206	1.227	not outlier
-0.052	0.603	1.393	-0.815	-0.241	1.206	0.108	not outlier
1.299	0.265	0.366	-2.921	0.272	0.252	-1.011	not outlier
0.218	-1.090	0.879	0.238	0.786	-0.226	0.388	not outlier
0.218	1.620	-0.662	0.238	-2.808	-1.658	-0.452	not outlier
-0.322	0.603	-0.148	0.765	0.786	-0.703	-0.731	not outlier
-0.322	0.942	0.879	-0.815	-0.241	-1.180	-1.011	not outlier
0.759	0.265	-0.148	0.765	1.299	-0.226	0.108	not outlier
-0.593	-0.074	-1.689	-0.815	0.272	-0.226	1.507	not outlier
1.029	0.942	0.879	-0.288	-1.268	-1.180	-0.452	not outlier
0.488	0.603	0.879	0.238	-1.782	1.684	0.388	not outlier
1.029	-0.413	-0.662	-0.288	-0.241	-0.703	0.668	not outlier
-1.944	0.942	0.366	0.765	-0.241	-0.703	-0.452	not outlier
1.299	1.620	0.879	0.765	-0.241	-1.658	-0.452	not outlier
-1.133	-0.413	-0.148	0.238	-0.241	-0.226	0.108	not outlier
0.759	-0.074	0.366	-1.868	1.299	1.206	-0.172	not outlier
-0.322	-0.752	-1.175	-1.868	-0.241	-0.703	0.108	not outlier
0.759	-0.752	-1.175	-1.341	1.299	-0.703	-2.970	not outlier
-1.404	0.265	-0.148	1.291	-0.241	0.729	-0.452	not outlier
1.299	0.265	-1.175	-0.815	0.272	-1.658	-0.172	not outlier
-0.863	-0.413	-2.717	-1.341	-1.782	-0.703	-0.731	not outlier
-1.404	0.603	-0.662	-1.341	-0.241	-0.226	0.108	not outlier
1.299	0.942	1.393	1.291	0.786	0.252	-0.452	not outlier
-1.404	-0.074	-0.662	0.238	1.299	0.729	0.108	not outlier
-0.052	0.603	0.366	-1.868	-2.295	0.729	0.388	not outlier
-0.052	-0.752	-1.689	0.765	-2.295	-0.703	0.668	not outlier
1.029	-1.090	-1.175	-0.815	-1.268	1.684	1.507	not outlier
1.299	-0.752	-0.148	-0.815	0.786	0.252	-0.172	not outlier
-0.863	-1.090	-0.148	-1.341	-0.241	-0.226	-1.291	not outlier
1.570	0.942	-0.148	0.238	0.272	-1.658	1.507	not outlier
-1.404	0.265	-0.148	-1.341	0.786	0.252	0.388	not outlier
0.759	0.265	0.879	1.291	0.272	-0.226	-1.291	not outlier
1.029	-0.413	-1.175	-1.341	0.786	0.729	-0.731	not outlier
-0.052	-1.090	0.366	-0.288	-0.241	-0.703	1.227	not outlier
1.570	0.603	1.393	-0.815	-0.755	0.729	0.668	not outlier
1.029	-0.074	-0.148	0.765	0.272	0.252	-0.731	not outlier
1.029	0.265	-0.148	-1.341	-0.241	-0.703	-1.571	not outlier
1.570	0.603	0.879	0.238	1.299	0.252	0.948	not outlier
0.218	-0.752	-1.175	-0.815	0.786	-1.180	0.668	not outlier
1.299	-0.413	1.393	0.765	0.786	1.684	0.108	not outlier
-0.593	1.620	0.879	0.238	0.272	-0.703	0.108	not outlier

-0.593	0.942	-0.148	-0.815	1.299	0.729	-0.452	not outlier
1.029	0.942	-0.662	-0.288	-0.755	0.252	0.948	not outlier
-0.593	0.265	0.366	-1.341	0.786	-1.180	-1.851	not outlier
0.488	-0.074	-0.148	-0.815	0.786	0.729	-2.131	not outlier
1.570	-0.752	0.879	0.238	-0.241	-0.226	0.108	not outlier
-0.322	0.603	-1.689	-2.394	-1.782	0.729	0.108	not outlier
0.218	-1.090	-1.175	-0.815	1.299	-0.703	0.388	not outlier
1.029	-0.413	-0.148	-0.288	-1.268	-0.703	0.108	not outlier
1.299	1.620	-0.148	-2.394	0.786	0.729	-1.291	not outlier
-0.052	0.942	-0.148	-2.394	0.786	0.252	-0.172	not outlier
0.488	0.603	0.879	-0.815	1.299	0.252	0.388	not outlier
0.759	-0.752	-2.203	-0.288	-0.755	-0.703	-1.851	not outlier
1.299	1.281	-0.148	0.238	1.299	-0.226	-1.011	not outlier
-1.404	1.281	-1.175	0.238	0.786	-0.703	-0.452	not outlier
0.218	0.603	-0.148	1.291	0.786	1.206	0.108	not outlier
1.299	-1.429	-0.662	1.291	-0.241	0.729	-0.731	not outlier
0.218	0.942	0.366	-0.288	1.299	1.206	0.948	not outlier
-1.133	1.620	-0.148	1.291	-1.268	0.252	0.388	not outlier
0.759	0.603	-1.175	-0.288	1.299	1.206	-1.011	not outlier
0.218	0.603	0.366	0.765	0.272	-0.703	1.507	not outlier
-0.052	0.265	-1.689	-1.868	-2.295	-0.226	0.948	not outlier
-1.404	1.620	-1.175	-0.815	1.299	-0.703	-0.172	not outlier
-0.322	0.942	-1.175	0.765	1.299	-1.180	-0.172	not outlier
1.570	-0.074	0.366	1.291	1.299	-0.226	1.227	not outlier
1.029	0.942	-0.148	0.765	0.272	-0.703	-0.452	not outlier
0.759	1.281	-0.148	-1.868	1.299	0.729	1.507	not outlier
1.570	0.265	-0.662	1.291	-0.241	1.206	0.948	not outlier
0.759	-0.074	0.366	-1.341	0.272	1.206	-0.172	not outlier
-1.404	1.281	-1.689	-0.815	1.299	0.729	-1.291	not outlier
0.218	0.265	1.393	0.765	1.299	1.206	1.507	not outlier
1.570	0.603	0.879	0.238	0.786	-0.226	1.507	not outlier
0.218	0.603	-0.148	0.765	0.272	-0.226	1.227	not outlier
1.299	1.620	-0.662	0.765	1.299	-1.658	0.108	not outlier
-0.593	-0.413	-1.175	-0.815	0.272	0.729	0.668	not outlier
0.759	0.942	-1.689	-0.288	0.272	-1.658	0.948	not outlier
-1.133	0.265	-0.662	-1.341	0.272	0.729	-0.452	not outlier
0.488	-0.752	-1.175	-0.288	-1.782	1.206	-1.011	not outlier
1.029	1.620	-0.148	-0.815	1.299	-0.226	0.108	not outlier
-1.944	1.620	-0.148	0.238	0.786	1.684	1.507	not outlier
-0.863	-0.413	-1.689	-2.394	1.299	-0.703	0.948	not outlier
0.218	0.942	-0.148	0.238	0.272	-0.226	-0.731	not outlier
1.029	1.620	-0.148	1.291	-0.755	-1.180	-0.172	not outlier
0.759	1.281	0.879	0.238	-1.782	-0.226	0.668	not outlier
0.488	0.942	-1.689	1.291	-0.755	-0.703	0.668	not outlier
1.029	1.620	0.366	1.291	0.272	-1.658	-0.172	not outlier
1.029	0.603	0.879	1.291	0.272	0.729	1.227	not outlier

-0.863	0.603	0.879	-0.815	0.786	1.206	1.227	not outlier
1.570	1.620	0.366	0.238	1.299	0.252	-0.172	not outlier
1.029	0.603	-2.203	-1.868	-0.755	0.729	0.668	not outlier
-1.404	0.265	-0.662	-0.288	1.299	0.729	-0.452	not outlier
0.218	0.942	-0.662	0.238	-0.241	-0.226	0.388	not outlier
1.570	1.620	0.879	-0.288	1.299	0.252	0.948	not outlier
1.299	0.603	1.393	0.238	-0.241	1.684	1.507	not outlier
1.029	0.603	-0.662	0.238	-0.241	-0.703	0.108	not outlier
1.029	1.281	-0.662	-0.288	1.299	-0.703	1.507	not outlier
0.488	1.281	-0.148	-1.868	-0.241	1.206	0.388	not outlier
-0.593	-0.074	0.879	0.238	1.299	1.684	-0.172	not outlier
1.299	1.620	1.393	1.291	1.299	0.252	0.668	not outlier
0.488	-0.413	0.879	1.291	0.272	0.252	0.948	not outlier
1.029	-0.413	-0.148	0.238	1.299	-0.703	1.227	not outlier
1.570	-0.074	0.366	-0.815	0.786	0.252	1.227	not outlier
0.488	0.942	-0.662	-1.868	0.786	0.252	1.507	not outlier
-0.052	-0.074	0.366	1.291	0.786	1.684	1.227	not outlier
0.759	1.281	0.879	0.765	0.786	1.684	0.948	not outlier
0.488	0.265	0.879	1.291	0.786	-0.226	0.108	not outlier
1.570	0.603	-0.148	0.238	1.299	1.206	0.668	not outlier
1.299	1.281	1.393	0.765	1.299	-0.226	1.507	not outlier
0.218	-1.429	0.366	-0.288	0.786	1.206	0.948	not outlier
1.299	-0.413	-0.662	1.291	0.272	-0.226	0.668	not outlier
0.759	-0.413	-1.175	0.238	1.299	0.729	0.668	not outlier
0.218	0.603	-2.717	-1.341	-1.782	1.684	1.227	not outlier
0.488	1.620	0.366	1.291	0.272	0.252	0.108	not outlier
1.570	1.620	-0.148	-0.815	-0.241	0.252	-1.011	not outlier
0.488	0.603	-1.689	0.765	0.272	-0.703	1.227	not outlier
0.218	0.603	-0.662	1.291	-0.241	-0.226	1.227	not outlier
-0.863	-0.413	0.879	0.765	1.299	1.684	0.668	not outlier
1.029	-0.413	1.393	1.291	-0.241	1.206	0.948	not outlier
-1.133	0.265	-1.175	-0.815	-0.755	0.252	0.108	not outlier
-0.322	1.281	1.393	0.765	1.299	1.684	0.388	not outlier
0.218	0.265	-0.148	0.238	0.272	0.729	1.507	not outlier
1.570	0.942	0.879	0.765	1.299	0.252	0.948	not outlier
-0.863	0.603	-1.175	0.238	-0.755	1.684	0.668	not outlier
0.488	0.603	-0.662	-1.341	1.299	-0.703	0.948	not outlier
0.488	1.620	-0.148	-0.288	0.786	0.252	1.507	not outlier
-0.322	0.603	1.393	1.291	-0.755	1.684	0.668	not outlier
-0.052	0.942	0.366	0.238	0.272	-1.180	1.507	not outlier
-1.674	0.265	-1.175	-0.288	-0.755	0.729	1.227	not outlier
0.218	1.281	0.879	0.238	1.299	1.684	1.227	not outlier
1.299	-1.768	-0.662	-1.868	1.299	-1.180	1.507	not outlier
-0.593	0.265	0.366	1.291	-1.268	1.684	1.507	not outlier
1.299	0.603	0.366	-0.288	0.272	1.684	0.668	not outlier
-0.322	-0.413	-0.662	-0.288	1.299	-0.226	-0.731	not outlier

-0.593	1.281	1.393	1.291	0.272	1.206	1.507	not outlier
0.759	-0.074	1.393	-0.288	0.272	1.684	1.507	not outlier
-0.863	-0.074	-0.148	-0.815	-0.755	1.684	1.507	not outlier
-0.593	0.603	0.879	0.238	0.272	0.252	0.668	not outlier
-0.322	1.281	-0.148	-0.815	0.272	1.206	1.227	not outlier
-0.322	-0.074	0.366	1.291	1.299	1.206	0.388	not outlier
0.759	-0.074	0.366	0.765	1.299	0.729	1.507	not outlier
1.299	-0.752	0.366	-0.815	-0.241	1.684	-0.731	not outlier
1.029	-1.429	-0.662	-0.288	-0.241	0.252	0.668	not outlier
1.570	1.620	1.393	0.238	-0.755	0.252	0.388	not outlier
1.299	0.265	0.366	1.291	-0.755	-1.658	0.668	not outlier
0.488	-0.074	0.879	0.765	1.299	0.729	1.507	not outlier
0.488	-1.090	1.393	0.765	0.272	1.684	0.948	not outlier
-0.593	0.265	-1.175	1.291	-1.268	1.206	0.108	not outlier
-0.593	-0.413	-0.148	1.291	1.299	0.252	0.948	not outlier
-1.404	1.281	0.366	-0.288	0.786	1.684	-0.172	not outlier
0.218	-0.074	-1.175	0.238	-0.241	1.684	0.948	not outlier
1.299	0.603	0.366	-0.815	-0.241	1.206	1.227	not outlier
-0.052	1.281	0.879	1.291	0.786	0.729	1.507	not outlier
0.759	-1.090	0.366	0.238	0.272	0.252	0.948	not outlier
-0.863	1.620	0.879	1.291	-0.241	1.206	0.668	not outlier
0.759	-0.413	1.393	1.291	-0.755	0.729	0.108	not outlier
1.029	1.281	0.366	0.238	0.272	0.252	1.507	not outlier
-0.052	-0.413	-1.689	-0.288	0.272	-1.180	1.227	not outlier
-0.593	1.620	0.366	0.238	0.272	1.206	1.507	not outlier

Appendix-D

Mahlnobis Distance test- script and results

untitled

File Edit Format Run Options Window Help

```
import pandas as pd
import numpy as np
from scipy.stats import chi2

# get file name from user input
file_name = ("E:\PERMAVG.csv ")

# load data into a pandas dataframe
df = pd.read_csv(file_name)

# select only numeric columns
num_cols = df.select_dtypes(include=np.number)

# calculate mean and covariance matrix of the numeric columns
mean = num_cols.mean()
cov = num_cols.cov()

# calculate the inverse of the covariance matrix
inv_cov = np.linalg.inv(cov)

# calculate Mahalanobis distance for each row
mahalanobis_distance = []
for i, row in num_cols.iterrows():
    diff = row - mean
    md = np.sqrt(diff.dot(inv_cov).dot(diff.T))
    mahalanobis_distance.append(md)

# calculate the threshold based on the chi-squared distribution
p = len(num_cols.columns)
threshold = chi2.ppf(0.99, p)

# create a new column for Mahalanobis distance and outlier detection
num_cols['Mahalanobis distance'] = mahalanobis_distance
num_cols['Outlier'] = num_cols['Mahalanobis distance'] > threshold

# save the resulting dataframe to a new CSV file
new_file_name = 'E:\Mahalanobis_PERM.csv'
num_cols.to_csv(new_file_name, index=False)

# print the number of outliers found
print(f"Found {num_cols['Outlier'].sum()} outliers.")
```

Result PERM:

```
    md = np.sqrt(diff.dot(inv_cov).dot(diff.T))
    mahalanobis_distance.append(md)

# calculate the threshold based on the chi-squared distribution
p = len(num_cols.columns)
threshold = chi2.ppf(0.99, p)

# create a new column for Mahalanobis distance and outlier detection
num_cols['Mahalanobis distance'] = mahalanobis_distance
num_cols['Outlier'] = num_cols['Mahalanobis distance'] > threshold

# save the resulting dataframe to a new CSV file
new_file_name = 'E:\Mahalanobis_PERM.csv'
num_cols.to_csv(new_file_name, index=False)

# print the number of outliers found
print(f"Found {num_cols['Outlier'].sum()} outliers.")
```

```
Found 0 outliers.
```

PERM outliers'detection working:

AW	HR	BR	TR	GV	MF	GR	IN	SI	CT	Mahalanobis distance	Threshold	Outlier
2.714	3.500	4.333	3.833	1.625	3.500	1.500	2.000	3.500	2.400	3.400	23.209	FALSE
1.286	2.000	2.667	1.667	1.250	4.000	4.750	2.500	3.750	2.600	3.426	23.209	FALSE
2.571	2.500	2.500	1.000	1.500	2.500	2.750	2.500	3.250	1.000	3.240	23.209	FALSE
2.429	2.000	2.167	2.667	1.375	2.500	4.250	3.000	1.750	1.800	3.264	23.209	FALSE
3.000	1.000	1.167	3.167	1.250	3.500	4.500	2.000	3.750	2.200	3.894	23.209	FALSE
3.143	3.000	2.000	2.167	2.875	2.500	2.500	1.500	4.500	1.600	3.269	23.209	FALSE
2.571	2.000	2.500	1.667	2.500	2.500	4.750	1.500	3.500	2.400	3.230	23.209	FALSE
1.143	1.000	3.833	1.833	1.500	4.000	2.500	1.000	2.750	2.400	4.249	23.209	FALSE
1.714	2.000	3.167	2.000	2.625	2.500	4.000	3.000	5.000	2.200	2.989	23.209	FALSE
2.143	3.000	1.500	1.833	2.000	4.000	3.500	1.500	3.750	2.000	3.107	23.209	FALSE
2.143	2.000	1.833	2.333	2.125	4.500	3.750	3.000	4.250	2.000	2.900	23.209	FALSE
2.571	3.500	1.333	2.167	1.250	3.500	3.250	1.500	3.250	2.200	3.216	23.209	FALSE
1.857	2.500	1.500	2.500	1.500	3.000	4.250	3.500	3.750	3.200	2.866	23.209	FALSE
2.429	3.000	2.500	2.333	2.250	4.500	3.250	2.500	3.750	1.800	2.427	23.209	FALSE
1.857	2.500	1.833	2.333	2.750	3.000	3.500	2.000	4.250	1.400	2.801	23.209	FALSE
3.000	3.000	1.333	1.667	2.375	2.500	2.000	1.000	4.000	1.200	3.797	23.209	FALSE
3.286	4.500	2.167	2.000	1.125	4.500	3.500	2.500	3.000	1.400	3.674	23.209	FALSE
1.571	4.000	2.333	2.167	1.250	2.000	4.750	1.000	3.250	1.800	4.140	23.209	FALSE
1.714	2.000	2.167	2.000	2.250	2.500	2.500	2.000	3.500	1.200	2.785	23.209	FALSE
3.286	3.000	2.667	1.333	2.125	1.000	3.500	3.000	3.000	2.400	3.151	23.209	FALSE
3.857	3.500	3.167	4.167	1.250	4.000	4.250	3.500	3.000	2.400	2.790	23.209	FALSE
3.000	3.000	3.000	2.667	2.125	2.500	3.250	2.000	2.750	1.800	2.111	23.209	FALSE
1.714	2.000	1.333	3.333	2.000	4.000	2.250	1.500	2.000	1.400	4.004	23.209	FALSE
2.571	4.500	3.167	2.500	2.875	3.500	2.500	3.000	2.750	1.200	3.141	23.209	FALSE
2.571	4.000	3.000	2.167	1.250	2.000	2.750	2.000	3.500	1.200	3.201	23.209	FALSE
2.857	2.500	3.500	2.333	2.625	4.000	2.750	4.000	3.250	3.200	2.255	23.209	FALSE
2.143	2.000	2.167	2.333	1.125	1.000	5.000	2.000	3.000	3.000	3.821	23.209	FALSE
3.286	3.000	2.667	2.833	1.000	2.500	2.500	2.000	2.750	1.600	2.904	23.209	FALSE
3.286	3.500	4.000	2.000	4.250	1.500	5.000	4.000	3.000	1.000	4.382	23.209	FALSE
1.429	2.000	2.833	1.667	1.500	4.000	5.000	3.500	1.500	2.600	4.164	23.209	FALSE
2.857	4.500	1.333	2.833	2.500	2.500	3.500	3.000	2.250	2.200	3.275	23.209	FALSE

3.429	1.500	1.500	1.667	2.250	5.000	5.000	4.000	3.750	3.000	3.818	23.209	FALSE
2.000	2.000	1.333	1.333	3.375	3.500	3.750	1.500	3.250	2.600	3.433	23.209	FALSE
3.714	4.000	2.167	3.167	1.750	3.000	1.750	3.000	3.000	3.200	3.032	23.209	FALSE
1.000	1.500	2.000	2.000	2.500	4.500	4.500	2.500	3.000	1.600	3.664	23.209	FALSE
1.000	2.000	2.333	1.500	3.625	2.000	3.750	2.000	2.500	1.600	3.542	23.209	FALSE
1.000	2.500	3.500	2.167	1.250	4.500	2.250	1.000	3.500	1.200	4.256	23.209	FALSE
2.857	3.500	2.167	2.333	1.125	1.500	4.250	4.000	5.000	2.000	3.779	23.209	FALSE
1.143	4.000	2.333	3.000	1.625	4.000	3.500	4.500	2.750	2.800	4.023	23.209	FALSE
1.429	2.500	2.667	2.333	1.125	3.500	3.250	1.500	2.500	1.200	3.210	23.209	FALSE
2.286	1.000	2.167	2.667	1.125	3.000	4.000	2.000	1.750	3.600	3.722	23.209	FALSE
1.714	3.500	3.000	2.167	1.250	3.000	4.500	3.000	4.750	2.200	3.239	23.209	FALSE
3.857	3.500	1.500	2.667	3.875	1.000	3.500	3.500	4.000	2.000	3.600	23.209	FALSE
2.429	4.500	2.167	1.833	4.500	2.500	4.250	5.000	4.500	4.400	3.998	23.209	FALSE
2.571	4.000	3.167	2.333	3.625	5.000	5.000	2.500	3.000	2.000	3.392	23.209	FALSE
2.714	4.000	2.667	3.667	3.250	4.000	5.000	5.000	5.000	4.400	2.964	23.209	FALSE
3.000	3.000	3.333	2.500	3.625	3.000	4.750	5.000	2.500	3.400	2.869	23.209	FALSE
3.571	3.500	2.667	4.000	1.750	4.000	4.750	4.000	2.500	3.000	2.800	23.209	FALSE
2.286	1.000	4.167	4.000	3.500	5.000	2.500	3.500	4.250	4.600	4.210	23.209	FALSE
2.143	2.000	2.167	2.667	2.250	2.500	4.000	4.500	4.750	3.400	2.928	23.209	FALSE
4.143	1.500	2.833	3.667	1.875	3.000	2.500	3.000	4.750	3.400	3.260	23.209	FALSE
3.571	3.000	3.333	2.500	1.750	3.500	2.750	3.000	3.250	4.600	2.641	23.209	FALSE
5.000	2.000	1.833	2.833	4.875	2.500	4.250	4.500	2.250	3.600	4.320	23.209	FALSE
2.857	2.500	3.167	2.500	3.875	4.000	4.500	5.000	4.000	3.400	2.535	23.209	FALSE
2.000	1.500	2.500	3.167	2.750	4.000	3.750	4.000	3.500	4.800	3.150	23.209	FALSE
3.571	3.500	2.333	4.167	3.125	1.500	4.250	5.000	3.500	4.400	3.267	23.209	FALSE
4.143	2.000	2.667	2.667	4.375	4.000	3.000	4.500	4.000	3.800	3.025	23.209	FALSE
3.429	1.000	3.333	1.500	2.625	5.000	4.750	5.000	3.250	3.800	4.210	23.209	FALSE
3.143	3.500	3.500	2.833	3.625	2.500	4.250	4.500	3.250	2.200	2.402	23.209	FALSE
3.143	2.000	2.833	3.000	4.250	5.000	4.250	5.000	4.500	2.400	3.559	23.209	FALSE
3.429	2.500	3.500	3.500	2.125	3.000	1.750	3.000	2.750	3.400	2.587	23.209	FALSE
4.286	2.000	3.667	3.333	3.375	4.000	4.250	5.000	4.250	4.400	2.540	23.209	FALSE
2.286	3.000	3.167	3.167	2.375	3.500	4.000	3.500	4.500	2.200	2.032	23.209	FALSE
2.429	3.500	2.833	3.500	4.000	5.000	3.500	3.500	2.750	4.200	2.801	23.209	FALSE
3.286	2.500	4.333	3.333	4.125	1.500	4.500	5.000	4.000	2.800	3.506	23.209	FALSE
2.571	1.500	2.167	2.833	2.250	1.500	3.500	2.000	2.250	2.000	2.942	23.209	FALSE
2.714	2.500	2.167	3.833	4.875	4.000	3.250	4.500	3.750	2.000	3.821	23.209	FALSE
3.429	4.500	3.500	4.500	3.500	1.500	4.000	5.000	4.000	3.200	3.099	23.209	FALSE
3.571	4.500	3.833	3.667	3.250	2.000	3.250	5.000	4.500	3.400	2.662	23.209	FALSE
3.429	3.500	4.000	2.833	3.500	2.500	4.000	2.500	3.250	4.200	2.712	23.209	FALSE
3.286	2.500	3.333	3.333	3.500	1.500	2.000	3.500	4.500	4.000	3.121	23.209	FALSE
2.286	2.500	3.000	4.500	4.125	3.000	4.500	4.500	4.000	2.600	3.227	23.209	FALSE
3.571	4.000	2.500	4.000	4.250	3.500	4.500	4.500	2.000	3.800	3.046	23.209	FALSE
3.000	2.000	2.333	2.000	2.875	5.000	3.500	5.000	3.250	4.000	3.508	23.209	FALSE
1.857	2.500	2.167	1.833	3.250	2.500	3.250	3.000	4.500	3.200	2.648	23.209	FALSE
2.571	2.500	1.667	3.333	1.625	3.000	3.500	2.000	3.000	1.400	2.854	23.209	FALSE
3.429	3.000	1.667	3.167	3.125	3.000	3.500	4.500	4.250	4.200	2.554	23.209	FALSE

2.286	3.000	3.833	2.500	2.750	1.500	4.250	2.500	4.500	2.400	3.054	23.209	FALSE
4.286	3.000	2.167	3.000	3.250	4.000	5.000	4.000	4.500	3.400	2.620	23.209	FALSE
2.714	4.500	2.333	4.667	3.375	3.500	3.000	2.500	2.250	1.600	3.759	23.209	FALSE
2.143	3.000	4.500	3.167	3.250	3.000	4.000	4.500	4.000	4.600	2.748	23.209	FALSE
2.143	1.500	3.167	3.333	3.375	4.000	3.750	5.000	2.500	4.800	3.746	23.209	FALSE
2.714	3.000	2.833	2.333	3.125	3.000	3.500	3.500	4.000	2.400	1.561	23.209	FALSE
3.714	3.500	2.167	2.667	3.375	4.000	3.750	2.500	1.750	3.800	3.015	23.209	FALSE
4.143	2.000	2.833	2.667	3.750	5.000	4.500	5.000	3.000	3.000	3.314	23.209	FALSE
3.429	2.500	1.333	2.167	2.625	1.500	3.500	4.500	4.250	4.600	3.769	23.209	FALSE
2.571	3.500	3.333	2.667	2.750	2.000	4.250	3.500	4.500	1.600	2.679	23.209	FALSE
4.143	2.000	3.000	3.333	3.250	3.500	4.750	4.000	3.500	3.800	2.267	23.209	FALSE
4.571	2.000	3.167	2.000	1.875	4.500	3.500	2.500	2.250	4.600	3.938	23.209	FALSE
1.857	3.000	2.167	3.833	2.625	4.000	4.000	4.500	4.000	4.200	3.006	23.209	FALSE
1.714	1.500	3.667	3.500	2.875	3.000	4.500	4.000	3.500	2.200	3.197	23.209	FALSE
3.286	2.000	2.833	3.833	3.375	1.000	4.500	5.000	4.250	4.600	3.713	23.209	FALSE
1.857	3.000	2.667	1.833	4.500	4.500	2.500	5.000	2.750	4.800	4.639	23.209	FALSE
3.714	3.000	3.500	3.667	3.125	2.500	4.000	4.500	4.000	4.200	1.712	23.209	FALSE
3.286	3.000	1.667	2.333	3.750	3.000	3.500	2.000	3.500	3.400	2.899	23.209	FALSE
4.429	4.000	2.000	2.833	2.000	5.000	4.750	5.000	3.000	3.800	3.596	23.209	FALSE
1.286	1.500	3.000	1.500	3.125	2.000	4.250	3.500	3.750	4.600	3.903	23.209	FALSE
4.714	2.500	2.833	3.833	4.375	3.500	4.750	5.000	2.250	4.400	3.430	23.209	FALSE
3.286	3.500	3.667	2.333	4.500	2.500	2.750	3.500	4.750	1.600	3.557	23.209	FALSE
3.857	2.000	2.000	3.667	2.750	4.000	4.750	4.500	3.250	3.000	2.931	23.209	FALSE
3.000	1.500	3.667	1.333	4.250	3.000	3.500	3.500	4.500	2.600	3.749	23.209	FALSE
2.857	3.000	3.500	2.333	3.625	3.000	2.000	2.500	3.750	3.400	2.700	23.209	FALSE
2.857	2.000	1.833	3.833	3.375	3.500	4.000	5.000	4.750	3.000	3.318	23.209	FALSE
3.286	2.000	3.833	2.000	2.500	2.500	4.250	1.500	1.250	2.600	3.987	23.209	FALSE
4.000	2.500	4.000	4.667	2.625	4.500	3.750	5.000	3.750	4.000	2.492	23.209	FALSE
2.143	2.500	1.833	1.500	3.125	2.000	4.250	2.000	2.750	2.000	2.939	23.209	FALSE
3.571	3.500	2.000	3.167	4.125	3.500	3.500	5.000	4.000	3.400	2.601	23.209	FALSE
3.714	2.000	3.167	3.833	4.625	2.500	3.500	4.000	4.000	4.800	3.111	23.209	FALSE
3.714	3.500	2.667	2.500	1.625	2.000	2.000	3.500	3.000	2.000	3.257	23.209	FALSE
4.143	3.000	2.333	2.167	4.750	5.000	2.500	4.000	4.250	3.400	3.688	23.209	FALSE
2.286	3.500	3.000	5.000	4.375	3.500	4.500	4.500	3.250	3.600	3.282	23.209	FALSE
1.714	2.000	3.500	3.000	1.625	4.000	3.250	4.000	4.250	3.600	3.003	23.209	FALSE
2.143	1.000	3.167	2.833	2.875	1.500	3.000	4.000	3.750	2.800	3.287	23.209	FALSE
3.571	4.500	2.167	2.333	3.500	3.000	4.500	5.000	4.000	3.000	2.939	23.209	FALSE
1.571	3.000	3.667	1.333	2.625	3.000	2.000	3.000	4.000	2.600	3.461	23.209	FALSE
4.000	2.500	4.167	3.167	4.625	3.000	4.250	5.000	3.250	4.200	2.887	23.209	FALSE
1.714	1.500	2.167	2.500	2.750	1.000	3.500	2.000	4.250	1.800	3.289	23.209	FALSE
3.429	2.500	2.667	3.000	3.375	2.500	3.500	4.500	4.750	4.600	2.584	23.209	FALSE
3.143	2.500	2.833	3.833	2.625	3.000	2.250	2.500	3.250	3.600	2.232	23.209	FALSE
4.000	2.000	2.500	4.500	2.625	3.000	3.750	5.000	2.500	2.600	3.750	23.209	FALSE
4.286	1.500	2.833	2.333	3.125	2.500	3.750	4.500	2.250	4.400	3.620	23.209	FALSE
2.857	3.500	2.500	1.667	1.125	4.500	3.750	3.000	2.500	4.200	3.620	23.209	FALSE
3.000	2.500	2.167	3.667	3.000	3.500	3.500	3.500	4.500	4.800	2.697	23.209	FALSE

4.000	3.000	3.500	4.667	2.750	4.000	5.000	4.500	3.000	3.400	2.519	23.209	FALSE
2.000	2.500	2.333	2.667	3.500	2.500	3.500	4.000	3.750	2.000	2.607	23.209	FALSE
2.571	4.000	3.333	4.167	4.375	3.000	4.750	5.000	3.000	3.000	3.103	23.209	FALSE
2.143	3.000	3.667	2.500	1.500	4.000	5.000	4.000	1.250	3.200	4.076	23.209	FALSE
3.714	5.000	4.500	2.167	4.000	1.000	4.500	5.000	3.250	5.000	4.635	23.209	FALSE
3.857	5.000	3.667	3.667	3.250	4.000	4.500	3.000	4.750	2.800	2.839	23.209	FALSE
4.429	2.500	1.333	2.333	2.500	5.000	4.000	5.000	4.250	3.200	3.867	23.209	FALSE
2.857	4.000	4.000	2.333	2.750	5.000	4.000	4.500	4.750	3.600	2.821	23.209	FALSE
3.714	3.000	4.833	1.833	3.625	4.500	4.750	3.000	3.500	1.400	4.053	23.209	FALSE
3.571	4.500	2.333	3.333	2.250	4.500	3.250	4.000	3.500	4.000	2.505	23.209	FALSE
4.571	4.500	3.500	2.167	3.125	1.500	4.500	4.500	5.000	2.200	3.992	23.209	FALSE
3.286	4.500	4.000	2.500	2.750	3.500	3.000	4.500	4.000	4.200	2.516	23.209	FALSE
3.714	5.000	3.667	5.000	2.875	3.500	3.500	4.000	5.000	3.800	2.736	23.209	FALSE
4.714	5.000	1.833	2.833	4.750	5.000	3.250	4.000	2.500	2.600	4.066	23.209	FALSE
3.857	4.500	4.500	3.833	3.250	5.000	2.500	4.500	2.750	2.800	3.017	23.209	FALSE
4.857	5.000	4.667	3.167	1.625	4.000	2.000	5.000	3.750	4.400	4.061	23.209	FALSE
4.571	4.500	5.000	3.667	3.250	3.000	4.750	4.500	2.500	3.000	3.094	23.209	FALSE
4.571	4.500	4.667	4.833	3.000	5.000	2.750	4.500	3.250	3.800	2.566	23.209	FALSE
4.143	5.000	3.000	2.833	3.500	5.000	4.000	4.500	4.500	2.600	2.838	23.209	FALSE
3.571	3.000	4.167	2.333	2.750	4.500	1.500	4.500	4.500	4.400	3.848	23.209	FALSE
4.571	3.500	4.167	4.333	3.375	4.000	4.500	4.500	3.750	4.200	1.706	23.209	FALSE
4.714	4.500	4.833	3.500	3.000	5.000	4.500	4.500	4.750	4.000	2.660	23.209	FALSE
4.143	3.000	3.667	3.500	2.625	5.000	4.500	3.500	5.000	2.400	2.970	23.209	FALSE
3.000	2.000	2.833	2.333	2.750	3.500	3.250	2.500	4.250	2.400	2.179	23.209	FALSE
3.143	5.000	5.000	2.833	4.125	3.500	4.000	5.000	4.000	2.200	3.530	23.209	FALSE
3.143	4.500	4.833	2.500	2.375	5.000	4.500	5.000	2.750	3.800	3.536	23.209	FALSE
5.000	3.000	4.833	4.500	1.375	4.000	3.750	5.000	4.250	2.400	3.951	23.209	FALSE
3.714	2.000	4.333	3.500	3.625	3.500	3.250	3.500	5.000	4.400	3.031	23.209	FALSE
2.571	4.000	4.167	4.000	5.000	5.000	5.000	5.000	4.250	5.000	3.491	23.209	FALSE
3.286	3.500	3.000	4.500	2.875	4.500	4.000	4.000	4.500	1.800	2.922	23.209	FALSE
4.571	4.500	5.000	3.000	4.750	5.000	3.750	4.500	5.000	3.600	3.353	23.209	FALSE
1.857	4.000	3.667	3.000	2.375	2.500	4.750	3.000	4.500	2.800	2.954	23.209	FALSE
4.571	2.000	4.167	3.167	1.875	2.500	5.000	3.500	3.750	2.800	3.455	23.209	FALSE
3.857	2.500	3.000	4.333	2.625	3.500	4.000	3.500	4.250	2.200	2.490	23.209	FALSE
2.857	3.500	2.167	2.167	3.500	5.000	3.000	3.000	4.500	3.800	3.135	23.209	FALSE
3.857	2.500	3.833	3.167	2.000	3.500	4.750	4.500	4.500	2.600	2.721	23.209	FALSE
3.429	2.500	3.833	2.333	4.875	4.000	2.750	3.500	3.750	3.600	3.194	23.209	FALSE
4.857	5.000	1.833	2.333	3.875	2.500	4.250	4.500	4.750	3.800	3.872	23.209	FALSE
3.429	3.000	3.167	2.167	2.125	4.500	4.750	4.500	5.000	3.400	2.947	23.209	FALSE
2.857	4.500	3.167	1.667	2.750	5.000	4.500	3.500	5.000	3.000	3.500	23.209	FALSE
3.714	3.500	4.167	3.500	3.125	4.000	3.500	4.000	2.000	4.000	2.220	23.209	FALSE
2.000	2.000	4.667	2.833	4.750	4.500	4.250	5.000	3.500	1.200	5.040	23.209	FALSE
4.143	4.500	4.333	2.833	1.750	2.500	3.250	4.000	4.750	2.600	3.208	23.209	FALSE
3.286	5.000	4.667	4.333	3.125	2.000	4.500	3.000	4.500	3.200	3.518	23.209	FALSE
2.143	4.500	3.833	3.833	4.000	3.500	4.000	4.500	4.250	4.800	2.901	23.209	FALSE
3.286	3.000	3.667	3.667	4.125	3.500	4.000	5.000	4.000	4.400	1.993	23.209	FALSE

3.857	5.000	4.000	5.000	4.375	4.500	4.500	4.500	4.500	2.000	3.481	23.209	FALSE
3.714	3.000	4.500	4.333	4.500	5.000	2.500	5.000	3.250	3.000	3.573	23.209	FALSE
1.571	4.500	3.500	2.833	4.125	5.000	5.000	3.500	3.750	3.400	3.660	23.209	FALSE
1.714	4.000	4.333	3.833	4.125	4.000	3.750	3.000	1.500	2.600	3.947	23.209	FALSE
2.714	4.500	3.000	3.500	2.375	4.000	3.750	4.000	4.000	4.400	2.344	23.209	FALSE
4.857	4.500	4.833	3.000	2.250	5.000	4.500	4.500	2.750	3.600	3.201	23.209	FALSE
4.286	3.500	3.667	4.000	3.000	1.500	4.750	5.000	4.750	4.800	3.363	23.209	FALSE
4.286	4.500	4.333	3.333	1.500	3.500	3.000	4.500	3.750	4.600	3.044	23.209	FALSE
3.571	4.500	3.667	3.333	2.375	5.000	4.750	4.500	2.750	5.000	3.050	23.209	FALSE
4.857	4.500	4.500	4.167	3.375	5.000	5.000	5.000	2.000	4.600	3.233	23.209	FALSE
3.143	3.000	4.833	3.667	3.375	5.000	5.000	4.500	3.000	4.200	2.834	23.209	FALSE
3.857	4.500	4.667	3.500	3.250	4.500	5.000	5.000	4.750	3.000	2.721	23.209	FALSE
4.571	2.000	4.500	2.667	3.625	5.000	3.750	4.000	4.750	2.400	3.786	23.209	FALSE
2.286	3.000	4.000	2.667	1.500	3.500	3.750	2.500	3.750	1.200	2.952	23.209	FALSE
3.143	3.000	2.333	2.500	2.875	5.000	1.250	4.000	4.750	4.400	4.179	23.209	FALSE
4.714	5.000	4.833	3.833	3.750	3.000	5.000	3.000	4.250	4.400	3.794	23.209	FALSE
3.143	4.500	3.167	4.833	2.500	5.000	5.000	3.500	2.750	3.400	3.267	23.209	FALSE
4.571	4.500	4.167	4.000	4.000	5.000	4.250	4.000	4.250	2.600	2.557	23.209	FALSE
3.000	4.500	3.500	4.833	3.375	2.000	5.000	5.000	5.000	5.000	3.771	23.209	FALSE
4.571	4.000	5.000	4.000	2.125	5.000	5.000	5.000	4.500	4.200	3.055	23.209	FALSE
3.714	4.500	3.833	3.833	3.750	3.500	3.250	3.500	1.750	3.600	2.616	23.209	FALSE
2.857	4.500	4.833	3.500	3.000	5.000	4.250	3.000	3.750	4.600	3.224	23.209	FALSE
4.857	4.500	4.167	3.500	3.875	3.500	4.500	4.000	5.000	4.400	2.814	23.209	FALSE
5.000	3.000	3.833	4.667	2.875	5.000	2.500	5.000	4.250	5.000	3.186	23.209	FALSE
5.000	2.500	5.000	4.333	2.875	4.500	3.000	5.000	3.750	4.200	3.105	23.209	FALSE
3.714	2.500	4.833	4.500	1.750	4.000	4.750	4.000	5.000	5.000	3.714	23.209	FALSE
3.714	2.000	5.000	4.833	3.875	5.000	5.000	3.000	5.000	4.600	4.603	23.209	FALSE
4.571	4.500	4.167	4.667	3.625	5.000	4.000	5.000	4.250	2.800	2.570	23.209	FALSE
3.714	4.000	5.000	3.833	4.625	3.000	4.500	4.500	3.250	4.400	2.770	23.209	FALSE
3.429	4.500	5.000	5.000	3.750	4.500	4.750	4.000	5.000	4.200	3.169	23.209	FALSE
3.286	4.500	4.333	4.333	4.000	3.000	4.250	5.000	4.000	5.000	2.534	23.209	FALSE
4.571	3.500	2.333	4.333	3.125	5.000	5.000	3.000	3.250	3.600	3.311	23.209	FALSE
4.143	3.000	3.333	4.833	2.750	5.000	3.750	4.000	4.750	3.600	2.661	23.209	FALSE
3.286	4.000	2.667	4.667	5.000	3.000	4.500	5.000	3.500	4.800	3.352	23.209	FALSE
3.286	5.000	4.167	3.167	3.000	5.000	5.000	5.000	4.750	4.800	3.191	23.209	FALSE
4.714	5.000	3.333	3.833	3.000	5.000	4.500	5.000	2.750	3.000	2.971	23.209	FALSE
4.714	3.000	4.667	5.000	3.750	4.000	4.000	3.500	3.000	2.800	3.042	23.209	FALSE
2.429	1.000	4.000	2.500	2.250	2.500	3.250	2.000	3.750	1.400	3.484	23.209	FALSE
1.143	2.500	4.333	4.000	1.000	2.500	1.000	2.500	3.500	2.600	4.563	23.209	FALSE
3.571	3.500	2.833	1.833	2.125	2.000	3.000	5.000	4.750	4.200	3.685	23.209	FALSE
3.714	4.000	2.000	1.833	2.750	3.500	1.250	3.500	2.500	4.000	4.072	23.209	FALSE
2.714	3.000	3.167	3.833	3.500	1.500	4.000	4.000	3.500	3.600	2.419	23.209	FALSE
2.143	4.000	2.667	3.833	2.000	1.000	2.000	3.500	3.500	3.000	3.615	23.209	FALSE
1.857	2.500	2.500	1.667	1.125	3.500	3.250	3.500	2.750	2.600	3.077	23.209	FALSE
3.143	4.500	2.333	2.167	3.125	5.000	2.000	4.000	2.250	3.200	3.919	23.209	FALSE
2.000	3.000	1.167	3.000	2.875	1.500	3.500	3.500	4.000	2.800	3.069	23.209	FALSE

3.857	2.500	2.500	3.500	1.875	1.500	3.250	4.500	4.500	3.000	3.198	23.209	FALSE
1.571	3.500	2.500	3.833	1.750	3.000	4.500	4.000	2.000	3.000	3.695	23.209	FALSE
4.143	4.000	4.333	2.167	1.750	2.000	2.250	4.500	2.500	3.800	4.149	23.209	FALSE
1.857	3.500	3.667	3.500	2.375	2.000	4.000	4.000	3.500	3.000	2.535	23.209	FALSE
1.143	3.500	4.000	2.500	2.000	2.000	3.500	4.000	3.000	2.800	3.471	23.209	FALSE
3.286	2.500	2.333	2.333	2.875	4.000	3.500	1.500	4.000	1.200	3.269	23.209	FALSE
2.429	3.500	1.500	2.000	3.375	1.000	2.750	2.000	1.500	1.000	4.200	23.209	FALSE
3.429	1.500	3.667	3.000	1.500	3.500	3.250	3.000	2.250	2.200	3.043	23.209	FALSE
1.286	3.000	2.167	1.500	1.000	4.000	3.500	2.500	4.500	2.000	3.593	23.209	FALSE
2.857	2.500	3.000	2.833	2.875	3.000	2.000	3.000	4.500	3.400	2.436	23.209	FALSE
1.857	2.000	2.000	2.167	2.375	3.000	3.500	1.500	2.750	3.200	2.805	23.209	FALSE
3.143	3.000	3.667	2.833	3.125	3.000	3.500	3.500	3.000	1.400	2.393	23.209	FALSE
4.429	3.500	4.667	3.000	1.250	3.500	3.250	4.000	4.500	2.400	3.361	23.209	FALSE
2.714	2.000	2.167	2.833	2.625	1.000	3.500	2.500	3.750	2.800	2.668	23.209	FALSE
4.000	4.000	2.333	2.000	2.625	2.000	3.000	3.000	3.750	1.600	3.015	23.209	FALSE
3.857	1.500	3.167	3.167	2.000	2.000	2.750	3.000	3.000	2.400	2.857	23.209	FALSE
4.143	2.500	1.000	1.000	3.000	2.500	4.250	2.000	4.250	1.600	4.242	23.209	FALSE
2.286	1.000	3.000	1.333	2.625	1.500	3.750	2.500	3.500	1.800	3.318	23.209	FALSE
4.857	4.000	3.500	2.167	2.625	2.000	4.500	4.500	1.750	3.800	4.058	23.209	FALSE
2.571	4.000	2.667	2.833	1.875	1.000	3.500	4.500	2.500	3.400	3.760	23.209	FALSE
1.143	1.000	1.833	1.500	2.000	2.500	3.250	1.000	3.000	2.200	3.403	23.209	FALSE
2.857	3.500	3.167	4.167	3.125	1.500	2.750	4.000	3.500	2.800	2.692	23.209	FALSE
2.857	2.000	3.167	3.500	2.250	2.000	4.500	4.000	4.250	4.000	2.649	23.209	FALSE
3.000	1.500	2.667	4.167	1.625	1.000	4.000	3.500	4.750	4.000	3.914	23.209	FALSE
1.857	4.500	3.167	2.833	3.250	1.000	2.500	2.500	3.750	2.600	3.468	23.209	FALSE
2.714	3.000	3.167	2.333	3.500	4.000	3.750	3.500	2.000	2.600	2.502	23.209	FALSE
3.000	4.000	2.333	3.167	2.500	3.500	2.000	3.500	3.500	3.000	2.486	23.209	FALSE
3.571	2.500	2.167	1.500	2.375	3.500	2.500	3.500	4.250	3.800	3.047	23.209	FALSE
1.571	3.500	2.333	3.167	2.375	3.000	2.250	3.000	3.250	1.400	3.152	23.209	FALSE
3.000	3.500	3.000	4.000	2.000	2.000	2.250	3.000	3.250	1.600	2.972	23.209	FALSE
2.143	2.000	1.833	4.667	1.625	2.500	3.500	2.000	3.250	2.600	3.623	23.209	FALSE
2.714	1.000	3.667	2.667	1.875	1.500	4.000	3.000	3.000	3.200	3.206	23.209	FALSE
3.000	4.000	3.667	4.000	1.875	2.500	3.250	5.000	4.000	3.000	2.915	23.209	FALSE
1.857	4.000	2.333	1.833	3.750	1.500	3.000	3.500	4.250	2.800	3.346	23.209	FALSE
2.000	5.000	4.333	3.500	2.250	1.500	2.000	4.000	3.500	4.800	4.398	23.209	FALSE
1.857	2.000	2.500	2.833	2.375	1.500	4.500	2.000	3.000	3.200	3.092	23.209	FALSE
4.714	2.500	3.167	4.500	2.125	2.500	3.750	2.500	2.250	3.800	3.437	23.209	FALSE
3.857	4.000	4.500	3.333	4.875	4.000	4.750	3.000	3.000	4.000	3.298	23.209	FALSE
4.714	3.000	2.667	4.000	4.750	3.500	3.250	4.500	4.000	3.400	2.832	23.209	FALSE
3.714	2.000	4.500	3.500	2.125	4.000	3.750	3.000	2.750	4.400	2.897	23.209	FALSE
1.714	3.000	3.833	3.667	3.375	4.500	4.750	3.000	2.750	4.000	3.229	23.209	FALSE
2.857	5.000	4.000	3.833	4.500	4.500	2.500	3.500	2.000	5.000	3.916	23.209	FALSE
4.857	3.500	4.000	3.833	3.625	3.000	2.000	3.500	3.750	4.400	2.781	23.209	FALSE
3.714	4.500	4.833	4.333	4.625	4.000	4.000	3.500	2.250	4.400	3.130	23.209	FALSE
4.571	4.500	3.833	4.500	3.250	2.500	3.000	3.000	3.000	2.600	2.744	23.209	FALSE
3.571	3.000	2.333	2.667	3.000	5.000	3.250	1.000	4.000	3.600	4.048	23.209	FALSE

4.429	4.000	3.500	4.500	4.125	5.000	3.000	4.000	3.500	2.600	2.697	23.209	FALSE
4.143	3.000	4.833	3.333	4.250	4.000	3.750	4.000	4.250	4.200	2.508	23.209	FALSE
4.143	2.500	5.000	4.333	3.875	3.000	3.750	4.000	4.000	4.200	2.728	23.209	FALSE
4.000	2.500	3.833	4.500	2.625	3.000	3.000	3.500	3.500	2.000	2.745	23.209	FALSE
4.143	4.000	2.167	3.000	3.250	3.500	4.000	2.500	4.250	1.800	2.939	23.209	FALSE
4.286	3.500	2.500	2.333	2.750	5.000	3.750	4.000	3.250	3.200	2.470	23.209	FALSE
4.714	4.500	3.667	3.167	4.375	4.500	4.750	4.500	3.000	4.800	2.719	23.209	FALSE
1.714	3.000	1.500	3.500	2.000	4.000	4.250	3.000	1.750	2.600	3.673	23.209	FALSE
4.000	3.500	5.000	3.000	2.750	3.500	2.500	3.500	3.500	3.000	2.571	23.209	FALSE
4.143	5.000	3.500	2.833	3.500	5.000	3.750	2.500	2.250	3.000	3.202	23.209	FALSE
3.000	3.500	3.500	2.333	4.750	2.000	4.000	4.500	5.000	5.000	3.759	23.209	FALSE
2.571	4.000	4.333	4.000	4.250	4.000	3.250	4.000	3.750	4.000	2.352	23.209	FALSE
4.429	2.500	3.833	4.833	2.875	4.500	3.500	4.000	3.250	3.200	2.534	23.209	FALSE
4.429	4.000	2.667	4.167	1.250	2.500	2.250	2.000	2.000	3.000	3.851	23.209	FALSE
5.000	4.000	3.833	4.000	3.375	5.000	4.250	5.000	5.000	3.400	2.569	23.209	FALSE
4.857	4.000	4.333	4.833	2.875	4.500	4.000	4.000	3.250	4.200	2.141	23.209	FALSE
3.714	5.000	4.333	3.667	3.875	2.000	2.000	4.000	4.250	4.600	3.448	23.209	FALSE
4.143	4.000	3.667	3.833	3.125	3.500	2.250	4.000	4.000	1.800	2.874	23.209	FALSE
3.429	3.000	2.333	3.833	2.625	3.500	2.250	2.500	3.250	3.400	2.319	23.209	FALSE
3.571	3.500	2.333	3.667	2.125	3.000	3.250	3.500	4.250	4.800	2.645	23.209	FALSE
4.286	5.000	3.333	3.667	3.750	5.000	5.000	4.000	2.750	2.400	3.044	23.209	FALSE
3.286	3.000	3.167	1.833	3.250	3.500	3.500	4.000	5.000	3.800	2.591	23.209	FALSE
4.286	2.500	5.000	5.000	3.500	3.500	1.750	4.500	4.000	3.400	3.742	23.209	FALSE
3.429	4.500	3.333	4.333	3.500	5.000	3.500	4.500	4.500	4.200	2.259	23.209	FALSE
2.286	3.000	3.167	3.833	3.250	3.500	4.500	3.500	3.000	3.000	2.032	23.209	FALSE
4.857	3.000	4.667	2.833	3.500	3.500	3.250	3.500	2.250	5.000	3.436	23.209	FALSE
4.143	3.000	3.667	3.833	2.750	4.000	4.000	3.500	2.250	4.400	2.256	23.209	FALSE
4.286	3.000	3.667	4.500	3.750	5.000	3.500	4.000	3.000	4.400	2.290	23.209	FALSE
2.143	4.500	4.167	4.667	2.500	3.000	3.750	3.000	3.750	3.800	2.997	23.209	FALSE
4.143	2.000	2.667	4.000	1.750	2.000	3.750	2.500	4.000	5.000	3.904	23.209	FALSE
2.857	5.000	4.000	3.833	3.250	4.000	2.750	2.000	4.000	4.800	3.806	23.209	FALSE
2.571	3.500	2.667	4.667	3.000	2.500	3.750	3.500	4.500	2.800	2.693	23.209	FALSE
2.143	3.500	3.833	3.833	3.500	1.500	5.000	2.500	2.250	1.400	4.126	23.209	FALSE
3.571	4.000	4.833	3.667	2.750	4.500	5.000	4.500	3.000	4.800	2.741	23.209	FALSE
3.143	4.000	3.167	3.667	4.500	3.000	4.500	4.000	5.000	3.400	2.658	23.209	FALSE
4.143	3.000	2.167	3.667	4.625	2.500	3.250	2.500	4.000	4.400	3.624	23.209	FALSE
4.286	4.500	3.500	2.167	4.375	4.000	4.000	3.000	3.250	4.600	3.367	23.209	FALSE
5.000	3.500	3.167	1.833	4.250	3.500	4.250	4.000	4.000	3.400	3.131	23.209	FALSE
2.714	4.000	4.833	3.500	3.000	4.000	3.750	4.500	3.250	5.000	2.704	23.209	FALSE
4.571	3.000	2.500	5.000	1.875	2.500	2.000	3.000	1.750	3.000	4.160	23.209	FALSE
4.571	4.500	2.667	4.333	3.000	4.000	5.000	3.500	3.500	4.600	3.076	23.209	FALSE
2.429	4.500	2.833	4.500	1.250	3.500	4.750	3.000	4.500	3.400	3.790	23.209	FALSE
4.571	3.000	3.167	4.667	1.750	2.500	4.000	4.000	4.000	4.600	3.098	23.209	FALSE
5.000	3.500	4.167	3.833	2.625	4.500	4.250	5.000	3.250	3.600	2.375	23.209	FALSE
2.429	4.000	4.000	2.833	2.000	4.000	2.500	2.500	3.000	3.600	2.714	23.209	FALSE
3.143	3.500	3.333	4.333	3.125	4.000	3.000	3.500	2.500	2.400	2.355	23.209	FALSE

3.429	4.500	4.667	4.333	3.750	4.000	2.750	3.500	3.250	3.400	2.286	23.209	FALSE
4.286	4.000	3.667	3.167	2.750	4.000	3.250	2.000	1.750	2.800	3.027	23.209	FALSE
2.429	2.500	4.167	5.000	1.750	3.500	1.750	4.000	4.500	3.600	3.883	23.209	FALSE
3.286	3.000	2.167	3.167	3.125	4.000	3.250	1.500	2.250	1.000	3.455	23.209	FALSE
4.000	3.500	2.333	3.500	2.875	4.500	2.500	4.000	3.250	3.600	2.373	23.209	FALSE
2.429	3.000	3.500	2.000	4.375	3.500	4.500	4.000	3.500	4.000	2.847	23.209	FALSE
3.000	4.000	3.000	3.667	3.875	5.000	4.000	4.000	4.250	3.200	2.173	23.209	FALSE
3.286	3.500	5.000	3.667	3.250	2.500	4.250	2.500	3.500	3.200	2.974	23.209	FALSE
4.286	3.500	3.833	3.000	3.750	3.500	4.750	3.500	2.000	4.000	2.812	23.209	FALSE
3.286	2.500	4.333	5.000	1.625	2.500	1.250	1.500	3.250	2.400	4.345	23.209	FALSE
4.857	4.000	2.667	2.667	3.750	3.000	2.750	3.000	3.250	4.400	3.041	23.209	FALSE
4.571	4.500	3.333	3.667	3.625	4.500	4.000	3.000	2.000	2.400	2.987	23.209	FALSE
3.571	4.000	3.167	4.500	4.000	2.500	3.250	4.500	2.750	4.800	2.801	23.209	FALSE
3.857	1.000	4.000	4.833	3.000	2.000	1.750	3.500	2.000	4.600	4.679	23.209	FALSE
4.429	4.000	2.500	3.167	3.750	2.500	2.500	2.500	2.750	4.000	3.084	23.209	FALSE
2.714	3.000	2.667	3.833	4.375	4.000	4.250	4.500	3.500	3.600	2.428	23.209	FALSE
3.429	4.000	4.167	2.667	2.625	2.000	3.500	4.000	2.500	2.600	2.793	23.209	FALSE
2.429	4.000	4.167	4.167	3.000	2.000	3.250	3.000	2.000	4.400	3.397	23.209	FALSE
4.857	4.000	3.833	3.500	3.750	2.500	3.500	5.000	3.750	3.200	2.516	23.209	FALSE
5.000	4.000	2.667	2.833	2.375	3.500	2.750	4.500	4.000	4.800	3.171	23.209	FALSE
4.143	2.000	4.667	5.000	3.125	4.000	3.500	4.000	2.500	2.800	3.455	23.209	FALSE
3.571	3.000	4.000	3.667	2.625	3.500	5.000	3.000	4.000	3.600	2.412	23.209	FALSE
3.286	3.500	4.833	3.333	3.375	3.000	4.250	4.500	4.500	2.200	2.799	23.209	FALSE
2.857	1.500	4.167	2.833	1.375	4.000	2.750	2.500	3.500	4.200	3.380	23.209	FALSE
4.000	4.500	4.667	3.667	2.250	3.000	3.750	2.500	2.750	3.000	2.798	23.209	FALSE
3.857	5.000	3.500	4.667	3.375	4.000	4.500	4.500	2.250	3.000	2.947	23.209	FALSE
4.286	5.000	4.167	4.333	2.500	3.500	4.250	4.000	2.750	3.400	2.436	23.209	FALSE
4.286	2.000	3.000	3.833	2.500	3.500	3.250	2.000	3.750	4.200	3.201	23.209	FALSE
3.286	4.500	3.667	3.167	4.250	2.500	4.250	4.500	3.500	3.200	2.342	23.209	FALSE
3.286	4.500	5.000	3.833	4.500	4.000	3.250	3.000	2.250	3.200	3.270	23.209	FALSE
3.429	2.500	3.500	5.000	3.125	5.000	2.250	4.000	3.250	3.600	3.230	23.209	FALSE
2.571	4.500	2.500	3.167	2.750	2.000	2.750	2.000	3.000	3.000	2.863	23.209	FALSE
4.571	4.500	4.333	4.833	2.000	3.000	3.000	5.000	4.500	4.800	3.142	23.209	FALSE
3.429	4.000	4.000	3.833	3.125	4.000	3.750	3.000	3.250	2.400	1.793	23.209	FALSE
3.714	5.000	4.167	4.667	4.125	3.500	4.250	5.000	3.500	3.200	2.497	23.209	FALSE
4.143	4.500	4.167	4.333	3.500	5.000	4.000	5.000	3.750	4.400	1.852	23.209	FALSE
4.429	4.500	5.000	3.500	4.625	4.500	2.500	5.000	3.250	2.800	3.552	23.209	FALSE
4.286	4.000	2.000	4.333	2.625	4.500	4.000	3.000	4.750	2.400	3.410	23.209	FALSE
4.571	3.500	4.833	4.667	3.875	5.000	2.500	4.000	3.500	3.000	3.022	23.209	FALSE
3.571	5.000	2.333	4.500	3.875	4.000	2.000	3.500	2.750	4.600	3.694	23.209	FALSE
3.143	4.000	4.667	4.167	2.875	3.000	3.750	2.500	2.750	4.200	2.853	23.209	FALSE
4.286	3.500	3.333	3.833	4.000	3.000	3.750	4.000	3.750	4.000	1.589	23.209	FALSE
5.000	4.000	2.167	4.667	4.500	4.500	4.500	4.500	4.250	3.200	3.360	23.209	FALSE
4.143	4.000	3.500	3.500	1.750	3.000	3.250	3.000	4.250	3.200	2.233	23.209	FALSE
4.286	2.500	3.500	4.667	2.750	5.000	3.250	4.000	3.750	2.400	3.015	23.209	FALSE
4.714	3.000	2.833	4.667	4.500	4.500	3.250	5.000	2.750	5.000	3.315	23.209	FALSE

4.857	4.000	2.667	3.333	3.125	4.500	4.250	4.500	3.750	5.000	2.593	23.209	FALSE
5.000	5.000	2.667	3.000	4.000	4.000	4.500	4.000	3.500	3.000	2.865	23.209	FALSE
3.714	4.500	4.667	4.333	4.375	4.500	3.000	3.500	4.000	2.600	2.851	23.209	FALSE
4.286	3.000	1.833	2.833	1.750	2.500	4.750	3.500	3.000	4.400	3.462	23.209	FALSE
4.429	4.500	4.833	4.167	4.500	3.000	2.000	2.500	2.500	3.600	3.787	23.209	FALSE
4.857	3.000	4.000	1.500	2.750	3.500	3.250	1.500	1.250	2.400	4.594	23.209	FALSE
4.571	5.000	4.667	4.000	3.625	3.000	4.750	5.000	2.500	2.800	3.303	23.209	FALSE
3.429	5.000	4.167	3.333	3.000	5.000	3.750	4.000	3.000	4.000	2.353	23.209	FALSE
3.286	4.500	2.333	4.667	3.625	4.000	2.000	3.000	3.750	2.600	3.403	23.209	FALSE
3.571	2.000	4.667	3.667	3.250	3.000	3.250	3.500	2.750	4.800	2.970	23.209	FALSE
4.857	4.500	4.833	4.667	3.750	5.000	4.750	5.000	4.250	4.800	2.456	23.209	FALSE
3.000	3.000	3.333	3.500	3.625	3.000	1.500	1.500	4.000	3.800	3.673	23.209	FALSE
4.286	3.500	3.667	4.500	4.250	4.500	3.250	3.500	2.500	4.600	2.657	23.209	FALSE
5.000	5.000	2.667	3.000	3.625	4.500	4.500	4.000	2.750	5.000	3.402	23.209	FALSE
4.714	3.500	3.667	4.000	3.750	4.500	3.500	3.500	3.500	4.800	2.230	23.209	FALSE
4.571	5.000	2.500	4.333	3.750	3.500	5.000	3.000	3.250	2.200	3.640	23.209	FALSE
4.571	3.000	4.500	3.833	2.250	2.500	4.250	3.500	3.750	3.600	2.623	23.209	FALSE
4.286	3.000	4.167	3.500	2.250	3.500	3.000	3.000	2.750	3.400	2.106	23.209	FALSE
2.857	5.000	4.167	2.167	3.375	3.500	3.250	3.500	5.000	1.600	3.647	23.209	FALSE
1.714	2.500	2.500	3.833	4.125	5.000	2.750	3.500	5.000	5.000	4.352	23.209	FALSE
4.000	3.500	4.333	3.000	3.875	3.000	3.000	2.500	3.000	4.400	2.941	23.209	FALSE
5.000	2.500	3.333	4.667	2.250	3.000	3.750	3.000	2.750	4.600	3.357	23.209	FALSE
1.571	5.000	4.000	3.833	3.000	5.000	5.000	3.500	3.500	3.800	3.785	23.209	FALSE
4.571	5.000	4.333	4.167	4.500	4.500	5.000	4.500	3.500	4.000	2.526	23.209	FALSE
3.000	4.000	2.500	4.500	4.500	2.000	3.500	3.500	2.500	3.800	3.372	23.209	FALSE
3.857	5.000	3.833	4.167	2.125	5.000	3.250	4.000	4.250	4.400	2.695	23.209	FALSE
4.857	3.500	3.167	3.000	4.000	5.000	3.500	3.000	2.750	2.800	2.878	23.209	FALSE
4.143	3.000	5.000	3.000	2.250	2.500	3.500	3.000	3.250	2.400	2.969	23.209	FALSE
4.143	3.000	3.833	4.167	3.375	4.500	4.000	3.500	4.250	4.000	1.967	23.209	FALSE
2.857	5.000	3.667	5.000	4.125	3.000	2.000	4.500	5.000	4.000	3.787	23.209	FALSE
3.714	5.000	3.833	2.667	2.250	2.500	2.000	3.000	4.750	4.600	3.881	23.209	FALSE
3.000	3.000	4.333	5.000	1.250	4.500	3.750	3.500	4.750	4.200	3.532	23.209	FALSE
4.857	5.000	5.000	4.000	4.250	3.500	3.500	4.500	4.250	3.800	2.537	23.209	FALSE
3.000	3.000	4.000	3.500	2.250	4.500	2.250	4.000	3.500	5.000	2.962	23.209	FALSE
4.000	2.500	2.500	1.833	3.250	5.000	4.250	3.000	2.750	4.800	3.610	23.209	FALSE
4.714	3.000	4.667	2.167	1.875	5.000	3.000	5.000	4.500	3.200	4.049	23.209	FALSE
3.000	3.500	3.500	2.167	3.125	4.000	2.750	5.000	2.250	4.600	3.605	23.209	FALSE
3.571	3.000	3.333	3.333	2.000	5.000	5.000	3.500	3.750	4.600	2.905	23.209	FALSE
3.857	4.500	3.333	2.500	3.250	3.500	3.500	3.000	3.500	3.400	1.970	23.209	FALSE
4.571	4.500	3.833	4.333	2.500	3.500	4.000	4.000	3.750	4.200	1.965	23.209	FALSE
3.714	4.500	4.833	4.333	3.250	4.000	4.000	4.500	3.000	3.600	2.037	23.209	FALSE
5.000	4.000	2.833	2.667	1.750	3.000	4.000	3.500	4.000	4.000	3.084	23.209	FALSE
4.857	3.500	4.000	4.500	3.625	2.500	2.250	3.000	4.000	4.000	3.047	23.209	FALSE
3.429	4.500	4.833	2.000	2.875	4.500	3.750	3.500	3.750	3.400	3.000	23.209	FALSE
4.286	4.000	3.667	5.000	3.375	4.000	4.500	5.000	4.500	4.800	2.316	23.209	FALSE
5.000	4.500	2.667	4.833	2.625	5.000	3.250	4.500	3.250	4.200	3.071	23.209	FALSE

3.714	2.000	1.833	3.167	3.250	3.500	4.250	3.500	3.250	4.000	2.510	23.209	FALSE
4.714	4.500	3.833	3.667	4.250	4.000	1.250	3.500	3.750	4.800	3.659	23.209	FALSE
3.571	5.000	3.500	4.500	4.125	4.000	2.750	4.000	3.500	4.600	2.582	23.209	FALSE
4.714	3.000	4.333	3.833	2.375	2.500	3.250	3.500	3.500	3.000	2.462	23.209	FALSE
4.857	4.500	2.167	3.667	3.500	5.000	3.000	3.500	4.250	2.800	3.159	23.209	FALSE
4.143	4.500	3.667	4.833	2.875	4.500	3.000	2.500	4.250	4.200	3.099	23.209	FALSE
3.857	3.000	3.500	2.500	1.125	4.500	4.250	2.500	3.500	4.000	3.263	23.209	FALSE
4.714	5.000	3.833	3.000	2.375	5.000	4.250	5.000	2.250	4.000	3.429	23.209	FALSE
4.143	3.000	4.833	3.333	2.125	3.000	4.500	3.500	4.500	3.600	2.867	23.209	FALSE
5.000	4.000	3.500	2.667	2.875	3.500	4.250	5.000	4.500	2.800	2.859	23.209	FALSE
3.857	4.000	3.500	4.500	3.250	3.500	3.750	4.500	4.500	4.000	1.627	23.209	FALSE
3.714	4.500	3.500	4.167	3.625	3.500	4.250	3.000	4.250	3.400	2.291	23.209	FALSE
3.429	5.000	3.167	4.833	2.125	4.000	4.500	4.000	4.000	3.400	2.885	23.209	FALSE
4.000	4.500	3.333	3.500	3.125	5.000	4.250	4.500	4.750	4.200	2.226	23.209	FALSE
2.571	4.000	3.667	4.000	3.250	3.500	4.000	3.500	4.000	4.600	2.235	23.209	FALSE
2.429	3.500	4.667	5.000	3.625	4.000	3.750	4.500	4.750	4.600	3.065	23.209	FALSE
4.286	3.500	3.833	4.333	4.125	5.000	3.500	4.500	3.000	4.400	2.170	23.209	FALSE
4.429	4.500	3.500	4.000	3.375	3.500	4.500	3.500	4.500	2.000	2.791	23.209	FALSE
4.571	4.000	2.833	3.500	3.000	3.500	4.000	4.500	3.750	3.600	1.712	23.209	FALSE
2.286	2.500	3.333	4.333	2.875	3.500	2.500	2.000	4.750	2.800	3.354	23.209	FALSE
3.571	4.000	4.500	5.000	2.000	5.000	5.000	5.000	4.500	4.000	3.197	23.209	FALSE
4.143	4.500	3.000	4.833	3.875	5.000	5.000	5.000	4.750	4.200	2.923	23.209	FALSE
3.286	3.000	1.833	3.833	4.000	3.000	4.500	5.000	4.000	4.200	2.922	23.209	FALSE
4.429	4.500	3.667	2.833	3.500	4.000	3.250	4.000	3.750	2.200	2.394	23.209	FALSE
4.286	3.500	4.833	4.167	2.250	4.500	3.500	4.500	4.000	5.000	2.504	23.209	FALSE
3.571	4.000	2.833	4.167	3.000	4.500	3.750	4.500	4.000	4.400	1.940	23.209	FALSE
4.571	3.500	4.667	5.000	4.625	4.000	4.750	4.500	4.250	3.800	2.843	23.209	FALSE
3.714	3.500	4.333	3.000	4.500	4.000	4.500	4.500	5.000	3.800	2.677	23.209	FALSE
4.000	3.500	3.667	3.667	4.250	4.500	3.000	4.000	4.750	3.000	2.424	23.209	FALSE
3.429	3.500	5.000	3.833	2.125	4.500	3.000	4.500	3.000	2.800	2.972	23.209	FALSE
4.571	3.500	4.000	3.667	2.625	3.000	3.750	4.000	4.750	3.400	2.096	23.209	FALSE
4.857	4.000	3.167	4.333	3.375	5.000	3.500	5.000	4.750	3.200	2.711	23.209	FALSE
3.857	3.500	3.000	4.833	3.875	4.000	4.750	4.000	4.750	3.400	2.722	23.209	FALSE
3.857	3.500	2.833	3.667	3.250	4.000	4.250	4.500	3.500	4.800	1.871	23.209	FALSE
5.000	4.000	5.000	4.833	2.875	5.000	3.750	5.000	4.500	4.800	2.644	23.209	FALSE
4.857	4.000	3.500	4.000	1.625	4.000	4.500	5.000	4.750	1.800	3.850	23.209	FALSE
4.857	5.000	5.000	3.833	2.375	3.500	3.750	5.000	5.000	3.800	3.098	23.209	FALSE
3.429	5.000	4.833	4.833	1.875	4.500	3.750	5.000	4.750	4.200	3.273	23.209	FALSE
2.714	3.000	5.000	3.833	2.500	5.000	4.500	4.500	3.750	4.400	2.942	23.209	FALSE
2.857	4.500	4.833	4.833	1.375	4.000	4.750	4.500	2.500	3.600	3.850	23.209	FALSE
4.143	3.500	3.167	4.333	3.500	4.000	3.500	4.500	4.750	3.400	1.968	23.209	FALSE
4.571	5.000	2.500	4.000	2.750	4.500	2.750	4.500	4.750	4.200	3.156	23.209	FALSE
2.571	4.000	4.500	4.000	2.625	3.000	2.750	4.000	3.750	3.400	2.317	23.209	FALSE
4.429	5.000	3.000	3.667	2.625	4.500	3.250	4.500	5.000	3.800	2.777	23.209	FALSE
2.571	5.000	3.667	3.167	3.125	4.500	3.500	3.500	4.250	3.400	2.478	23.209	FALSE
1.857	4.500	3.833	4.167	3.125	4.500	3.250	4.500	3.750	3.600	2.990	23.209	FALSE

4.857	4.500	3.833	4.667	4.375	2.500	3.250	4.500	4.500	3.400	2.843	23.209	FALSE
4.857	4.000	5.000	4.833	4.625	5.000	4.000	5.000	4.000	4.800	2.610	23.209	FALSE
4.571	2.000	2.667	4.333	3.375	3.000	3.500	5.000	3.000	2.200	3.788	23.209	FALSE

Result : TECH

```
# calculate the threshold based on the chi-squared distribution
p = len(num_cols.columns)
threshold = chi2.ppf(0.99, p)

# create a new column for Mahalanobis distance and outlier detection
num_cols['Mahalanobis distance'] = mahalanobis_distance
num_cols['Outlier'] = num_cols['Mahalanobis distance'] > threshold

# save the resulting dataframe to a new CSV file
new_file_name = 'E:\Mahalanobis_TECH.csv'
num_cols.to_csv(new_file_name, index=False)

# print the number of outliers found
print(f"Found {num_cols['Outlier'].sum()} outliers.")
```

```
Found 0 outliers.
```

TECH Working:

PC	PB	IN	PS	CA	RA	PE	Mahalanobis distance	Threshold	Outlier
2.500	3.000	3.500	2.500	2.000	3.000	3.750	2.512	18.475	FALSE
1.750	2.333	2.000	3.500	3.000	2.000	2.500	2.542	18.475	FALSE
2.500	2.333	3.000	4.000	4.500	1.000	3.000	2.893	18.475	FALSE
2.750	1.667	3.000	2.500	1.500	1.500	2.500	3.147	18.475	FALSE
2.000	2.667	3.000	1.500	2.500	2.500	3.000	3.050	18.475	FALSE
1.500	2.667	2.000	2.000	1.500	1.500	2.750	3.481	18.475	FALSE
1.250	1.667	3.500	2.500	3.500	3.500	3.250	3.252	18.475	FALSE
4.250	2.333	3.500	2.000	2.500	1.000	1.750	3.681	18.475	FALSE
4.000	2.000	3.500	3.000	2.000	1.500	2.500	2.895	18.475	FALSE
4.000	1.333	3.000	2.500	4.000	3.000	3.250	2.661	18.475	FALSE
4.000	1.000	3.000	4.000	2.500	3.000	2.750	3.022	18.475	FALSE
3.000	2.333	5.000	3.000	3.500	3.500	2.500	2.768	18.475	FALSE
1.750	2.333	2.000	4.000	3.000	4.000	1.500	3.616	18.475	FALSE
1.750	1.333	2.500	4.000	2.500	3.000	4.000	3.118	18.475	FALSE
2.250	3.333	2.000	2.500	2.500	2.500	4.250	2.644	18.475	FALSE
3.000	2.000	3.500	5.000	1.500	2.000	2.500	3.227	18.475	FALSE
3.000	1.333	5.000	4.000	3.500	4.000	4.250	3.170	18.475	FALSE
1.750	2.667	2.500	3.500	2.500	1.500	3.000	2.585	18.475	FALSE
2.250	1.667	2.500	2.500	1.500	2.500	2.750	2.937	18.475	FALSE
3.250	1.667	5.000	4.000	2.000	3.000	2.750	3.158	18.475	FALSE
4.000	3.000	4.000	4.500	3.500	1.500	4.000	2.201	18.475	FALSE
3.750	2.667	4.000	4.000	2.000	2.000	2.250	2.603	18.475	FALSE
4.000	1.667	3.000	2.000	2.500	2.500	2.500	2.922	18.475	FALSE
1.250	2.667	3.000	2.000	3.500	3.000	2.500	3.140	18.475	FALSE

1.500	2.000	2.000	4.500	3.000	3.500	2.250	3.354	18.475	FALSE
2.750	2.667	2.500	3.000	2.500	1.500	2.750	2.153	18.475	FALSE
3.500	1.667	3.000	2.500	4.500	2.500	2.750	2.585	18.475	FALSE
4.000	1.667	3.000	3.000	1.500	3.500	3.750	3.133	18.475	FALSE
3.750	4.000	5.000	3.500	3.000	1.500	2.000	3.312	18.475	FALSE
4.500	4.667	5.000	4.000	3.500	3.500	3.500	2.030	18.475	FALSE
1.750	2.333	2.500	2.000	4.000	3.000	2.750	2.775	18.475	FALSE
4.250	3.000	3.000	4.000	3.000	2.000	3.500	1.833	18.475	FALSE
3.750	3.000	5.000	4.000	3.500	3.500	3.750	1.655	18.475	FALSE
2.250	1.667	3.000	4.000	4.000	4.500	2.500	2.901	18.475	FALSE
4.750	3.333	5.000	4.000	4.000	4.500	2.250	2.899	18.475	FALSE
2.250	2.667	3.500	2.500	3.000	3.500	1.500	2.991	18.475	FALSE
2.000	3.333	4.000	4.000	3.500	3.500	3.250	1.936	18.475	FALSE
3.000	1.333	2.500	3.000	4.500	3.000	2.750	2.666	18.475	FALSE
3.250	3.000	4.500	4.000	4.500	3.000	3.500	1.556	18.475	FALSE
2.250	2.667	3.500	3.000	4.000	2.000	5.000	3.170	18.475	FALSE
2.500	2.667	3.000	3.000	5.000	3.500	3.750	2.208	18.475	FALSE
3.000	1.667	4.000	4.500	2.500	3.500	4.250	2.695	18.475	FALSE
3.000	2.667	3.500	3.000	3.000	2.500	4.000	1.714	18.475	FALSE
3.000	3.667	4.000	4.500	3.500	4.500	3.750	1.645	18.475	FALSE
5.000	3.333	4.000	4.500	3.500	4.500	4.250	2.253	18.475	FALSE
3.500	2.667	4.000	4.000	3.500	3.500	2.000	2.111	18.475	FALSE
3.750	2.000	4.000	1.500	4.000	2.500	3.750	3.344	18.475	FALSE
4.250	2.667	5.000	4.000	5.000	2.500	4.750	2.900	18.475	FALSE
3.000	2.000	3.000	3.500	4.000	3.000	3.000	1.658	18.475	FALSE
1.000	3.333	2.500	4.000	3.000	3.000	2.500	3.073	18.475	FALSE
2.750	2.667	4.000	4.500	4.000	2.000	3.250	2.048	18.475	FALSE
2.250	1.000	3.500	4.500	3.000	3.500	4.000	3.122	18.475	FALSE
4.000	3.333	4.000	3.500	3.000	1.500	2.250	2.452	18.475	FALSE
4.000	2.667	4.500	4.000	3.000	4.000	3.250	1.799	18.475	FALSE
3.250	1.333	4.000	4.000	4.000	2.500	3.250	2.483	18.475	FALSE
2.250	1.667	3.500	4.500	3.500	3.000	3.250	2.346	18.475	FALSE
4.500	1.667	5.000	3.000	3.500	5.000	4.500	3.526	18.475	FALSE
4.500	1.333	4.000	3.000	2.500	4.000	3.250	3.151	18.475	FALSE
3.000	3.333	3.000	4.000	3.000	1.000	3.000	2.291	18.475	FALSE
2.500	2.000	3.000	4.500	4.000	4.000	3.000	2.397	18.475	FALSE
2.000	3.000	2.000	3.000	3.000	2.000	3.500	2.294	18.475	FALSE
4.500	4.333	4.000	3.000	2.500	1.500	4.750	3.186	18.475	FALSE
3.250	3.000	3.000	3.000	3.000	4.000	3.500	1.518	18.475	FALSE
3.000	2.333	3.000	3.000	3.500	2.500	4.750	2.309	18.475	FALSE
2.250	3.667	3.000	4.500	3.500	3.000	2.500	2.246	18.475	FALSE
5.000	4.000	4.500	4.000	2.500	2.000	3.500	2.659	18.475	FALSE
2.750	3.667	4.000	4.500	3.000	2.500	2.500	2.050	18.475	FALSE
3.750	3.667	4.500	3.500	5.000	2.000	4.250	2.485	18.475	FALSE
2.250	3.667	4.500	3.000	2.500	2.000	3.250	3.029	18.475	FALSE
2.250	3.000	4.500	4.500	4.000	2.500	3.500	2.332	18.475	FALSE
3.750	2.667	4.500	4.000	4.000	3.500	4.250	1.542	18.475	FALSE
4.250	2.667	3.500	4.500	3.500	2.500	1.500	3.003	18.475	FALSE

4.000	1.667	3.500	3.000	3.500	4.500	2.250	2.983	18.475	FALSE
3.000	1.000	5.000	4.500	3.500	4.000	3.750	3.313	18.475	FALSE
2.000	2.667	1.000	3.000	4.000	1.500	3.750	3.277	18.475	FALSE
3.250	2.333	3.500	1.500	4.500	4.000	4.000	3.070	18.475	FALSE
3.750	4.333	4.500	4.500	2.500	1.500	4.500	2.974	18.475	FALSE
3.500	2.333	5.000	4.000	3.000	4.500	2.750	2.599	18.475	FALSE
2.750	3.333	5.000	5.000	3.000	1.500	2.500	3.178	18.475	FALSE
3.000	2.000	3.500	3.000	4.000	3.500	3.250	1.782	18.475	FALSE
3.000	4.000	4.500	5.000	3.500	2.000	2.750	2.457	18.475	FALSE
4.000	3.000	4.000	3.500	3.500	3.500	5.000	1.890	18.475	FALSE
3.250	2.667	4.000	5.000	5.000	3.500	1.750	3.164	18.475	FALSE
3.250	3.667	4.000	3.000	4.500	1.500	3.750	2.528	18.475	FALSE
4.750	3.000	5.000	4.000	4.000	2.500	4.500	2.434	18.475	FALSE
2.500	4.000	4.500	5.000	2.000	4.500	5.000	3.480	18.475	FALSE
5.000	4.333	5.000	5.000	3.000	3.500	3.750	2.443	18.475	FALSE
4.500	4.000	4.500	4.000	2.500	2.000	4.000	2.441	18.475	FALSE
2.500	5.000	4.500	5.000	5.000	2.000	5.000	3.655	18.475	FALSE
4.250	3.000	3.000	4.500	5.000	4.000	4.000	2.339	18.475	FALSE
4.750	3.333	3.500	2.000	4.000	2.500	4.000	2.577	18.475	FALSE
3.250	3.333	3.500	5.000	4.500	2.500	3.500	1.879	18.475	FALSE
2.750	3.000	3.500	4.000	3.000	4.500	4.750	2.268	18.475	FALSE
3.750	3.333	3.500	5.000	3.000	2.500	2.500	2.236	18.475	FALSE
3.750	4.667	3.000	2.000	2.500	3.000	2.500	3.118	18.475	FALSE
4.750	2.667	4.500	4.500	4.500	5.000	2.000	3.526	18.475	FALSE
2.000	2.667	4.500	5.000	4.000	4.500	3.500	2.753	18.475	FALSE
3.250	5.000	5.000	2.500	4.500	3.500	3.750	3.136	18.475	FALSE
3.750	3.000	5.000	4.000	3.000	4.500	4.500	2.297	18.475	FALSE
4.750	5.000	5.000	4.500	4.000	3.000	4.750	2.335	18.475	FALSE
3.000	3.333	3.500	2.500	5.000	3.500	4.000	2.183	18.475	FALSE
3.500	3.667	5.000	4.000	4.000	4.500	4.000	1.742	18.475	FALSE
1.000	4.667	1.500	4.500	4.500	2.000	3.500	4.351	18.475	FALSE
4.000	3.667	5.000	5.000	4.000	2.500	3.750	1.974	18.475	FALSE
1.500	2.333	3.500	4.500	4.500	3.500	3.750	2.865	18.475	FALSE
3.250	4.000	4.000	5.000	4.500	3.500	3.500	1.681	18.475	FALSE
4.250	3.667	4.500	5.000	3.000	2.500	2.500	2.432	18.475	FALSE
3.750	4.000	3.500	4.500	4.000	2.500	2.750	1.786	18.475	FALSE
4.250	4.667	4.500	4.500	5.000	4.500	4.000	2.015	18.475	FALSE
3.750	5.000	5.000	4.000	4.000	2.500	2.250	3.024	18.475	FALSE
2.250	4.000	4.500	4.500	4.500	5.000	4.750	2.828	18.475	FALSE
2.250	3.333	4.500	3.000	2.500	2.500	3.250	2.776	18.475	FALSE
3.000	3.333	4.000	4.500	4.500	2.500	2.750	1.896	18.475	FALSE
4.250	3.333	3.000	4.000	5.000	5.000	2.500	3.283	18.475	FALSE
3.750	4.000	1.500	2.500	4.000	3.500	3.750	2.804	18.475	FALSE
2.500	3.667	5.000	5.000	4.000	3.500	3.000	2.431	18.475	FALSE
3.000	4.000	4.000	5.000	3.500	3.000	3.500	1.683	18.475	FALSE
3.250	3.333	4.000	4.500	5.000	1.500	4.000	2.646	18.475	FALSE
4.250	4.000	4.000	4.500	5.000	2.000	2.250	2.859	18.475	FALSE
4.750	2.667	5.000	4.000	5.000	3.000	3.750	2.498	18.475	FALSE

3.000	3.667	4.000	3.000	1.500	3.000	2.500	2.897	18.475	FALSE
3.500	3.000	5.000	4.000	3.500	3.500	4.250	1.872	18.475	FALSE
3.750	2.000	4.000	5.000	4.500	4.000	3.000	2.525	18.475	FALSE
4.250	3.000	5.000	5.000	4.000	2.000	4.250	2.590	18.475	FALSE
3.250	4.333	2.000	3.000	5.000	4.000	3.500	2.860	18.475	FALSE
2.750	5.000	5.000	4.000	3.500	4.500	3.500	2.773	18.475	FALSE
2.750	2.667	4.500	5.000	5.000	1.500	3.500	3.239	18.475	FALSE
3.750	5.000	4.500	4.500	3.000	4.000	3.750	2.207	18.475	FALSE
4.500	5.000	4.500	2.500	5.000	5.000	5.000	3.197	18.475	FALSE
4.500	4.333	4.000	4.000	4.000	3.000	2.750	1.943	18.475	FALSE
3.250	4.000	2.500	4.500	2.500	4.500	4.500	3.007	18.475	FALSE
4.750	3.000	5.000	5.000	3.500	3.500	4.500	2.305	18.475	FALSE
2.750	5.000	4.000	3.500	5.000	2.500	3.250	2.774	18.475	FALSE
3.750	4.000	3.000	4.500	4.000	2.500	4.500	1.857	18.475	FALSE
3.250	4.667	5.000	4.500	4.500	3.500	3.500	2.112	18.475	FALSE
4.250	2.000	3.500	5.000	4.000	3.500	4.250	2.542	18.475	FALSE
3.750	5.000	4.000	3.500	4.000	3.500	4.500	1.838	18.475	FALSE
3.500	3.333	3.500	4.500	5.000	4.000	4.500	1.881	18.475	FALSE
3.000	2.333	4.500	4.500	1.000	3.500	3.250	3.377	18.475	FALSE
4.250	4.000	5.000	5.000	3.500	4.500	4.500	2.081	18.475	FALSE
4.250	4.000	5.000	3.500	4.500	5.000	2.500	2.937	18.475	FALSE
3.500	4.000	5.000	5.000	3.000	3.000	3.750	2.083	18.475	FALSE
2.750	4.000	5.000	4.500	5.000	3.500	2.750	2.661	18.475	FALSE
4.500	3.000	3.500	3.500	3.500	1.500	4.000	2.200	18.475	FALSE
4.250	2.667	3.500	4.500	4.500	4.000	1.750	3.193	18.475	FALSE
4.750	4.333	5.000	5.000	3.000	4.500	3.750	2.551	18.475	FALSE
3.750	2.000	3.500	4.500	4.000	3.500	4.750	2.370	18.475	FALSE
5.000	4.667	5.000	5.000	4.000	3.000	4.250	2.270	18.475	FALSE
4.000	4.000	5.000	4.000	5.000	5.000	3.750	2.226	18.475	FALSE
4.000	3.000	4.000	3.500	4.000	3.000	3.750	1.012	18.475	FALSE
4.500	3.667	4.500	4.000	3.500	4.000	5.000	1.922	18.475	FALSE
3.500	2.667	3.000	3.000	5.000	4.000	3.250	2.125	18.475	FALSE
4.750	4.667	4.500	5.000	4.000	2.500	3.750	2.219	18.475	FALSE
3.250	3.667	4.000	4.500	4.000	4.000	5.000	1.812	18.475	FALSE
3.500	5.000	4.000	4.500	2.000	5.000	3.750	3.357	18.475	FALSE
4.500	3.667	2.500	3.500	2.500	1.500	2.750	2.767	18.475	FALSE
4.000	4.667	4.000	5.000	2.000	2.500	3.250	2.898	18.475	FALSE
3.250	3.667	4.000	3.500	3.500	2.500	3.500	1.194	18.475	FALSE
4.750	2.000	3.000	3.500	3.500	2.000	2.750	2.639	18.475	FALSE
3.750	2.333	2.500	3.500	4.500	2.500	1.750	2.905	18.475	FALSE
3.250	1.667	3.500	3.000	3.500	2.000	2.500	2.340	18.475	FALSE
3.000	2.667	2.500	3.000	2.500	2.000	2.250	2.132	18.475	FALSE
3.250	3.333	1.500	3.000	1.500	1.000	4.750	3.882	18.475	FALSE
3.500	3.000	2.000	3.500	3.500	3.000	3.750	1.843	18.475	FALSE
4.250	4.000	3.000	2.500	3.500	2.500	2.750	2.206	18.475	FALSE
2.250	3.667	2.000	2.500	3.000	2.500	3.250	2.300	18.475	FALSE
3.500	4.000	5.000	4.500	4.000	3.500	3.750	1.557	18.475	FALSE
4.750	2.333	2.000	5.000	4.000	1.500	3.750	3.749	18.475	FALSE

3.750	3.333	2.500	3.000	2.000	1.000	4.500	3.177	18.475	FALSE
5.000	3.333	5.000	4.000	4.000	3.000	3.750	2.043	18.475	FALSE
3.000	1.667	3.000	4.000	4.500	4.000	2.250	2.835	18.475	FALSE
3.000	3.000	3.000	4.000	5.000	2.000	3.250	2.195	18.475	FALSE
2.500	4.333	5.000	5.000	4.000	3.500	2.000	3.229	18.475	FALSE
2.500	3.667	2.000	1.500	3.500	2.000	2.750	2.955	18.475	FALSE
3.000	3.333	3.500	4.500	4.000	4.500	2.250	2.542	18.475	FALSE
3.000	2.333	5.000	4.500	5.000	3.500	2.250	3.021	18.475	FALSE
3.000	2.667	4.000	4.000	1.500	4.500	2.250	3.277	18.475	FALSE
2.250	3.333	3.000	4.000	1.000	3.000	2.250	3.325	18.475	FALSE
2.250	1.667	2.500	2.500	3.500	1.500	4.500	3.363	18.475	FALSE
3.000	3.000	2.500	5.000	4.000	3.000	3.000	2.414	18.475	FALSE
2.750	1.333	2.000	5.000	3.500	1.500	4.000	3.692	18.475	FALSE
2.500	3.333	2.000	3.500	2.500	4.000	2.750	2.715	18.475	FALSE
2.000	3.667	2.500	1.500	1.500	2.500	1.750	3.889	18.475	FALSE
2.250	1.333	3.000	4.000	3.000	2.500	3.000	2.463	18.475	FALSE
2.500	2.333	2.000	3.000	5.000	2.000	4.500	3.195	18.475	FALSE
2.500	3.667	4.500	5.000	3.500	2.500	3.500	2.251	18.475	FALSE
3.750	3.000	2.500	4.500	4.500	3.500	3.750	2.183	18.475	FALSE
2.250	3.000	1.500	4.000	3.500	2.000	2.750	2.765	18.475	FALSE
3.500	3.333	5.000	4.000	5.000	4.000	3.250	2.082	18.475	FALSE
3.500	3.333	4.500	3.000	4.000	4.500	4.750	2.208	18.475	FALSE
3.500	4.000	5.000	3.000	3.500	4.500	3.750	2.351	18.475	FALSE
4.750	3.667	4.000	1.000	4.000	3.500	2.750	3.760	18.475	FALSE
3.750	2.333	4.500	4.000	4.500	3.000	4.000	1.958	18.475	FALSE
3.750	5.000	3.000	4.000	1.000	1.500	3.250	3.859	18.475	FALSE
3.250	4.000	3.500	4.500	4.500	2.500	3.000	1.807	18.475	FALSE
3.250	4.333	4.500	3.000	3.500	2.000	2.750	2.622	18.475	FALSE
4.250	3.667	3.500	4.500	5.000	3.000	3.750	1.779	18.475	FALSE
3.000	3.333	2.000	3.000	4.000	3.000	5.000	2.524	18.475	FALSE
4.500	4.333	4.500	3.500	2.500	2.000	3.250	2.619	18.475	FALSE
4.000	4.000	4.500	4.000	2.000	5.000	4.000	2.901	18.475	FALSE
4.500	3.000	3.000	3.500	3.500	2.500	4.250	1.794	18.475	FALSE
1.750	4.333	4.000	4.500	3.500	2.500	3.250	2.752	18.475	FALSE
4.750	5.000	4.500	4.500	3.500	1.500	3.250	2.930	18.475	FALSE
2.500	3.000	3.500	4.000	3.500	3.000	3.750	1.302	18.475	FALSE
4.250	3.333	4.000	2.000	5.000	4.500	3.500	2.872	18.475	FALSE
3.250	2.667	2.500	2.000	3.500	2.500	3.750	2.098	18.475	FALSE
4.250	2.667	2.500	2.500	5.000	2.500	1.000	4.055	18.475	FALSE
2.250	3.667	3.500	5.000	3.500	4.000	3.250	2.306	18.475	FALSE
4.750	3.667	2.500	3.000	4.000	1.500	3.500	2.601	18.475	FALSE
2.750	3.000	1.000	2.500	2.000	2.500	3.000	3.082	18.475	FALSE
2.250	4.000	3.000	2.500	3.500	3.000	3.750	2.175	18.475	FALSE
4.750	4.333	5.000	5.000	4.500	3.500	3.250	2.220	18.475	FALSE
2.250	3.333	3.000	4.000	5.000	4.000	3.750	2.304	18.475	FALSE
3.500	4.000	4.000	2.000	1.500	4.000	4.000	3.498	18.475	FALSE
3.500	2.667	2.000	4.500	1.500	2.500	4.250	3.397	18.475	FALSE
4.500	2.333	2.500	3.000	2.500	5.000	5.000	3.692	18.475	FALSE

4.750	2.667	3.500	3.000	4.500	3.500	3.500	2.090	18.475	FALSE
2.750	2.333	3.500	2.500	3.500	3.000	2.500	2.071	18.475	FALSE
5.000	4.333	3.500	4.000	4.000	1.500	5.000	2.920	18.475	FALSE
2.250	3.667	3.500	2.500	4.500	3.500	4.000	2.406	18.475	FALSE
4.250	3.667	4.500	5.000	4.000	3.000	2.500	2.220	18.475	FALSE
4.500	3.000	2.500	2.500	4.500	4.000	3.000	2.736	18.475	FALSE
3.500	2.333	4.000	3.500	3.500	2.500	4.750	2.312	18.475	FALSE
5.000	4.000	5.000	3.000	3.000	4.000	4.250	2.682	18.475	FALSE
4.500	3.333	3.500	4.500	4.000	3.500	3.000	1.871	18.475	FALSE
4.500	3.667	3.500	2.500	3.500	2.500	2.250	2.558	18.475	FALSE
5.000	4.000	4.500	4.000	5.000	3.500	4.500	1.987	18.475	FALSE
3.750	2.667	2.500	3.000	4.500	2.000	4.250	2.305	18.475	FALSE
4.750	3.000	5.000	4.500	4.500	5.000	3.750	2.447	18.475	FALSE
3.000	5.000	4.500	4.000	4.000	2.500	3.750	2.346	18.475	FALSE
3.000	4.333	3.500	3.000	5.000	4.000	3.250	2.250	18.475	FALSE
4.500	4.333	3.000	3.500	3.000	3.500	4.500	2.140	18.475	FALSE
3.000	3.667	4.000	2.500	4.500	2.000	2.000	3.051	18.475	FALSE
4.000	3.333	3.500	3.000	4.500	4.000	1.750	2.915	18.475	FALSE
5.000	2.667	4.500	4.000	3.500	3.000	3.750	2.097	18.475	FALSE
3.250	4.000	2.000	1.500	2.000	4.000	3.750	3.490	18.475	FALSE
3.750	2.333	2.500	3.000	5.000	2.500	4.000	2.465	18.475	FALSE
4.500	3.000	3.500	3.500	2.500	2.500	3.750	1.939	18.475	FALSE
4.750	5.000	3.500	1.500	4.500	4.000	2.500	3.953	18.475	FALSE
3.500	4.333	3.500	1.500	4.500	3.500	3.500	2.934	18.475	FALSE
4.000	4.000	4.500	3.000	5.000	3.500	4.000	2.005	18.475	FALSE
4.250	2.667	1.500	3.500	3.000	2.500	2.000	3.391	18.475	FALSE
4.750	4.667	3.500	4.000	5.000	3.000	2.750	2.704	18.475	FALSE
2.250	4.667	2.500	4.000	4.500	2.500	3.250	2.748	18.475	FALSE
3.750	4.000	3.500	5.000	4.500	4.500	3.750	2.157	18.475	FALSE
4.750	2.000	3.000	5.000	3.500	4.000	3.000	3.308	18.475	FALSE
3.750	4.333	4.000	3.500	5.000	4.500	4.500	1.927	18.475	FALSE
2.500	5.000	3.500	5.000	2.500	3.500	4.000	3.006	18.475	FALSE
4.250	4.000	2.500	3.500	5.000	4.500	2.750	3.151	18.475	FALSE
3.750	4.000	4.000	4.500	4.000	2.500	5.000	1.994	18.475	FALSE
3.500	3.667	2.000	2.000	1.500	3.000	4.500	3.428	18.475	FALSE
2.250	5.000	2.500	3.000	5.000	2.500	3.500	3.166	18.475	FALSE
3.250	4.333	2.500	4.500	5.000	2.000	3.500	2.754	18.475	FALSE
5.000	3.333	4.000	5.000	5.000	3.000	4.750	2.551	18.475	FALSE
4.500	4.333	3.500	4.500	4.000	2.500	3.250	1.959	18.475	FALSE
4.250	4.667	3.500	2.000	5.000	4.000	5.000	3.065	18.475	FALSE
5.000	3.667	3.000	5.000	3.500	4.500	4.500	3.095	18.475	FALSE
4.250	3.333	4.000	2.500	4.000	4.500	3.500	2.166	18.475	FALSE
2.250	4.667	2.000	3.000	5.000	4.000	2.500	3.646	18.475	FALSE
3.750	3.667	5.000	4.500	5.000	4.500	5.000	2.277	18.475	FALSE
5.000	4.000	4.500	4.000	4.500	3.000	5.000	2.177	18.475	FALSE
3.750	4.000	3.500	4.500	4.000	3.000	4.750	1.596	18.475	FALSE
4.750	5.000	3.000	4.500	5.000	1.500	3.750	3.251	18.475	FALSE
3.000	3.000	2.500	3.000	4.000	4.000	4.250	1.878	18.475	FALSE

4.250	4.333	2.000	3.500	4.000	1.500	4.500	2.961	18.475	FALSE
2.500	3.667	3.000	2.500	4.000	4.000	3.250	2.090	18.475	FALSE
4.000	2.667	2.500	3.500	2.000	4.500	2.750	3.200	18.475	FALSE
4.500	5.000	3.500	3.000	5.000	3.000	3.750	2.438	18.475	FALSE
1.750	5.000	3.500	4.000	4.500	5.000	5.000	3.582	18.475	FALSE
2.750	3.000	2.000	1.500	5.000	2.500	4.500	3.442	18.475	FALSE
3.750	4.333	3.500	4.000	4.000	3.000	3.000	1.483	18.475	FALSE
4.500	5.000	3.500	5.000	3.000	2.000	3.500	2.869	18.475	FALSE
4.250	4.667	4.500	4.000	2.000	3.000	4.250	2.703	18.475	FALSE
4.000	4.333	2.000	5.000	3.000	2.500	4.250	3.246	18.475	FALSE
4.500	5.000	4.000	5.000	4.000	1.500	3.500	2.868	18.475	FALSE
4.500	4.000	4.500	5.000	4.000	4.000	4.750	1.867	18.475	FALSE
2.750	4.000	4.500	3.000	4.500	4.500	4.750	2.625	18.475	FALSE
5.000	5.000	4.000	4.000	5.000	3.500	3.500	2.451	18.475	FALSE
4.500	4.000	1.500	2.000	3.000	4.000	4.250	3.569	18.475	FALSE
2.250	3.667	3.000	3.500	5.000	4.000	3.250	2.367	18.475	FALSE
3.750	4.333	3.000	4.000	3.500	3.000	4.000	1.461	18.475	FALSE
5.000	5.000	4.500	3.500	5.000	3.500	4.500	2.394	18.475	FALSE
4.750	4.000	5.000	4.000	3.500	5.000	5.000	2.537	18.475	FALSE
4.500	4.000	3.000	4.000	3.500	2.500	3.750	1.756	18.475	FALSE
4.500	4.667	3.000	3.500	5.000	2.500	5.000	2.659	18.475	FALSE
4.000	4.667	3.500	2.000	3.500	4.500	4.000	2.803	18.475	FALSE
3.000	3.333	4.500	4.000	5.000	5.000	3.500	2.313	18.475	FALSE
4.750	5.000	5.000	5.000	5.000	3.500	4.250	2.355	18.475	FALSE
4.000	3.000	4.500	5.000	4.000	3.500	4.500	1.797	18.475	FALSE
4.500	3.000	3.500	4.000	5.000	2.500	4.750	2.361	18.475	FALSE
5.000	3.333	4.000	3.000	4.500	3.500	4.750	2.264	18.475	FALSE
4.000	4.333	3.000	2.000	4.500	3.500	5.000	2.789	18.475	FALSE
3.500	3.333	4.000	5.000	4.500	5.000	4.750	2.361	18.475	FALSE
4.250	4.667	4.500	4.500	4.500	5.000	4.500	2.134	18.475	FALSE
4.000	3.667	4.500	5.000	4.500	3.000	3.750	1.595	18.475	FALSE
5.000	4.000	3.500	4.000	5.000	4.500	4.250	2.394	18.475	FALSE
4.750	4.667	5.000	4.500	5.000	3.000	5.000	2.474	18.475	FALSE
3.750	2.000	4.000	3.500	4.500	4.500	4.500	2.426	18.475	FALSE
4.750	3.000	3.000	5.000	4.000	3.000	4.250	2.543	18.475	FALSE
4.250	3.000	2.500	4.000	5.000	4.000	4.250	2.562	18.475	FALSE
3.750	4.000	1.000	2.500	2.000	5.000	4.750	4.569	18.475	FALSE
4.000	5.000	4.000	5.000	4.000	3.500	3.750	2.046	18.475	FALSE
5.000	5.000	3.500	3.000	3.500	3.500	2.750	2.974	18.475	FALSE
4.000	4.000	2.000	4.500	4.000	2.500	4.750	2.877	18.475	FALSE
3.750	4.000	3.000	5.000	3.500	3.000	4.750	2.273	18.475	FALSE
2.750	3.000	4.500	4.500	5.000	5.000	4.250	2.546	18.475	FALSE
4.500	3.000	5.000	5.000	3.500	4.500	4.500	2.353	18.475	FALSE
2.500	3.667	2.500	3.000	3.000	3.500	3.750	1.860	18.475	FALSE
3.250	4.667	5.000	4.500	5.000	5.000	4.000	2.520	18.475	FALSE
3.750	3.667	3.500	4.000	4.000	4.000	5.000	1.649	18.475	FALSE
5.000	4.333	4.500	4.500	5.000	3.500	4.500	2.044	18.475	FALSE
2.750	4.000	2.500	4.000	3.000	5.000	4.250	2.893	18.475	FALSE

4.000	4.000	3.000	2.500	5.000	2.500	4.500	2.467	18.475	FALSE
4.000	5.000	3.500	3.500	4.500	3.500	5.000	2.172	18.475	FALSE
3.250	4.000	5.000	5.000	3.000	5.000	4.250	2.596	18.475	FALSE
3.500	4.333	4.000	4.000	4.000	2.000	5.000	2.397	18.475	FALSE
2.000	3.667	2.500	3.500	3.000	4.000	4.750	2.742	18.475	FALSE
3.750	4.667	4.500	4.000	5.000	5.000	4.750	2.307	18.475	FALSE
4.750	1.667	3.000	2.000	5.000	2.000	5.000	4.123	18.475	FALSE
3.000	3.667	4.000	5.000	2.500	5.000	5.000	3.080	18.475	FALSE
4.750	4.000	4.000	3.500	4.000	5.000	4.250	2.181	18.475	FALSE
3.250	3.000	3.000	3.500	5.000	3.000	3.000	1.841	18.475	FALSE
3.000	4.667	5.000	5.000	4.000	4.500	5.000	2.660	18.475	FALSE
4.250	3.333	5.000	3.500	4.000	5.000	5.000	2.533	18.475	FALSE
2.750	3.333	3.500	3.000	3.000	5.000	5.000	2.801	18.475	FALSE
3.000	4.000	4.500	4.000	4.000	3.500	4.250	1.548	18.475	FALSE
3.250	4.667	3.500	3.000	4.000	4.500	4.750	2.295	18.475	FALSE
3.250	3.333	4.000	5.000	5.000	4.500	4.000	2.141	18.475	FALSE
4.250	3.333	4.000	4.500	5.000	4.000	5.000	2.081	18.475	FALSE
4.750	2.667	4.000	3.000	3.500	5.000	3.000	2.843	18.475	FALSE
4.500	2.000	3.000	3.500	3.500	3.500	4.250	2.332	18.475	FALSE
5.000	5.000	5.000	4.000	3.000	3.500	4.000	2.571	18.475	FALSE
4.750	3.667	4.000	5.000	3.000	1.500	4.250	2.782	18.475	FALSE
4.000	3.333	4.500	4.500	5.000	4.000	5.000	2.074	18.475	FALSE
4.000	2.333	5.000	4.500	4.000	5.000	4.500	2.619	18.475	FALSE
3.000	3.667	2.500	5.000	2.500	4.500	3.750	3.147	18.475	FALSE
3.000	3.000	3.500	5.000	5.000	3.500	4.500	2.343	18.475	FALSE
2.250	4.667	4.000	3.500	4.500	5.000	3.500	2.877	18.475	FALSE
3.750	3.333	2.500	4.000	3.500	5.000	4.500	2.715	18.475	FALSE
4.750	4.000	4.000	3.000	3.500	4.500	4.750	2.300	18.475	FALSE
3.500	4.667	4.500	5.000	4.500	4.000	5.000	2.204	18.475	FALSE
4.250	2.333	4.000	4.000	4.000	3.500	4.500	1.886	18.475	FALSE
2.750	5.000	4.500	5.000	3.500	4.500	4.250	2.678	18.475	FALSE
4.250	3.000	5.000	5.000	3.000	4.000	3.750	2.188	18.475	FALSE
4.500	4.667	4.000	4.000	4.000	3.500	5.000	1.882	18.475	FALSE
3.500	3.000	2.000	3.500	4.000	2.000	4.750	2.570	18.475	FALSE
3.000	5.000	4.000	4.000	4.000	4.500	5.000	2.467	18.475	FALSE