Nudging contracting firms rivals within municipal road projects in Saudi Arabia to bid competitively

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Thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy - Architecture Department

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Abstract

Several preventive measures have been proposed to tackle bid-rigging practices in public procurement, which are based on reducing opportunities for such illicit arrangements. Maximising the number of market players is one of the most prevalent measures suggested in previous studies. However, there has been little empirical examination of strategies to ensure this increase, particularly in the Saudi Arabian public procurement context. Accordingly, this research aims to develop an institutional framework which will be adopted by relevant stakeholders to reduce risk of bid-rigging by targeting an increase in the number of potential bidders.

Accordingly, the research consisted of two main stage, each of them with two data collection steps. The exploratory stage began by investigating the nature of local contractors' engagement in bidding. More than 500 sets of minutes were studied, recording the opening of sealed bids in five major municipalities over a five-year period. Based on a proposed framework developed according to four market screening tools (market concentration, members number, participation rate, and prices volatility), the scarcity of contractors' participation in these tenders was demonstrated, especially the contractors in lower classifications. It was found that a few contractors suspiciously monopolised these contracts.

Integratively, the key factors that local contractors believed were contributing to their failure to engage in this market were identified through a desk study, which included reviewing literature concerning the rationale for contractors' participation in the same context and reviewing barriers to delivering public construction projects in Saudi Arabia associated with the tendering phase. Consequently, the attributes which might encourage decision-makers in contracting firms to bid were proposed, and were subsequently examined in the second stage.

The second stage adopted a sequential explanatory mixed method approach. First, a 5-point Likert questionnaires were distributed to local contractors in order to examine the influence of each attribute on their desire to participate in bidding. The

majority of contractors agreed on the potential influence of these attributes on future participation, although there were slight differences in influence assessment by contractors according to their classification or success in previous bids. The three most influenced attributes were: accurate and detailed terms and technical specifications, technical advice to tackle bidders' problems in electronic bidding, publishing the contractors' classification criteria and their weighting scores.

Then, standardised open-ended interviews were conducted with both contractors and relevant government authorities, to assess current performance level of these attributes. The customer satisfaction was employed when interviewing contractors, while the self-assessment was the base of the government authorities' interviews. A different level of performance of the relevant stakeholders in these attributes has recorded, which supported prioritising the proposed institutional framework.

Therefore, an Importance-Performance Analysis grid, with a zero gap diagonal line, was adopted. Interestingly, most of these attributes have a performance gap, and consequently, need the concentration of the relevant stakeholders' efforts. This research provides a useful reference for other public construction authorities in similar contexts to adopt requisite managerial actions achieving the same aim, yet further investigation on rivals' assessments of importance and performance are needed to reprioritize those actions.

Acknowledgements

First of all, I would like to express my thanks, deep appreciation, and sincere gratitude to my supervisor Dr Andrew Agapiou for generously offering his time, patience, continuous guidance, and the inspiration that every PhD student needs during this challenging journey. His directions and input contributed significantly to the improvement of the quality of this thesis. I am indebted to him for helping me on this long road.

I would also like to thank everyone who helped to gather this empirical research data, especially the Projects Management Department of the Ministry of Municipal and Rural Affairs in Saudi Arabia, which supported and coordinated with the five municipalities to allow me to use their archive of municipal road tenders information. Furthermore, my special thanks go to my 12 interviewees and the 93 contractors who filled in my questionnaires. It would have been difficult to reach the final conclusions of this thesis without these valuable contributions.

I am deeply thankful to the National Anti-Corruption Commission in Saudi Arabia for funding the entire PhD research. This funding has helped me a great deal throughout my task, and I hope that the results of this thesis will contribute to the development of the work of our Commission to address and prevent such practices.

To my great parents: thank you for your endless support and love during my entire education. Your motivational words are always in my mind and drive me every morning to work hard. Of course, a special thank-you goes to my amazing wife and my two lovely kids, who shared my PhD journey from day one. I was surrounded by their warm feelings every single evening which recharged my energy for the next day.

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Chapter 1: Introduction

1.1 Overview

Saudi Arabia's economy was ranked 30th by the Global Competitiveness Report 2017, which was introduced by the World Economic Forum (see Figure 1-1). According to one of this report's indicators, the size of the market is considered the largest in the region and may well enter the list of the top 10 markets in the world in the near future. The Saudi economy relies mainly on the oil sector, which accounts for 42.7% of Gross Domestic Product (Ministry of Economy and Planning, 2015). However, in the light of recent developments, the national 2030 Vision is substantially aimed at reduction of this dependence. According to this recently introduced national plan, the country seeks to promote the effective participation of all other key sectors in the national economy.

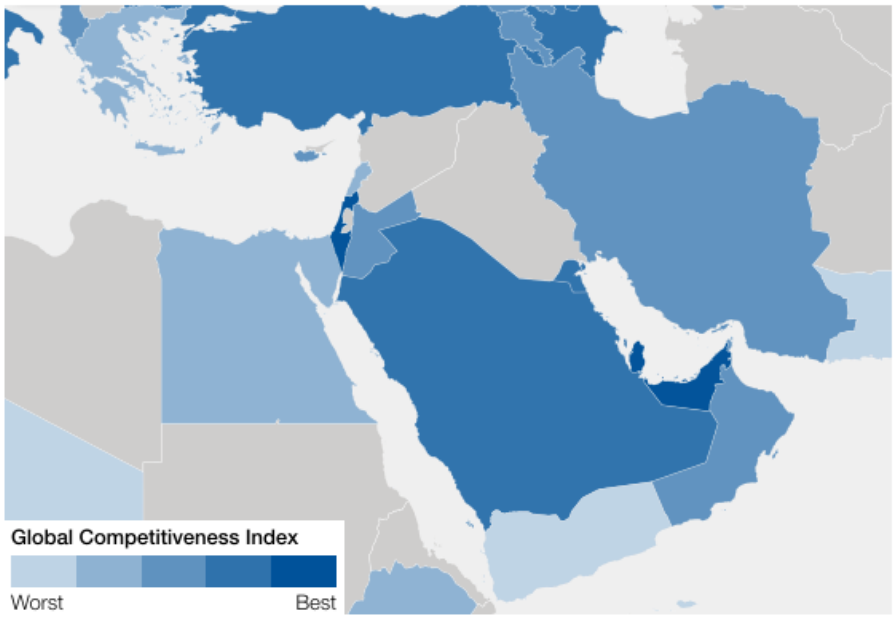


Figure 1-1 Saudi Arabia comparing to MENA region on Global competitiveness index 2017 (World Economic Forum)

One of the current key drivers of the Saudi economy is the public construction works industry, with total government expenditure exceeding $120 billion over the last decade (Alrashid et al., 2014). This industry needs to be managed with a high level of efficiency to ensure competitiveness, which is reflected in access to goods and services at lower

prices and higher quality (Schooner, 2002; Onur et al., 2011). A practice that threatens competitiveness in such markets is collusion agreements between rivals (Bowen et al., 2007), which increase prices above the competitive level (Asker, 2010). Moreover, the damage caused by such practices is not limited to the public procurement authorities but extends to other competitors (Maci, 2012). Therefore, several international organisations, such as the World Bank, Transparency International and the OECD, have issued guidelines to unify efforts to tackle these illicit practices in the public procurement sector. Public procurement markets in Saudi Arabia have certainly not been immune from such practices, and some bid-rigging cases were recently disclosed by the national competition authority.

The literature on reducing collusive bidding practices in the public procurement markets is mainly based on developing methods to detect these practices, through a deeper understanding of the mechanisms of these arrangements. Identifying indicators of suspicious behaviour reveals patterns that serve as a starting point for detailed investigations. Despite notable progress in the development of detection tools, they are still not applicable due to their lack of certainty, reliability and validity (Chotibhongs and Arditi, 2012a). Consequently, developing preventive measures is a fundamental factor in tackling bid-rigging practices (Hüschelrath, 2013). In one recent empirical study, Oke et al. (2017) demonstrated that banning detected bid-riggers from participation in public tenders, screening suspicious practices and transparent public procurement procedures were the most effective prevention measures, in the opinion of construction professionals in South Africa. Nevertheless, few similar empirical studies have been conducted to assess the effectiveness of the proposed prevention measures.

Broadly, collusion has been linked to behavioural motives, therefore opportunities for such behaviours need to be reduced. Advice on how to maximise the number of market players plays a vital role within this strand of literature (Mankiw, 2011). Accordingly, behavioural incentives that will increase potential bidders by stimulating their decision-making should be investigated. In this regard, the assertion of Oke et al. (2017) that

transparent public procurement procedures help reduce collusive bidding practices concurs with the OECD (2009) report aiming to increase the number of potential bidders. As a result, there is a need to empirically examine the extent to which the bidders can be indirectly stimulated by facilitating transparent tendering procedures.

1.2 Research aim and objectives

Based on the preceding discussion, this research mainly aims to develop an institutional framework which will be adopted by relevant stakeholders to reduce the risk of bid-rigging by targeting an increase in the number of potential bidders. Therefore, to ensure that local contractors engage with the process, it seeks to investigate how to nudge the rival firms in public procurement in Saudi Arabia to competitively participate in future tenders.

The public procurement market is quite wide and cannot be fully covered by a PhD thesis. Therefore, the scope of this research was restricted to municipal road construction works contractors. Local municipal road network contracts were chosen to be considered here because of the high rate of recurrent contracts, a lack of product differentiation, and stable demand in local procurement practices, which are considered significant factors to motivate market players to arrange for bid-rigging. However, future researches could address the same research issue in other Saudi public works markets.

To reach this aim, the following research questions have been raised:

1. How are local contractors participating in municipal roads network tenders?
2. What are the obstacles that might cause local contractors' failure to engage in this sort of tender?
3. How could those local contractors be encouraged to participate in bidding?

In order to address these questions, the following research objectives were formulated:

1. Understanding the nature and extent of local contractors' participation in municipal road tenders, thereby identifying indicators of potential bid-rigging in the Saudi municipal roads construction works market.
2. Exploring key factors that local contractors consider to contribute to their failure to engage in this market.
3. Measuring the influence of the proposed tendering phase attributes in enhancing the desire to participate in future municipal tenders.
4. Investigating the current level of stakeholders' performance on those attributes.

1.3 Research design

Exploratory desk-based studies will be carried out to formulate the propositions. These preliminary studies will encompass the development of some indicators of suspected bid-rigging in the context of local municipal roads tenders, as well as a review of the literature on obstacles in public construction work in Saudi Arabia which might be considered by local contractors to affect their decision whether to bid or not. To test those propositions, and based on the nature of the formulated objectives, the next research stage adopts a sequential explanatory mixed-methods approach that combines both qualitative and quantitative methods. The interaction between both methods is critical to the collecting and analysis of the data. The quantitative and qualitative strands will then be mixed during the interpretation stage, where an Importance-Performance Analysis (IPA) matrix is used.

After conducting the preliminary exploratory studies, the main research stage starts with a quantitative study based on semi-structured questionnaires to assess the influence of the proposed tendering attributes in enhancing local classified contractors' desire to participate in future tenders. The questionnaire was developed and conducted through the web-based tool Qualtrics and distributed to 203 contractors. Proportional stratified sampling was adopted to ensure the representativeness of all contractors' classes. Responses were obtained from 93 local contractors who are classified by the Ministry of Municipal and Rural Affairs in the field of municipal roads. After analysing

the quantitative data, it was discovered that all these attributes are generally considered of high importance to all the contractors' categories, despite the presence of slight differences in their assessment of the level of importance of some of these attributes.

In order to obtain further elaboration on the first-phase findings, a follow-up qualitative study is conducted, which aims to measure the performance level of the relevant stakeholders on each attribute. In order to avoid biased results, this qualitative study, in addition to the contractors, targeted some of the concerned departments within the municipalities by applying a purposive sampling method. The study of both sides in this study allowed for the adoption of the most common performance measurement techniques, which are, respectively, customer evaluation and self-evaluation. In total, 12 standardised open-ended interviews were conducted, comprising five contractors, two procurement directors, two bid evaluation committee members, two municipal roads directors and a contractor classification team. Accordingly, the findings of this study will give a second dimension to the proposed attributes, which will consequently facilitate the use of the IPA technique.

Overall, combining the findings of qualitative interviews and quantitative questionnaires enabled the prioritisation of the proposed managerial actions necessary for municipalities to achieve a higher level of competition in future tenders. By assessing the agreement of contractors in the first part of the study, despite the diversity of their classification, on the impact of the proposed attributes to stimulate their future participation, the research came up with generalisable findings. Respondents to the influence assessment questionnaires were mostly decision-makers in contracting firms. Additionally, participants in the performance evaluation interview were involved in preparing bidding documents or holding parts of the tendering procedures; consequently, their insight into more competitive tenders is valuable and credible.

1.4 Thesis structure

This thesis is broadly organised into eight chapters: Chapter-1, the Introduction; Chapter-2, Literature Review on collusive bidding in the public procurement markets; Chapter-3, Development of research conceptual framework; Chapter-4, Research methodology; Chapter-5, Indicators of potential collusion in the research context; Chapter-6, Barriers to the participation of local contractors in public construction work tenders; Chapter-7, Tendering attributes - IPA results' analysis & discussion; and Chapter-8, the Conclusion.

Chapter-2 aims to provide a critical review of the literature relevant to collusive bidding in public procurement markets. The chapter starts by presenting a brief overview of the competition and the public procurement market. It identifies bid-rigging practices as a serious risk to the competitive market. Therefore, an extensive review of the literature relevant to this practice is offered, including identification of gaps in knowledge.

Integrated with the previous chapter, Chapter-3 encompasses the development of the research conceptual framework. This chapter will discuss theoretically the proposed conceptual framework which addresses the issue by presenting the main schools of thought that have contributed to building the conceptual framework of this research.

Chapter-4 presents the adopted (mixed-method) research design. To justify the reasons for choosing this research design, the chapter initially explains the research philosophy and rationale for combined methods. Subsequently, the details of all conducted studies within this research are presented as follows: data collection instruments, the selection of survey participants, data collection implementation, data screening, and analysis techniques. Finally, the mechanism of integrating methods in the interpretation stage is presented, in addition to the stage of testing the final results' external validity procedures.

Chapter-5 presents the first study of the exploratory phase of the research, which aims to understand the nature and extent of contractors' participation in previous municipal roads tenders. The findings of this phase enable the development of potential collusion practices indicators and incidents in this market. Accordingly, the second stage of the preliminary phase is determined.

Chapter-6 aims to identify the key factors that local contractors consider to contribute to their failure to engage in this market. Initially, a comprehensive background, including developments in this sector. as well as the regulative framework, is displayed. Next, it provides a discussion of motives for the rational decision to participate bidding and barriers to the successful delivery of public construction projects, particularly in the tendering phase. Finally, the research variables, which might encourage the rationality of decision makers in contracting firms, are generated.

Chapter-7 presents the findings analysis on the assessing of tendering attributes' importance by local contractors as well as evaluating the current performance levels of responsible stakeholders. Alongside, it provides a discussion of these key findings, including linking these findings to the previous relevant studies and considering the tools used in these findings. Accordingly, the proposed institutional framework is presented.

Finally, Chapter 8 summarises the thesis and points out the research limitations, future research options and some critical reflections. Figure (1-2) illustrated the research steps have been taken to formulate this structure.

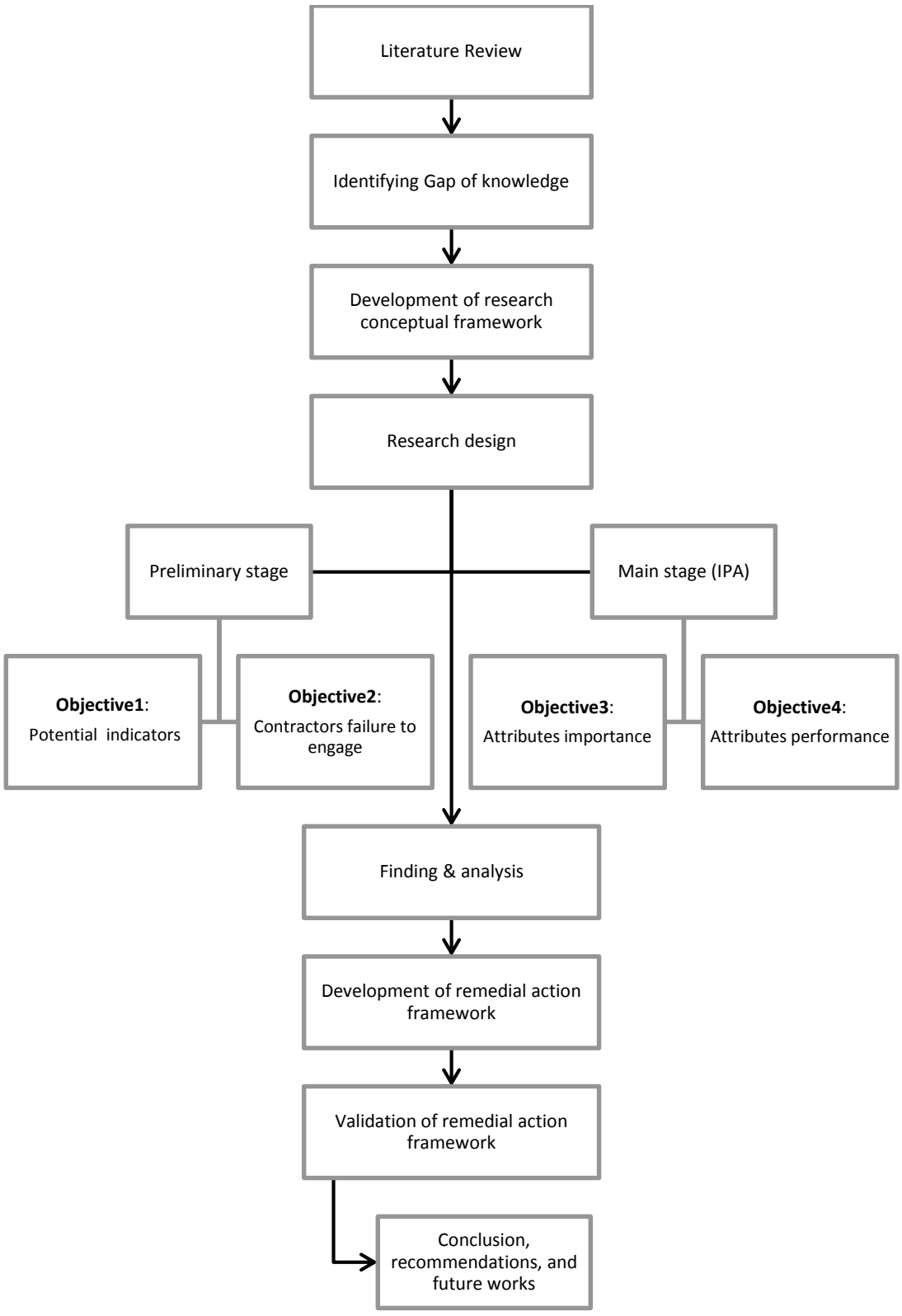


Figure 1-2 Research process

Chapter 2: Collusive bidding in the public procurement markets

2.1 Introduction

This chapter aims to provide a critical review of literature relevant to collusive bidding in the public procurement markets, which is the first phase of the research outlined in the preceding chapter. This literature review begins with a brief overview of competition and the public procurement market, aiming to provide an understanding of the risk of competition in this market. After identifying bid-rigging practices as an acute risk, the next section is an extended review of previous relevant studies regarding collusive bidding (bid-rigging), comprising motivations for bid-rigging, the impacts of bid-rigging, bid-rigging mechanisms, detection of bid-rigging, as well as bid-rigging prevention. Finally, the gaps in knowledge within this stream of literature is identified.

2.2 Competition and the public procurement market

In order to understand the risks of competition in public procurement markets, this section initially attempts to draw a comprehensive perception of the importance of the public procurement sector. After that, an overview of the main characteristics of this sector is conducted, including common types of public procurement routes, methods of public tendering procedures. The role of full competition in public procurement, as well as threats to this role, will be discussed in the final part of this section.

2.2.1 The importance of the public procurement sector in the economy

The procurement process is a documented process by which goods or services are delivered by outsourcing within a predetermined time frame (Bolton, 2006; Mark, 2012). Public procurement, therefore, may be defined as the process by which public sector departments acquire goods, services, and works from the private sector. This process encompasses a series of activities starting with needs assessment, through tender process management, to final payment (OECD, 2015b). Public procurement is considered to be one of the major economic activities accounting for a large share of

Gross Domestic Product worldwide (Onur et al., 2011). For instance, the European Commission indicates that around 14 per cent of their members' countries GDP is spent on public procurement (Public Procurement - European Commission, 2018). Given the size of this sector, public procurement policies can affect the overall structure and performance of market competition in the long term, particularly in the absence of a clear regulatory framework. As a result, public procurement processes must be effectively managed to protect competitive markets as well as maximize the benefits to society, thus securing the best value for public money (Fiorentino, 2006). On the other hand, effectively managed public procurement will avoid public funds squandering.

2.2.2 Prevalent procurement routes in public construction work

Adopting the most appropriate procurement route has been identified as a critical influence to project success (Bennett and Grice, 1990; Oyetunji and Anderson, 2006), thereby failure in this task might lead to project failure (Masterman, 2002). The development of the construction sector has prompted the introduction of various changes to the public procurement routes. These changes took place at different stages. The Design – Bid – Build route, which also known as the traditional procurement route, was commonly adopted to accomplish most projects in the first half of the 20th century (Dorsey, 2004). As time moved on, this traditional approach was considered less convenient for some projects, particularly with the emergence of other procurement routes (Alhazmi and McCaffer, 2000). In the mid-20th century, the private sector developed the Design and Build procurement route in order to reduce cost and time as well as to improve contractual relations (Adedokun et al., 2009). Subsequently, other procurement routes, such as construction management and management contracting, have been developed (Brook, 2017). The most prevalent procurement routes in public construction work will be discussed in detail, as follows.

To date, the most common procurement route in public construction work is the traditional procurement route or Design – Bid – Build (Oyegoke et al., 2009), in which

the design phase is completed by a selected initial technical team. Then, tender documents are prepared, including drawn designs and specifications, as well as a bill of quantities in most cases. Consequently, tenders are conducted according to the adopted tendering procedure. After selecting the winning bid, the construction contract is signed to start construction work. The sequential nature of this route of procurement may increase the time taken to implement the construction work. Yet, the traditional procurement route is the least risky approach due to the high level of certainty about design, cost, and duration – if executed precisely. Therefore, public procurement authorities with limited budgets commonly adopted this route (Brook, 2017).

The Design and Build route is another commonly adopted procurement route, in which one contractor is responsible for the project design and construction work, generally for a fixed-price lump sum. This procurement route trend has become widespread in recent years (RICS, 2010). It is considered faster than the traditional procurement route since construction work can begin before the design is completed (Brook, 2017). Furthermore, the risk is reduced in the Design and Build procurement route due to the impossibility of dividing responsibility for faults in accomplished work, which is designed and constructed by a single contractor. Nevertheless, the risk of losing control over design and specifications is increased in this route of procurement (Marzouk and Elmesteckawi, 2015).

In the Construction Management route of procurement, the public procurement authorities appoint a technical team to carry out the design task (Rahmani et al., 2017). Simultaneously, a construction manager will be engaged to supervise the construction process and coordinate with the design team in order to improve the buildability of the design (Brook, 2017). Unlike the Design and Build route, risk is not allocated to a single main contractor in the Construction Management procurement route. Construction work is divided into packages, and each package is carried out by a single contractor through direct contracts. Each contractor is appointed once the design of each package has been completed, which leads to an opportunity to complete the project faster

(Scheepbouwer and Humphries, 2011). However, the project cost, as well as time, is less certain in this route until all packages reach completion (Morledge and Smith, 2013).

The last widespread procurement route, discussed by Brook (2017), is the Management Contracting approach. In this approach, procurement authorities appoint a contractor to manage the entire construction procedure. The management contractor has direct contractual relations with all the contractors involved in the project, as opposed to the Construction Management route of procurement (Rahmani et al., 2017). Therefore, without carrying out any construction work, the management contractor is fully responsible for the procurement authorities for all construction work (Morledge and Smith, 2013). On the other hand, the design team is appointed by the procurement authorities, and as a result, the procurement authorities bear the design team's risk, which may cause delays in the implementation phase. Design drawings and specifications are delivered to all construction contractors by the management contractor. Similar to the Construction Management approach, each contractor starts his own construction work package once the package design is completed, without having to complete the entire project design Brook (2017). Consequently, the Management contracting route is adopted to fast-track projects. However, cost certainty is not accomplished until the completion of all packages (Rahmani et al., 2017).

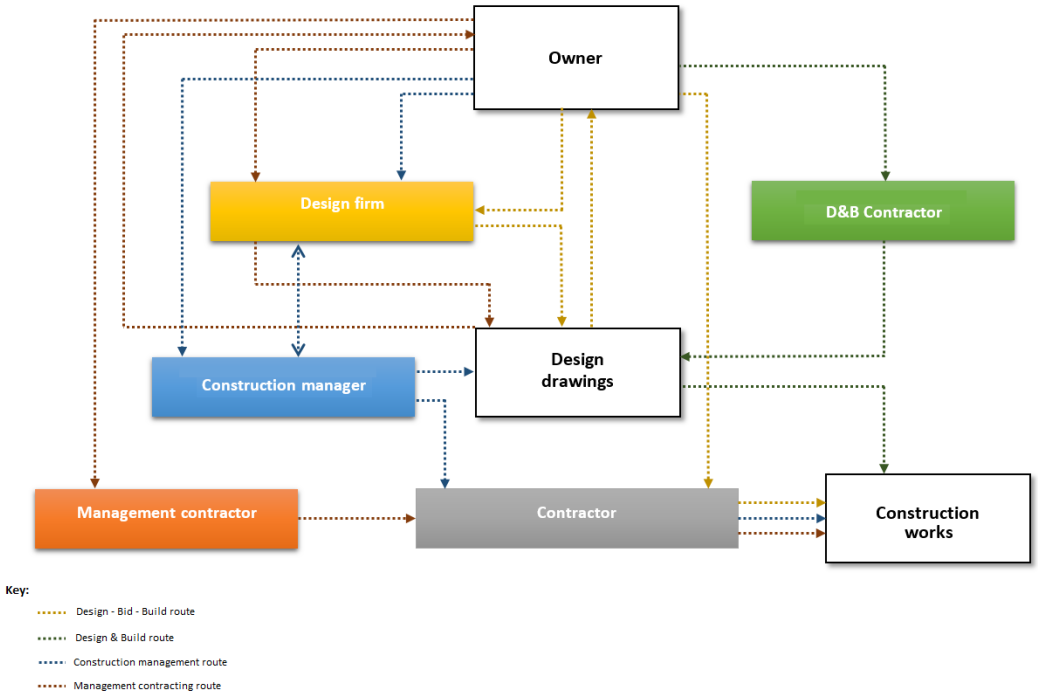


Figure 2-1 Contractual relations in the prevalent procurement routes

2.2.3 Prevalent tendering procedure methods in public construction work

Eriksson and Westerberg (2011) stated that the tendering procedure aims mainly to select a suitable contractor for an appropriate period with an acceptable offer in order to award a contract. The contractor selection process is one of the critical factors for project success (Birchall and Ramus, 2007; Adedokun et al., 2013). The public construction industry has been exercising tenders for hundreds of years (Burrows, 1981) in order to organize the pre-contract communication between architects and contractors (Adedokun et al., 2013). Since its origins, various developments have been introduced to tendering practice in this industry, such as the introduction of the bill of quantities (BOQ) at the beginning of the nineteenth century (Skitmore, 1989; Franks, 1998). Open tendering was the most common method used for public construction work contracts until the 1950s (Brook, 2017). This method was criticized by Simon Committee (1944), which in turn advised minimizing the use of this approach. Consequently,

selective, negotiated and serial tenders were gradually adopted via tools such as prequalification of contractors and the standing list (Holt et al., 1993).

The following is a summary of the most prevalent public tender procedure methods identified in the literature, as illustrated in Figure (2-2). Firstly, open tendering, which is usually initiated by publishing an advertisement to invite contractors to submit their bids to the client in local newspapers or by other technical means (Thwala and Mathonsi, 2012). To maximize competition and increase accountability, this method of tendering is preferred in public procurement competitions (Ngai et al., 2002; Chinyio, 2011). However, a number of purchasing authorities commonly impose restricted tendering or selective tendering in public construction by determining the financial value of the maximum contract value to which the company can bid, according to their financial and technical abilities. In selective tendering, interested contractors are invited to submit a qualification test to determine their suitability and capability to execute the contract, defined as prequalification (Huang, 2011; Brook, 2017). The majority of public construction work, such as roads contracts, are awarded via a selective tendering method (Holt et al., 1993).

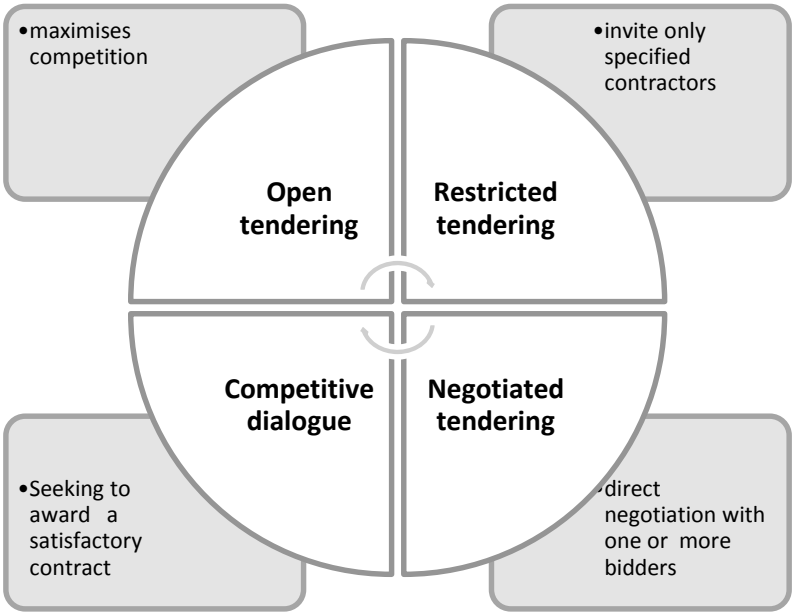


Figure 2-2 Prevalent tendering procedures methods in public construction work

Literature further indicates that two other common methods mainly applied in large and complex projects are negotiated tendering and competitive dialogue. In negotiated tendering, the procurement authority negotiates directly with a particular bidder or more (Brook, 2017). Accordingly, this method of tendering is subject to a more rigorous set of procedures and conditions (Morledge and Smith, 2013). In the competitive dialogue tendering method, a procurement authority discusses different options with bidders with a view to identifying the best solutions to meet its needs (Brook, 2017). Competitive dialogue is adopted in case of seeking to award a satisfactory contract that other tendering methods cannot offer (Morledge and Smith, 2013). With regards to low-value purchases, conversely, quotation-based purchasing, as well as direct purchasing, are widely practiced (Jones, 2012). In quotation-based purchasing, three or more suppliers are directly encouraged to submit their price quotations. While in direct purchasing, just one company is encouraged and then the price and contract terms are negotiated.

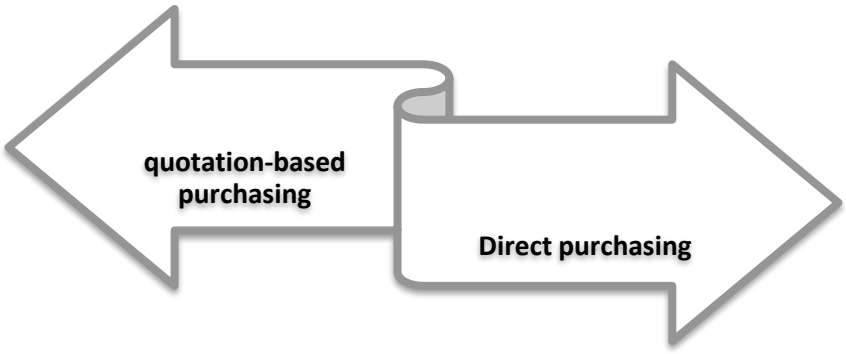


Figure 2-3 Prevalent tendering procedure methods for low-value purchases

2.2.4 Competition in public procurement

In order to enable government authorities to acquire goods, services, and works at lower prices and better quality, it is necessary to provide competitive and transparent markets. Achieving this goal requires a simplification of procedures, thus reducing related

administrative costs and upgrading the sector (Fiorentino, 2006). Therefore, competition is one of the key aims of national procurement systems to essentially achieve good performance (Schooner, 2002; Onur et al., 2011). Nevertheless, promotion of competition within the public procurement markets has not received the same attention as enhancing transparency within these markets (Anderson et al., 2011). Therefore, the competitive framework of these markets and the economic returns will be discussed below.

In light of the current economic difficulties faced by some developing countries, such as Saudi Arabia following the decline in oil prices, and given the large amount of expenditure on the public procurement sector, an efficient and functional public procurement mechanism is critical (Kelly, 2010). Consequently, good governance requires the efficiency of public procurement, which promotes value for money and fairness in contractors' or suppliers' treatment (Jones, 2012). To achieve these principles, several countries – particularly developing countries, such as Singapore and Malaysia – have introduced reforms in their public procurement systems as well as the imposition of fair competition laws (Jones, 2012). Such reforms that promote competitive markets will additionally produce economic advantages and thereby serve society as a whole (Munro, 2006). Ensuring "cost-effective purchase" tenders is critical to a country's macroeconomic dynamics (Onur et al., 2011). Furthermore, taxpayers benefit from the application of free competition principles by increasing pecuniary savings and improving the quality of public services (Kelly, 2010). For instance, pecuniary savings of between €5 billion to €25 billion were generated between 1993 and 2002 by enforcement of the Public Procurement Directives of the European Communities (Europe Economics, 2006).

A competitive market is defined by Galbraith (2017) as a market in which "a progressive technology" is produced, leading to price reduction and higher production. Badenhorst and Hugo (2001) defined competitive markets from the suppliers' point of view as markets that ensure a lack of barriers to business practices. Van Vuuren and Badenhorst-

Weiss (2003) further defined the competitive public procurement market as a market that has "simple, fast and efficient" tendering processes. Nevertheless, barriers to the entry of suppliers particularly lead public markets to fail economic models tests, and are thereby considered as uncompetitive (Caldwell et al, 2005).

2.2.5 Risks of competition in public procurement:

In 2013, the Saudi General Authority of Competition (SGAC) filed 5 million S.R. charges against rice suppliers who colluded with each other to share the market. Such collusive practices obstruct the competitive principles of a market (Bowen et al., 2007). Public procurement procedures, particularly for construction work, medical goods and services, are vulnerable to distortion by these uncompetitive practices. For instance, about (103) companies were fined by the UK Office of Fair Trading (OFT) in 2009 for their involvement in collusive bidding practices in the British construction industry. These detected illicit practices aimed to inflate winner bid prices through the use of the cover pricing approach as well as associated compensation payments. These infringements resulted in losses exceeding £200 million on both public and private sector construction projects across the United Kingdom. The considerable size of public procurement creates attractive opportunities for collusion, especially when combined with a regimented system (Kelly, 2010). This considerable size additionally complicates the monitoring and detection of anticompetitive behaviours. Furthermore, public procurement is characterized by highly-predictable processes due to regulatory requirements which in turn increase the potentiality of collusion. For example, the compulsory requirement of disclosing the identity of bidders in public procurement laws may facilitate colluder companies in monitoring any threat to their continuity (OECD, 2011).

Collusive bidding practices violate the main principles of free competition in any market. Broadly speaking, anticompetitive practices have a destructive impact on social services mainly provided by the public sector (Sharma, 2012). Moreover, such practices lead to raising prices above the competitive level (Asker, 2010). Furthermore, these impacts are

inconsistent with one of the pillars of public procurement: ensuring the efficiency of public money use. Therefore, and to reduce the risks of competition in public procurement, the OECD (2009) recommended public procurement authorities design tendering procedures in a way that minimizes collusion opportunities. In this regard, they stressed the importance of having enough competitors in the public procurement market to ensure reasonable competition. Empirically, Iimi (2006) reports that increasing the number of bidders reduced the contract price during his investigation into Japanese procurement tenders. In that instance, the participation of one more bidder within the bidding pool generated an average of 3.9 per cent reduction in the contract price. In an attempt to determine the ideal number of bids to take full advantage of competition, Estache and Limi (2008) concluded that the number ranged from three to seven bids depending on the type of projects involved. On the other hand, national competition laws and policies play a key role in the elimination of barriers to competition (Anderson et al., 2011). This uncompetitive practice will be discussed in detail next in this chapter, including definitions, motivation, impact, mechanisms, detection, and prevention methods.

2.3 Collusive bidding – (Bid-rigging)

In a broad sense, collusion, introduced as a market strategy by the economist Adam Smith (1776), is defined by the World Bank (2011) as 'an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party'. In public procurement tenders, however, collusive bidding refers to an illicit arrangement among a group of competitors called cartel members to coordinate their bidding conduct in order to manipulate a market and restrict competition, thus obtaining unfair profits (Dorée, 2004; Chotibhongs and Arditi, 2012). Such illicit arrangement, characterized mainly by secrecy and reducing competition, are the most critical contravention of the competition legislation (Heimler, 2012). The practice of collusion seriously corrodes the foundation of the competitive principle in the construction industry, which promotes rivalry and avoids monopolies (Zarkada-Fraser and Skitmore, 2000).

One form of collusive practices is bid-rigging, conducted by tenderers during project biddings in order to win contracts (Bowen et al., 2012). Despite the illegality of these agreements, collusive bidding is a pervasive issue in public procurement and occurs worldwide, in various forms (Ishii, 2014). Bid-rigging agreements generally fall into the following four categories: bid suppression, cover bidding, bid rotation, and market allocation (Hüschelrath, 2013). The Finnish Competition Authority (2012) defined these agreements as follows:

Bid suppression agreements: 'the agreements in which market competitors agree to abstain from bidding or withdraw their previously submitted bids in favour of another competitor'.

Cover bidding agreements: 'when market competitors agree in advance between them who should win a tender, and the others will submit artificially higher bids than in order to mislead the purchaser's impression of the market price'.

Bid rotation agreements: 'agreements in which competitors agree on an allocation of contracts equally for a specific period of time by taking turns being the winning tender'.

Market allocation agreement: 'when supposed competitors agree on an allocation of an appointed geographical area or a category of clients to a certain contractor'.

However, and based on Bowen et al.'s (2007) survey on ethical conducts within the South African construction industry, cover bidding agreements were ranked the most common form of bid-rigging.

Several researchers have studied the conduct of collusion in public procurement bids in various contexts. Five primary themes have been identified to categorize the research concerns of these studies, including motivation of bid-rigging, impacts of bid-rigging, bid-rigging mechanisms, bid-rigging detection methods, and bid-rigging prevention

strategies. Accordingly, these studies will be reviewed under these identified mainstreams in the following sub-sections**.**

2.3.1 Internal and External factors motivating collusive practice

Collusion is a human behaviour; therefore, the literature has linked the practice of collusion to behavioural motivations. Ni and Guan (2013) built behavioral motivation model of bid-rigging in order to investigate the reasons of bid-rigging in the Chinese context. They initially defined motivation as a group of internal and external factors driving an individual to be involved in particular activities, to move towards directed trends actively, and take actions to achieve a particular objective. Therefore, they classified needs as the internal factors and incentives as the external factors in stimulating motivation. They further revealed that motivation is reduced when activities deviate from the objective, thus the individual's desire to continue activities may decline or even cease entirely.

Internal factors (Needs)

A study of the existing literature in different contexts disclosed that members of the collusion ring mainly aim to raise their share of profits in the market (Bachrach et al., 2011). This increase will be accomplished by raising the probability of winning tenders (Ni and Guan, 2013; Hüschelrath, 2013), leading to a monopoly in the market (Heilmer, 2012). Another objective was added by Adnan et al. (2012): sustaining the stability of business flow. Yet, to achieve those aims, members of the collusion ring pay additional costs. Ni and Guan (2013) classified these costs into three categories: the cost of preparing normal bids, the cost of executing collusion (which is usually higher than the normal costs), and costs associated with collusion risk. They added that the reduction of these costs will relatively increase profits.

Ni and Guan (2013) considered bid-rigging psychologically as a kind of criminal group behaviour. They further demonstrated that criminal groups often have similar psychological characteristics. Firstly, these groups put invisible psychological pressure

on their members, thereby driving them to ignore their consciences and participate expected group behaviours. Additionally, transferring emotions amongst the members of such groups change the perceived nature of these acts, thus promoting bid-rigging. Lastly, the members of these groups share concerted outcomes and responsibilities, which in turn reduce the cost of feeling guilty. On the other hand, Dorée (2004) explained that national culture also plays a major role in this behaviour, in his investigation of collusion factors in the Netherlands construction projects market. He inferred that cultural characteristics such as corporatism, pragmatism, consensualism and risk aversion all contributed to the persistence of collusion practices in the Dutch construction industry. For example, similar risks perceived by a group of rivals lead them to work together to try to avoid those risks, thus adopting collusive bidding strategies that minimize risks to individual firms.

External factors (incentives)

Dorée (2004) further summarized opportunities that promote the practice of collusion, applying industrial organization theory. He pointed out that collusion is often associated with theories of oligopoly. Therefore, the shortage of market players means more potential collusive practices, as collusion agreements are more manageable; this link was confirmed in a different context, which is the Japanese public procurement, by Ishii (2014). While inspecting the stability of bid-rigging arrangements conceptually, Heimler (2012) demonstrated that the current procurement approach allows public clients to play a significant role in facilitating bid-rigging by creating competition on prices and shaping a predictable selection process. He added that another substantial factor is the stability of the market in terms of demand, as well as high barriers to enter or exit the market. Therefore, market instability complicates regulating collusion agreements. The lack of market players, as well as product homogeneity, play a vital role in cartelized industries (Heimler, 2012).

Furthermore, Dorée (2004) stated that the inadequacy of competition legislation and sanctions which do not damage the reputation of offenders is a critical factor inducing

bid-rigging rings to collude. This was confirmed by Ni and Guan (2013), who indicated that incomplete systems of tender law, supervision, and market credit led to an increase in opportunities for bid-rigging. On the contrary, Kelly (2010) has a different perspective in his study of tackling the risk of bid-rigging in the Irish public procurement. He presumed that the strictness of the public procurement procedures can facilitate communication among competitors, thereby facilitating collusion agreements. He linked this assumption to limitations in how to deal with potential collusion cases within the sector. Transparency in the public procurement process, which requires the disclosure of information such as the identity of bidders and their offers, allows competitors to uncover aberrations from collusion agreements and to improve coordination in future bids.

2.3.2 Bid-rigging mechanisms:

Heimler (2012) classifies bid-rigging practices as one of the most serious cartel arrangement, which is characterized by secrecy as well as its intent to significantly dampen competition among rivals. Nevertheless, he explains what distinguishes bid-rigging from other cartels. The first difference is that bid-rigging rings increase prices without modification to quantities, while other cartels may place an agreed scope on prices within their arrangement, but still compete on quantities or quality, or agree on price level for some customers, but compete on others. The other substantial difference is that bid-rigging arrangements appear to be more stable than other cartel agreements because the opportunities of breaking the rules of these arrangements are greatly reduced due to transparent procurement procedures, which make the task of monitoring cartel members unnecessary (Heimler, 2012). Therefore, Zimmerman and Connor (2005) concluded that bid-rigging arrangements generally last longer than other cartel agreements.

Consequently, bid-rigging arrangements may include a much greater number of members than in other cartel agreements (Heimler, 2012). Indeed, there is no definite evidence for the average number of conspirators in bid-rigging ring. The only data

available are about discovered cases, which, according to assumption, are unstable agreements (Heimler, 2012). However, Heimler (2012) underlined that the number of players is usually within the range of five to ten players. On the other hand, competitive bidders, especially in public construction work, determine their bids by calculating their own potential costs as well as considering the distribution of other firm's bids (Bajari and Ye, 2003).

With regards to coordination, Ishii (2014) pointed out that bid-rigging members which were disclosed by the Japanese Fair Trade Commission (JFTC) used one of the following approaches: either conspirators determine the reference price at the meeting and the nominated winner bids less than the reference price while others bid higher than the reference price, or the designated winner primarily selects his bid price and then reports this offer to others, who then bid accordingly. The predominant use of these two practices was confirmed by Dorée (2004) when he was investigating the collusion arrangements in the Dutch public construction work industry. He emphasized that conspirators met shortly before they submitted their bids, which is identical to what McMillan (1991) disclosed as the Dango price fixing mechanism in the Japanese construction industry. Lee and Hahn (2002) classified such agreements as complementary bids. According to Porter and Zona (2008), cartel members may bid high or refrain from bidding in anticipation of the opportunity to obtain higher profits, either contemporaneously, or in the future.

Bid-rigging arrangements require their members to communicate continuously to determine the most profitable course of action. Thereby, a government tenders allocation system should be identified through these communications (Heimler, 2012). Dorée (2004) explained that in the discovered cover bidding in the Dutch construction industry, the member who provides the highest compensation to other bid-rigging arrangement members wins the formal bidding procedures. While the rest of the members have to bid higher than that member, they receive the agreed compensation. McAfee and McMillan (1992) emphasized that achievement of efficient bid-rigging is

possible when compensation, as well as prior communications, are used together. However, there is no need for such compensation in the case of bids rotation agreements, because bid-rigging arrangement members share profits by rotating successful bids amongst themselves. Furthermore, bid-rigging arrangements systematically take into account market conditions and frequent changes in costs during their communications (Lee and Hahn, 2002).

On the other hand, Heimler (2012) suggested that market allocation practices are seemingly more stable than other bid-rigging practices. In interpreting this assumption, he indicated that in the case of market allocation practices, markets might be distributed among bid-rigging ring through just one informal meeting. Thus, a ring member, who the market has been allocated to, will not face competition in term of prices, service, quality, or even innovation. In addition, such market allocation practices will not force ring members to monitor others' pricing practices thoroughly, thus, eliminating pressure that may cause the breaking of any agreement. Accordingly, this stability of market allocation practices makes them more influential on competition than other bid-rigging arrangements (Heimler, 2012).

Dorée (2004) revealed in detail the two methods used by participants in bid-rigging in the Dutch construction to ensure the stability of these practices by rising barriers for new entries into the market. He emphasized that participants by adopting those two methods effectively restrict any new entry through collective actions and sanctions. In the first method, participants in bid ringing are forced to coordinate among themselves to bid lower to ensure that the arrangement will not be broken. After that, the participants distribute the costs of this loss among each other, thus none can enter the market unless by bidding less than the cost price. Consequently, new market entrants are forced to engage in such arrangements. The second method relies on dominating the supply of critical resources to restrict any new market entry. Therefore, new market entrants are either forced to pay a higher cost for resources or are prevented from

obtaining these resources, which in turn weakens the new market entrants' performance and their reliability.

In an attempt to understand the mechanisms applied, several empirical studies have investigated the differences among manifestations of bid-rigging arrangements' tenders and competitive tenders. These investigations include the residuals from estimated bids, bid cost structures, clustering of potential cartel bidders, and observable costs. With regard to bid residuals (vertical distance between a data point and the regression line), Bajari and Ye (2003) examined highway repair contracts data in the Midwest of the US in order to develop a statistical model for bid-rigging in procurement. They pointed out that the residuals from estimated bids are more correlated in bid-rigging arrangements than in competitive tendering. This finding is consistent with the outcome of Porter and Zona (1993) who develop a similar model in New York state highways contracts context. This further is recently confirmed by Chotibhongs and Arditi (2012a), when they developed a detection model for collusive bidding in more than 100 collected contracts.

Another stream of investigations involved a comparison of the cost structures. Initially, Porter and Zona (1993) elucidated that the bid cost structure of the competitive bidding environment is identical, contrary to collusive bidding. This observation is confirmed by Pesendorfer (2000) in the context of supply contracts in America, Bajari and Ye (2003) in the context of construction works contracts in the Midwest of America, Arai et al. (2011) in the context of Japanese Public procurement, and Chotibhongs and Arditi (2012a) in the context of the major construction works contracts in America.

On the other hand, the differences in observable costs have been investigated by Porter and Zona (1993) and Arai et al. (2011). These observable costs included the distance to the construction site and the construction materials storage site, and the actual bids themselves. The results of these studies have demonstrated that the observable costs significantly influence the bid value of rivals in a competitive bidding environment, therefore a bidder with better observable cost conditions would bid a lower bid price.

However, this status did not apply to collusive bidding cases. Meanwhile, Chotibhongs and Arditi (2012) confirmed that the bid clustering of potentially collusive bidding is denser than that of the competitive bidding environment. They interpreted this as evidence that the majority of bid-rigging arrangement members in a cover bidding agreement bid slightly higher than the designated winner in order to regulate and control the bidding environment.

In a different empirical study, Ishii (2014) investigated the 'roundness' level of bids, or what was defined as the number of zeros at the end of the bid. His findings concluded that collusive tendering recorded a higher rate of roundness than competitive tendering. Moreover, even within collusive tendering bids, the lowest bids recorded a higher rate of roundness than higher bids. Nevertheless, in contrast to his assumption, both collusive and competitive bids did not significantly record any difference in roundness within detected instances of collusive tendering. He postulated that barriers to non-members of bid-rigging arrangements weakened their motivation to participate in bidding effectively, thus prompting them to choose an arbitrary high, round number.

To sum up, the detected bid-rigging arrangements mechanisms were characterised by their simplicity, which led to the failure of these arrangements by introducing inefficiency and raising the probability of detection. On the contrary, advanced and complicated bid-rigging mechanisms are harder to track (Arai et al., 2011). Furthermore, sophisticated bid-rigging practices mechanisms must promote revealing private information between all members of the cartel, as well as encouraging them to bid in accordance with the agreement (Arai et al., 2011).

2.3.3 Impacts of bid-rigging:

Generally, bid-rigging practices do not produce any kind of advantages for society (Hüschelrath, 2013). On the contrary, bid-rigging agreements impose economically significant damages on the market (Asker, 2010). The literature revealed those impacts on three levels: a direct impact on the market, an impact on the contracting authority,

and an impact on the other competitors. Additionally, the amount of damage caused is determined by three critical factors: the frequency of the occurrence of these agreements, by how much they overcharge, and their duration (Hüschelrath, 2013).

Successful collusive bidding arrangements are expected to cause an increase in the average market prices, up to the monopoly level (Asker, 2010; Hüschelrath, 2013). Additionally, bid-rigging ring member profits will be increased as well, above the normal competitive level (Bajari and Summers, 2002). This growth contributes to reduce the negative impact of those agreements on bid-rigging members (Asker, 2010). Indeed, the significant economic damages of bid-rigging agreements are not tied to an increase in the market price alone (Heimler, 2012). Furthermore, bid-rigging agreements introduced inefficiency into the market (Asker, 2010). Such illicit arrangements create a non-competitive bidding environment (Zarkada-Fraser and Skitmore, 1998). On the other hand, Zarkada-Fraser (2000) indicated that damaging the Austrailian construction sector reputation through collusion behaviour has led to a reduction of public confidence.

Estimates of price increase rate

Estimates of price increases in public procurement that faced collusive agreements are various. One of the oldest of these estimates is the study of the Froeb et al. (1993) which was based on the data from an investigation of the supply of frozen seafood to the US Department of Defence. Their study pointed out that detected cases of bid-rigging agreements had increased the market price by 23.1 per cent Between 1986 and 1988. Additionally, Anderson and Kovacic (2009) stated that bid-rigging agreements add 20 to 30 per cent to the cost of public contracts. The Office of Fair Trading in the UK (2009) further confirmed a 30 per cent price reduction after “OFT” action was taken against previous bid-rigging agreements. Other contexts estimated different overcharges of the total expenditures in this market, namely 15.5 per cent in Lee and Hahn’s (2002) study in the Korean context and 8.8 per cent in Dorée’s (2004) study in the Dutch context.

The affected parties

There are two main potential victims of such market damages caused by bid-rigging agreements among bidders in public works tendering, which are other competitors that do bid individually and don't choose to be in a bid-rigging agreement, and the contracting authority, who is forced to purchase at the rigged prices (Maci, 2012). Because of the inefficient allocations introduced by collusive tendering, other competitors might not be awarded a public contract by the contracting authorities (Asker, 2010; Maci, 2012), thus creating a non-competitive bidding environment (Zarkada-Fraser and Skitmore, 1998). Consequently, the number of bidders will be decreased, resulting in a poor project delivery (Oladinrin and Ho, 2014; Zarkada- Fraser and Skitmore, 2000).

On the other hand, bid-rigging agreements directly add to the price paid by contracting authorities for goods and services (Hochschlarth, 2013). Since public tenders have the largest share of previously discovered cases of collusive tendering, the state and the taxpayers thereby incur an equivalent loss from bid-rigging agreements (Maci, 2012). Additionally, curbing the natural competition among rival firms in the market leads to, in addition to a reduction in the number of competitors, a reduction in the motivation for innovating or superiority in production, which negatively affects the welfare of the taxpayers in the long term (Heimler, 2012).

The recurrence of arrangements, overcharges, and persistence are the main determinants of the level of harm bid-rigging practice inflict (Hüschelrath, 2013). The frequency of occurrence of bid-rigging arrangements is mostly difficult to estimate due to the lack of complete knowledge of the actual number of these arrangements. However, Froeb et al. (1993) and Connor (2010) reached totally different conclusion when they calculated the total percentage criminal collusion cartel cases; 80 per cent and 20 per cent, respectively. Thereby, the number of detected cases of bid-rigging is undoubtedly an imperfect measure of the frequency of occurrence of such arrangements (Hüschelrath, 2013). Regarding the persistence of bid-rigging

arrangements, Zimmerman and Connor (2005) revealed that on average these arrangements persist longer than other cartels. This is due to the nature of public procurement, which necessitates the disclosure of the winning bid, thus complicating cheating amongst the conspirators. Additionally, the small profit margins of such markets creates smaller cartel groups.

2.3.4 Detection of bid-rigging:

Cartels and bid-rigging arrangements issues are deemed to be one of the most critical issues encountered by the anti-competition authorities, globally. These authorities are still making various efforts to improve their capability to detect these arrangements, yet, these efforts have faced various difficulties (Heimler, 2012). One such problem is that is almost impossible to define the extent of such behaviours (Arai et al., 2011). Additionally, collusive behaviour, as identified previously, has various of forms. Together, these factors hinder the establishment of a unified and comprehensive detection model to detect all forms of bid-rigging arrangements (Chotibhongs and Arditi, 2012b). Nevertheless, several studies have developed some detection methods that can be adopted in this regard. In this section, these studies will be discussed in detail.

In contrast to other cartels, bid-rigging arrangement mechanisms in public procurement, such as bid rotation agreements, were generally recognized to leave some clues (Heimler, 2012). Furthermore, one of the most important characteristics of the public construction work industry is the common rules that used in most public administrations to regulate public tenders' procedures (Chotibhongs and Arditi, 2012b). Thus, Heimler (2012) asserted that well-trained public procurement officers, when substantial effort been made throughout collecting required data, can find evidence of the bid-rigging arrangements existence. That analysis is limited to data related to the demand side only, since cartels influencing the supply side are fixed (Heimler, 2012). Consequently, facilitating the development of a model reveals potential bid-rigging arrangements in the public construction work industry (Chotibhongs and Arditi, 2012b).

Heimler (2012) emphasized that public officials responsible for public procurement in Italy do not have the right incentives to focus their efforts on detecting those arrangements. In his interpretation, he pointed out that the department that discloses or helps detect those arrangements does not retain the money being recovered. This recovered money is returned to the central administration, which in turn redistributes it to all department budgets. Therefore, public purchasers tend to disregard the detection of bid-rigging arrangements. Instead, they appreciated the interest in their ability to set up and run bidding processes, as well as speeding up the delivery of the goods and services they purchased. Moreover, public purchasers are rarely in a position to reveal the existence of bid-rigging arrangements. As a result, bid-rigging arrangements can only be discovered by the antitrust authority's enforcement. Despite this, Heimler (2012) suggested competition authorities establish a particular channel of communication for public purchasers in order to report any suspected cases.

Since arrangements of bid-rigging are illegal in most countries, they are overwhelmingly subject to confidentiality, which thereby requires the consolidation of allegations of potential bid-rigging with legal evidence of compromised communications between bidders prior to the submission deadline of tenders (Chotibhongs and Arditi, 2012ab).

Hüschelrath (2010) stated that there are various methods, both proactive and reactive, that can be chosen by competition authorities to detect collusive bidding practices. In order to differentiate between them, the International Competition Network (2010) defined reactive methods as methods based on an external act conducted prior to the awareness of the antitrust authority of the issue, while proactive methods are launched from within the authority. The most prominent reactive method revealed by the literature is the compliance of competitors, customers, and employees, in addition to leniency applications and whistleblowing. On the other hand, significant examples of proactive methods include an elaborate analysis of previous cartel cases, industry monitoring, cooperation between antitrust authorities, and finally, an application of Economics approaches, such as market screening tools.

Heimler (2012) considers leniency programmes, which were introduced by some jurisdictions, an important step in enhancing the enforcement of competition laws in the field of cartel detection. For instance, the European Commission indicated that such programmes contributed to disclose six bid-rigging cases in 2010. Those leniency programmes stimulate incentives for cartel members to cooperate with antitrust authorities, which in turn provides them with leniency in sanctions. Thereby, this cooperation of cartel members reveals direct legal evidence of poor conduct that other cartel participants want to hide (Brenner, 2009). Leniency programmes have been adopted by all OECD countries and have been proved successful in detecting many cartel agreements. Brenner (2009) also confirmed that the legally obtained inside evidence gleaned from this cooperation is obtained faster and at a minimal direct cost compared to other investigation methods. The collaborator parties are promised reduced fines or even complete amnesty by antitrust authorities (Helmer, 2012). The European Commission reduced more than 6 billion euros fines between 1996 and 2003.

Nevertheless, Heimler (2012) denied that leniency programmes have effectively contributed to detecting bid-rigging arrangements in public procurement bidding, despite how widespread these arrangements are in this sector. In his explanation, he stressed that the stability of bid-rigging arrangements in the public procurement sector, the small number of participating members, in addition to the local nature of these arrangements restricted the success of leniency programs. He also added that in some countries, such as Italy, collusion arrangements are a criminal offense, thus all members, including collaborators, are subject to criminal investigation. Therefore, he suggested that detecting bid-rigging arrangements involves the use of other tools as well as the cooperation of public procurement agencies.

Harrington (2006) defined a market screening process as a process by which the sectors that may be under the impact of a cartel is determined. Indicators generated from this process may lead to further investigation procedures to detect existing cases of collusion arrangements. Predominantly, the market screening tool is utilized in two sequential

steps. In the first, a structural assessment is applied to identify markets with characteristics that raise suspicions of the presence of cartel. This is followed by an in-depth behavioural assessment of those suspected markets in order to find proof of the presence of collusion arrangements (Abrantes-Metz, 2014; Hüschelrath, 2013). The screening processes were further categorized by Abrantes-Metz and Bajari (2009) according to the data as: screening based on tendering data to investigate correlation among bidders' prices, screening based on price and cost information to investigate the reflection of cost on bid prices, screening based on market shares to investigate share stability, or screening based on Benford's law to investigate the frequency distribution of digits.

Although market screening procedures require data, namely all submitted bids and the identity of those who bid across a wide set of tenders, which is difficult to collect, Hüschelrath (2013) demonstrated that utilizing screening processes is an appropriate tool for identifying bid-rigging arrangements, particularly. He attributed this suitability to the clarity of public tender markets, firstly, as well as the detailed data being consistently generated from public tender procedures, thereby facilitating the application of further behavioural assessments. Yet, on the other hand, Hüschelrath (2013) also pointed out that government procurement authorities are responsible for the tender procedure, thus in a position to collect respective bidding information, which might lead them to restrict antitrust authorities wanting to apply screening tools. Therefore, he advised antitrust authorities to adopt a two-part strategy to eliminate this restriction. His strategy includes providing the public procurement authorities officials with training sessions on how to detect suspicious bidding behaviour as well as requesting public procurement authorities to submit their tenders data.

The literature on behavioural screening tool has expanded remarkably over the last decade, wherein this tool has been suggested mostly to identify bid-rigging arrangements. To design behavioural screening tools, Abrantes-Metz (2014) stressed the need to develop knowledge to distinguish the difference between collusive and

competitive bids, as well as the impact of collusion on market outcomes. As a result, researchers are able to develop statistical methods to investigate changes in market outcomes, and the related literature is currently focusing on the identification of price irregularities (Chotibhongs and Arditi, 2012). The most salient of this literature will be discussed by classifying them into two categories below

Suspicious behavioural patterns

Recognizing unusual behaviour patterns in a competitive bidding market, which in turn might demonstrate collusive bidding, is indispensable in providing economic evidence of bid-rigging arrangements (Harrington, 2006). Many international organizations have identified these suspicious patterns. For instance, The US Department of Justice indicated potential collusive bidding behaviour, including: the same bidder winning many bids, the same group of bidders regularly submitting bids, bidders within a group taking turns to be the lowest bidder, bids being much higher than the engineer's estimate or previous bids by the same bidders, fewer bidders bidding compared to normal, bidders bidding significantly higher on some bids than on other bids with no reasonable cost differences explaining the price rise, bidders submitting higher bids to local owners than to distant owners, the bidder who is awarded the bid subcontracts work to competitors that submitted unsuccessful bids on the same project, bid prices dropping whenever a new or infrequent bidder submits a bid, and bidders submitting identical bids.

The Finnish Competition Authority further subdivided such unusual behavioural patterns into four categories, which are the bidding process, bidding documents, bidding prices, and bidder behaviour. Those four categories have also been adopted by the OECD in their guidelines for combatting bid-rigging in public procurement. Potential bidding process patterns include: the same firm mostly being the lowest bidder, rivals winning tenders in rotation, an apparent geographic allocation of the lowest bidder, some bidders unexpectedly withdrawing from a tender or bidding differently from previous bids in other public tenders, the number of participants bidding decreasing significantly,

failure to bid from regular bidders who are expected though they continue to bid for other tenders, specific companies always submit bids but never win, and the tender winner frequently subcontracts work to unsuccessful bidders.

Additionally, with regards to the analysis of bidding documents, both organisations indicated general similarities between competitors' bids, such as identical miscalculations, wording, estimates of certain items, or even spelling errors. Moreover, they added signs such as bids referring to each other in a way that suggests illegal coordination, numerous last-minute adjustments from different companies, and bids where details are insufficient. Furthermore, collusive markers in bidding price comparisons include sudden collective price rises compared to previous tenders without an apparent explication such as cost increases, identical price offers, the presence of a considerable distinction between a winning price and other submitted bids, local contractors bidding higher for local tenders than for distant tenders, and a drop in the level of bid prices after the entry of a new competitor. Lastly, bidder behaviour, including private meetings of competitors before the tender deadline, a bidder submitting both its own bid and another competitor's bid, a submission of several bids at the same time or by the same person, and different bidders escalating similar inquiries to the procurement agency, can be used to compile evidence of bid-rigging arrangements.

Harrington (2006) listed some collusive bidding markers based on repeated game model and evidence, such as a sudden rise in bid prices with low variation, a number of notable price rises following an important drop in prices, asynchronous rise in price with the reduction of imports, increased positive correlation between the pricing of various bidders, and low price variance between bidders. Nevertheless, the author emphasized that these signs and patterns are not conclusive evidence of collusive bidding. Instead, they serve to screen industries to determine whether they are worthy of more intense investigation.

Empirical studies based on quantitative techniques

A number of quantitative techniques have been developed and applied through various empirical studies to create additional evidence of a bid-rigging arrangement, supported by various suspicious behaviour patterns previously identified. The majority of these empirical studies are concentrated around suspicious patterns related to bid prices. In this regard, Harrington (2005) noted that irregular patterns can be identified in competitive environments by monitoring the inconsistency of bidding behaviour with competition, and any structural break in this behaviour. Mostly, the variation in bid prices, cost structure, residual costs, the relationship between bid prices, as well as changes in the average bid prices, were often analysed by those empirical studies.

Porter and Zona (1993) investigated the differences in the cost structures between known cartel bidders and non-cartel bidder groups in highway-paving construction work contracts in New York. The authors pointed out a correlation between the cost and the lowest bid price of a conspirator, which was not found in other higher bids of other bid-rigging arrangement members. Pesendorfer (2000) investigated differences in cost structures in Florida and Texas school milk contracts during the 1980s. His main findings include that asymmetry in bids increases as cartel members succeed in selecting the lowest cost member. Additionally, the average cost to arrangement members is less than for others. On the other hand, distribution of cartel member bids is stochastically subject to the distribution of non-member bids. Finally, the determinants of collusion arrangement member bids diverge from those of non-members.

Regarding competition and collusion comparison, Bajari and Summers (2002), based on economic theory, demonstrated that competitive bids should not be correlated and should reflect costs. Furthermore, Porter and Zona (1993) demonstrated that bids of the losing firms who are members of bid-rigging arrangements differ from those of losing firms who are not members of such arrangements. Chotibhongs and Arditi (2012b) developed a detection model for non-competitive bidding behaviour, which was based on cost structure stability tests as well as residual tests. However, they indicated a

limitation of the proposed model as it cannot be utilized to detect collusive bidding at the time of occurrence. Instead, and in the case of accessed detailed historical bidding information, the model facilitates detection of suspected collusive bidding in the past. Hüschelrath (2013) explained that two statistical tests were applied by the Swiss Competition Commission in the case of a Ticino region bidding cartel. The commission noted a large growth in the price index, in addition to a significant reduction in the price volatility analysis.

On the other hand, with respect to changes in average bid prices, Abrantes-Metz et al. (2006) investigated price changes in a collusive bidding situation among seafood processors supplying United States military installations. The authors observed a slight decrease in prices after the cartel's collapse. Further, in terms of bid price variation, they observed a major increase in bid variance, suggesting that the coefficient of variation was the main measure to be considered in developing a screening test for collusive bidding arrangements. Therefore, they deemed the large ratio between the mean and the variance as a critical sign of collusive bidding. This was confirmed by Blanckenburg et al. (2012) when they tested some statistical tools on several detected price-fixing cartels. Those tests measured the different periods of time a single market or geographic area was active with a single product. However, Hüschelrath and Veith (2014) failed to draw the same conclusion when they applied sequential t-tests to test for significant changes in the mean of prices in the German cement cartel.

Nevertheless, and despite the development of proposed screening tools in empirical studies to detect collusive bidding, the applicability of these tools is limited due to their lack of certainty, reliability, and validity (Chotibhongs and Arditi, 2012a). Therefore, Arai et al. (2011) emphasized that, in the long term, the progress in collusive bidding detection method accuracy would prevent bid-rigging arrangements.

2.3.5 Bid-rigging prevention:

When using an integrated system of detection, using the techniques mentioned in the previous section, prevention measures are an essential factor in the prevention of collusion conduct in tenders (Hüschelrath, 2013). The literature has revealed many of these preventive measures. As a general strategy, Ni and Guan (2013) deemed that reducing the impetus of collusive bidding motivation was a key consideration in the effective prevention of bid-rigging arrangements. To achieve this objective, the researchers identified three major schemes. The first states that the income of bid-rigging arrangements should be reduced simultaneously with an increase in the costs of bid-rigging arrangements. This strategy will be achieved through reducing the chances of success of such arrangements, raising the possibility of investigation, and raising the risk of damage through punishment. The second scheme recommends reducing the psychological power of group dynamics. This strategy will be achieved through minimizing opportunities for communication among bid-rigging conspirators and maximizing the number of bidders. The last scheme requires diminishing the opportunity for bid-rigging. This strategy will be achieved through promoting each of the following systems: the legal system, the supervision system, and the market credit system.

Consistent with Ni and Guan (2013), Hüschelrath (2013) stated that one of the most influential reasons for rational decision-makers to stop participating in such arrangements is antitrust authorities effectively prosecuting the perpetrators of collusive bidding. Furthermore, he claimed that effective prosecution requires both promoting detection success and imposing deterrent penalties for firms involved in such arrangements. These penalties shall be in the form of pecuniary fines for both individuals and firms. In addition, such penalties may result in exclusion from public tenders for a certain period. In extreme cases stronger penalties could be considered, such as considering breaches of protocol criminal offenses and punishing these with fines or imprisonment.

A more accurate estimation of deterrent penalties would more effectively deter firms from participating in collusive bidding (Lee and Hahn, 2002). Therefore, Dorée (2004) believes that the risk of fines and damage to a firm's reputation are efficient sanctions in such cases. Some researchers even suggested that conspirators should be blacklisted and therefore excluded from future tenders (Sohail and Cavill, 2008; Gupta, 2001). The rigorous enforcement of an effective competition law and the sanctions it includes will provide discipline, which in turn enhances market competitiveness in the long term (Heimler, 2012).

Accompanied by effective prosecution, some researchers recommended strategies in the design and implementation of public procurement procedures to make them less prone to collusion. Likewise, several international organizations, as well as some competition authorities, such The Organisation for Economic Co-operation and Development (OECD), have developed recommendation frameworks aimed at designing public procurement procedures to reduce the risk of bid-rigging efficiently. These efforts have mostly been aimed at promoting awareness of the destructive consequences of such practices and therefore complicating the chances of successful implementation of collusive tendering. For instance, Hüschelrath (2013) outlined the Canadian Competition Bureau's strategies to protect the integrity of public procurement. These strategies include maximising the number of bidders, constant screening of the competitors participating, a mandatory exposure of subcontractor pacts, deep scanning of bids in cases of suspicious bidding, comparing the cost levels of winning bids in a certain region with the cost levels in other regions, and steady training of public crew participating in tender procedures.

In another contribution, Heimler (2012) clarified several essential procedural and legal steps to reduce the chances of success of collusive bidding practices. Initially, he recommended the centrality of public procurement, which in turn increases the chances of detecting such collusive biddings practices. In addition, consistent with what Froeb and McAfee (1988) recommended in favouring small firms in public tenders against large

firms, they added that public authorities should robustly prevent small horizontal conglomerates forming among those small firms. Furthermore, the author recommended strengthening legal sanctions, which include fines and reputation damage. Lastly, he added compliance with competition laws. These recommendations were consistent with results in other contexts such as Dorée (2004), who further emphasized the necessity of a code of conduct. He also called for a balance of competition and cooperation in public tenders.

Competition authorities are not alone in having responsibility for protecting public procurement from such illegal practices. Hüschelrath (2013) noted that other stakeholders play a similar role in these efforts, but internally rather than externally. Firms can apply both compliance policy and schemes to detect and prevent suspicious behaviours internally. Moreover, they might impose fines on employees detected as being complicit in collusion. In addition, they can improve their organizational structure, making the implementation of such arrangements much more complicated.

Supplementary recommendations have been put forward in the literature in order to reduce the risk of collusive bidding practices. Sohail and Cavill (2008) alluded the necessity for raising awareness of corrupt outcomes in construction as a recommendation to prevent collusion between contractors. In many of its reports, the OECD has further referred to the promoting of transparency as a strategy to reduce corruption and increase market player participation in government tenders. In this regard, Ayodele (2011) emphasized the importance of developing a management system for procurement and transparency. Moreover, Dorée (2004) advised government authorities to encourage emerging firms to compete, while Haberbush (2000) recommended that bidders should be required to disclose programs for compliance as part of bidding requirements. In a different recommendation, Choti Bongs and Arditi (2012a) suggested government authorities should improve the accuracy, consistency and reliability of the engineer's cost estimation.

However, few empirical studies measured the effectiveness of collusion prevention strategies. In one of these exceptional empirical studies, Oke et al. (2017) distributed questionnaires, using a 5-point Likert scale, to construction professionals in South Africa in order to investigate their assessment of the efficiency of collusion preventive measures contained in the previous literature. The researcher disclosed that among these prevention measures, banning detected bid riggers from participation in public tenders, screening suspicious practices, transparent public procurement procedures, a whistleblowing system, reviewing the regulative framework, commitment to payment periods, fraud risk management, downgrading contractors' class, and ethical conduct codes for professionals rated at the top of the list for preventing collusion. The researcher concluded, furthermore, that both training and raising awareness are essential in detecting collusion.

2.4 Definition of knowledge gap

Previously in this chapter, the relevant literature on the risks of non-competitive practices in the public procurement sector has been reviewed. Bid-rigging arrangements have thus been identified as one of the most threatened practices of competitive markets. Although most of the literature surrounding bid-rigging arrangements revolve around implementation mechanisms and methods of detection, the literature review clearly revealed several measures that have been proposed to address the risk of collusion in public procurement bids. Most of these measures are designed to diminish the chances of successful collusive bidding arrangements. However, it was discovered that there is a scarcity of research on enforcement tools to activate these measures, their appropriateness in different contexts, and to measure their effectiveness in tackling such practices. Moreover, except Oke et al.'s (2017) study, there is lack of empirical approaches in the field of collusion prevention in public procurement. In the next chapter, the conceptual framework of this research will be developed based on relevant schools of thought.

Chapter 3: Development of the research conceptual framework

3.1 Introduction

The preceding chapter demonstrated the gap of knowledge. Accordingly, this chapter will discuss theoretically the proposed conceptual framework which fill this gap. The key relevant schools of thought that support building this research argument will be reviewed primarily. This review will cover oligopoly and game theory principles, collusion and human behaviour theories, human behaviours and ethics theories, compliance theories, and institutionalism. The sequence of these schools of thought have contributed to construct the conceptual framework of this research, which will be presented at the end of this chapter.

3.2 Schools of thought

In this section, the schools of thought which are found to be related to these illicit practices and are able to create solutions will be reviewed. How these schools of thought can be linked to each other sequentially will be considered. Initially, oligopoly theory, which is closely related to the main outcome of the previous chapter, is investigated. Simultaneously, game theory principles are reviewed because of their application to the area of oligopoly. This review leads to the recommendation to increase the number of market players. Nevertheless, changing the behaviour of contractors needs a review of some schools of thought which are related to different human behaviours, particularly collusion behaviour. Accordingly, related schools of thought which demonstrate human behaviours encompass collusion and human behaviour theories, human behaviours and ethics theories, and compliance theories are reviewed. Then Nudge theory, which is a new concept in seeking compliance, is investigated. Finally, institutionalism is introduced as part of an effort to propose a development framework that enhances the desire of contractors to participate in future tenders.

3.2.1 Oligopoly and game theory principles

Oligopoly is identified as competition among only a few market players. Puu (2010) emphasises that oligopoly is conceptually a market situation which is better than monopoly, yet it does not reach a perfect competition level. He, nevertheless, states that oligopoly is more complicated to examine and explore than either monopoly or full competition. Thus, oligopoly call for different tools of analysis. Since the purpose is to explore the interdependence of firms (Dastidar, 2017; Dixon, 2001), the theory of oligopoly has been linked with theories of industrial organisation. The industrial organisation approach mainly examines the structure of firms and markets. Industrial organisation, therefore, defines the determinants of competition and monopoly in the market (Stigler, 1987; Zingales, 2008). Similarly to monopolists, oligopolists aim to equate marginal revenue with marginal cost. However, due to oligopolists' significant influence on market price, marginal revenues depend on the supply of all the competitors. Consequently, competitors must anticipate others' reactions on each of their own possible moves in order to make decisions. Cournot (1838) introduced the first analysis of oligopoly theory.

Game theory outcomes, such as Shubik's mixed strategies and the use of subgame perfection for model credibility, have predominantly been applied in the area of oligopoly (Dixon, 2001). Game theory, based on the rationality and intelligence of other players' decisions in a market, established mathematical strategic equilibrium in order to surmise what others' strategic decision-making is (Moorthy, 1985). Indeed, the identified equilibriums allow for modelling situations of conflict and for anticipating market players' behaviour (Manshaei et al., 2013). Game theory principles are widely applied in limited resource markets with a few players. Specifically, non-cooperative game theory is the branch of the theory that explores oligopolistic markets (Friedman, 1977). In contrast, cooperative game theory examines the behaviour of colluding firms (Moorthy, 1985).

Using game theory principles, oligopolies are studied basically from an equilibrium perspective, most commonly Nash equilibrium, which applies in a one-off game with a perfect information case. However, equilibrium concept was refined for the case of repeated games by Selten (1965), who introduced subgame perfection. There are two main models of oligopolistic competition that use game theory principles, Cournot's (1838) and Bertrand's (1883). Both equilibriums rely mostly on predictions of firms' behaviour. On the one hand, in Cournot's model, the firms compete on quantities, while in Bertrand's model, the firms compete on price (Dastidar, 2017). Consequently, these models generate different predictions. Bertrand equilibrium expects each firm's pricing to be at marginal cost, while Cournot equilibrium expects each firm's pricing to be above marginal cost (Friedman, 1977). The theory of repeated games, which was initially introduced by Friedman (1971) and Rubinstein (1979), provides an appropriate tool to analyse the case of collusion arrangements (Dastidar, 2017).

Nonetheless, the validity of these predictions resulting from those equilibriums in auctions is disputed. In particular, many recent experimental studies have demonstrated that Nash equilibrium strategy cannot be applied to bidding behaviour (Lorentziadis, 2016). However, Mankiw (2014) asserted that maximising market players, and thus decreasing the market share, will reduce the power of strategic interactions analysis and, consequently, enhance competitiveness. This is a confirmation of Shapiro's (1989) recommendation. He emphasised that the increase in the number of market firms complicates the maintenance of the stability of collusion arrangements in standard oligopoly models. Thus, firms prefer not to engage in collusion arrangements. Yano (2009) added that the importance of market quality increases by improving three essential factors, which are the quality of competition, the quality of information and the quality of products.

3.2.2 Collusion and human behaviour theories

Zarkada-Fraser and Skitmore (2000) linked collusive tendering behaviour to moral content. Indeed, corruption is defined as a behaviour that violates formal ethics rather than the rule of law (Park and Blenkinsopp, 2011). Therefore, Gebel (2012) asserted that corrupt practices should be addressed on the behavioural factors level as well as on the technical factors level. Generally, human behaviour, whether ethical or unethical, is a result of certain causes and is motivated by incentives such as financial profits (Oyewobi et al., 2011). Interestingly, Stansbury (2005) emphasised that the majority of corrupt contractors feel compelled to engage in this behaviour rather than desiring to do so. Furthermore, motivations, laws, regulations and individual values influence intention reduction (Takim et al., 2013).

In this regard, Rabl and Kühlmann (2008), in a distinctive contribution, developed a model of corrupt action based on the model of effortful decision-making and enactment by Bagozzi et al. (2003). In testing their model, they asserted that the intention to act corruptly is a very strong indicator of corrupt practice. This intention is influenced by some factors, mainly, the attitude toward corrupt action, the subjective norms and perceived behavioural control. The intention is based on a thoughtful process, in which the desirability and feasibility of achieving the goal are investigated. The results achieved by Rabl and Kühlmann (2008) show that the availability of opportunities leads to corrupt actions, which resulted from the interplay between motivational, volitional and cognitive components within a situational context.

Therefore, prevention measures may include promoting each ethical environment and integrity, as well as the effective application of rewards and sanctions (Rabl and Kühlmann, 2008). Furthermore, Nordin et al, (2013) investigated the correlations between the components of Rabl and Kühlmann's model of corrupt action. Their findings revealed that the desire to achieve a private or professional goal through corrupt actions, subjective norms, perceived behavioural control and attitude are positively related to corrupt acts. On the other hand, they found that intention to

achieve a private or professional goal through a corrupt action did not correlate with corrupt acts.

The Auditing Standards Board of the American Institute of Certified Public Accountants has interpreted the reasons for committing fraud through Cressey's (1973) fraud triangle theory. The three dimensions of the triangle are a perceived financial pressure, a rationalisation process to justify behaviour and the available opportunities (Albrecht et al., 2008). Firstly, pressure is defined as the need for a person to avail of the advantages gained through fraud. Rationalisation, on the other hand, is defined as the process to justify a behaviour for logical reasons, which allows offenders to convince themselves that the act of fraud is acceptable or at least not mischievous. Finally, there are the opportunities that facilitate fraud perpetration, which have been grouped by Le et al. (2004) into two categories, namely, an ineffective regulation system and the lack of a positive industrial climate. After a perpetrator discovers deficiencies in control processes and procedures, those deficiencies will be turned into opportunities to perpetrate fraud (Gunduz & Önder, 2013).

Scholars have developed and extended the concepts of the fraud triangle. Wolfe and Hermanson (2004) proposed a fraud diamond model which includes incentives, opportunities, rationalisation and capability. Moreover, Kranacher et al. (2010) included motivation, money, ideology, coercion and ego in the model in order to investigate fraud. Hence, the fraud triangle theory contributes to developing the capacity of policymakers to mitigate fraud by making and enforcing policies that influence group behaviour through relieving pressure, targeting rationalisation and minimising opportunities.

3.2.3 Human behaviours and ethics theories

By shifting the focus to ethics theories, we attempt to explore the capability of those theories to demonstrate the reasoning behind human behaviours. Wood (1990) defined ethics as a combination of moral principles that govern individuals' behaviour as well as group behaviour. He further considered morals as accepted rules and standards of human character or behaviour that distinguishes between right and wrong. In particular, professionals' ethics were defined by the author as obligated duties with regard to the exercise of their profession. Robinson et al. (2007) explained ethics as a philosophical approach to determining what is right or wrong in human behaviour and what principles should govern it. Baumane-Vitolinaa et al. (2016) asserted that those moral norms play a vital role in each society so as to ensure that individuals intercommunicate beneficially as well as mutually. Scholars divide ethics into two different groups, normative ethics and descriptive ethics. Normative ethics demonstrate how things should be to instruct professionals to act ethically, while descriptive ethics depict what humans actually do in order to predict the unethical behaviour (Jameton, 1984; Oberlechner, 2007).

Ethical behaviour should not only be limited only to compliance with laws (Dunham & Washer, 2012). Many philosophical approaches have been applied to study ethical behaviour. Ethical theories have widely categorised into three main classical philosophical approaches, which are teleological, deontological and virtue ethics theories (Boatright, 2012; Fisher, 2003; Jonsson, 2011; Belak and Rozman, 2012). The assessment of consequences is the basic assumption in teleological ethics theories to study a decision behind a particular behaviour. In this philosophical approach, the conduct is not assessed, either positively or negatively, but the evaluation will be of the impact of this conduct. One of the most important branches of this philosophical approach is utilitarianism, which is commonly applied in economics to investigate rational decision-making. In utilitarianism theory, a conduct is evaluated based on the amount of satisfaction and efficiency resulting from this conduct. In contrast, deontological theories focus on the conduct itself regardless of the consequence. In this philosophical approach, the emphasis is on the existence of global ethical principles that

need to be followed. Furthermore, motives behind a particular behaviour play an important role in this approach. The last philosophical approach is virtue ethics, which are associated with Aristotle. In this approach, ethical conduct is determined by the character and habits of the actor, who ensures the taking of ethically right decisions.

Human conduct and decision-making in classical economics are commonly based on utilitarianism concepts. Thus, the main assumption in this approach is that the nature of human behaviour is to attempt to maximise personal benefit by continually evaluating the gains and benefits brought on by this behaviour (Baumane-Vitolinaa et al., 2016). Such economic behaviour is affected by rights and regulations, which in turn restrict personal options (Van Staveren, 2007). In this context, Stead et al. (1990) proposed an ethical behaviour model to explain factors that influence the decision-making process in business organisations. On the other hand, organisational culture, as well as the failure of top management to heavily enhance ethical conduct, often leads to ethical failure in organisations (Brien, 1998).

With regard to public procurement, Ray et al. (1999) indicated that the key players involved in the public construction industry often do not comply with the ethical rules included in tendering codes. They, therefore, suggested that improving the code of practice in tendering processes should be continued and empirically tested. In addition, Bowen et al. (2007) recommended expanding ethical conduct research to include investigating the interplay between the cost and benefits of ethics compliance. The most important pillars of a procurement system are laws and regulations (Thai, 2017), which, in turn, enhance ethical principles such as fairness, integrity and objectivity.

3.2.4 Compliance theories

Compliance refers to a rule that direct individuals regarding a particular conduct (Hønneland, 1999). Specifically, Mwakibinga (2008) defined compliance as a set of behavioural benchmarks which have been developed to control the interdependent actions of individuals. Compliance theories mainly aim to interpret the causes why states, companies or individuals decide whether or not to comply with laws and regulations. Accordingly, such theories offer guidelines for a deeper understanding of compliance behaviour, thus suggesting different approaches that can be applied to influence the state, a firm or an individual to comply with laws and regulations (Dao and Ofori, 2008).

March and Olsen (1998) asserted that the influence can be brought to bear through two fundamental categories of human behaviour logic, namely, the logic of consequences and the logic of appropriateness. Individuals in the logic of consequences make decisions based on the assessment of outcomes. In the logic of appropriateness, the decision-making is based on social norms and standards. Consequently, the logic of consequences is in agreement with the rational actor, while the logic of appropriateness is compatible with normative models (Hathaway, 2017). Form this classification viewpoint, theories of compliance can be categorised into two main models, which are rationalist models and normative models. Deterrence and enforcement are the main prevention measures for non-compliance in rationalist models. On the other hand, cooperation and compliance assistance are the main prevention measures for non-compliance in normative models.

Rationalist compliance theories rely on the logic of consequences. Therefore, this branch of theories focuses on enforcement and deterrence that aim to alter individuals' assessment of benefits and costs. In this context, Becker (1968) initially emphasised that the high probability of detection as well as severe sanctions influence potential offenders' decisions. This find was confirmed afterwards by Stigler (1970). Accordingly, compliance can be enhanced either by developing monitoring activities to increase the probability of detection or by reforming laws and regulations to increase the severity of

sanctions (Cohen, 2000). Based on this approach, firms that attempt to maximise their profits will comply just in case that the expected punishment will be higher than the cost of compliance. Behavioural decision theory is another approach in rationalist theories, which takes into account individuals' cognitive aspects in assessing consequences. In this theory, the perception level of non-compliance risk will influence compliance decisions.

On the other hand, normative compliance theories rely on the logic of appropriateness. In this approach of theories, individuals are considered honest when they aim to comply, but cannot (Malloy, 2003). Cohen (1993) demonstrated that the incidence of compliance behaviour required both capacity and commitment from firms. In this context, capacity includes full knowledge of rules as well as the financial and technological ability to comply. Commitment is limited by norms, regulators' consciousness and the stimulus of compliance. Therefore, regulators should adopt a more cooperative approach to ensure compliance, including information dissemination, technological assistance and compliance guideline schemes. Normative theories suggest that individuals generally follow regulations that are developed and implemented impartially. The complexity critique is one of the most prominent normative compliance approaches. This approach finds that bureaucratic and administrative constraints, numerous changes in regulations and difficulties in understanding regulations weaken individuals' capability to comply. Consequently, individuals cannot perfectly comply because they are not fully aware of what compliance behaviour is required. In particular, this approach corresponds to small firms which not able to update their records with changing organisational demands (Spence, 2001).

In another prominent contribution, Etzioni (1975, 1997) developed an innovative approach to clarify compliance, in which he classified organisations in terms of force types used to direct members' behaviours into three main categories, which are coercive, utilitarian, and normative. All three types of powers can be useful in obtaining the cooperation of members in organisations. Accordingly, the reaction of members of these organisations varies depending on the type of force applied by the organisation.

According to this approach, when an organisation uses coercive force, members usually react to the organisation with hostility, which is called alienative involvement. On the other hand, when utilitarian power is used, participants aim to increase their individual gain, and this is called calculative involvement. Finally, normative power generally involves the moral involvement of members. In some cases, two or more types of force are combined by organisations.

In a remarkable development of the theories of compliance, especially with regard to behavioural economics, Thaler and Sunstein (2008) introduced nudge theory. This an approach aimed at achieving compliance with rules based on a process of influencing decision-making (Meleyal, 2017). Thaler and Sunstein emphasised the existence of a 'choice architecture' that adjusts human behaviour in a predictable manner without the need to prohibit any other options. The theorists, therefore, assume that there is a choice architect who designs the environment to enhance the choice of a particular option. Similar to what normative compliance theorists claim, nudge theory states that individuals might act against the interests of society in case that the right choice is complicated and vague. As a result, the task of facilitating and clarifying the right choice is equally significant to threats, education or moralising to enhance individuals' compliance. Nudge theory proposes that individuals' motives, incentives and decision-making can be influenced by positive inducements and indirect instructions. Thus, non-enforced compliance can be achieved (Thaler & Sunstein, 2008).

Arno and Thomas (2016) called those procedures applied to provide positive inducements and indirect instructions as 'libertarian paternalism'. They can improve individuals' behaviour directions by maintaining freedom of choice. The authors noted that this approach aims to achieve strong governmental oversight without the need for rigorous regulations or deterrent consequences. Therefore, nudge theory highlights the wide potential of governments for using innovative forces rather than using coercive forces to enforce compliance. Policymakers can develop their perceptions of individuals' behaviours by applying the principles of nudge theory, thus facilitating the influencing

of those behaviours. Consequently, it helps to design more efficient and less costly policies while assisting individuals to achieve their objectives (Kosters & Van der Heijden, 2015). The assumptions of this theory are that the behaviour of individuals is unpredictable through the application of economic theory (Thaler & Sunstein, 2008). This is attributed to the incapacity of individuals to make optimal economic decisions due to their not having all the information needed, in addition to their inability to analyse that information (Simon, 2013).

3.2.5 Institutionalism

In order to add a relevant scaffold to formulate research propositions as advised by (Jennifer et al., 2018), Obanda's (2010) recommendation, which adopt institutionalism approaches to investigate adopted strategies in the Ugandan public procurement procedures to ensure compliance, will be applied. This research will measure the influence of each proposed attribute as an individual policy, thereby the systems approach will be discarded. Furthermore, institutional studies have been broadly linked to organisational structures and behaviour since the emergence of organisations as a field of study in the early 1950s (Scott, 2001; Powell & DiMaggio, 2012).

Institutionalism theory aims to explain individuals' conduct (Koelble, 1995). This theory further provides a distinguishing approach to the study of social, economic and political phenomena (Thoenig, 2011). Scott (1995) has emphasised that institutions consist of regulative structures, normative rules and cognitive activities that bring steadiness to social behaviour. Accordingly, Scott (2001) proposed a comprehensive framework to analyse the institutional elements which shape the behaviours of organizations. Within this framework, institutions rely on three fundamental pillars: regulative, which focuses on the calculation of consequences, normative, which focuses on the principle of appropriateness, and knowledge, which focuses on integrity (Scott, 2005).

The regulative pillar refers to regulative processes that compel and regulate behaviour. Scott (2001) argues that utilitarianism and coercion are essential elements to ensure

compliance in institutions. Consequently, rules and regulations control utilitarianism and coercion in this pillar. The regulative pillar of institutions concentrates on a rational choice framework, which requires attention to design and build institutional frameworks to support collective action (Scott, 2005).

The normative pillar refers to norms and values directing individuals' conduct by designating how things should be done (March & Olsen, 1998). In the normative pillar, social commitment is the essential element for compliance in institutions. Norms and values ensure 'a prescriptive, evaluative and obligatory dimension' in social life (Scott, 2001). These rules and values constitute expectations that are considered as external pressures directing individuals' behaviour (Scott, 2005).

The cognitive pillar in institutionalism refers to the common concepts that shape the nature of social reality (Scott, 2001). Constitutive rules as shared conceptions are essential elements of compliance in institutions (Scott, 2005). Consequently, common assumptions and the construction of social identities form individuals' behaviour in this pillar (Scott, 2005).

Institutionalism principles were applied to demonstrate the impact of technological growth changes, social norms, and related regulations on the process of decision-making (Hall, 2010; Rivera,2004; Brown et al., 2006) to investigate influences that enhance the persistence and legitimacy of organisational behaviours (Baumol et al., 2009; Brunton et al., 2010; Hirsch, 1975; Lai et al., 2006; Roy,1997), as well as to examine institutions' structures, rules and routines in order to direct their individuals' behaviour (Scott, 2005). The principles of institutionalism are widely applied in determining what appropriate or acceptable conduct is, and, consequently, what is unacceptable conduct (Powell & DiMaggio, 2012; Scott, 2008). In addition, institutionalism theory can be applied to directing opportunistic behaviours and promoting collective constancy (Thoenig, 2011). Brunsson and Olsen (2018) suggest that public affairs organisations should be conceptualised based on the institutionalist approach.

3.3 The developed framework

As discussed in Chapter 1, this study focuses on developing an institutional framework can be adopted by the relevant stakeholders to reduce the risk of bid-rigging by targeting an increase in the number of potential bidders. Accordingly, sections 3.2.1 to 3.2.5 identify key concepts that provide the basis for the development of the empirical work. Decisively, a conceptual framework that draws on linking previous insights is established to propose and examine institutional measures which enhance contractors participation in future tenders. The development of the adopted conceptual framework, as illustrated in Figure (3.1), is discussed below.

Due to the relevance of collusion to the Oligopoly theory, the advice of both Shapiro (1989) and Mankiw (2014) in maximising market players will be the starting point of the adopted conceptual framework in this research. According to market equilibrium basics, efforts that seek to reduce market share will complicate maintaining the stability of collusion arrangements, thereby enhance competitiveness. Therefore, investigation of what leads to an increase in the number of players in the market will be the cornerstone for developing the research's conceptual framework. Yet, such investigations require building a theoretical approach to rely on, which in consequence identify the research dimensions.

Given the significance of considering behavioural factors in remedying corrupt practices (Gebel, 2012), the behavioural incentives that will enhance all contractors to participate in bidding as well as reduce the availability of opportunities to arrange for collusion will be investigated. This approach corresponds to one of the most pivotal dimensions of Cressey's (1973) fraud triangle theory, which states that opportunities for fraud behaviours need to be reduced. Therefore, relevant policymakers should enforce policies influencing group behaviour to participate in bidding. In this regard, ethics theories play a vital role in demonstrating the reasoning behind human behaviours. Accordingly, both the logic of consequences and the logic of appropriateness will be

applied to stimulate the rational decision-making by principal contracting firms and, thus, turn it into a normative decision to participate in future tenders.

To ensure the restriction of utilitarian behaviours organisational factors in the tendering phase of municipal roads bids will be examined to enhance ethical principles, such as fairness, integrity and objectivity. Additionally, to ensure that contractors comply with municipalities' scheme in raising the participation rate of future bidding, and based on the logic of appropriateness, transparency and integrity should be increased in bid procedures. Nevertheless, these transparent and fair procedures must be supported by analysing the benefits of the decision to participate compared to the expected cost (Bowen et al., 2007). Therefore, the principles of nudge theory will be applied to guide contractors indirectly in enhancing their participation in future bidding. The inducements will be the cornerstone of behaviour redirection here, omitting to prohibit any other behaviour options.

The OCED (2009) guidelines in implementing the principles of integrity in public procurement, particularly in tendering attributes, will be the basis upon which the main variables of this research are constructed. The adoption of this report is due to the fact that it is tackling the risk of bid-rigging propose developing public procurement procedures in order to increase the number of players in the market, which consistent with the scope of this research. While other reports, such as the World Bank (2011), discuss preventive measures adopting deterrence force or detection methods improvement. The OECD guidelines encompass ensuring transparency for contractors' qualification processes, lowering the cost of bidding, ensuring project specifications are clear and comprehensive but not discriminatory, providing accurate project costs estimations, and ensuring clear and objectively defined award criteria.

Finally, institutionalism approach will be adopted in this reseach in consistency with Obanda's (2010) recommendation to add a relevant scaffold to formulate research propositions. In order to arrive at an institutional framework that ensures the

sustainability of such compliance behaviour, the three pillars of institutionalism theory (regulative, normative and cognitive) will be added to the main variables to establish sub-variables that will be examined in this research. Consequently, the influence of each proposed attribute will be examined separately.

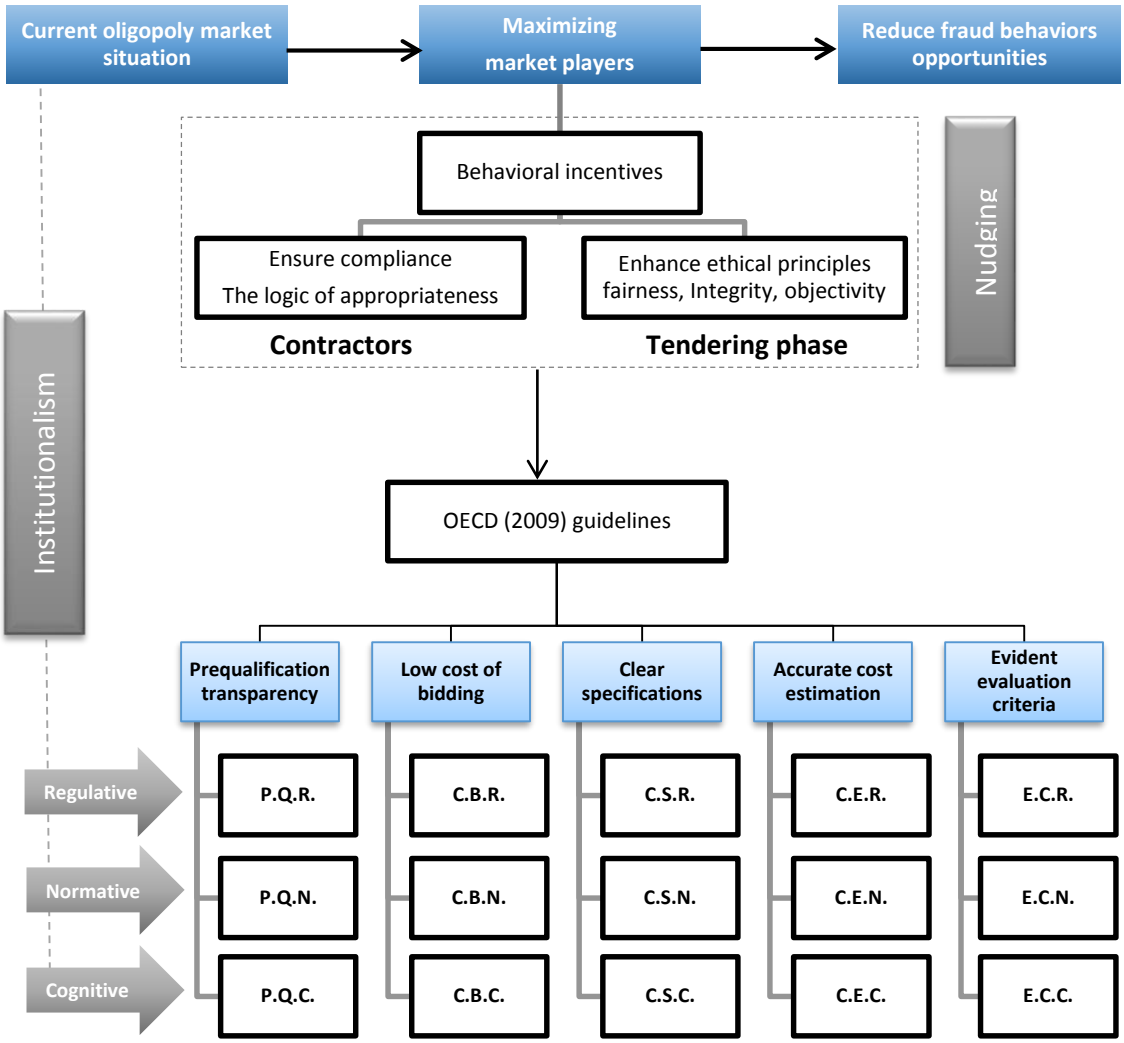


Figure 3-1: The developed conceptual framework

Chapter 4: Research methodology

4.1 Introduction

The preceding chapter presented the adopted conceptual framework, which focuses on increasing the number of players in the market by motivating local classified contractors to participate in future tenders. To ensure that contractors will comply and bid competitively, the adopted conceptual framework identifies research propositions, which need to be investigated to recommend a managerial framework for relevant stakeholders. These propositions assume that the development of relevant tendering phase attributes will increase the willingness of local contractors to participate in future tenders. Those fifteen attributes are established from extant literature, thus informing the research questions. This chapter outlines the research method and procedures employed in examining these research propositions.

This study mainly adopts a mixed-method research approach, which was selected based on the nature of the research questions, as well as the characteristics of Saudi Arabian public construction work. In this chapter, a discussion on the research paradigm adopted in this study initially will be conferred. After that, an overview of the research approaches will be presented, including the justification for choosing the adopted research approach. This is followed by data collection procedures and methods, which encompasses data collection instruments, the selection of survey participants, data collection implementation, and data analysis techniques for both quantitative and qualitative strands. Subsequently, an overview of the mixing procedures of qualitative and quantitative strands is provided, including detailed descriptions of the Importance – Performance technique. Finally, a summary of this chapter is provided.

4.2 Research paradigm

Mertens (2014) described research as designed processes of systematic investigation used to collect, analyse, and interpret data in order to understand, describe, predict or control a phenomenon. Consequently, Mertens defined the "philosophical

assumptions" which direct these processes as the research paradigm, which corresponds to the definitions of Bogdan and Biklen (2007) as well as Cohen et al. (2011). Mac Naughton et al. (2010), on the other hand, emphasized that the research paradigm encompasses three main elements: a belief about the nature of knowledge, a methodology, and criteria for validity. The selection of an appropriate research paradigm is considered an influential factor in research (Guba and Lincoln, 1994), as subsequent choices, such as selecting particular research methods, rely decidedly on the adopted research paradigm (Mackenzie and Knipe, 2006). To sum up, the adopted research paradigm defines how the researcher perceives the world, how knowledge in the study is created, as well as which research methods can be applied to comprehend reality (McKerchar, 2010).

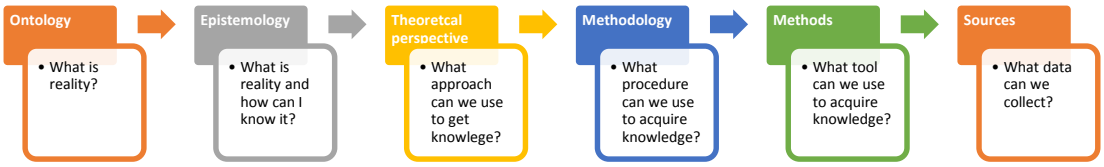


Figure 4-1 Research paradigm framework

Burrell and Morgan (1979) introduced an initial matrix, employing fundamental assumptions which are related to the nature of social science and of society. This initial matrix includes four distinct research paradigms: functionalism, interpretivism, radical structuralism, and radical humanism. Since then, scholars have developed and updated several research paradigms, the most frequently used of which are: post-positivist, interpretivist, transformative, and pragmatic. These common paradigms differ from each other according to their ontology and epistemology, thus methodology and methods applied in each paradigm are distinct. Table (6-1) summarizes the main characteristics of these commonly applied paradigms in social research. However, the

details of positivism, which will be adopted in this research, will be generally reviewed in the following section.

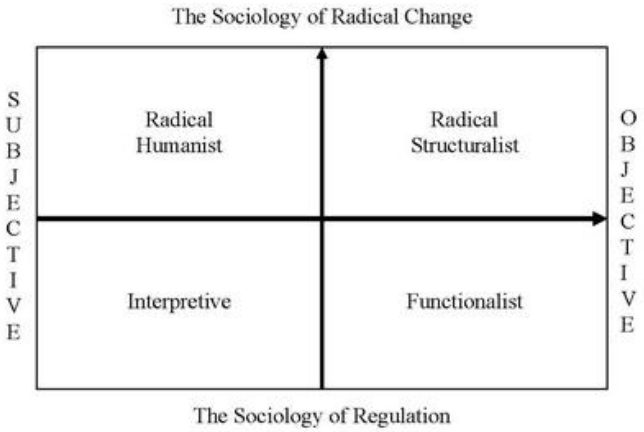


Figure 4-2 Burrell and Morgan's matrix – 1979 (Ardalan, 2018)

	Positivist	Interpretivist	Critical
Ontology	Reality is singular (one truth), apart from the researcher (external reality), detached from the researcher and the participants (independent of them), realism.	Reality is multiple (multiple perspectives of truth) and constantly changing through the interpretations of participants and the researcher. Reality is socially constructed. (idealism)	Reality has been interpreted in ways that preserve structures of dominance. (critical idealism)
Epistemology	Objectivist; researcher is independent from that being researched; Value free and un-biased, objectivism.	Researcher interacts with that being researched; Value-laden and biased, Constructivism, Subjectivism.	Subjectivist (socially constructed & Emancipatory ...etc.
Question	What works?	Why do you act this way?	How can I change this situation?
Method	Closed-Questionnaire, structured interview, .etc.	Open-ended Interview, observation, documents, audio-visual materials, ...etc.	Critical interview, critical observation, critical discourse, ...etc.
Role Of Researcher	Neutral	A respectful listener or observer	A social activist

Figure 4-3 The main characteristics of the commonly applied paradigms in social research

The positivism paradigm has emerged based on the rationalist, empiricist philosophy (Mertens, 2014), which assumes that establishing the "truth and objective reality" rely solely on the scientific method (Chilisa and Kawulich, 2012). Aristotle, Francis Bacon,

John Locke, August Comte, and Emmanuel Kant were the pioneers of this paradigm during its early development (Mertens, 2014). O'Leary (2014) emphasized that positivists believe that the world is knowable as well as predictable. Positivists further suggest that natural science methods, techniques, and procedures present the best framework to investigate the social phenomena (Chilisa and Kawulich, 2012; O'Leary, 2014). Positivism is considered an empirical approach which demonstrates facts and the causes of behaviour (Bogdan and Biklen, 2003), thus consequences or impacts are determined by causes (Creswell and Clark, 2017). Positivist research is commonly aligned with quantitative methods in data collection and analysis.

Tashakkori and Teddlie (2010) and Corbin and Strauss (2014) confirmed the importance of research questions in selecting research designs. Accordingly, the positivism paradigm is deemed most appropriate to answer the research questions introduced in Chapter (1). Additionally, the majority of research conducted in the construction management domain is based upon the positivist research paradigm due to the capability of quantitative methods to produce statistically precise as well as rigorous studies. Therefore, the positivism paradigm will be adopted here.

4.3 Research approach

Positivists assume that "authentic knowledge" is obtained using a scientific method which encompasses empiricism in addition to specific principles of logic (Punch, 2013). Aspin (1995) referred the philosophical term "empiricism" as the theory that considers experience the origin of knowledge. Therefore, the empirical study is research which relies on direct experience or observation of the world (Punch, 2013). Empirical studies, as other studies, require a research approach to guide each phase of research. The research approach describes the procedures which will be followed by a particular researcher from adopting broad assumptions to detailed tools of data collection, analysis, and interpretation (Creswell, 2013). Research approaches further identify the connection between research questions and data (Punch, 2013). It is broadly considered that research approaches fall into three categories: quantitative approach, qualitative

approach, and mixed methods approach. The strategies followed, the conceptual framework, who and what will be studied, as well as data collection and analysis tools, are the key components that determine the selection of the appropriate research approach (Punch, 2013). Furthermore, Creswell (2013) defined three similar determinates, which are the nature of the research problem, the researchers' personal abilities, and the study audiences.

4.3.1 The qualitative method approach

Qualitative research mainly aims to understand and explore a social phenomenon (Creswell, 2013), which in consequence generate texts as data to be analysed (McCusker and Gunaydin, 2014). Furthermore, the qualitative research approach seeks to answer questions about the what, how or why of a phenomenon (McCusker and Gunaydin, 2014). This approach depends on post-positivist, critical, and constructivist philosophies, which propose the presence of multiple realities which can't be embodied by manipulation and control (Levesque, 2011). There are many qualitative data collection methods, but observations, interviews, or artefacts remain the most common (Levesque, 2011). Emerging questions and procedures can be raised in collecting qualitative data. Nevertheless, qualitative researchers may use a protocol in the process of gathering the information (Creswell, 2013). On the other hand, these collected data are analysed based on inductive reasoning and the interpretations rely on the researchers and their personal paradigms (Creswell, 2013). Accordingly, ensuring the quality of the process is the key task of qualitative researchers (McCusker and Gunaydin, 2014). The patterns, categories, and themes are created during the analysis stage by converting the data into summarized units (Creswell, 2013). In addition, the qualitative data analysis process accepts both quantitative and qualitative analyses (Levesque, 2011).

4.3.2 The quantitative method approach

The quantitative research approach mainly aims to test objective theories by examining the relationship among variables according to specified hypotheses, which in

consequence generate numerical data that will be analysed in order to support or refute those hypotheses. A variable, in this context, is defined as a measurable or observable attribute of an individual or an organisation (Creswell, 2013). This approach of research depends on post-positivist philosophical assumptions, which rely on reason and logic to interpret data generated from experience (Gerber and Macionis, 2011). In this approach, researchers employ objective measures to describe observations and consequently test theories deductively (McMillan and Chumacher, 2009). Several quantitative data collection methods have been utilized, the most common of which are surveys and experimental designs. A survey is a data collection tool aids to gain quantitative description of trends, attitudes, or opinions of a whole population by examining a sample of this population (Creswell, 2013). Accordingly, the researcher generalizes findings to the population. The basic objective of an experimental design is to test the consequence of interference on a certain phenomenon (Creswell, 2013). Under this research approach, the quality of the collected data further plays a vital role in avoiding inaccuracy in the analysis stage (McCusker and Gunaydin, 2014). On the other hand, the validity and reliability of this method empower meaningful interpretations of the data (Creswell, 2013). Reliability is identified as "the relative consistency of results using the same instrument", while validity is identified as the extent that the instrument measures what it was designed to measure (Levesque, 2011).

4.3.3 Mixed methods approach, strategies, and implications

The mixed methods research approach comprises collecting both quantitative and qualitative data as well as integrating these forms of data by employing distinct designs (Tashakkori and Teddlie, 2010; Creswell, 2013). Creswell and Clark (2017) emphasized the importance of this approach, particularly if one of the two previous approaches (quantitative or qualitative) alone is inadequate to investigate a particular research problem. Accordingly, the integration of both qualitative and quantitative approaches enhances the understanding of such research problems, and furthermore, diminishes the limitations of each approach. Additionally, the findings acquired from either method might lead to discovering potential further research areas (Tashakkori and Teddlie,

2010). They further suggested that questions which ordinarily would arise at the end of a research project can be processed at an earlier stage under this approach. It requires a researcher to be familiar with both quantitative and qualitative methods, as well as to allocate adequate time and resources to collect both quantitative and qualitative data (Creswell and Clark, 2017).

However, a mixed methods researcher should assign the adopted mixed methods design, which reflects how a qualitative method integrates with a quantitative method. In this regard, four key decisions facilitating the choice of an appropriate mixed methods design have been identified by Creswell and Clark (2017), which are: "the level of interaction between the strands, the relative priority of the strands, the timing of the strands, and the procedures for mixing the strands." On the other hand, Tashakkori and Teddlie (2010) characterize the so-called multiple methods approach as an approach that encompasses two or more studies using different methods, which address the same research question or different parts of the same research question. They confirmed that these methods could be both qualitative, both quantitative, or a mixture of the two. Under this approach, a researcher commonly might carry out each method and publish it separately, then conduct and publish a "synthesizing article" manifesting the integral relationship of the findings in addressing the research question (Tashakkori and Teddlie, 2010).

4.3.4 The adopted approach

Given the nature of the research questions, which originated from practical issues faced in the construction industry, it was determined that a mixed methods approach would be suitable, based on a deductive form of inquiry. The nature of the first two objectives necessitates conducting exploratory research to generate the propositions which will be examined through the next stage of the research. Accordingly, the exploratory study will begin by identifying suspicious patterns within the municipal road contracts market, through a desk examination of all tender documents for these markets over a period of five years. The literature on barriers to local contractors' involvement in bids for general

construction contracts in Saudi Arabia over the past four decades will also be reviewed, in an attempt to link the findings to factors affecting decisions to participate in bidding.

The next stage of the research will be based on an explanatory sequential design. As the third objective of this research calls for the identification of factors that influence the desire to participate in future tendering, requiring the testing of propositions, then a quantitative approach is best. However, the fourth research objective calls for evaluation of the current performance of stakeholders with particular attributes, requiring comprehensive understanding of those stakeholders' experiences. Therefore, a qualitative approach was adopted here. An independent level of interaction is adopted between the quantitative and qualitative strands of the second stage of the research within this study, therefore data collection and data analysis are separate. Additionally, the two methods have an equal priority in addressing the research problem. Both methods will be conducted in two sequential phases: the quantitative data will be collected and analysed first and then the qualitative data. The integration of both methods will be conducted during the interpretation stage.

The findings of the quantitative method as well as the qualitative method will be related to each other in an Importance-Performance Analysis (IPA) matrix, which facilitates achieving the research aim – developing an institutional framework which will be adopted by relevant stakeholders to reduce risk of bid-rigging by targeting an increase in the number of potential bidders. The adopted research design in the second stage is commonly adopted in strong quantitative orientated fields, however, one of the key challenges in this instance is the unequal sample size for each phase of the study (Creswell, 2013). Nevertheless, this design enables the assessment of trends and relationships with quantitative data as well as demonstrating the potential reasons behind these findings (Creswell and Clark, 2017).

4.4 Data collection procedure and methods

Figure (4-4) illustrates the mixed methods strategy adopted for this study. In the first stage, the minutes of opening sealed bids will be collected initially from each municipality in order to identify indicators of potential bid-rigging. Subsequently, the literature on the issues of general construction contracts in Saudi Arabia will be collected, to be reviewed in order to identify the barriers to participation of local contractors within this context. In the second stage, quantitative data will be collected from questionnaires to identify potential attributes that might enhance the desire of local contractors to participate in future tenders. The next data collection phase will be of a qualitative nature and will be conducted as a follow-up to the quantitative results (importance measure). This phase aims to clarify contractors' perspectives through assessing the current performance of relevant stakeholders.

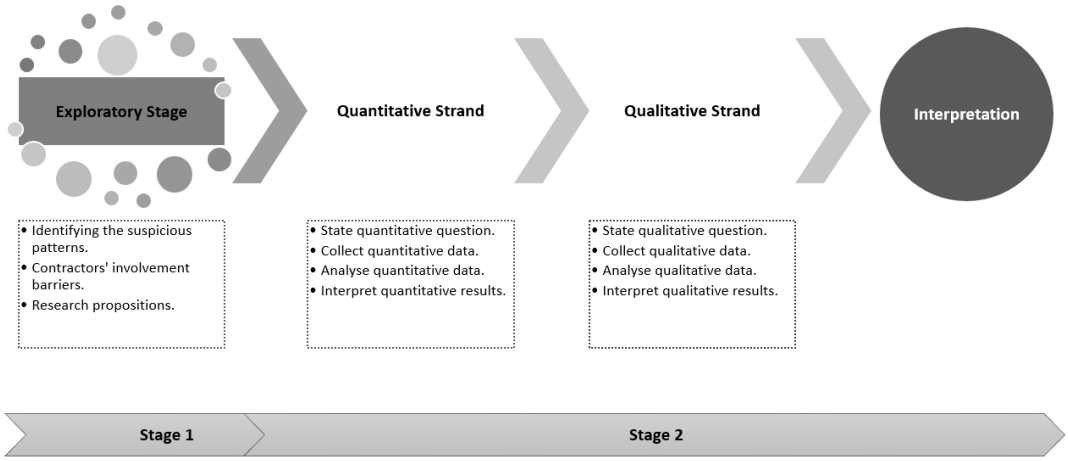


Figure 4-4 The adopted research design

4.4.1 Exploratory stage

Prior to reaching the propositions, preliminary desk studies were carried out to identify what might affect decision makers in the local contracting firms regarding participation in public construction works tenders. This research included the identification of some

indicators of suspected bid-rigging in the context of the municipal roads contracts, as well as a review of the literature on Saudi Arabian public construction issues. Both of these desk studies and the data collection are complementarily employed.

Indicators of suspicious bid-rigging in the study context

Due to the lack of empirical studies of bid-rigging practices in the context of the Saudi Arabian public construction industry, indicators and incidents of bid-rigging should be established. Therefore, an empirical study which proposed a model for conducting an economic screening approach to establish those indicators was conducted. This study aims to explore the local market structure of the local road construction market, thus facilitating the discovery of future bid-rigging cases by competition authorities. The potential incentives within this market for such behaviour, therefore, will be comprehended, promoting prevention future illicit behaviour. In the proposed model, several consecutive statistical tests were used, which include market concentration, number of class members, price volatilities, and participation rate. These tests were adopted from other bid-rigging detection tests to suit the studied context, which does not require pre-existing collusion cases. The details of this study method will be discussed in the following paragraphs.

In order to achieve the above mentioned purpose, a two-step historical analysis of tender bid submission patterns, encompassing municipal road construction and maintenance contracts, is adopted. With regards to sampling strategy, a convenience sampling strategy is employed, wherein five municipalities are selected from Saudi Arabia due to the time limitations for data collection. In order that these municipalities remain anonymous, the phonetic alphabet coding system has been adopted to identify each of them. Table (4-1) illustrated some main characteristics of the selected municipalities.

Municipality	Population (million)	Geographic	Municipal Road Contracts		
				Value	
			Number	In Saudi Riyal (billion)	In GBP (million)
Alpha	1.77	Mountainous terrain	101	3.01	617
Beta	1.06	Desert area	105	2.05	420
Gamma	4.03	Coastal area	113	3.89	798
Delta	0.60	Mountainous terrain	114	1.02	209
Omega	1.06	Desert area	111	2.15	441

Table 4-1 Characteristics of the selected municipalities (The ministry of municipalities)

An oligopoly is considered one of the outcomes of collusion (Dorée, 2004), and is similar to the goal of some market mergers. Therefore, we initially measured the market concentration index (HHI) of our sample, which includes (544) contracts, in order to identify the likelihood of collusion. The HHI is a primary concentration measure which is utilised as a part of the antitrust examination, and is calculated as the sum of the squared market shares of all market participants. The United States Department of Justice Agencies consider markets with an HHI under 1,500 points to be non-concentrated, markets with an HHI between 1,500 and 2,500 points to be moderately concentrated, and markets with an HHI above 2,500 points to be highly concentrated (The US Department of Justice, 2010).

To facilitate calculating HHI, and based on the assumption of easiness communication among contractors from the same area, contractors from the same municipal area “Internal” will be isolated from other contractors who are from outside the municipal area “External”. Furthermore, each of these two categories will be diveded to five sub-categories according to thier classification. After measuring HHI, the size of the monopolist class “contractors from same sub-category in a concentrated market ” will be examined, as Heimler (2012) observed that the number of players in a collusion agreement is almost never higher than ten and is very often lower than five. In this study, we assume that there is a collusion agreement between contractors of the same class in order to reduce the level of competition and to increase barriers to new participants entering the market.

In the second step, the participation rate will be analysed for the suspected markets before measuring the volatility of the bidder prices for the market controlled by a small number of players. Volatility of bidder prices is computed as the standard deviation of the percentage change in the offers' prices. It is reasonable to expect a reduction in price volatilities after the effective execution of a bid-rigging scheme (Hüschelrath, 2013). If the participation rate reduces bidding variation, then this is an indication of successful collusion (Zarkada-Fraser and Skitmore, 2000). This detection method has been utilised by the Swiss Competition Commission. Unlike other detection methods, both the HHI and price volatility do not need previously disclosed collusion cases to be utilised, which makes them suitable for application to available Saudi Arabian road contracts data, which has never revealed any cases of collusion within the public procurement market. Hence, we will obtain an in-depth understanding of the composition and features of suspected collusion, and consequently be able to develop indicators and incidents of potential collusion practices among the main contracting firms bidding for municipal road network projects. Figure (4-5) illustrated the Proposed model to investigate collusion in public procurement.

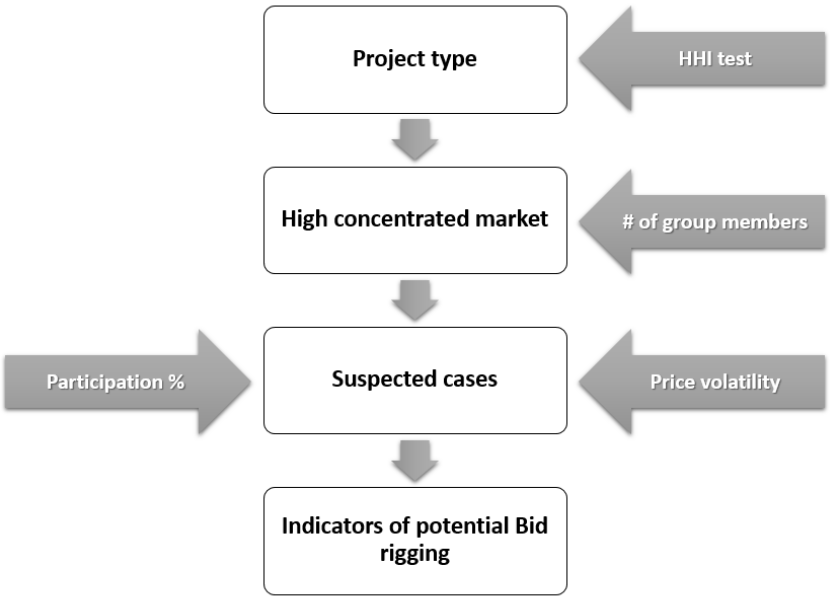


Figure 4-5 Proposed model to investigate collusion in public procurement

An eight-digit coding system has been implemented to identify contractors in this research. The first three digits identify the location of a contractor's headquarters, while the middle two digits identify a contractor's class, and the last three digits represent a contractor's number on the Ministry of Municipalities list.

Location		Class		List#
ALP	-	02	-	079

Figure 4-6 Identification coding for classified contractors

Literature review on contractors' failure to participate in bidding

To identify the underlying causes behind the lack of local contractors' engagement in the municipal roads networks construction works tenders, the literature on the issues of the public construction works in Saudi Arabia will be attentively reviewed, with a relative focus on the contractors' point of view in order to link them to the research scope. This literature review will cover books, articles, reports, internet sites, and previous studies addressing causes of failure in delivering public construction work in Saudi Arabia. This review relies mainly on the University of Strathclyde's library database. No time limit has been set as for the generated literature, since the oldest published paper on this subject was in the 1980s. Furthermore, the total number of articles collated does not exceed forty.

After providing a brief overview of this industry, including main developments in the field and the regulatory framework, the only revealed study which examined the issue of decision making to participate in tenders within the Saudi public construction context will be discussed. After that, the developed conceptual framework of this research will

be the cornerstone to direct the review of relevant literature. The literature will be listed chronologically to emphasise that the same issues appear to have persisted for decades without procedural intervention to mitigate them. Accordingly, the attributes which might influence the rationale of decision makers in contracting firms will be proposed.

4.4.2 Quantitative strand

Data collection related to local contractors' assessments of the importance of the proposed attributes integrates the positivist approach of the research design by employing a quantitative survey in order to focus on the research hypotheses, which are constructed based on the conceptual framework. Under the quantitative data collection techniques, the researcher is considered external to the actual research, and results are expected to be replicable (Weinreich, 2012). The survey method is preferred in such techniques, particularly questionnaires, where there is a large population to facilitate the generalisation of findings. Furthermore, questionnaires frequently have more rapid, quicker, and cheaper responses (Oppenheim, 2000; Bryman and Cramer, 2012; Creswell, 2009). Data collection instruments, selection of survey participants, data collection implementation, and subsequent analysis of the collected data will be discussed in detail in the following section.

Data collection instruments

Instrument design

In order to address the scarcity of contractors' participation in municipal road projects tenders, an assessment of the perception of the classified contractors' demands is essential. Consequently, this phase of the study broadly explores the participants' opinions regarding the influence of the fifteen attributes thought to enhance participants' desire to engage in future municipal road tenders during the tendering phase. Consistent with the survey study framework proposed by Malhotra and Grover (1998), the development of the quantitative study instrument utilized during this research primarily comprised of two sequential steps involving questionnaire design and

pre-testing. In this regard, available questionnaires on attitudes and behaviours (Batool, 2012), compliance behaviour (Sapiei and Kasipillai, 2012; Yami, 2015), construction regulations (Al-Sinan, 2004; Mzyece, 2015), and fighting corruption in public procurement (Obanda, 2010) were considered. A semi-structured questionnaire was designed to quantitatively measure the influence of those attributes. When developing a questionnaire, the type of scaling should be decided guardedly. Additionally, respondents' capability to answer and the researcher's ability to analyze the subsequent data shouldn't be overlooked during scale selection. Therefore, a five-point Likert scale was utilized to record respondents' opinions from 'strongly disagree' to 'strongly agree' without taking up too much time. The use of this scale is commonly applied in other IPA-related studies when measuring importance and performance (Bacon, 2003; Chang et al., 2017).

Instrument contents

The importance assessment questionnaire comprised three main sections, referred to as Section (A) to (C). Section (A) consisted of six main questions regarding the demographic information of the respondents. The respondents are initially asked about their current classification in the field of road projects as well as the location of their firm's headquarters. Then, they were asked about the presence of branches outside the main headquarters. If they answered yes, the location of these branches is requested. Subsequently, the rest of section (A) shifts the focus onto the nature of contractors' participation in municipal road contract tenders during the study period. These questions inquire about the importance of this sort of project for the contractors, the rate of their participation in previous tenders (both inside and outside their respective zones), as well as the number of contracts previously awarded. A five-point Likert scale is employed to record respondents' answers. However, an open-ended question seeking to gather information on the reasons behind companies not participating outside their zones was utilized at the end of this section, consistent with advice offered by Oppenheim (2000) regarding the use of this type of question. One of the main purposes of this section is to facilitate a statistical comparison of data gathered in section (B).

When respondents move onto section (B) the influence of the fifteen proposed attributes on their desire to participate in future tendering is assessed, employing the five-point Likert scale, from 'not at all influential' to 'extremely influential'. Finally, section (C) provides a space for respondents to state any additional comments regarding the entire questionnaire, as well as to show their interest in participating in a further, in-depth interview.

Instrument content validity

The content validity of the data collection instrument, considered essential for the development of a research questionnaire (Hinkin, 1998), is ensured through the literature review and the evaluation of an expert panel. Initially, the literature review formed the basis for gathering survey items. Next, a pre-test study exercise was carried out to assess the questionnaire design's clarity, comprehensibility, and equality of representation. The experts who assessed the questionnaire during this pre-test study exercise included construction mangers, road engineers, and academic professors, all of whom have more than 10 years of experience of working in their field. The panel of experts were given the opportunity to add comments or provide feedback regarding any items included in the survey. The pre-testing of the survey took place in May 2016. The response was generally positive in terms of ease of comprehension, the format of questionnaire, and the clarity of the terms used. Nevertheless, there were a few valuable suggestions made to improve the questionnaire, each of which was considered during the revision stage (see Table 4-2).

#	Modification
A-1	Has been rephrased to clarify that the intended is the current classification
A-5	The period has been identified from 2011 to 2015 instead of (five years)
B-9	The word (users) has been replaced by (contractors) for more clarification
C	This section has been divided into two parts. First, question about further comments. Second, seeking the approval to participate in interviews.

Table 4-2 The pre-test outcomes (Questionnaire)

Selection of survey participants (population and sampling)

Field (2013) defines population as a statistical term that indicates a collection of units on which a researcher intends to generalize a set of findings. He further suggests that a population could include people, things, or events. In this study, the target population is municipal roads contractors who are classified by the Ministry of Municipal and Rural Affairs within five selected municipalities of Saudi Arabia. The registered classified contractors on the list of roads projects produced by the Contractors Classification Committee on the 15th December 2015 totaled 430 companies spread over the five zones, as listed below (Table 4.3). As this is too large a population to study in its entirety due to budgetary and time constraints (Evans, 1995), a sample was utilized. As clarified by Field (2013), a sample is a smaller collection of units from a population used to determine truths about that population.

	1st class	2nd class	3rd class	4th class	5th class	Total
Zone 1	7	7	14	45	107	180
Zone 2	0	1	5	22	90	118
Zone 3	2	3	5	15	38	63
Zone 4	0	1	3	9	20	33
Zone 5	0	3	2	9	22	36
Total	9	15	29	100	277	430

Table 4-3 Classified contractors involved in roads projects within the five zones

According to Lapin (1994), an ideal sample size should be identified to obtain the most desirable balance between the chances of making errors, the costs of these errors, as well as the costs of sampling. Roscoe (1975) suggests that a sample size should be between 30 to 500 units, with at least 30 samples for each sub-population. Additionally, he prefers have a sample size 10 times greater than the number of variables under examination. Nevertheless, Fowler (2013) demonstrates that a random sample size of 150 would describe a population of both 15,000 or 15 million, but with a different degree of accuracy. Views proposed by these authors will be considered when determining the sample size of this study.

In this context, the probability sample is defined as a sample in which every unit in the population has a chance greater than zero of being selected in the sample, and this probability can be accurately determined. This method of sampling is the most widely accepted method for allowing quantification of sampling error (De Leeuw et al., 2012). Proportional Stratified Sampling provides a means of ensuring that the sample is representative of the population subgroups of interest, as well as reducing sampling error (Lohr, 2009). Stratified Sampling is often used when one or more stratum in the population has a low incidence relative to the other strata (Lohr, 2009). Therefore, our population has been divided into five groups (strata) based on their classification, so that each population unit belongs to exactly one stratum. Each stratum is then sampled as an independent sub-population, out of which individual elements can be randomly selected. The sample size of 203 contractors was determined by considering a Yamane's (1967) equation, with a margin of error of 5%.

$$\boldsymbol{n} = \frac{\mathbf{N}}{\mathbf{1} + \mathbf{N}\,(\boldsymbol{e})^{\mathbf{2}}}$$

Equation 4-1 Calculating the samle size

Where:
$\boldsymbol{n}$ = the sample size.
$\boldsymbol{N^2}$ = the population size.

<u>Data collection implementation</u>

Based on the parameters determined by the previous phase, the questionnaire was developed through Qualtrics to be distributed to 203 local contractors. A self-administered questionnaire survey method was initially utilized in order to obtain more reliable responses and a higher response rate (Oppenheim, 2000). Questionnaires using this method can be personally distributed, providing the opportunity for researchers to cautiously provide clarifications to ambiguous questions, thus ensuring data quality (Robson, 2002). An anticipated response rate of 30% was targeted in order to conduct a meaningful analysis (Naoum, 2016). Moreover, it is widely reported that the construction industry generally has a sluggish response rate (e.g. Sutrisna, 2004; Ankrah,

2007) and because of this, and in effort to raise the response rate and to reach an acceptable sample size, instead of sending online questionnaires, the researcher met with the owners, project managers, or technical department heads of these firms.

Nevertheless, several of the fifth-class contractors' addresses, which were included in the Contractor Classification Agency list, were not recognised. Web-based search engines were used to update these addresses, but the assistance obtained from these searches was limited. As a different strategy, an email containing a link to the questionnaire was sent to these contractors' official registered emails, but the response rate to these emails was very weak. In addition, incomplete questionnaires were observed, and three contractors only completed the first part of the questionnaire. Handling these questionnaires will be addressed in the analysis section.

With regard to contractors with recognized addresses, visits were made to their headquarters. At the beginning of these visits, and in compliance with the University of Strathclyde Code of Practice on Investigations Involving Human Beings, an invitation script was read by the researcher and a copy of participant information sheet was handed over (Appendices B-1). By the end of this invitation, a respondent's consent was sought verbally to start the questionnaire. Consequently, section (A) of this questionnaire was collected verbally, as an interview. Then, the researcher's iPad, or a printed out copy of the questionnaire in case on limited internet connection, was handed over to respondents to complete both sections (B) and (C) of the questionnaire. This method had many advantages, such as:

1) It provides the respondent with a better explanation to the questions.

2) It eliminates concerns about the intent of the study and engenders confidence in the source of the questionnaire.

3) It diminishes the chance for participants to refuse to respond.

Nevertheless, drawbacks are also evident in such a method, the foremost of which is the time taken to attend every business on the list. It took an average time of 30 minutes to entirely fill out each response, though the estimated time taken to fill out each questionnaire was not more than 15 minutes. Moreover, in many cases, the right person was not there, and the researcher had to call again on an alternative day. Additionally, in many cases the researcher had to carry out irrelevant conversation with respondents.

The survey period spanned three months, from June 2016 to August 2016. Consequently, ninety-three 93 responses were obtained, which represented an overall response rate of 45.3 per cent of the 203 contractors surveyed (Table 4.4). As noted in this table, the fifth-class contractors' response rate, which was 31.01 per cent, is much less than the rate of response of other classes of contractors, which was 73.24 per cent. This low response rate is caused by the lack of response from those contractors who received the questionnaires via their registered emails due to the difficulty of locating their offices. As was the intention, the targeted respondents held various management-level positions, including owners, project managers, or technical department heads. However, the majority of the respondents were company owners.

	Full study sample			**Class (4) and above**			**Class (5) only**		
Zone 1	85	37	43.50%	34	25	73.50%	50	12	24.00%
Zone 2	57	23	40.40%	14	8	57.10%	42	15	35.70%
Zone 3	30	19	63.30%	11	10	90.90%	18	9	50.00%
Zone 4	15	6	40.00%	6	5	83.30%	9	1	11.10%
Zone 5	16	7	43.80%	6	4	66.70%	10	3	30.00%
Total	203	92	45.30%	71	52	73.24%	129	40	31.01%

Table 4-4 Response rate

Pre-analysis

Data screening

Prior to data entry, all completed questionnaires were examined visually for data accuracy and completeness. Such data screening processes are implemented to ensure an equitable analysis (Tabachnick and Fidell, 2007). To this end, two main criteria were applied to screen the dataset. As for the missing data, respondents who did not answer section (B), which represents more than 50% of questionnaire questions, were excluded. Invalid responses, responses who selected the same option in all of questionnaire questions, were excluded as well. Accordingly, three responses were found to be incompletely filled out and were thus excluded. Therefore, 90 total valid and usable responses were used for the data analysis, which slightly lowered the response rate to 44.3 per cent.

Reliability (Cronbach's alpha test)

Naturally, the reliability of the data collection strategy is essential in quantitative research. Field (2013) recognizes reliability as "the ability of a measure to produce consistent results when the same entities are measured under different conditions". Prior to the development of this approach, researchers were commonly measuring reliability by two methods: test–retest reliability and split-half reliability. Adopting the second method, Cronbach (1951) introduced Cronbach's alpha, α, which is the average of the correlation coefficient for each split. The Cronbach's alpha is calculated as depicted in the following equation:

$$\propto = \frac{N^2\,\overline{Cov}}{\sum S^2_{item} + \sum Cov_{item}}$$

Equation 4-2 Reliability test

Where:

$\boldsymbol{N^2}$ = number of items squared
$\boldsymbol{\overline{Cov}}$ = average covariance between items
$\boldsymbol{S^2}$ = item variances
$\boldsymbol{Cov}$ = item covariance

A measure is commonly considered reliable when a Cronbach's alpha coefficient exceeds a score of 0.7 (Kline, 1999). In this study, the calculated Cronbach's alpha coefficient was (0.771), which is higher than the threshold of (0.7). Therefore, the evaluations provided by the respondents can be considered as reliable.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.771	0.803	15

Table 4-5 Reliability test result

Normality (Shapiro-Wilk test)

Before starting the data analysis stage, the normality of distribution was examined. The decision to select an appropriate analysis test, whether a parametric or non-parametric test, depends on the outcome of this distribution examination (Field, 2013; Spiegel and Stephens, 2018). The normality of the distribution can be measured statistically by undertaking the Kolmogorov-Smirnov test and the Shapiro-Wilk test, which both compare the scores in the sample to a normally distributed set of scores that have the same mean and standard deviation (Field, 2013). Under these tests, the data could be described as 'normal' if the p value is more than 0.05. The implication of both tests in this study suggests that the distribution is significantly different from a normal distribution. Therefore, non-parametric tests will be adopted here.

Univariate descriptive analysis

Frequency distributions

A frequency distribution is a statistical process whereby the number of individuals in each category is specified on a scale of measurement (Gravetter and Wallnau, 2016). These statistical processes are often carried out after the collection and screening of data (Field, 2013). They present the data collected in a study in purposeful forms, allowing researcher a more complete view of the entire data (Manikandan, 2011), as well as facilitating the observation of general trends (Field, 2013; Gravetter and Wallnau,

2016). Frequency distributions can be displayed either as tables or as graphs (Gravetter and Wallnau, 2016). On the other hand, measures of central tendency and location, measures of dispersion, the extent of symmetry/asymmetry, and the flatness or peakedness are four important characteristics of frequency distribution (Rao and Richard, 2012). Within this study, frequency distributions have been applied to data collected during both section (A) and section (B) of the questionnaire.

Importance index

For section (B) of the questionnaire, a relative importance index, which is usually applied when ranking results, was employed to determine the rank of the influence of the proposed attributes. The idea behind the importance index is a weighted mean (Johnson and LeBreton, 2004). The following formula was used to compute the relative importance index:

$$\boldsymbol{RII} = (\sum \boldsymbol{W}) \,/\, (\boldsymbol{A} * \boldsymbol{N})$$ *Equation 4-3 Calculating relative importance index*

where:

$\boldsymbol{W}$ = the weighting given to each attribute by the respondents (ranging from 1 to 5),
$\boldsymbol{A}$ = the highest weight (i.e. 5 in this case),
$\boldsymbol{N}$ = the total number of respondents.

Five points are assigned to "extremely influential", four points to "very influential", three points to "moderately influential", two points for "slightly influential", and one point to "not at all influential". The (RII) values range from 0 to 1, where the higher the (RII) value, the more influential the attribute is in encouraging contractors to participate in the future tenders.

Application of non-parametric tests

The normality test referred to previously suggests applying nonparametric tests in order prepare for further statistical analysis. The application of nonparametric tests ensures

consideration of parameters such as skewness and kurtosis of the data. Therefore, the nature of the distribution of the data required the application of following nonparametric tests: Spearman's rho correlation test, Pearson's chi-square test, Wilcoxon and Mann-Whitney tests, the Kruskal–Wallis test, and Freidman's ANOVA test. All these tests were conducted using the IBM Statistical Package for the Social Sciences (SPSS) 23.0. A brief discussion explaining the purpose of these tests is provided below.

Correlation tests were carried out to understand the relationships and in an attempt to link the findings of the questionnaires with the findings of the bid-rigging indicators study in the same context. One the one hand, Spearman's rho correlation test was adopted to examine the effect of the contractors' classification or their zones on their view of the importance of municipal roads contracts, as well as the impact on their participation rate in terms of bidding over the last five years. On the other hand, Pearson's chi-square test was adopted to examine the effect of the market concentration index on their view of the importance of municipal roads contracts.

Furthermore, in order to verify whether significant differences existed among respondents in their assessment of the influence of tendering phase attributes, based on their classification (Upper or Lower), the Wilcoxon and Mann-Whitney tests were applied, whereby two groups of respondents were compared according to their mean of ranking. The Kruskal–Wallis test was applied to verify whether significant differences existed among respondents in their assessment of the influence of those attributes, based on their participation and success in receiving contracts (not participated at all, participated without contracts awarded, or participated and awarded at least 1 contract). Finally, the Friedman's test was applied to verify whether significant differences existed among the three institutional pillars (regulative, normative, and cognitive) in each of the five OECD guidelines (prequalification, bidding cost, specifications, cost estimates, and bids evaluation criteria).

4.4.3 Qualitative strand

Integrated with the first part of the research, the aim of the second part is to facilitate the assessment of the current level of stakeholder performance with the proposed attributes. Contrast to the first phase of the investigation, which was measured by contractors only, this second objective requires knowledge of the views of all relevant stakeholders in order to avoid bias. Interviewing is considered the most efficient qualitative method for this purpose (Seidman, 2013). Furthermore, qualitative research generally is characterized by diversity (Punch, 2013), which contributes to the integration and analysis of different points of view. Qualitative data which presents different perspectives can be obtained through both focus groups and in-depth interviews (Babbie, 2013). The in-depth interviews are easier for the researcher to control than focus groups; interviews also provide ease of recording and arrangement (Denscombe, 2014). In this study, therefore, one-to-one interviews were preferred. Researchers mostly adopt in-depth interviews to reach a comprehensive perception of the interviewees' perspectives. These comprise open-ended and probing question in order to extract respondents' perceptions (Berry, 1999). Furthermore, in-depth interviews allows the researcher to observe interviewees' experiences, feelings, opinions, and knowledge (Patton, 2015). Interviewing is distinguished from other data collection methods by interaction, relative informality, thematic approach, and inferencing through interaction (Mason, 2017). Data collection instruments, selection of survey participants, data collection implementation, and analysis of data collected during this phase will be discussed in detail in the following sections.

Data collection instrument

Instrument design

In order to collect valuable data from interviewees, Creswell et al. (2007) pointed out that several forms of interview design can be developed. Gall et al. (2006) further classified those forms into three main categories, which are: informal conversational interview (unstructured), general interview with a guided approach (semi-structured),

and standardized open-ended interview (structured). An unstructured interview is a conversation about a topic facilitated through open-ended questions (Speziale et al., 2011). In this sort of interview, the interviewer abstains from adopting a definitive framework to direct the questions. During semi-structured interviews, interviewers have a clear list of issues to be addressed and questions to be answered (Bryman and Bell, 2015; Denscombe, 2014). Nevertheless, there is some flexibility under this sort of interviewing as the interview evolves (DiCicco-Bloom and Crabtree, 2006). On the other hand, a standardized open-ended interview is extremely structured in terms of content as well as wording. Open-ended questions asked during this kind of interview are kept the same for each interviewee (Gall et al., 2006).

The employment of standardized open-ended interviews is widespread in research studies (Turner, 2010). Patton (2015) identified several reasons for the widespread adoption of this sort of interviewing. The most important of which are: the availability of the adopted data collection instrument, the capacity of reducing variation among interviewers, effective use of time given the framework of questions, and the ease of analysis due to the presence of comparable responses. Furthermore, the open-ended questions in standardized interviews provide the opportunity for interviewees to share as much detailed information as desired (Turner, 2010). For these reasons, in addition to the nature of this phase's objective, a standardized open-ended interview method will be adopted to evaluate the current performance of the proposed attributes influencing contractor engagement in Saudi Arabian public road construction project tendering.

Potential interviews' questions are generally classified under six main categories which are: experience and behaviour questions, opinion and values questions, feeling questions, knowledge questions, sensory questions, and demographic questions (Patton, 2015). O'Leary (2014) discusses effective interviewing steps, providing detailed guidance on the design process, including planning, preparation, piloting, and modification. With regards to creating effective interview questions, McNamara (2009)

suggests several recommendations, among them the wording of questions should be open-ended to enable respondents to select their own phrases in answering, ensuring neutrality as well as clarity of questions, and combined questions should be avoided where possible. Furthermore, studies by Gordon (1975) and Ackroyd and Hughes (1992) emphasized the importance of ensuring that the sequence and wording of questions for all interviewees in standardized open-ended interviews is identical.

Patton (2015) provides a useful guideline for designing interviews questions, particularly the sequence and flow. With respect to the sequence of questions, he proposes starting the interview with questions about "noncontroversial" current behaviours. Consequently, opinions and feelings about the experiences described will be gathered. He further emphasizes the importance of establishing a context before asking knowledge and skills questions. Accordingly, prefatory statements and transition announcements are highly advisable when moving to a new topic, which both maintains attention and facilitates flow. Similarly, probing questions are recommended in order to seek elaboration or more detailed responses. Consequently, an interviewer ensures all aspects of the question are covered by interviewers to build cogent interpretations.

Instrument contents:

Since there are two groups of respondents involved in this study, two sets of interviews were constructed. Patton's (2015) directives have been taken into consideration to build a logical flow into the interviews. Therefore, the five main early stage components were listed in chronological order, as illustrated in Table (4-6). To facilitate responses, prefatory statements been used when shifting topic. Moreover, since opinion and feeling are likely to be more grounded and meaningful once the respondent has verbally relived the experience, each section begins by assessing the level of experience, followed by questions that examine respondents' opinions. In the pre-qualification section, to assist contractors in recalling their experiences, they were initially asked about their previous success in recognizing the minimum required degree of classification for tender announcements. Then, questions are asked to evaluate recent

classification experience, classification procedures and criteria clarity, and accessibility to these standards, respectively. Finally, they were asked to suggest recommendations to the Contractors Classification Agency. Similarly, in the bidding cost section, contractors were initially asked to assess their experiences when adopting e-procurement. Later, respondents were asked to evaluate the transition progress from traditional to e-procurement, the similarity of bidding documents, and the municipalities' response to bidder inquires, respectively. Finally, they were asked to suggest recommendations to reduce bidding cost.

Section	Description
1	Prequalification
2	Bidding cost
3	Specifications
4	Cost estimation
5	Bid evaluation criteria

Table 4-6 Sequence of interview questions targeting contractors

The specifications section began by asking respondents to assess the clarity of municipal road project specifications, based on their past experiences. After that, participants were asked to evaluate the application of the local building code, and the level of communication with municipalities to clarify specifications. Finally, they were asked to suggest recommendations for improving the level of clarity in specifications. In the cost estimation section, contractors were initially asked to identify experiences and qualifications for their cost estimate teams. Moreover, they were asked to determine their pricing benchmark. Then, they were asked to evaluate the adequacy of the period wherein a company must provide accurate estimates, stipulated according to Government Tendering and Procurement Law. Finally, they were asked to suggest recommendations to improve the accuracy of cost estimates. Similar to other sections, contractors were asked to rate their experiences with bids evaluation decisions. Then, they were asked to evaluate the clarity of bid evaluation criteria, the accessibility to these criteria, and the municipalities' performance in the clarification of those criteria.

Finally, they were asked to suggest recommendations for facilitating accessibility to the bid evaluation criteria.

On the other hand, municipalities' staff interviews were divided into four sections, as illustrated in Table (4-7), each section relating to a particular municipal department, with whom it will be discussed. Section one included questions about procedures relating to the prequalification process, as well as accessibility to them; this section will be addressed to the Contractors Classification Agency. Section two includes questions about providing the required classification in tender announcements, the progress in shifting to e-procurement, standardizing tendering documents, and tackling bidders' inquiries; these questions will be put to the municipal procurement departments. Section three includes questions about the methods applied when preparing specifications and cost estimates, the adopted specification code, communication channels with contractors to explain updates; these subjects will be discussed with the municipal roads departments. In the final section, questions about the adopted bid evaluation criteria were written, including exclusion criteria and ways of disseminating those criteria; these questions will be discussed with the Bidding Evaluation Committees.

Section	Description
1	Contractors Classification Agency
2	Municipal procurement departments
3	Municipal roads departments
4	Bidding Evaluation Committees

Table 4-7 Sections of interview questions targeting municipality staff

Instrument content validity

As applied in the quantitative strand, a pilot study exercise was carried out to assess the interview design's clarity, comprehensibility, and representation. A panel of five experts, include construction mangers, road engineers, and academic professors who all have more than 10 years' experience of working in their field, was invited to pre-test the

contents of both interviews. This panel was given the opportunity to add any comments or feedback regarding any items included in the survey. The pre-testing of the survey instrument took place in December 2016. Responses to the interview questions were generally positive regarding the comprehensibility of questions, the format of the interviews, and the clarity of the terms used. Nevertheless, there were a few valuable suggestions made to improve the wording of the interviews, which in turn played a vital role in the revision of these questions.

Selection of survey* participants *(population and sampling)

Patton (2015) emphasized that the choice of cases to be investigated is the cornerstone of qualitative research. Therefore, researchers need to be keen to select cases that will help them to better understand the research question (Creswell, 2013). Accordingly, the sampling framework generally includes naming the population, determining sample size, as well as the adopted sampling strategy (O'Leary, 2014). Due to the nature of the objective of the self-assessment phase, wherein the current performance of the relevant stakeholders will be evaluated, the target population will be the municipalities in the same five zones as previously selected, represented by the procurement departments, the departments which supervise road projects, and the Contractors Classification Agency. For the customers' assessment part, the same classified contractors in the field of road projects who participated in the previous questionnaires will act as the target population. In summary, the population in the qualitative strand includes the classified contractors, in addition to municipal staff within the five specified zones.

As for the target sample size of this stage, several approaches have been reviewed. Borenstein et al. (2011) indicates that the appropriate minimum sample size is four to six in-depth interviews, while Kuzel (1992) proposes twelve to twenty interviews in order to achieve maximum variation. On the other hand, Creswell (2013) classifies the minimum sample size based on the adopted qualitative research design. He suggests one or two individuals for narrative research, three to ten for phenomenology, twenty to thirty for grounded theory, and four to five for ethnographic research. This difference

explains what Patton (2015) points out, namely that the sample size is determined according to the research purpose, the usefulness for the search findings, and the availability of resources. The sample size of this qualitative section is determined to be from ten to twenty interviews, which in turn facilitates quantitatively summarizing the findings at the interpretation stage (O'Leary, 2014).

Selecting a search sample generally requires convenient and representative sampling (O'Leary, 2014). Accordingly, the aim here is to cover all of the relevant stakeholders in the sample of this research phase. A purposive sampling, which is a type of non-probability sampling in which the sample selection process relies on the researcher's judgment (Babbie, 2011), is applied. Purposive sampling commonly seeks "information-rich cases" in order to generate a deep understanding instead of generalizations (Guba and Lincoln, 1994; Patton, 2015). Furthermore, purposive sampling ensures the relevancy of all sample elements to the objectives of the research (Mason, 2017). Obviously, a sound judgment enables researchers to obtain a representative sample (Black, 2016). On the other hand, researchers adopting this approach of sampling are advised to seek participants who interested in sharing their information openly and sincerely (Creswell et al., 2007). Therefore, the selected sample will be asked to be involved in these interviews voluntarily. Nevertheless, sample representativeness will not be overlooked to reduce bias commonly experienced in the use of volunteer sampling (O'Leary, 2014). Eleven contractors agreed to participate in the interviews designed to measure customer satisfaction in the first phase of the research. Moreover, all five municipalities were contacted, in addition to the Contractors Classification Agency, in order to gather volunteers to complete the interviews designed to measure the commitment of government agencies.

Data collection implementation

The interviews for the study were undertaken between January 2017 and February 2017. Initially, the researcher contacted those contractors who volunteered and showed their willingness during the questionnaire stage to conduct an in-depth interview. Some

of them did not respond or reported their preoccupation at that time. Nevertheless, the researcher has endeavored to interview available contractors. Five contractors from four different zones and all classes except class (2) were interviewed; these interviews were undertaken in an average time of 40 minutes. All five interviewees were the owners of their firms.

On the other hand, all of the five municipalities were invited, through the heads of their municipalities, to conduct interviews with municipal staff. Due to limited time, as well as the need to travel to five different zones, interviews were conducted within each municipality that where they could be conducted during the same day. Accordingly, seven interviews in total were conducted with the Contractors Classification Agency, municipal procurement departments, municipal roads departments, and Bidding Evaluation Committees. Table (4-8) provides the details of all interviewees.

#	interviewee code	Category
1	ALP-04-044	Contractor
2	BET-03-018	Contractor
3	DEL-05-022	Contractor
4	GAM-01-002	Contractor
5	GAM-04-025	Contractor
6	CCA	Contractors Classification Agency
7	ALP-PRC-DPT	Municipal procurement department
8	GAM-PRC-DPT	Municipal procurement department
9	ALP-EVA-COM	Municipal roads department
10	GAM-EVA-COM	Municipal roads department
11	ALP-ROD-DPT	Bidding Evaluation Committee
12	GAM-ROD-DPT	Bidding Evaluation Committee

Table 4-8 Interviewees' details

In compliance with the University of Strathclyde's Code of Practice on Investigations Involving Human Beings, the participant information sheet was read to each interviewee

at the beginning of each interview, including an emphasis on confidentiality and privacy. Then, participants were asked to give their verbal consent to indicate their willingness to participate in the study and to allow the recording and transcription of their interviews. Copies of the oral consent script as well as the participant information sheet are provided in (Appendix C-1) and (Appendix C-2) respectively. As a result, twelve interviews were conducted, taped, and transcribed. Clean read or smooth verbatim protocol has been utilized. A coherent text, simple to understand, but representing the original wording and grammatical structure, is produced.

Analysis

Qualitative research analysis procedures mainly aim at extracting supportive information from text data, by following systematic sequential steps (Creswell, 2013). Diverse techniques and practices have been used in analyzing qualitative data (Punch, 2005), the most common being content analysis, narrative analysis, discourse analysis, and interpretive phenomenological analysis. Content analysis, which investigates the text data and seeks to identify a theme which is determined prior to data collection phase (Krippendorff, 2004), will be adopted in this investigation. This qualitative analysis technique aims to present a summarized description of a phenomenon (Elo and Kyngas, 2008). One of the advantages of the content analysis technique is its ability to quantify the qualitative data (Grimmer and Stewart, 2013). Furthermore, content analysis enables the researcher to classify text data into smaller and more contextually relevant groups (Cavanagh, 1997).

The content analysis technique follows several types of systematic procedures adopted in advance in interpreting qualitative data (Neuendorf, 2017). These sequential procedures differ according to the purpose of interpreting the qualitative data. Mayring (2014) explains three main forms of interpretation, which are: reductive, explication and structuring. He indicates that reductive procedures aim to provide a comprehensive summary by abstraction, while explication procedures aim to add supplemental materials that will help to enhance understanding, and structuring procedures aim to

filter out the material to be assessed deductively based on predetermined criteria. Converting qualitative data into a useful digital format by adopting one of these procedures will be useful (Tashakkori and Teddlie, 2010), and this task can be conducted generally through the coding process (Gerring, 2017).

For the purposes of this section of the research, ordinal deductive category assignment, which is a sub-form of structuring interpretation (Mayring, 2014), will be adopted. Mayring indicates that the structure in this deductive approach is created in a categorical system form, where the establishment of these categories relies mainly on empirical research and theories. He emphasizes that determining the category generally passes through three main stages, which are: category definition, anchoring samples within these categories, and finally coding rules. Subsequently, all of the collected qualitative data are systematically classified into those categories. After coding a portion of the collected data into these deductively derived categories, they should be compared to the deductive coding framework to ensure reliability. The coding process of all the collected data is then completed. Again, a summative check will be conducted to ensure reliability and the consistent application of coding rules. It is worth mentioning that the coding procedures must be provided in detail and transparently to readers (Drisko and Maschi, 2015). The general description of the adopted ordinal deductive category content analysis is shown in the procedural model illustrated in figure (4-7).

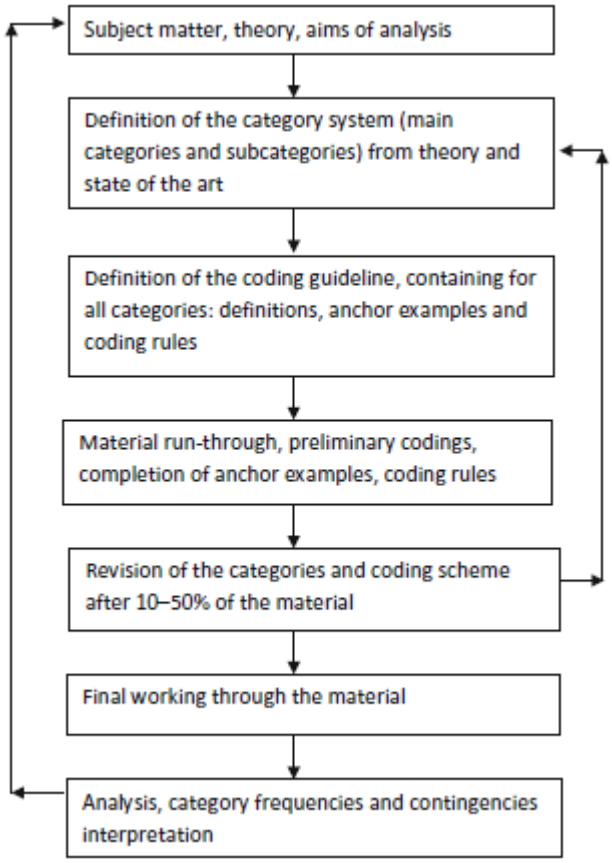


Figure 4-7 Deductive category assignment procedural model (Mayring, 2014)

In order to facilitate interpretation, interviews texts have been divided into segments (coding unit, context unit, and recording unit). A categorical system with 5-point ordinal scales (high - good - average - poor - very poor) has been developed for all of the proposed tendering attributes. The 5-point scale is similar to that adopted in measuring importance, in order to enable the integration of quantitative and qualitative data in the interpretation stage. Accordingly, we established a coding guideline containing definitions, anchor examples and coding rules for those 75 categories (See an example in Table 4-9). The coding process was conducted manually with the aid of QSR NVivo 11 software, as illustrated in Figure (4-8). According to the advice of Potter and Donnerstein (1999), all coding steps were performed by the researcher only (one coder) to achieve consistency for the qualitative analysis of this research.

The provision of technical advice to tackle user problems in e-procurement			
Variable	**Value**	**Definition**	**Encoding rules**
Contractors' satisfaction	P.Q.N.1. very satisfied	High feeling of satisfaction for municipalities' responses to tackling issues	Found a proper means to raise the issue Got sufficient and quick responses
	P.Q.N.2 Somewhat satisfied	Only partial or fluctuating certainty of the municipalities' responses to tackle issues	Found a means to raise the issue but couldn't get sufficient or quick responses sometimes
	P.Q.N.3 Not at all satisfied	Conviction of having difficulties in obtaining the municipalities' responses to tackling issues	Could not communicate, which led to withdrawal from bidding
	P.Q.N.4 Not inferable	The demands were reported but the manner of dealing with them remains unclear	
Government officers' self-evaluation	P.Q.N.11 Already committed	High subjective feeling of ability to respond to competitors' queries	Provide a proper means to respond quickly and sufficiently
	P.Q.N.22 Somewhat committed	Partial certainty of having coped with responding to competitors' queries	Some observations on the method provided
	P.Q.N.33 Not at all committed	Conviction of having coped badly with responding to competitors' queries	No provision of any communication method at all
	P.Q.N.44 Not inferable	The demands were reported but the manner of dealing with them remains unclear	

Final analysis encoding	
High performance	All contractors are satisfied + all procurement departments are committed.
Good performance	One to two cases of dissatisfaction or lack of commitment.
Average performance	More than two cases but not more than half of the interviewed showed dissatisfaction or lack of commitment.
Poor performance	More than half but not all of the interviewed showed dissatisfaction or lack of commitment.
Very poor performance	All contractors not satisfied + all of the procurement departments committed.

Table 4-9 Coding guideline of performance assessment - the provision of technical advice to tackle user problems in e-procurement

Figure 4-8 Nvivo coding process example

4.5 Mixing qualitative and quantitative strands

Both quantitative and qualitative strands in the second stage of this research will be integrated into the interpretation of results by adopting an Importance-Performance Analysis (IPA) technique. The IPA was first introduced by Martilla and James (1977) as a management tool to develop services' improvement strategies in order to enhance customer satisfaction. IPA is deemed a simple, valuable, and effective tool (Hansen and Bush, 1999; Sever, 2015; Lai and Hitchcock, 2015), that allows an intuitive assessment to visually identify gaps between stakeholders' perceptions of the importance of a specific attribute and the actual performance of a firm or destination on managing that attribute. This in turn supports management decisions (Silva and Fernandes, 2011; Sever, 2015; Chang et al., 2017) to determine what needs to be improved to gain customer satisfaction (Silva and Fernandes, 2011; Trang et al., 2016), identify strengths and weaknesses (Lopes and Maia, 2012; Yin et al., 2016), prioritize improvement procedures (Bacon, 2003; Lai and Hitchcock, 2015; Chang et al., 2017), and maintain sustainable development (Sörensson and Friedrichs, 2013).

The present research focuses on improving tendering attributes in order to enhance local contractors' desire to bid. In order to set the stage for improvement in a managerial format, the proposed institutional framework actions require to be prioritised. A key method in the decision making of prioritising tasks is Eisenhower matrix (Obolensky, 2017). This matrix was initially introduced by the U.S. President Dwight D. Eisenhower (Dabell, 2018). Tasks will be prioritised in this tool based on urgency and importance. Nevertheless, Eisenhower's Urgent-Important Matrix will not be considered since urgency is not the scope here. Instead, the IPA technique by which the performance of tendering attributes and importance assigned to them by local contractors will be analysed, is adopted to provide greater insights. Furthermore, IPA is based on the fact that there is a linear relationship between performance and customer satisfaction, which supports the main research aim.

The IPA technique mainly assumes that the performance and importance of attributes are independent variables (Martilla and James, 1997; Oliver 2014; Bacon 2003), and attribute performance and customer satisfaction are linked through a systematic and linear relationship (Pezeshki, 2009). To et al. (2015) suggest four main steps to conduct an IPA technique. They emphasize that the key attributes need to be identified initially, so a field survey is conducted to measure the level of importance of the attributes as well as the level of performance. Subsequently, the means of the importance and performance scores are calculated for each attribute. Finally, those attributes' means are plotted in the IPA grid.

As illustrated in Figure (4-9), a traditional IPA grid is divided into four quadrants and all attributes are spread over these quadrants. The first quadrant includes attributes of high importance according to the respondents' perspective, while the organisations' performance on those attributes are assessed as relatively low. Accordingly, more attention need to be taken over these key attributes and managerial actions should concentrate on this area. The second quadrant includes attributes of high importance according to the respondents' perspective, and the organisations' performance on those attributes are evaluated as high. Therefore, the proper managerial strategy here is to maintain a good standard of work. The third quadrant includes attributes of less importance according to the respondents' perspective, while the organisations' performance on those attributes are evaluated as relatively low. A lower priority should be given here and poor performance will be considered after ensuring the improvement of the first quadrant's attributes. The fourth quadrant includes attributes of less importance according to the respondents' perspective, while the organisations' performance on those attributes are evaluated as high. This indicates that too much effort was expended here compared to what was actually needed.

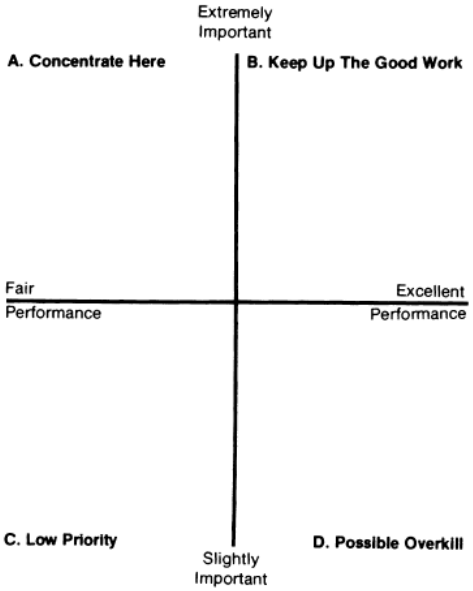


Figure 4-9 Traditional IPA grid (Martilla & James, 1977)

Usability as well as simplicity in interpretation of results are the most prominent features of the IPA approach (Matzler et al., 2003; Kitcharoen, 2004; Abalo et al., 2007; Silva and Fernandes, 2011; Lopes and Maia, 2012; Sever, 2015), which has been reflected in its growing popularity in management research (Sever, 2015). Therefore, the application of IPA has extended from its original purpose, which is marketing to a wide range of fields, including service quality (e.g., Matzler et al, 2003), meetings and events (e.g., Go and Zhang, 1997), hospitality (e.g., Deng, 2007), travel markets (e.g., Enright and Newton, 2004; Murdy and Pike, 2012), healthcare (e.g., Skok et al., 2001; Yavas and Shemwell, 2001; Abalo et al., 2007), accommodation (e.g., Beldona and Cobanoglu, 2007; Chu and Choi, 2000; Cvelbar and Dwyer, 2013), convention centres (e.g., Breiter and Milman, 2006), the automotive industry (e.g., Matzler al., 2004), agency tours (e.g., Hudson et al., 2004; Zhang and Chow, 2004), destination competitiveness (e.g., Dwyer et al., 2014), banking (e.g., Yeo, 2003; Joseph et al., 2005), tourism (e.g., O'Leary and Deegan, 2005; Vaske et al., 2009), and IT services (e.g., Ainin and Hisham, 2008). In the construction industry particularly, Chang et al. (2017) applied the IPA tool to construction firms to classify their managerial priorities in sustainability.

Worth mentioning here, the misinterpretation of the IPA findings could lead to recommendations to improve attributes that do not support the main purpose of the organisation (Feng et al., 2014). Therefore, several suggestions were taken into account for an appropriate interpretation. Lai and Hitchcock (2015) summarized the six commonly applied IPA grid approaches, as shown in Figure (4.10). Accordingly, as for the locations of the grid lines that map the quadrants, mean values of observed importance and performance were considered in this research when determining the crosshair point in the IPA grid, as suggested by (Oh, 2001; Bruyere et al., 2002; Silva and Fernandes, 2011; Sever, 2015). Consequently, the IPA grid in this research is constructed using data means as the intersection point of the x (performance) and y (importance) axes. In accordance with the expectation disconfirmation theory (Bacon, 2003), a diagonal line representing a zero-performance gap will be added. As illustrated in Figure (4-11), this flexible data-centred diagonal line allows researchers to adjust the partitions based on their own situation (Lai and Hitchcock, 2015). Furthermore, the distance of those attributes from this diagonal line refers to the degree of discrepancy between performance and importance scores, which enable priority ordering of managerial actions evenly in each quadrant (Ziegler et al., 2012; Azzopardi and Nash, 2013).

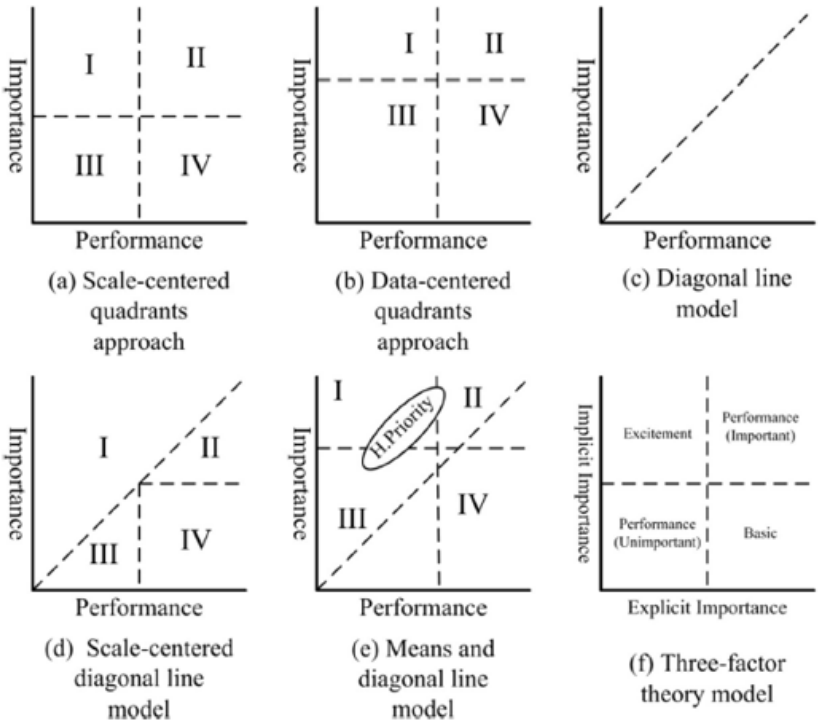


Figure 4-10 Different IPA grid application approaches (Lai & Hitchcock, 2015)

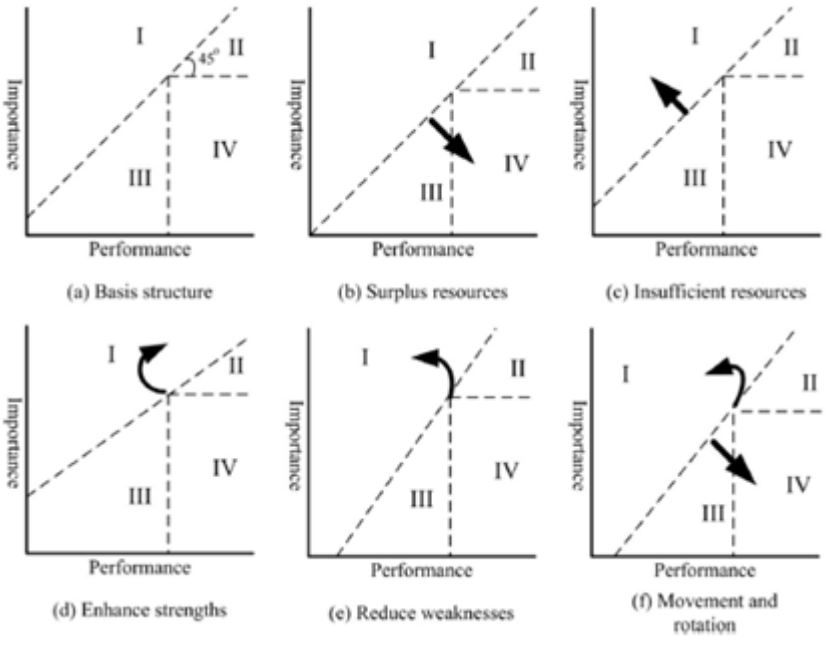


Figure 4-11 Flexible data-centred diagonal line models (Lai & Hitchcock, 2015)

4.6 External validity

Due to limited time and resources, the research concentrated on particular cases within the municipal road projects sector, which might not confirm the suitability and effectiveness of the findings for others beyond the scope of the study. Therefore, an external validity survey is applied, by which the extent of generalisation of the conclusions drawn beyond the research context are measured (Bryman, 2016). One of the most common methods to amplify framework validity is to assess its feasibility by a panel of experts (Polit and Beck, 2006). Accordingly, following the development of the proposed framework based on the findings discussion of both quantitative and qualitative strands, it will be presented and evaluated by experts outside the sampling which were adopted on both strands.

Instrument design

The data collection tool in this phase aims mainly to assess the clarity, completeness, conciseness, and correctness of the proposed framework in web-based questionnaire. Additionally, the tool is designed to ensure the response time should not exceed 20 minutes. Consequently, the questionnaire seeks quantitative responses from the participants by adopting a 5-point Likert scale to record respondents' opinions from ‘strongly disagree’ to ‘strongly agree’, which increase the respondents' capability to answer and facilitate the ability to analyse data.

The tool encompasses three main sections. In section (A), general background information about each respondent including organisation, position, years of experience, and number of municipal road tenders participated in was requested. Then, the proposed framework was presented as a table of priorities, where the required managerial actions were demonstrated under each priority in Section (B). Section (C) requests each respondent to assess the presented framework in terms of clarity, completeness, conciseness, and correctness. In case of disagreement with one of those four elements, each participant was given the opportunity to add qualitative data as comments on the proposed framework. Furthermore, a further section will be

introduced in case of disagreement with the correctness of the framework to assess each attribute separately based on 5-point Likert scale. A pilot study was held among a few colleagues to seek suggestions about the wording and structure of the instrument. Based on these suggestions (see Table 4-10), the overall quality of the survey tool has been improved.

#	Modification
A-4	Has been rephrased to emphasise the number of tenders.
C-1	The phrase (In terms of language) has been added to explain what is intended by the clarity.
C-2	The phrase (covering all of the tendering stage aspects) has been added to explain what is intended by the completeness.
C-3	The phrase (short but comprehended) has been added to explain what is intended by the conciseness.
C-4	The phrase (In enhancing the desire to bid) has been added.

Table 4-10 The pre-test outcomes (External validity survey)

Selection of participants

Another key point in conducting a successful external validity survey is the quality of the experts' panel selection (Keeney et al., 2001; Hallowell and Gambatese, 2010). Therefore, Day and Bobeva (2005) emphasize that the external validity survey requires individuals who are interested in the subject area as well as have the proper knowledge and experience. Accordingly, two main criteria were identified for the nomination of participants, which are:

- Individuals with more than 10 years of experience in road projects, and
- Individuals holding managerial positions in their firms

In order to avoid bias which might affect the possibility of generalizing the findings, multiple participant categories were targeted, including consultants, contractors, municipalities, and academics (Hallowell and Gambatese, 2010). Due to the difficulty of

direct access to these individuals, the Saudi Contractors Authority, the Saudi Council of Engineers, and the Ministry of Municipal and Rural Affairs have been contacted to send participation invitations. On top of this, some construction management academics were invited directly.

Data collection implementation

In compliance with the ethical requirements, invitation letters, including participant information sheets (Appendix D-1), were sent via email to the public relations department of each organisation to gain the consent (Appendix D-2) of participants by providing the email addresses of each participant. A total of 10 experts who met the selection criteria accepted the invitation to participate. Consequently, a web-based questionnaire through Qualtrics (Appendix D-3) was applied to run the survey. Despite the initial agreement from this panel of experts to contribute to the study, it took more than three months of following up to collect all responses. The results of the external validation test of the proposed framework are discussed later by the end of Chapter-7.

4.7 Summary

This chapter has discussed the different approaches adopted for the research design. Research paradigms, research approaches, research design, and mixing procedures are discussed in order to justify the adopted research design, which enabled the accomplishment of the research aim and objectives, with a consideration of time and cost. This research design was adopted based on the nature of the research objectives and the limited accessibility of respondents. Initially, the research begins with an exploratory study of the context including two phases of desk study. This stage mainly aims to identify indicators of potential bid-rigging in the market and to investigate the scarcity of participation in bidding from local contractors. As a result, research propositions are presented to be examined in the next stage.

The next research stage adopts a sequential explanatory mixed-methods approach that combines both qualitative and quantitative methods. Firstly, a quantitative study is

conducted to measure the importance of the proposed attributes in the tendering stage from the point of view of local contractors. This quantitative study employs a semi-structured questionnaires and applies a 5-point Likert scale. The questionnaires target the local contractors in the five designated zones. To seek more elaborations about these local contractors' assessments, the second phase of the study uses a qualitative standardised open-ended interview method to evaluate the current performance of the relevant stakeholders on each attribute. To avoid bias, these interviews survey both local contractors and some municipal staff. These qualitative study results will give a second dimension to the proposed attributes, which will facilitate the use of the IPA technique. Combining the findings of the qualitative interviews and the quantitative questionnaires enables the prioritisation of the proposed managerial actions necessary for municipalities to achieve a higher level of competition in future tenders. The next chapter will discuss the findings of the first phase of the exploratory study, which examines the nature and extent of the local contractors' participation in municipal roads network tenders.

Chapter 5: Indicators and incidents of potential collusion among main contracting firms in Saudi Arabian municipal road network projects

5.1 Introduction

The literature review has revealed a lack of empirical analysis of the Saudi Arabian public construction industry, particularly in the scope of suspected collusion practices. Therefore, it was imperative to understand the nature and extent of participation of classified contractors, which is considered one of the main research objectives of this study, to enable the development of potential collusion practice indicators and incidents in Saudi Arabian public construction works procurement. Consequently, the potential incentives within this market for such behaviour will be comprehended and hence mechanisms can be developed to prevent future potential collusion practices.

In this study, we propose a model for conducting an economic screening approach that establishes indicators and incidents of potential bid-rigging in the Saudi Arabian public construction works sector. The intention is to explore the market structure of the local municipal roads construction market, and thereby to facilitate future detection of collusive bidding by competition authorities, thus protecting the market from such illicit behaviour. Local municipal road network projects were considered here because of the high rate of recurrent contracts, a lack of product differentiation, and stable demand in local procurement practices, which are considered significant factors in motivating bidders to collude. Forms of suspected bid-rigging, such as market allocation, bid suppression, and bid rotation, are all investigated.

5.2 Saudi Arabian municipal road network projects – a brief background

Municipal road projects in Saudi Arabia are administered by sixteen Kingdom-wide major municipalities, each comprising many sub-municipalities of major cities and affiliated smaller towns. The Ministry of Finance provides financing for these projects according to the municipality budget, which is approved annually. Those local municipal road projects fall mainly into four categories: asphalting, paving, and lighting projects,

construction of bridge and tunnels, restoration of older roads, and improving and beautifying entrances and roundabouts. In the major cities, the focus is on bridge and tunnel projects to minimize traffic jams, while municipalities concentrate on asphalt projects in the small governorates in order to complete the road network and deliver all services.

Figure 5-1 Types of local municipal roads construction works

Working on municipal road projects requires a pre-qualification phase for contractors. The Ministry of Municipalities, represented by the Contractors Classification Agency, classifies contractors into five classes, each of which has a contractual financial limit that cannot be exceeded, as illustrated in Table (5-1). This includes the consideration of contractor capabilities and technical possibilities, which include management and technical expertise, equipment, and performance on previous projects. Likewise, they evaluate the financial status of each contractor, including their budget, profit and loss account, cash flow, and sources of funding. These classification procedures will be held every three years for contractors who intend to renew their classification certificates.

Contractor Class	Contract Financial Limit	
	Saudi Arabian Riyal (million)	In GBP (million)
Class 1	>420	>86.1
Class 2	420	86.1
Class 3	140	28.7
Class 4	42	8.6
Class 5	14	2.9
Unclassified	4.2	0.9

Table 5-1 Classification of municipal roads contractors (The Ministry of Municipalities)

5.3 Results and Discussion

5.3.1 Alpha Municipality

This domain includes a major city, which has a population of about one million, and an urban area of 15,159.30 hectares, as well as two small towns and various villages with populations not exceeding 100,000. Mountainous terrain is the distinguishing feature of this municipality. This area experienced 101 municipal roads projects of all types during the five years specified in the study. More than half of these projects (51.49 per cent) were asphalting, paving, and road lighting projects, followed by 19.80 per cent for bridge and tunnel projects. In terms of the value of those projects and the classification requirements, 35.64 per cent of those projects were awarded with values under 14,000,000 Saudi Riyals, which were available to class (5) contractors and above. Furthermore, the majority of those projects (85.15 per cent) were awarded with values under 42,000,000 Saudi Riyals, which were available to class (4) contractors and above. 118 contractors in the field of municipal road works were classified within this municipality. Table (5-2) illustrates the distribution of those contractors based on their class.

Classification	Class (1)	Class (2)	Class (3)	Class (4)	Class (5)
Members	0	1	5	22	90
Availability of projects	100%	100%	97.03%	85.15%	35.64%

Table 5-2 Distribution of Alpha's contractors based on their classes

Market concentration:

Table (5-3) illustrates the market concentration index (HHI) for all types of municipal road projects within this municipality. By considering the categories of contractors' dominating this market, we can see that the class (1) external contractors have been awarded 80.00 per cent of the bridge and tunnel projects in this municipality. Additionally, the class (2) external contractors have been awarded 29.41 per cent of the municipal roads restoration projects. Finally, 40.00 per cent of the town entrances and roundabouts projects have been awarded to the class (4) external contractors. On the other hand, no dominance is observed in asphalting, paving and road lighting projects. The domination of the class (4) external contractors in town entrances and roundabouts projects will be excluded from further investigations because the total projects of this sort is 10, which is insufficient for further analysis. For the same reason, the domination of the class (2) external contractors in municipal roads restoration projects will be excluded from further investigations.

Project Type	Internal					External					HHI
	1	2	3	4	5	1	2	3	4	5	
Asphalting	0.0	14.3	18.4	16.3	4.1	0.0	22.4	2.0	18.4	4.1	1707.63
Bridge	0.0	0.0	0.0	5.0	0.0	80.0	10.0	0.0	5.0	0.0	6575.00
Restoration	0.0	5.9	11.8	5.9	23.5	17.6	29.4	0.0	5.9	0.0	1997.32
Roundabouts	0.0	0.0	0.0	20.0	10.0	0.0	20.0	0.0	40.0	10.0	2625.00

Table 5-3 HHI test results for the Alpha municipality

Participation rate:

The mean participant number of bidders in the bridge and tunnel projects awarded to the class (1) external contractors was 4.57, compared to 3.25 participants in other, similar projects awarded to other contractors. Additionally, the mean participant number of bidders within those monopolized contracts in the main city was 4.38 higher than the rate of participants in small towns (3.50). Despite the availability of the majority of these projects (85.00 per cent) to the Internal class (3) contractors, based on the awarded contracts values, only contractor (ALP-03-006) has participated in those tenders, with a total absence of the rest of the class (3) Internal contractors. Moreover,

three other Internal contractors of different classes have participated to a limited extent and just one has been awarded a contract in the main city, despite the participation of one the monopolized contractors.

On the other hand, 73.33 per cent of those monopolized bridge and tunnel contracts have been awarded just to three of the class (1) external contractors. The total value of these contracts was SAR 1.34 billion, which represents 70.60 per cent of the total bridge and tunnel projects values in this municipality. They competed against each other in almost all of these tenders. The first contractor achieved a success rate of 42.86 per cent for bridge and tunnel tenders that he has participated in, with a total value of contracts awarded of about SAR 541.8 million. Meanwhile, the second contractor achieved a success rate of 50.00 per cent for the same sort of tenders, with a total value of contracts awarded of about SAR 687.1 million. Finally, the third contractor achieved a success rate of 16.67 per cent for the same sort of tenders, with a total value of awarded contracts of about SAR 111.8 million.

Price volatility:

With regards to the price volatility, the mean price volatility of bridge and tunnel projects awarded to the external class (1) was 0.213, as illustrated in figure (5-2), which is somewhat higher than the mean price volatility of other, similar projects that have been awarded to other contractors (0.145). Moreover, tender (ALP-076), as well as tender (ALP-085) recorded a price volatility of more than 0.400. All of these monopolized contracts were within the main city. Therefore, no further analysis needs to be applied in order to compare price volatility of the main city with other small towns.

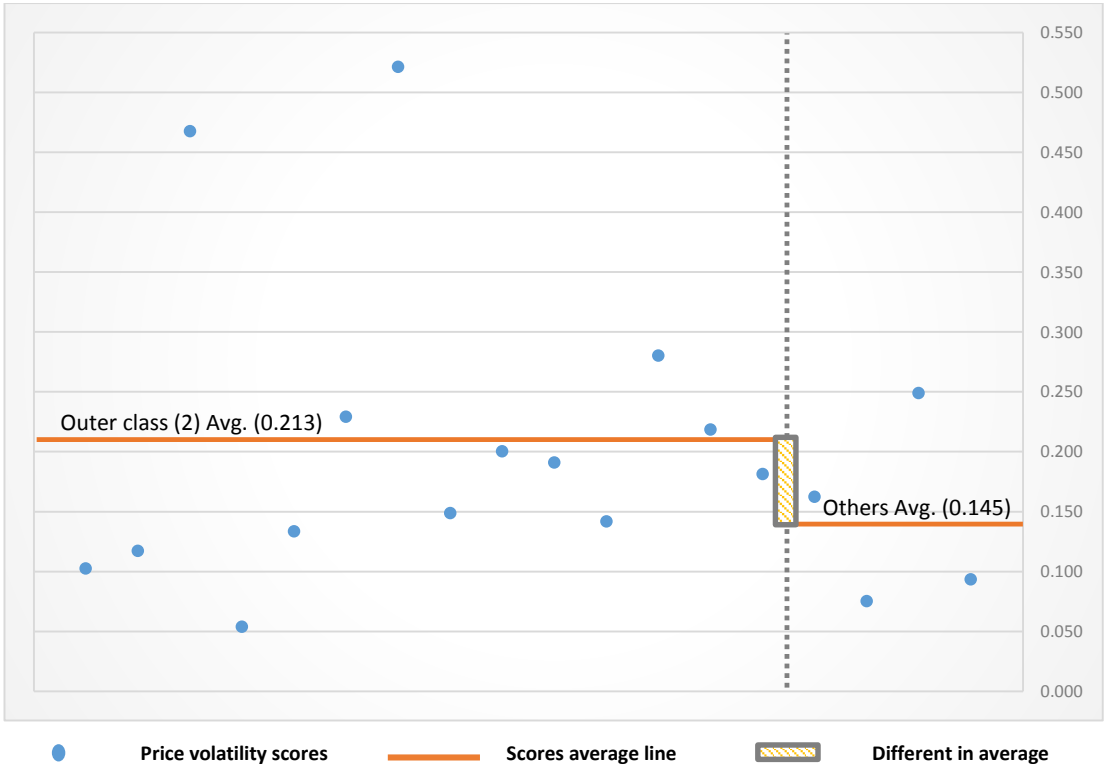


Figure 5-2 Bids' prices volatility of bridge and tunnel contracts awarded by external class (2) in the Alpha Municipality

Discussion:

The majority of bridge and tunnel projects were awarded to three external class (1) contractors, which is compatible with Heimler's (2012) assertion that the number of participants in collusion agreements commonly does not exceed five. Moreover, this oligopoly market situation is consistent with Dorée's (2004) emphasis that collusion leads to the creation of monopolistic markets. On the other hand, the Internal contractors' participation was scarce, especially Internal class (3) contractors, who were eligible to participate in most of these bids. This outcome corresponds to Oladinrin and Ho (2014) as well as Zarkada-Fraser and Skitmore (2000), both of which studies suggested that collusion diminishes the participation of other contractors. Interestingly, contractors' participation rates in tenders located in small towns was somewhat lower than the participation rate in the main city. The mean price volatility of bridge and tunnel projects that have been awarded to these three external class (1) contractors was somewhat higher than the mean price volatility of other similar projects, which contrasts

with the decline anticipated by Hüschelrath (2013) in average price volatility when collusion take a place. This suggests that some of the class (1) external contractors may have applied a complementary bidding scheme in Alpha bridge and tunnel tenders, which is indicated by the monopolized contractors' participation in tenders awarded to another monopolized contractor in most of these projects.

5.3.2 Beta Municipality

This municipality includes a major city and number of smaller towns, which together have a population of 1.06 million. What distinguishes this area is the large geographical area it covers – more than five hundred km2. This area experienced 105 municipal road projects of all types during the five years specified in the study. The majority of these projects (60.38 per cent) were asphalting, paving, and road lighting projects, followed by 21.70 per cent for town entrances and roundabout projects. In terms of the value of those projects and the classification requirements, most of those projects (75.24 per cent) were awarded with values under SAR 14,000,000 which were available to class (5) contractors and above. Furthermore, the majority of those projects (89.52 per cent) were awarded with values under SAR 42,000,000, which were available to Class (4) contractors and above. 49 contractors in the field of road projects were classified within this municipality. Table (5-4) illustrates the distribution of class among those contractors.

Classification	Class (1)	Class (2)	Class (3)	Class (4)	Class (5)
Members	2	3	4	14	35
Availability of projects	100%	99.05%	98.10%	89.52%	75.24%

Table 5-4 Distribution of Beta's contractors based on their classes

Market concentration:

Table (5-5) illustrated the market concentration index (HHI) for all types of the municipal road projects within this municipality. And by considering the contractors' categories that dominate this market, we can behold that the class (2) external contractors have

been awarded 31.03 per cent of the asphalting, paving, and road lighting projects in this municipality. On the other hand, the class (1) external contractors have been awarded 33.33 per cent of bridge and tunnel projects. Additionally, 40.00 per cent of the municipal roads restoration projects have been awarded to Internal class (4) contractors. Finally, Internal class (5) contractors have been awarded 46.67 per cent of the town entrances and roundabouts. The domination of class (1) external contractors in bridge and tunnel projects will be excluded from further investigation because the total projects of this sort is 9, thus insufficient for further analysis. Similarly, the domination of Internal class (4) contractors in municipal roads restoration projects will be excluded from further investigations. Additionally, On the basis of table (4-5), the domination of Internal class (5) contractors in town entrances and roundabouts projects will also be excluded from further investigations because this group contains a very high number of members (35), which would make coordination among them difficult and inhibit the collusion mechanisms described in the literature review.

Project Type	Internal					External					HHI
	1	2	3	4	5	1	2	3	4	5	
Asphalting	5.2	3.4	20.7	17.2	6.9	0.0	31.0	5.2	0.0	10.3	1908.4
Bridge	0.0	0.0	22.2	11.1	22.2	33.3	11.1	0.0	0.0	0.0	2345.7
Restoration	0.0	20.0	0.0	40.0	20.0	0.0	20.0	0.0	0.0	0.0	2800.0
Roundabouts	0.0	0.0	6.7	20.0	46.7	0.0	13.3	0.0	0.0	13.3	2977.8

Table 5-5 HHI test results for the Beta municipality

Participation rate:

The mean participant number of bidders in the asphalting, paving, and municipal road lighting projects that have been awarded to class (2) external contractors was 2.38, compared to 2.89 participants in other, similar projects awarded to other contractors. Additionally, the mean participant number of bidders within those monopolized contracts in the main city was higher than the rate of participants in small towns (3.50 and 2.00 respectively). Despite the availability of these projects (72.22 per cent) to the Internal class (4) contractors, based on the value of the awarded contracts, only three out of fifteen Internal class (4) contractors have participated in those tenders.

Moreover, those monopolized contracts have been awarded just to two of the class (2) external contractors. They have never competed against each other. The first contractor achieved a success rate of 64.71 per cent for the asphalting, paving, and municipal road lighting tenders that he has participated in, while the other contractor achieved a success rate of 41.67 per cent for the same sort of tenders. These two contractors monopolized 48.20 per cent of the total value of asphalting, paving, and municipal roads lighting contracts in this municipality.

Price volatility:

With regards to the price volatility, the mean price volatility of asphalting, paving, and municipal road lighting projects awarded to the external class (2) contractors was 0.147, which is slightly higher the mean price volatility of other, similar projects that have been awarded to other contractors (0.090). With a deeper analysis within projects awarded to the external class (2) contractors, as illustrated in figure (5-3), it is clear that projects located in the main city have a higher mean of price volatility (0.223) than projects located in small towns (0.122).

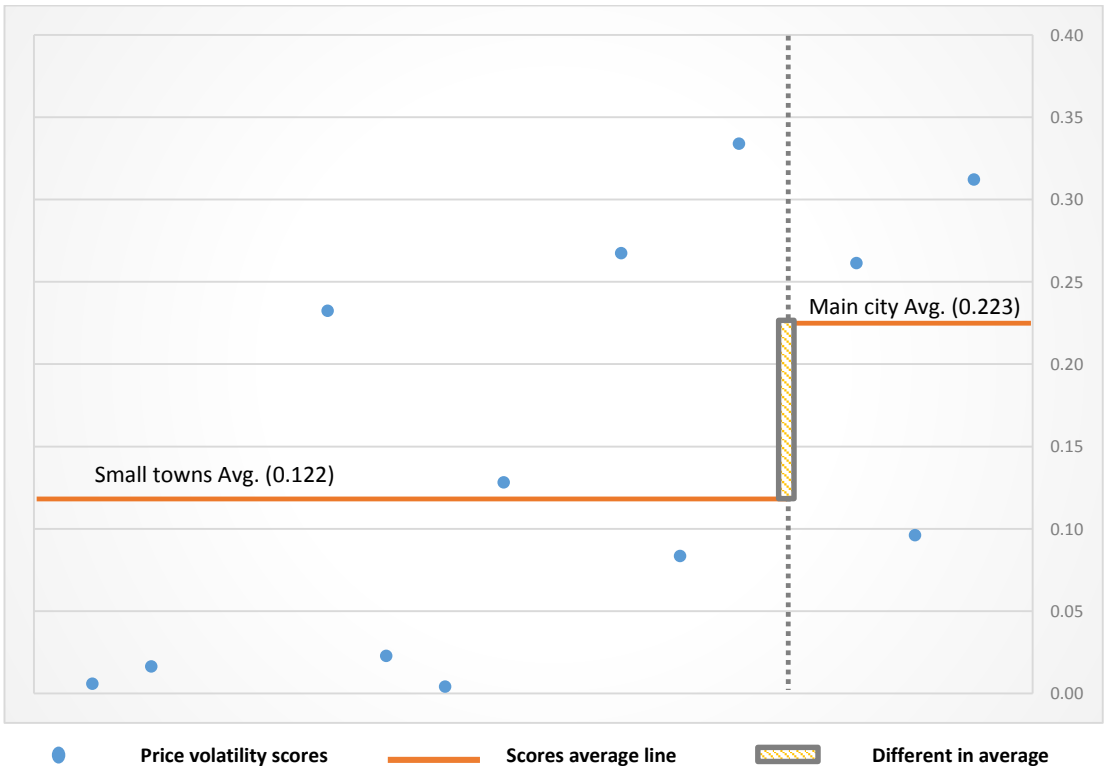


Figure 5-3 Bids' prices volatility of asphalting contracts awarded by external class (2) in the Beta Municipality

Discussion:

A suspicious percentage of asphalting, paving, and lighting contracts were awarded to two external class (2) contractors, which is compatible with Heimler's (2012) assertion that the number of participants in collusion agreements commonly does not exceed five. Moreover, this oligopoly of the market is consistent with Dorée's (2004) conclusion that collusion leads to monopolistic markets. On the other hand, Internal contractor participation was infrequent, especially the fourteen Internal class (4) contractors, who were eligible to participate in most of these bids. This outcome corresponds to Oladinrin and Ho (2014), as well as Zarkada-Fraser and Skitmore (2000); both studies contend that collusion diminishes participation of other contractors. Nevertheless, these two contractors have faced competition from some of the Internal class (1) and class (3) contractors, who successful tendered for a similar percentage of this sort of contract. Interestingly, contractor participation rate in tenders located in small towns was somewhat lower than participation rates in the main city. The mean price volatility of asphalting, paving, and lighting bids that have been awarded to these two external class (2) contractors was somewhat higher than the mean price volatility of other, similar projects, which contrasts with the expected decline in average price volatility when collusion takes place put forward by Hüschelrath (2013). Therefore, the findings do not indicate probable collusion among these monopolized contracts.

5.3.3 Gamma Municipality

The Gamma Municipality encompasses a metropolitan city and several small coastal towns. This area experienced 113 municipal road projects of all types during the five years examined in the study. The largest percentage recorded of these projects was 40.71 per cent for asphalting, paving, and road lighting projects, followed by 24.78 per cent for municipal road restoration projects. In terms of the value of those projects and the classification requirements, more than half of those projects (55.75 per cent) were awarded with values under SAR 14,000,000, which were available to class (5) contractors and above. Furthermore, most of those projects (76.11 per cent) were awarded with values under SAR 42,000,000, which were available to class (4) contractors and above.

180 contractors in the field of road projects were classified within this municipality. Table (5-6) illustrated the distribution of those contractors based on their class.

Classification	Class (1)	Class (2)	Class (3)	Class (4)	Class (5)
Members	7	7	14	45	107
Availability of projects	100%	100%	95.58%	76.11%	55.75%

Table 5-6 Distribution of Gamma's contractors based on their classes

Market concentration:

Table (5-7) illustrates the market concentration index (HHI) for all types of municipal road projects within this municipality. By considering the contractor categories dominating this market, it is clear that class (1) Internal contractors have been awarded 40.91 per cent of the bridge and tunnel projects in this municipality. Moreover, the class (1) external contractors have been awarded 45.45 per cent of the same sort of projects. On the other hand, 35.71 per cent of the town entrances and roundabout projects have been awarded to Internal class (1) contractors. The domination of Internal class (1) contractors in town entrances and roundabouts projects will be excluded from further investigations because the total projects of this sort numbers 14, which is insufficient for further analysis.

Project Type	Internal					External					HHI
	1	2	3	4	5	1	2	3	4	5	
Asphalting	25.6	18.6	27.9	7.0	7.0	9.3	0.0	2.3	2.3	0.0	1873.9
Bridge	40.9	0.0	0.0	4.5	0.0	45.5	0.0	0.0	4.5	4.5	5510.2
Restoration	19.0	14.3	9.5	23.8	19.0	0.0	4.8	4.8	4.8	0.0	1804.1
Roundabouts	35.7	0.0	21.4	35.7	7.1	0.0	0.0	0.0	0.0	0.0	3407.2

Table 5-7 HHI test results for the Gamma municipality

Participation rate:

The mean participant number of bidders in the bridge and tunnel tenders awarded to the Internal class (1) contractors was 4.68, compared to 5.91 participants in other, similar projects awarded to other contractors. Additionally, the mean participant

number of bidders within those monopolized contracts in the main city was higher than the rate of participants in small towns (5.50 and 3.33 respectively). Despite the availability of (77.27 per cent) of these projects to the Internal class (3) contractors, based on the awarded contract values, and more so, half (50.00 per cent) of these projects were available to the Internal class (4) contractors, there was a lack of bidding participation from those contractors in those monopolized contracts.

Price volatility:

With regards to price volatility, the mean price volatility of bridge and tunnel projects awarded to the Internal class (1) contractors was 0.184 which is slightly higher the mean price volatility of other similar projects that have been awarded to other contractors (0.165). With a deeper analysis within projects awarded to the Internal class (1) contractors, as illustrated in figure: (5-4), it is clear that the projects located in the main city have a higher mean of price volatility (0.219) than the projects located in small towns (0.112).

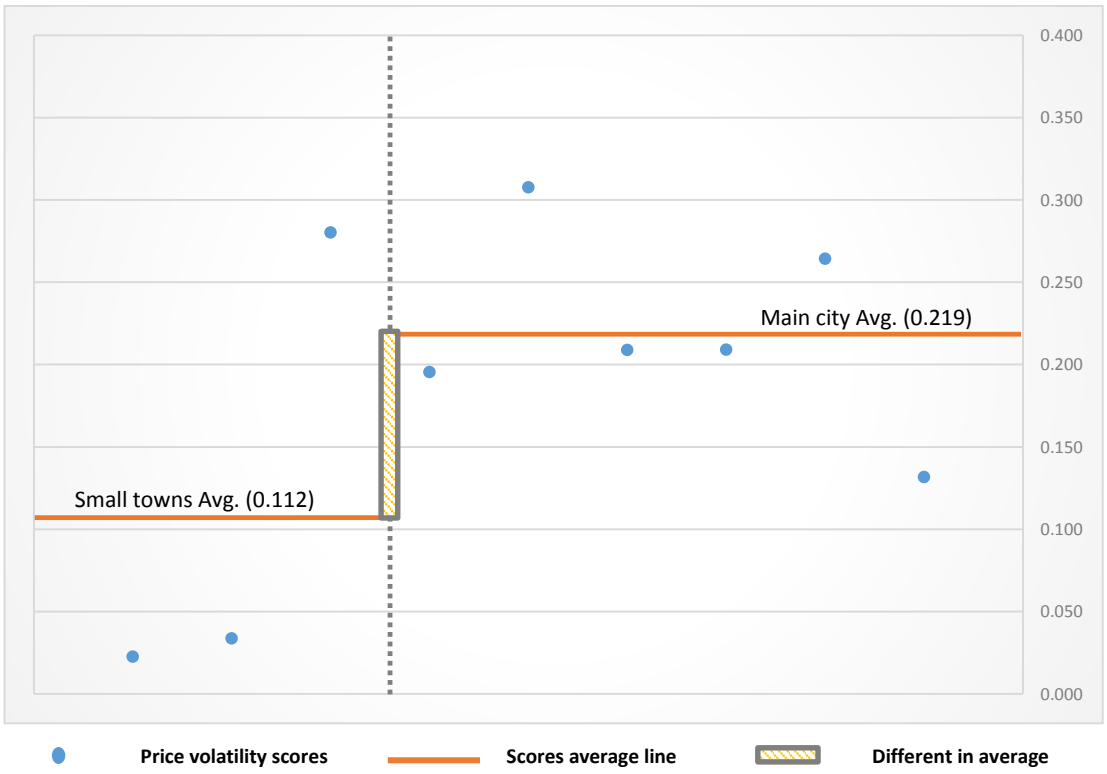


Figure 5-4 Bids' prices volatility of bridge and tunnel contracts awarded by Internal class (1) contractors in the Gamma Municipality

Discussion:

A suspicious percentage of bridge and tunnel contracts were awarded to two Internal class (1) contractors, which is compatible with Heimler's (2012) assertion that the number of participants in collusion agreements commonly does not exceed five. Moreover, this oligopoly situation within the market is consistent with Dorée's (2004) assertion that collusion leads to the formation of monopolistic markets. Conversely, the Internal contractors' participation was scarce, especially across the forty-five Internal class (3) contractors who were eligible to participate in most these bids. Additionally, the average number of bidders in the bridge and tunnels tenders awarded to the Internal class (1) contractors was less than other, similar tenders. These outcomes correspond to Oladinrin and Ho's (2014) and Zarkada-Fraser and Skitmore's (2000) confirmations that collusion diminishes the participation of other contractors. Interestingly, contractors' participation rate in tenders located in small towns was somewhat lower than their participation rate in the main city. Indeed, this region contains seven Internal class (1) contractors, yet only two of them have been awarded nine bridge or tunnel contracts.

5.3.4 Delta Municipality

This municipality includes a major city and eleven small towns, and covers an area of 120,000 square kilometres. This area experienced 114 municipal road projects of all types during the five years specified in the study. The majority of these projects (70.18 per cent) were asphalting, paving, and road lighting projects. In terms of the value of those projects and the classification requirements, most of these projects (85.09 per cent) were awarded with values under SAR 14,000,000, available to class (5) contractors and above. 30 contractors working in the field of road projects were classified within this municipality. Table (5-8) illustrates the distribution of those contractors based on their class.

Classification	Class (1)	Class (2)	Class (3)	Class (4)	Class (5)
Members	0	1	3	7	19
Availability of projects	100%	100%	100%	96.49%	85.09%

Table 5-8 Distribution of Delta's contractors based on their classes

Market concentration:

Table (5-9) illustrates the market concentration index (HHI) for all types of municipal road projects within this municipality. Considering the contractor categories that dominate this market, Internal class (2) contractors have been awarded 25.00 per cent of the asphalting, paving, and municipal road lighting projects in this municipality. Over the same period, the Internal class (4) contractors were awarded 35.00 per cent of the same sort of projects. Additionally, 60.00 per cent of municipal roads restoration projects have been awarded to both class (4) and class (5) Internal contractors. Finally, Internal class (2) contractors have been awarded all of the bridge and tunnel projects. The domination of Internal class (2) contractors in bridge and tunnel projects will be excluded from further investigations because the total number of projects of this sort was 2, which is insufficient for further analysis. For the same reason, the domination of both class (4) and class (5) Internal contractors in municipal roads restoration projects will be excluded from further investigations.

Project Type	Internal					External					HHI
	1	2	3	4	5	1	2	3	4	5	
Asphalting	0.0	25.0	8.3	35.0	11.7	1.7	5.0	1.7	10.0	1.7	2188.9
Bridge	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10000.0
Restoration	0.0	20.0	0.0	30.0	30.0	0.0	20.0	0.0	0.0	0.0	2600.0
Roundabouts	0.0	20.0	10.0	20.0	20.0	0.0	0.0	10.0	10.0	10.0	1600.0

Table 5-9 HHI test results for the Delta municipality

Participation rate:

The mean number of participant bidders in the asphalting, paving, and municipal road lighting projects awarded to the Internal class (4) contractors was 3.10, compared to a rate of 2.84 participants in other, similar projects that have been awarded to other contractors. Additionally, the mean participant number of bidders in the main city was lower than the rate of participants in small towns (2.38 and 3.54 respectively). Despite the availability of 86.25 per cent of these projects to the Internal class (5) contractors based on the contract values, there was a lack of participation from them.

Prices volatility:

With regards to price volatility, the mean price volatility of asphalting, paving, and municipal road lighting projects awarded to class (4) Internal contractors was 0.085, which was less than the mean price volatility of other, similar projects awarded to other contractors (0.142). Following a deeper analysis within projects that have been awarded to the Internal class (4) contractors, as illustrated in figure (5-5), it can be seen that the projects located in the main city have a lower mean price volatility (0.076) than projects located in small towns (0.090).

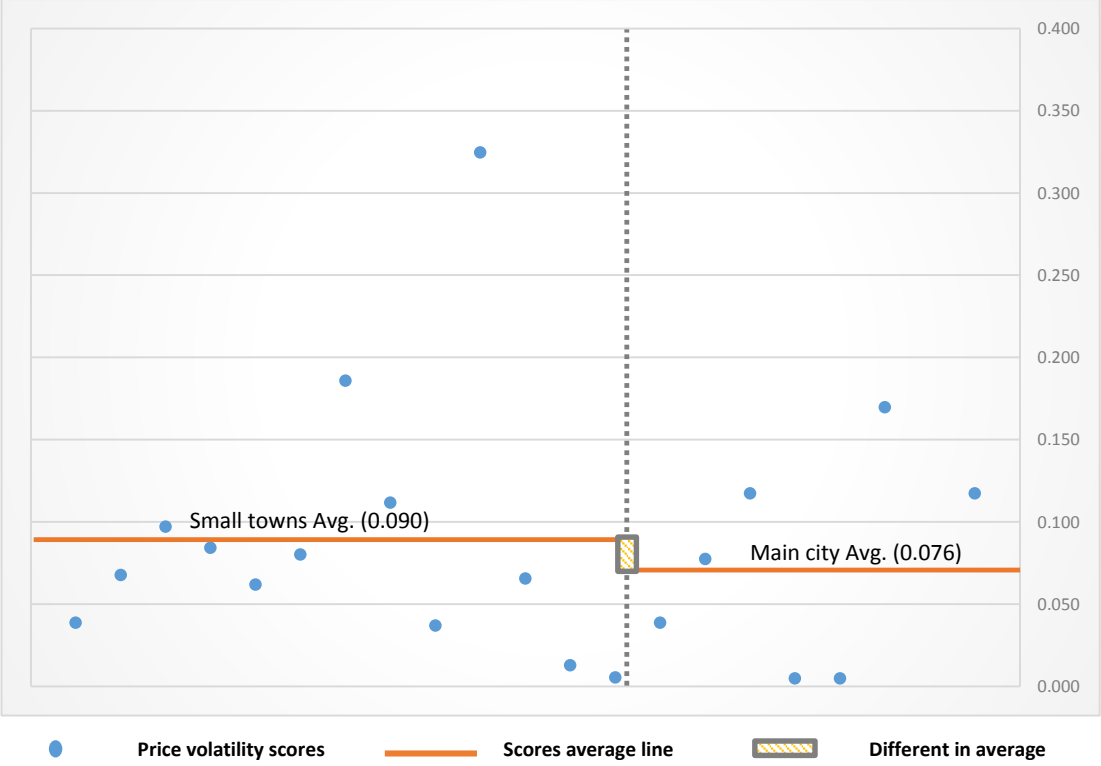


Figure 5-5 Bids' prices volatility of asphalting contracts awarded to Internal class (4) contractors in the Delta Municipality

Discussion:

A suspicious portion of asphalting, paving, and lighting contracts were awarded to six Internal class (4) contractors is contrary to Heimler's (2012) assertion that the number of participants in collusion agreements commonly does not exceed five. Nevertheless, this oligopoly market situation is consistent with Dorée's (2004) assertion that collusion

creates monopolistic markets. On the other hand, Internal contractor participation was scarce, especially the 19 Internal class (5) contractors who were eligible to participate in most of these bids. This outcome corresponds to Oladinrin and Ho's (2014) and Zarkada-Fraser and Skitmore's (2000) conclusions that collusion diminishes the participation of other contractors. In contrast to other zones, contractors' participation rates in tenders located in small towns was somewhat higher than participation rates in the main city. The mean price volatility of asphalting, paving, and lighting bids awarded to these two Internal class (4) was somewhat less than the mean price volatility of other, similar projects, consistent with the decline in average price volatility anticipated by Hüschelrath (2013) when collusion takes place.

Furthermore, those monopolized contracts have been awarded to six out of the total of seven Internal class (4) contractors, who competed against each other in just 4 tenders, which represents 19.05 per cent of the total number of monopolized contracts. Contractors (DLT-04-007), (DLT-04-008), (DLT-04-009), and (DLT-04-011) achieved a success rate of 100.00 per cent for those monopolized asphalting, paving, and municipal road lighting projects, and each of them achieved this full success rate in a different location. Furthermore, contractor (DLT-04-010) achieved a success rate of 75.00 per cent for the same sort of projects. However, this contractor has been awarded the highest number of contracts (6), in the main city and a certain small town. Lastly, contractor (DLT-04-005) achieved a success rate of 50.00 per cent for the same sort of projects, all within a certain small town. This suggests that these contractors may have applied the market allocation approach and employed the bid suppression concept, indicated here by the high rate of successes of those contractors and the lack of competing against each other in most of these tenders.

5.3.5 Omega Municipality

This municipality includes two cities and a few small towns, and covers an area of 534,000 km2. This area experienced 111 municipal road projects of all types during the five years specified in the study. The largest percentage recorded of these projects was

41.44 per cent, for asphalting, paving, and road lighting projects, followed by 32.43 per cent for municipal road restoration projects. In terms of the value of those projects and their classification requirements, a large number of those projects (69.37 per cent) were awarded with values under SAR 14,000,000, which were available to class (5) contractors and above. 36 contractors were classified within this municipality in the field of road projects. Table (5-10) illustrates the distribution of those contractors based on their class.

Classification	Class (1)	Class (2)	Class (3)	Class (4)	Class (5)
Members	0	3	2	9	22
Availability of projects	100%	100%	100%	91.89%	69.37%

Table 5-10 Distribution of Omega's contractors based on their classes

Market concentration:

Table (5-11) illustrates the market concentration index (HHI) for all types of municipal road projects within this municipality. And by considering the categories of contractors that dominate this market, it is clear that the Internal class (3) contractors have been awarded 31.71 per cent of the asphalting, paving, and municipal road lighting projects in this municipality. On the other hand, the external class (1) contractors have been awarded 71.43 per cent of the bridge and tunnel projects. Additionally, 52.63 per cent of the town entrances and roundabout projects were awarded to class (5) Internal contractors. The domination of external class (1) contractors in bridge and tunnel projects will be excluded from further investigations because there are only 7 of these, which is insufficient for further analysis. Moreover, and on the basis of the classification sizes of the Omega contractor groups, we excluded the domination of Internal class (5) contractors in town entrances and roundabout projects from further investigations because this group includes a slightly higher number of members (22), which would make coordination among them difficult and inhibit the collusion mechanisms described in the literature review.

Project Type	Internal					External					HHI
	1	2	3	4	5	1	2	3	4	5	
Asphalting	0.0	12.2	31.7	14.6	0.0	9.8	9.8	17.1	4.9	0.0	1873.9
Bridge	14.3	0.0	0.0	14.3	0.0	71.4	0.0	0.0	0.0	0.0	5510.2
Restoration	14.3	14.3	28.6	11.4	5.7	2.9	20.0	0.0	2.9	0.0	1804.1
Roundabouts	0.0	5.3	10.5	15.8	52.6	0.0	0.0	0.0	15.8	0.0	3407.2

Table 5-11 HHI test results for the Omega municipality

Participation rate:

The mean number of participant bidders in the asphalting, paving, and municipal road lighting projects that have been awarded to the Internal class (3) contractors was (3.77), which is close to the mean number of participants in other, similar projects that have been awarded to other contractors (3.81). Additionally, the mean participant number of bidders in the main two cities was much higher than the rate of participants in small towns (4.71 and 2.67 respectively). On the other hand, and despite the availability of 91.30 per cent of these projects to the Internal class (4) contractors, based on the contract values, there was a lack of participation from them.

Price volatility:

The mean price volatility of asphalting, paving, and municipal road lighting projects awarded to class (3) Internal contractors was 0.176, which is less than the mean price volatility of other, similar projects that have been awarded to other contractors (0.214). Following a deeper analysis within projects that have been awarded to the Internal class (3) contractors, as illustrated in figure (5-6), the projects located both in the main cities and in small towns have very close means of price volatility (0.178) and (0.174), respectively.

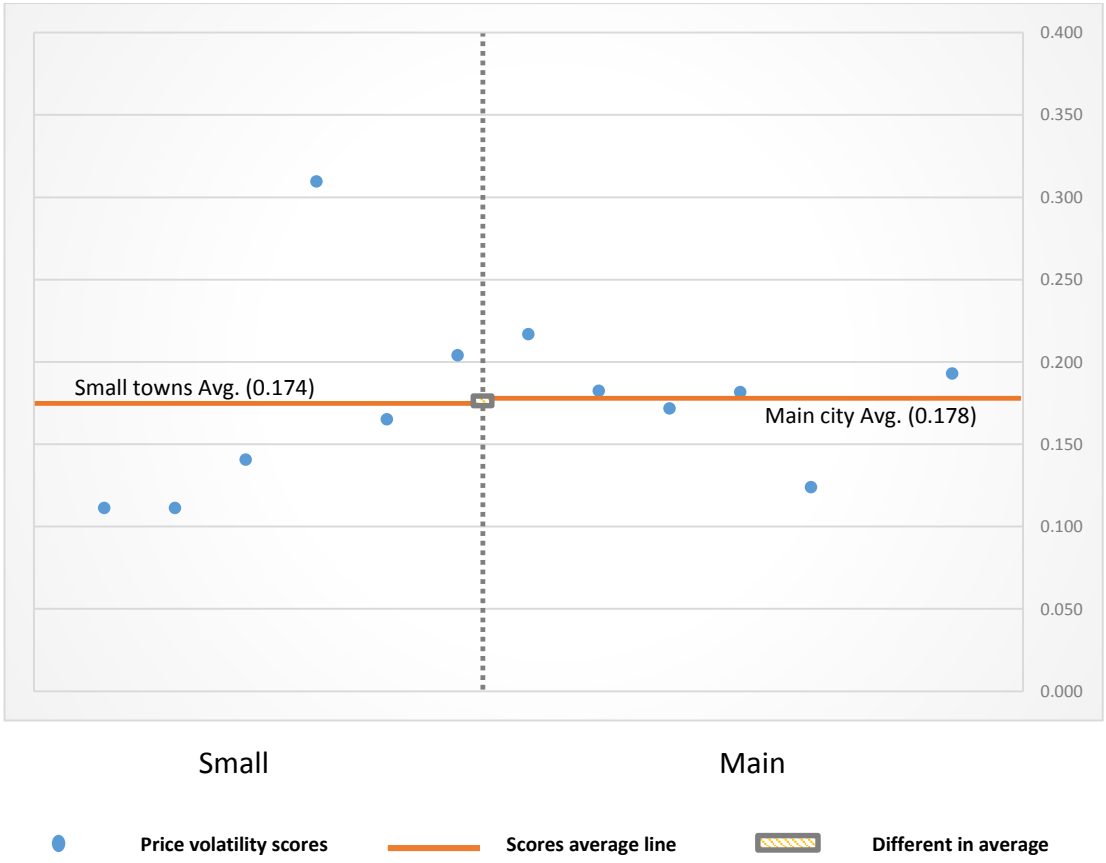


Figure 5-6 Bids' prices volatility of asphalting contracts awarded by Internal class (4) contractors in the Delta Municipality

Discussion:

A suspicious portion of asphalting, paving, and lighting contracts were awarded to two Internal (class-3) contractors, which is compatible with Heimler's (2012) assertion that the number of participants in collusion agreements commonly does not exceed five. Moreover, this oligopoly situation is consistent with Dorée's (2004) contention that collusion leads to monopolistic markets. On the other hand, the Internal contractors' participation was scarce, especially across the nine Internal class (4) contractors who were eligible to participate in most these bids. This outcome corresponds to Oladinrin and Ho's (2014) as well as Zarkada-Fraser and Skitmore's (2000) conclusions that collusion diminishes the participation of other contractors. Interestingly, contractor participation rates in tenders located in small towns was somewhat lower than participation rates in the main city. The mean price volatility of asphalting, paving, and lighting bids awarded to these two Internal class (3) contractors was somewhat less than

the mean price volatility of other, similar projects, which is consistent with the decline in average price volatility anticipated by Hüschelrath (2013) when collusion takes place.

Nevertheless, those monopolized contracts have been awarded mostly to contractor (OMG-03-019), while contractor (OMG-03-021) got the rest (2 contracts). These two contractors competed against each other twice, wherein each of them won once. In general, contractor (OMG-03-019) achieved a success rate of 91.67 per cent for those monopolized asphalting, paving, and municipal road lighting projects in both the main cities and small towns. However, this contractor faced heavy competition from various Internal and external classified contractors. In greater detail, contractor (OMG-03-019) won five tenders when competing against (OMG-01-001), who is classified as class (1) contractor. Additionally, two of the Internal class (2) contractors, (OMG-01-016) and (OMG-01-017), lost three tenders against contractor (OMG-03-019). Therefore, the findings do not indicate probable collusion among these monopolized contracts.

5.4 Summary

The aim of this chapter was to seek a comprehensive understanding of the nature and extent of classified contractors' participation in the Saudi Arabian municipal road network tenders, through incorporating a deductive, two-step historical analysis of bidding data. The analysis has examined market concentration metrics, measures of the volatility of bidders' prices, as well as participation rate in tender bid submissions for municipal road network development projects, encompassing Saudi Arabia's five main administrative regions over a five-year period. The main findings indicate that while some municipalities did not reveal any potential collusion among bidders based on the proposed model, some indicators of potential collusive bidding have identified in other municipalities.

Mainly, this study has demonstrated a scarcity of Internal class (4) and class (5) participation in bidding, despite the availability of the project value limits of most tenders. Moreover, industry participation in the bidding rate overwhelmingly decreased

among projects in small towns and villages compared to main cities. Consequently, some top-class contractors won a suspiciously high proportion of these contracts, most of which were for asphalting, paving, and road lighting projects. This suggests that these contractors may have applied the market allocation approach by employing a bid suppression concept, which is indicated by their comparatively low rate of participation in tenders. Indeed, the means of price volatility for monopolized bids were mostly higher than other contracts, while the price volatility for small town bids mostly displayed lower averages than bids in main cities. As already mentioned in the literature review, price volatility can be utilised to detect bid rotation, but is inadequate for the detection of bid suppression with a low rate of participation in tenders.

Due to data collection time limitations, this section has presented the analysis of 544 contracts from the selected five municipalities over the past five years, consequently, further investigations need to be conducted for other municipalities as part of the process of verification. After establishing potential collusion practice indicators and incidents, which is the first objective of this research, key factors might cause failure of local contractors' engagement in public procurement tenders will be identified in the following chapter.

Chapter 6: Barriers to the participation of local contractors in public construction works tenders

6.1 Introduction

According to the key findings of the preceding chapter, this chapter aims to identify the key factors that local contractors consider to contribute to their failure to engage in this market achieving the second objective of this research. This chapter begins with providing a brief overview of the construction sector status within the local economic system. After linking the development of this sector to the economic growth of the country, the most prominent organizational aspects were presented under which the public construction work processes are managed. Then, Bageis and Fortune (2009) study, which is the only found empirical study that investigate the motives for the rational decision to participate bidding in the context of Saudi Arabian public procurement, will be reviewed. Next, to determine weakness points which required remedial action, and based on the developed conceptual framework of this research, the obstacles to the successful delivery of public construction projects have been discussed in a chronological order from the 1980s to the present decade. In conclusion, the attributes in tendering phase of the municipal roads network contracts which might encourage the rational of decision makers in contracting firms will be proposed.

6.2 Local public construction development

The total area of the Kingdom of Saudi Arabia is about (1,960,582) square kilometres, with a population of (31,742,308) people, including (11,677,338) non-citizens (The General Authority of Statistics, 2016). The oil-dependent economy country, with a GDP per capita of (20816.6 US$), has been ranked as the 15th largest market worldwide, based on the Global Competitiveness Report (2016-2017) (see Figure 6-1). Over the past five decades, since the discovery of oil, the country has undergone economic growth. Many national economic sectors have notably benefited from this growth. One of these is the construction and public works sector, which is considered a significant and reliable indicator of the trends and health of the national economy.

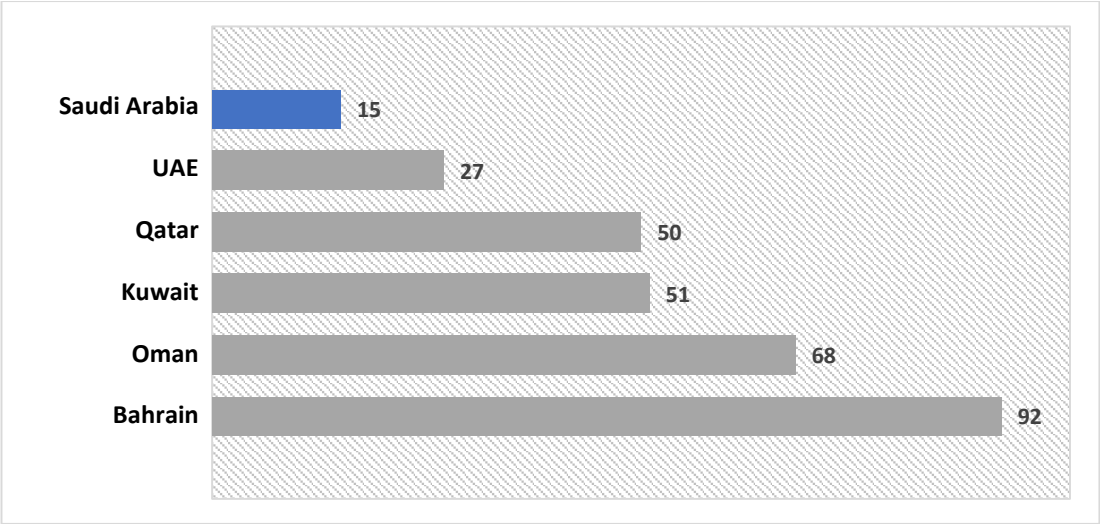


Figure 6-1 Saudi Arabian market size compared to other GCC markets (World Economic Forum)

Consequently, the Saudi construction sector has witnessed rapid growth over the past decades, both in urban and rural areas. Through this expansion, a large number of projects have been implemented in both the public and private sectors. These projects have attracted construction contractors, consultants, and design teams from all over the world to invest in continuing large-scale construction activities, thereby stimulating the development of the non-oil sectors. This growth has been reflected in the increase in the participation of the construction sector in the national gross national product, which represents 6.60 per cent of the country's GDP in 2016. These efforts have resulted in considerable expenditure on construction and infrastructure projects over the past few years, which are estimated to be more than US $ 120 billion, annually (Alrashid et al., 2014).

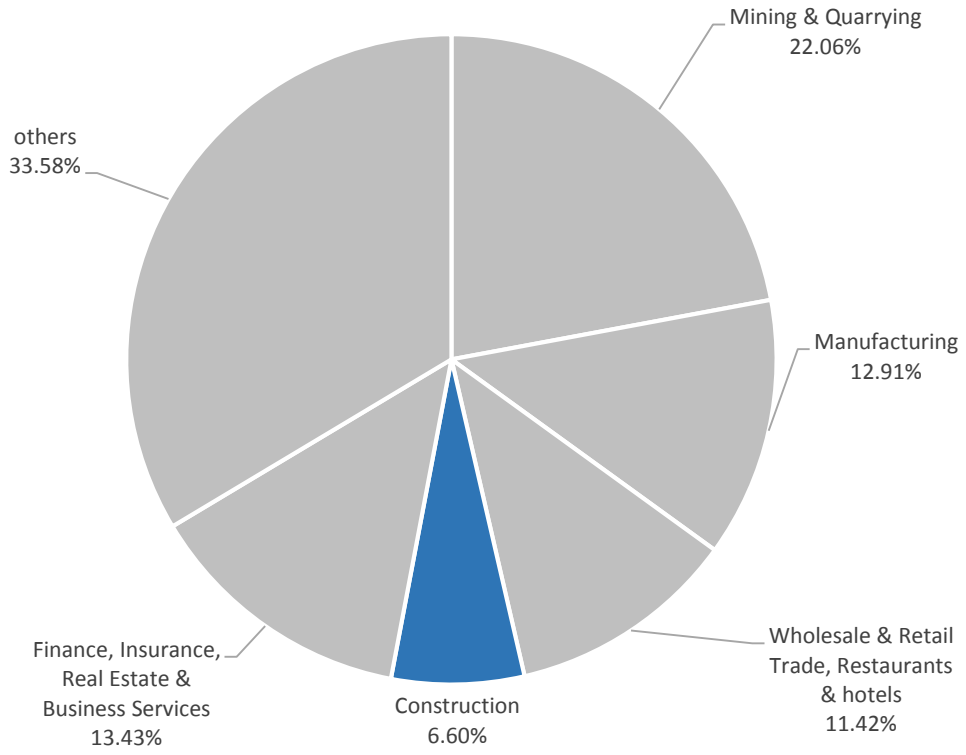


Figure 6-2 Saudi Arabia GDP by kind of economic activity (The General Authority of Statistics, 2016)

This remarkable development in the Saudi Arabian construction industry has contributed to the employment of 15 per cent of the workforce in Saudi Arabia, where foreign workers account for 91 per cent of construction workers (Dhahran International Exhibition Co., 2015). Despite the dissimilarity of these foreign labourers' skills, the vast majority of them are unskilled labours from high-unemployment countries, and obtained low wages. Consequently, local workers abandoned working in the construction industry, which led to the industry being dominated by foreign labour. Moreover, the construction industry contributes significantly to the quality of human life through the provision of housing, buildings, factories and infrastructure (DETR, 2000). The Saudi Arabian public sector, which is the main source of construction expenditure, accounting for 86 per cent of the total construction sector in Saudi Arabia (SAMA, 2000), represented by government ministries, is responsible for national infrastructure and development projects and plays a central role in industrial activities.

This is reflected in how the government encourages the private construction sector to engage more in industrial development and diversification under the Saudi free market, which is considered a key factor driving Saudi construction sector growth (Alsahimi et al., 2012).

This massive expenditure has led many globally to recognize the Saudi construction industry as one of the largest construction markets in the Middle East and it is expected to lead growth in the region (Langdon, 2012). The abundance of cash available for public projects and the introduction of new government regulations encouraged developers and investors to explore opportunities in the construction industry and build relatively large projects in a very short period of time. The construction industry was the largest recipient of government expenditure during the first three national Development Plans, from 1970 to 1985, exceeding 49 per cent of the total government expenditure. Thereafter, the Saudi construction industry has undergone many changes, since the national economy has relied heavily on oil revenues, whose prices have fluctuated during this period. The decline in oil prices in several periods has led to a global economic recession, especially for Saudi Arabia. This downturn was reflected in the delay of projects, in particular major ongoing infrastructure projects and Development Plans (Alsedairy, 2001). These recessions have also affected payments flows, financial assistance and guarantees to contractors, harming market competition, usually by reducing profits and wages.

The entry into the various public tenders depends on a firm's classification levels, which are based on the resources that contractors have (the technical staff, the station and the financial sector, etc.). Based on the latest online statistical reports of the Contractors Classification Agency, issued in July 2017, more than 3,500 classified local construction companies are working with the public and private sectors, while there are about 20 classified foreign companies operating in both sectors. On the other hand, there are far more non-classified companies operating in the private sector, which are not allowed to work with the public sector. The number of classified contractors in the field of road

projects exceeds 1700 contractors, most of whom are classified as fifth class contractors, representing 65.14 per cent of the total number of contractors adopting small projects in the public sector; this is worth less than 14 million Saudi Riyals (2.9 million pounds). The fourth and third class have 21.66 per cent and 7.54 per cent, respectively, of the total number of contractors, and can obtain contracts worth less than 42 and 140 million riyals, respectively. Second and first class contractors comprise 2.57 per cent and 3.09 per cent, respectively, and allowed to obtain contracts of less than 420 million riyals for the second class, and more than 420 million riyals for the first class.

6.3 Saudi Arabian public construction work regulatory framework

In Saudi Arabia, a public construction work contract is predominantly awarded based on public tenders, in which all eligible contractors may submit tenders and no limit applies to the number of participants. The legislative reference that regulates and manages those government tenders is the new Government Tenders and Procurement Law (GTPL), which was introduced by the Ministry of Finance in September 2006. The new law explains in detail the basic rules and setting procedures for Government procurement. All subsequent directives and explanatory circulars issued or to be issued by public tenders in the Kingdom are subject to this law and its regulations. All public sector bodies, which are considered by this law to be client representatives, are empowered with full contracting authority to procure works and services, including construction projects. The new law stipulates that any public contract that exceeds SR1 million must be put forward for public tender.

This Government Tenders and Procurement Law consists of 81 articles, divided into the following thirteen subsections: basic principles, submission of bids and opening of sealed-bids, examination of bids and the power to contract, contract drafting and execution period, bank guarantees, increase and decrease of contractor obligations, payment of entitlements, rules of direct purchase, procurements and works exempted from public tenders, penalties and extension of contracts, sale of movables, leasing and investment of real property, and general provisions. The articles of this law began

clarifying the main principles to be targeted, such as transparency, fairness and equality, in addition to protecting public funds and maximizing benefits through competition. Those principles have been confirmed by the contents of many articles of this law.

A review of current literature reveals that the traditional procurement path (design - bid - build), in which the owner secures separate contracts for design and construction, is commonly used in the Saudi Arabian public construction works industry for decades (Al-Jarallah, 1983; Al-Mansouri, 1988; Al-Turki, 2000; Alsaedan, 2004; Al Saudi, 2011; Alsuliman, 2014). Design offices are selected based on their qualifications through the competitive process and contractors are selected on the lowest responsive and responsible bid. The reason for the spread of this procurement path, as claimed by Alsaedan (2004), is that the cost certainty is reasonable and known before the project has been constructed. Furthermore, persuasive arguments for this procurement system include the simplicity of overall management as well as assurance that the client will secure the lowest bid to execute his project. And from another point of view, this procurement path is not commensurate with the desire to build faster and less new culture for developers and the private sector (Al Sobiei, et al. 2005, Jaweed 2004, Al-Khalil & Al-Ghafly, 1999).

On the other hand, with regards to procurement systems in Saudi Arabia, the most frequent procurement systems used by the public sector are quantity with unit price contracts, cost reimbursable contracts, and two stage tendering contracts (Albayoudh, 2003). Indeed, all local municipal roads contracts are tendered as unit price contracts, where the tenders of contractors who have the appropriate classification grade for the work at hand are adjudicated on the basis of "cheapest win".

Based on the GTPL (2006), all public construction tenders begin at the competition declaration phase, which is mandatory and published through the government electronic procurement portal (Tabadul), in addition to at least two local gazettes. The deadline for bids acceptance and the location where sealed bids will be opened are

determined through this announcement. At the specified time, bids are opened by the Bids Opening Committee. The competitors' names and their offered prices are announced. After that, the Bids Examination Committee must evaluate the bids from both technical and financial aspects. The recommendations of this committee are submitted as a report to the Contract Award Committee, who in turn have the power to award the contract to the appropriate bid, which is usually the lowest bidder who passed the technical requirement threshold.

Upon completion of the selection process and the appointment of the contractor, the Standard Public Works Contract, which was designed based on the traditional procurement route, will be signed. This standard contract includes the following documents: basic contract document, special conditions (if any), general conditions, special specifications (if any), drawings and drawings, general specifications, bill of quantities, and the letter of acceptance of the offer. Moreover, the basic contract document consists of the following items: contract purpose, contract documents list, contract duration, guarantee duration, contract value, payment methods, anti-bribery statement, clarification laws regulating the contract.

According to Article 12 of the General Conditions of the Standard Public Works Contract, a foreign contractor is obliged to sub-contract a Saudi contractor for not less than 30 per cent of the contracted works. An exemption shall be made if there are no works that can be performed by a local contractor. Additionally, an international investment license is required from the international firms which aim to perform local public construction work. This license can be obtained by the Saudi Arabian General Investment Authority (SAGIA). Next, the foreign firm must register with the Ministry of Commerce and Investment. Finally, the foreign firm should submit a classification application to the Contractors Classification Agency in order to be eligible to bid in public construction tenders. On the other hand, Article 8 of the General Conditions stipulates that any contractor is not entitled to sub-contract any part of the work without the prior written

consent of the employer. However, this approval does not relieve the contractor the liability or obligations under the contract.

The Saudi Council of Engineers (SCE), which is part of the Ministry of Commerce and Industry, supervises engineers and engineering offices in Saudi Arabia. According to the statute of this council issued in 2003, the main obligations of this Council involve regulating standards and licensing requirements for the engineering professions within Saudi Arabia, carrying out assessments for licensing, and the preparation of research and development. In 2016, the number of engineering and consultancy firms licensed by the Council was 3,485 and the number of engineers in Saudi Arabia registered by the Council is 230, 943, of which 7.81 per cent are Saudis.

The Ministry of Labor and Social Development has been motivating all national economic sectors latterly to hire Saudis, including the construction and public works sector (Nitaqat scheme, 2017). Under the Saudization domains scheme, known as Nitaqat, firms are required to maintain a certain percentage of Saudi workers to obtain some special privileges as well as to avoid obstacles. Companies are classified using a coded scale based on the number of Saudi employees and companies that are not committed to achieving those intended percentages are facing sanctions, including the suspension of issuing licenses in various government agencies. In conclusion, despite these regulatory measures, various recent research studies such as Al-Khalil & Al-Ghafly (2010), Albogamy et al. (2012), Ikediashi et al. (2014), and Alhammadi et al. (2015) have indicated poor performance in the Saudi Arabian public construction work sector. This poor performance was due to some obstacles within the industry. The literature provides many general issues concerning the failure of the Saudi construction industry. These issues include financial constraints, competition, procurement, licensing, cultural issues, structural issues, and labour issues, which will be discussed in the following section.

6.4 Tendering phase factors that influence contractors' decision to bid: a review of the empirical studies within Saudi public construction context

Bageis and Fortune (2009) investigated factors which influence on the rational decision of participation in bidding in the Saudi Arabian public procurement context. Initially, they identified about 100 factors which might affect the bidding decision were recognized on the reviewed literature. Then, a questionnaire was distributed to local contractors aiming to collect their assessment of the relative importance for those factors. After analysing the results of the respondents, a list of the most prominent factors that distinctly influence the decision to participate in bidding from the local contractors' perspective was presented. This list includes factors such as the client financial capacity, prompt payment habit of the client, ability of project execution, past experience with the client, current work load, size of contract in SR, and the location of project. However, the concentration of the review here will be on the factors related to the tendering phase due to the scope of this research.

In attempt to clustering those critical factors around the five identified OECD guidelines in the developed conceptual framework, irrelevant factors to the tendering phase were initially eliminated. Subsequently, the remaining factors were grouped by their association to the guidelines. With regard to the recommendation of transparent prequalification processes, local contractors in Saudi Arabia considered the classification class required as well as the prequalification requirements are significantly influence their decision to bid. Corresponding to the recommendation of lowering the cost of bidding, they contemplate time of bidding, the cost of preparing the bid, time allowed for submitting bids, and bidding document price more than other factors to decide to bid.

In harmony with the recommendation of ensuring clear specification, Bageis and Fortune emphasised that clarity of the work and specifications, degree of possible alternative design to reduce cost, the possibility of additional work, duration of the project, the ability of modifying the contract, sufficiency of project's information, design

quality, completeness of drawings and specification, and the possibility of project extension were the most influent factor respectively on contractors decision to bid. As for the recommendation of ensuring accurate cost estimates, local contractors in Saudi Arabia give a high attention to cost estimates by the client as well as uncertainty in cost estimate before take their decision to bid. Finally, in harmony with the recommendation of ensuring objective bids evaluation criteria, both of the size of contract in SR and the availability of work are highly considered.

Nevertheless, and due to the lack of empirical studies in this context, the review will not be stopped over Bageis and Fortune study, instead will be enriched by reviewing the literature on the barriers to deliver public construction works successfully in Saudi Arabia, particularly from local contractors' point of view, in an attempt to link them to research scope. Moreover, the review of those barriers will facilitate the detection of weakness points, thereby strengthen proposing the attributes. This literature review will be presented chronologically in the next section.

6.5 Impediments to deliver the public construction work successfully

6.5.1 The 1980s

The starting point of research into Saudi Arabian public construction issues was a study conducted by Al-Jarallah (1983), which coincided with the first decline in oil prices in the country. The purpose of this research was to describe the state and size of this sector. The researcher identified four groups of problems faced by the sector: economic, social, technical, and legal and management problems. He recommended that the design of the Saudi heritage environment should be kept consistent without transferring designs applied in other countries, which design of projects of this period often did to the detriment of the local built heritage. He also referred to the problem of delaying projects and the consequent financial burdens. This finding was later confirmed by Zain Al-Abidien (1983) and Al-Sultan (1989), who reported that 70 per cent of Saudi Arabia's public projects had time overrun issues.

Consequently, failures in public projects delivery were investigated by Almudlej (1984), Alhazmi (1987), and Alsubaie (1987). They highlighted that non-payment, or delays in payments, to contractors in Saudi Arabia had become the major cause of the delay of public projects. On the other hand, Alhazmi (1987) found that change orders by the client and slow decisions in approving plans, materials, etc. caused slower performance. Furthermore, Al-Ojaimi (1989) added contractor inexperience to the list of causes.

Setting the construction contract duration itself was presented as an issue by Al-Sultan (1989). His study evaluated the practice applied at the time to set the duration of construction contracts for public projects. He concluded that the public sector wasn't following a systematic method or, at least, formal procedures to set the duration of construction contracts such as Critical Path Method. In analysing reasons for delays in contractor payments, Najeem and Abdulatif (1989) identified a list of the most important factors which were: disputes between contract parties, the slow processing of the contractor payments by the client supervisory team, the annual Fiscal year transitional period, and the complicated administrative procedure. This research confirmed that project time overran, targeted quality was reduced, projects were interrupted, contract parties were subjected to claims and suspiciousness or distrust were the likely consequences of such delays.

Moreover, Al-Mansouri (1988) identified that the most common contributory factors in the inefficiency of Saudi Arabian public works are shared between the consulting firms and the contractors. These factors include the separation of the design from the construction process, inefficient project management structure and techniques, and the lack of trust between contractors and consultants. Al-Mansouri emphasised that designers were occasionally forced to deliver necessary design work at a lower quality due to time limitations. He added that only contractors who wanted to take short cuts in delivering the projects by reducing the effort put into design work favoured Design and Build contracting.

6.5.2 The 1990s

Ubaid's (1991) study of the performance of contractors in the Saudi construction industry added that some of the delays were caused during the implementation phase. Out of thirteen major measures, the most influential factors were: lack of trust between clients and contractors, lack of proper project management tools, the presence of unrealistic contractual clauses that shift all risks to the contractors.

Al-Hammad and Assaf (1992) conducted a survey which identified the highly important interface issues in the relationship between design and construction in Saudi Arabian public construction works. These were classified as lack of detail in working drawings, unfamiliarity with local conditions, buildability, lack of unified building codes and government regulations, incomplete and inadequate plans and specifications, the economic situation, and lack of designer knowledge of available construction materials and equipment. Meanwhile, Bubshait and Al-Musaid (1992) carried out a survey to measure the level of involvement of public clients in the construction stages in Saudi Arabia. They were found to have less influence in the design phase than in the construction and planning phases. In order to improve the total quality of construction projects efficient client involvement is needed in the design phase.

Al-Barrak (1993) concluded that the major internal and external causes for contractor failure in Saudi Arabia were the following: insufficient experience, poor cost estimating practices, lack of any restriction or criteria on those entering the construction market, the recession of the national economy, delays in payments, poor labour productivity, and autocratic management in the contracting firms.

Assaf et al. (1995) studied the causes of delay in large building construction projects in Saudi Arabia. They revealed that contractors, consultants, and owners differ somewhat in the classification of these factors, yet they all agree generally that financial factors caused the most delays. Contractors considered the most important delay factors to be the preparation and approval of shop drawings, payment delays by clients, and design

changes. The most important delay factors to the consultants were cash problems, the relationship between different subcontractor schedules, and slow decision making by the clients. The clients considered the most important delay factors to be design errors, excessive bureaucracy in client organizations, labour shortages and inadequate labour skills; of these, labour shortages and inadequate labour skills were unanimously ranked highest.

Alghafly (1995) discussed the nature, extent, and causes of delay in public water and sewage construction work in Saudi Arabia and discovered that the contractors believed that 37 per cent of the projects suffered from delays, whereas consultants believed that 84 per cent of the projects under their supervision suffered from delays. He also reported that the average estimated time overrun amounted to 39 per cent of the contracted time period. He summarized the substantial causes which led to the delay of projects as: financial difficulties including project cash flow issues, onerousness in obtaining work authorizations, influential involvement of government authority during construction, efficiency of the early stages including planning and design, poor contractor performance in construction and management, poor coordination and communication between stakeholders, contracts awarding criteria based on the lowest bidder, subsurface conditions, site obstructions, and supervision of unprofessional or untrained consultant engineers or technical staff.

Jannadi (1997) identified major factors contributing to the failure of construction contractors in the Eastern Province of Saudi Arabia. He reported that both contractors and clients were not carefully interpreting the scope of the project. He concluded that the most important factors were: difficulty in acquiring work, bad judgment, lack of experience in the firm's line of work, difficulty with cash flow (finance), lack of managerial experience, and low-profit margins.

In Al-Hazmi’s (1999) study, in order to develop a more formalized and structured approach to advising the client as to the best procurement system that can be effectively

and efficiently undertaken, recommended that a systematic procedural method should be developed and used for strict enforcement and implementation of the Project Procurement System Selection Model in government offices. An updated procedural system should be developed to include all the new factors related to procurement system selection issued by council ministers or other government offices. Government authorities are urged to initiate procurement system selection seminars where consultants and contractors, as well as competent government personnel, are invited to participate. These will provide a forum for the discussion of all the issues related to the methods of procuring public projects, along with the sharing and exchange of experiences and knowledge in an informal environment. It is strongly recommended that consultation should take place with experts in the field regarding the performance of different procurement systems with respect to the selection criteria, in order to obtain better results from the proposed model.

Al-Khalil & Al-Ghafly (1999) investigated frequency, extent, and responsibility for delay in the construction of water and sewage works in Saudi Arabia. The results of this investigation showed that delays appear repeatedly in Saudi Arabian public utility works and the extent of these delays is severe. Moreover, the contractor's classification grade also correlated with the frequency of delayed projects. The most substantial underlying causes for the delay based on the respondents' perspectives were cash flow and financial difficulties, difficulties in obtaining work permits, awarding contracts to the lowest bidder without regards to qualification, underestimating project duration, effect of sub-surface conditions, changes in project scope, ineffective planning and scheduling by the contractor, and the shortage of manpower. The results also showed that while clients and consultants assigned the major responsibility for the delay to the contractor, the clients were consistently blamed by the contractor.

6.5.3 The 2000s

Alhazmi and McCaffer (2000) developed a Project Procurement System Selection Model with the aim of assisting government agencies in Saudi to select the most appropriate procurement system for their projects. This model was intended to examine the relationship between different procurement systems, with reference to six criteria: project characteristics, market attributes, contractor and architect/engineer (A/E) needs, categories of clients, client design organization, and local design and construction regulations. Their results showed that Saudi public sector clients consider the Design and Build option the most appropriate procurement system for their projects.

In his study of the state of Saudi construction, Alsedairy (2001) concluded that a number of factors are thought to stimulate competition among contractors in Saudi Arabia. An increase in the number of companies involved in construction, a decreasing rate of construction demands from the government sector, client requirements for high-quality, the growing technological and technical capabilities of some contractors, the financial capabilities of some contractors, employment of highly competent consultants/technical staff, differences in pricing or costing of projects, demographic location, political clout, broadness of services offered, and contractor reliability.

Asif (2003) conducted a study in Saudi Arabia to investigate the most critical success factors (CSFs) for different project objectives. He concluded that clients, contractors and consultants ranked adequate planning and controlling techniques, client satisfaction, clearly defined project mission objectives and scope, and adequacy of plans and specifications as the most important CSFs. The study reiterated that time was considered the most crucial project objective by all the project stakeholders. They defined a successful project as one that starts with clearly defined objectives and scope, advances with meticulous planning, monitoring and control, and ends with results that encourage client satisfaction.

Falqi (2000) identified and compared the causes of delay in public construction work in Saudi Arabia and the UK. The results of his study showed a difference between assessing the importance and extent of these factors in these two countries. The results also indicate that the average time of actual completion of the contract period in both countries ranges between 110% and 130%. the most important causes in Saudi Arabia were: difficulties in financing the project and cash flow problems, delay in the settlement of contractor claims, ineffective planning, scheduling, control of project progress and poor coordination between the parties involved in the project.

Al-Sinan (2004) identified the major problems in the Saudi construction industry based on the contractors' perspective: intense competition, labour regulations, high turnover of labourers, low labour productivity, delay in payments, fluctuation of demand, and poor specification and contract documents. Those issues are barriers towards the effective implementation of total quality management in the Saudi Arabian public construction industry. Al-Sinan further alleged that the construction sector in Saudi Arabia receives insufficient attention from the Government, as the above problems could have been resolved through direct government involvement.

Arain et al. (2006) identified the causes of inconsistencies between design and construction. The research results suggested that the involvement of designers as consultants, the communication gap between constructor and designer, insufficient working drawing details, lack of coordination between parties, lack of human resources in design firms, lack of designer’s knowledge of available materials and equipment, and incomplete plans and specifications were considered to be the most important causes of project design and construction interface inconsistencies. These inconsistencies had a significant negative impact on the performance of construction projects in Saudi Arabia.

Assaf and Al-Hejji (2006) studied the underachievement in performance in construction projects in Saudi Arabia to determine the causes of delay in the Eastern Province of Saudi

Arabia and their importance. Most contractors and consultants interviewed indicated that the average a project overruns by is between 10 and 30 per cent of the original duration. Surveys also concluded that 70 per cent of projects experienced time overrun. All three parties agreed that change orders were one of the most common causes of delay. However, these factors include mistakes and discrepancies in design documents, delays in producing design documents, unclear and inadequate details in drawings, the complexity of project designs, insufficient data collection and surveying before beginning the design, misunderstanding of the client's requirements by the design engineer, inadequate design team experience, and the non-use of advanced engineering design software.

Al-Kharashi and Skitmore (2009) identified the major causes involved in Saudi Arabian public works delay. They placed those factors in seven categories: client, contractor, consultant, materials, labour, contract and contractual relationship related causes. It is found that the most influential cause of delay at the time of the study was the deficiency of qualified and experienced manpower. Additionally, the lack of finances, non-payments, delay in the progress of payments, and suspension of work due to additional requirements requested by the client were considered to be major causes of underachievement on public projects. The researchers recommended three main changes that could be implemented to have a positive effect on the duration of construction projects in the Saudi public construction industry: the development of strategic plans for scheduling future construction projects, encouraging contractors and consultants to cooperate with external companies with more experience to improve the level of local experience, and the use of more modern management methods to measure each party’s progress or quality of work.

6.5.4 The current decade

Al-Khalil & Al-Ghafly (2010) conducted a study to determine the most important causes of delay in public water and sewage projects, based on the frequency and severity of the causes. The results showed that the three parties surveyed statistically agreed on the importance ranking of delay causes. Among the most important causes found were cash flow problems and financial difficulties experienced by the contractor, difficulties in obtaining permits, the requirement to select the lowest bidder without regard to prequalification, changes in the scope of the project, ambiguities, mistakes, and inconsistencies in specifications and drawings, poor contractor coordination with the parties involved in the project, shortage of technical professionals in the contractor's organization, an improper technical study by the contractor during the bidding stage, delay in the settlement of contractor claims by the client, slow decision making by the client, effects of subsurface conditions (type of soil, utility lines, water table).

Al Saudi (2011) discussed barriers to the adoption of the Design and Construction procurement approach in the Saudi Arabian public construction industry. The majority of the consulting and contracting firms reported that they face major contractual, scope definition and financial problems. Among these obstacles, which consequently led to contentious relationships among the contract parties, were the lack of qualified staff, the accuracy and the quality of the work plans, lack of accurate scope of work definition and means of interpreting the performance specifications, lack of fair financial compensation, non-refundable change orders and variations, the absence of an independent cost engineer, the unavoidable amount of rework, poor coordination, contracts awarded based on low cost tendering, and failure to reach agreement on contractual and scheduling terms. Al Saudi proposed several developments, including the following: require a clear scope of work and specifications with equitable contractual clauses that define the responsibilities, rights, and duties of each party, consideration of reputation and track record while selecting a contractor, working jointly to eliminate cultural barriers between clients and contractors, assigning an independent cost engineer to monitor and control cash flows.

Albogamy et al. (2012) outlined the main causes of delay in public building projects in Saudi Arabia, along with their relative importance. The delay causes were classified into four categories based on their relationship to the contracting parties. The findings of this research suggested that the contractor and client related factors are the most critical factors causing the delays in the Saudi Arabian construction projects at the time of the study. The lowest bidder approach in the local government tendering system, postponement in progressing payments, inadequate project planning in the early stages, postponement in contract submittal approval, slow client decision making processes, and design changes were the most critical client related delay factors. On the other hand, the most significant contractor related delay factors were delays in the sub-contractor's work, poor qualification skills and experience, deficient planning and scheduling, lack of qualified engineers, delay in the preparation of shop drawings, and cash flow issues. Other critical factors include delay in approval for shop drawings, design changes, inadequately qualified supervisory crew, documentation issues, absence of key workforce, scarcity of utilization of professional construction contract management, and increased materials prices.

Ikediashi et al. (2014) developed a framework to identify and classify causes of project failures in the Saudi construction industry. They concluded that the most critical factors of project failure in infrastructure projects were: poor risk management, budget overruns, poor communication management, schedule delays, poor estimation practices, cash flow difficulties, design discrepancies, lack of efficient change management, inadequate project structure, and lack of teamwork. To address the abovementioned failures, and based on the study results, they recommended that project risk management frameworks should be improved to guide clients and other stakeholders, and to help predict the exposure of a project to unexpected risk. Contractors should manage their finances and hire highly experienced cost managers. Meanwhile, payment obligation to contractors should be accomplished by clients. Additionally, clear channels of communication should be specified and developed.

Alofi et al. (2015) discussed approaches to develop the current Saudi procurement system which, consequently, improve low performance. The results of their survey suggested that the traditional Saudi procurement system selects poor performing contractors and the selection of contractors based only on the lowest price criterion, which has a negatively effect on projects. Additionally, providing a plan, reviewing and verifying the scope of work, resolving all client concerns, and risk identification should be required by contractors prior to contract signing in order to improve project performance. Alofi et al. assert that significant delay causes in Saudi Arabian public construction works can be resolved with the application of the Best Value Approach (BVA) and the Performance Information Procurement System (PIPS).

Alhammadi et al. (2015) discussed underachievement in Saudi Arabian public construction works and potential solutions. In their discussion, they elucidated that several attributes characterize the Saudi Arabian public construction industry, which is considered a price-based environment. The attributes were: changes orders, time extensions, cost overrun, stakeholder dissatisfaction, non-accountability for deviations, excess detailed specifications provided to the contractors in the bidding stage, awarding criteria based on the lowest price using the minimum specifications, lack of contractor pre-planning before contracts are awarded, and lack of local experienced subcontractors.

Elawi et al. (2015) examined the substantial delay factors in infrastructure work in the Mecca province of Saudi Arabia. Those factors were grouped into four categories based on the stakeholder responsible. The average project time overrun was found to be 39 per cent of the scheduled time. It was concluded that the major causes for delay were attributed to the clients, rather than the other stakeholders. Land acquisition, deficiency of contractor proficiency, changes in design, and haphazard underground public utilities were the most significant delay factors that contributed to the majority of time overrun.

6.5.5 Synthesis

Saudi Arabia distinctly lacks adequate empirical research investigating contractors' decisions to participate bidding in public procurement, and therefore just Bageis and Fortune (2009) study has been identified in this context that previously examined attitudes and behaviours of the public procurement rivals with the help of a comprehensive theoretical framework. Accordingly, and in an attempt to support findings of this study, this section mainly provided a chronological review of literature relevant to the impediments to the successful delivery of Saudi public construction works. In order to connect those impediments to the developed conceptual framework of this research, Table (6-1) summarizes studies which addressed issues related to the tendering phase distributed on the five OECD guidelines. Moreover, figure (6.3) enumerates the most frequent impediments which related to tendering phase, adopting same distribution as well. On the other hand, this chronological review reveals that most of the literature which presented impediments to the success of Saudi Arabian public projects have not specified managerial tools to mitigate those success impediments. Consequently, most of these studies focused on identifying problems only, thus the same issues in this sector were identified repeatedly over time.

	Prequalification	Bidding cost	Specification	Cost estimates	Awarding criteria
Alhazmi 1987			√		
Al-Mansouri 1988			√		
Ubaid 1991		√			
Al-Hammad & Assafa 1992			√		√
Al-Barrak 1993	√			√	
Assaf et al. 1995			√		
Alghafly 1995			√		√
Jannadi 1997			√	√	√
Al-Khalil & Al-Ghafly 1999	√		√		√
Falqi 2000			√		
Alsedairy 2001				√	
Al-Sinan 2004		√	√		√
Arain et al. 2006			√		
Assaf & Al-Hejji 2006			√		
Al-Kharashi & Skitmore 2009			√		
Al Saudi 2011		√	√	√	√
Albogamy et al. 2012			√		√
Ikediashi et al. 2014			√	√	
Alofi et al. 2015			√		√
Alhammadi et al. 2015			√	√	√
Elawi et al. 2015			√		

Table 6-1 Summary of studies demonstrated impediments which related to tendering phase

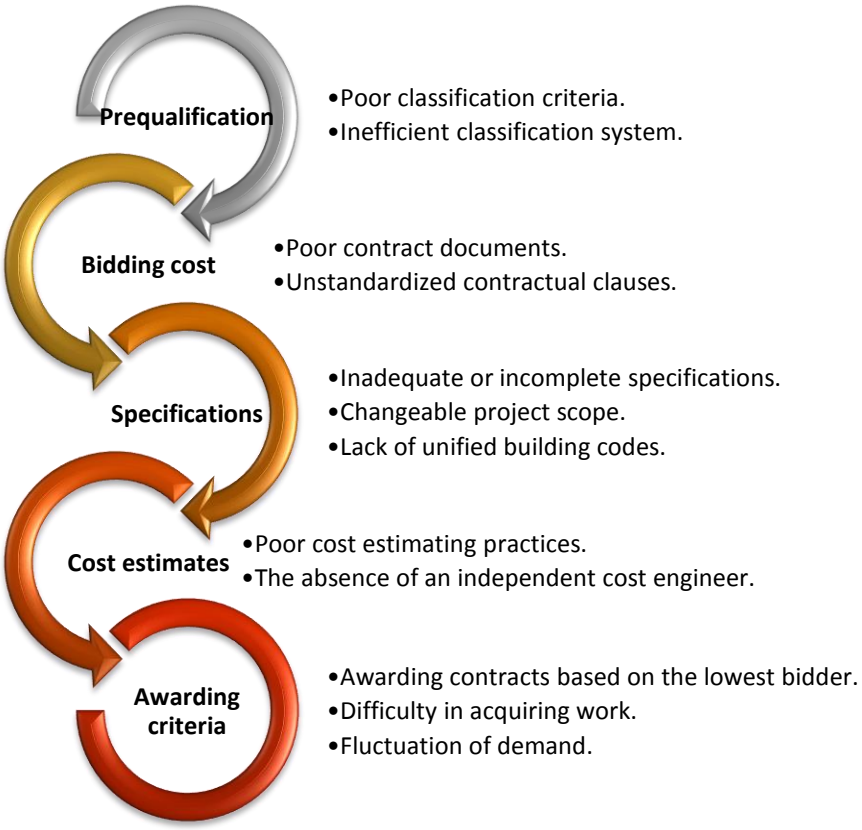


Figure 6-3 The most frequent impediments which related to tendering phase

6.6 Tendering attributes influencing contractors' desire to participate in future tenders

The proposed institutionalism framework for the tendering phase process for local municipal road projects attributes in Saudi Arabia is based on the principle of enhancing transparency, which in turn promotes openness and limits corrupt behaviour (Kolstad and Wiig, 2008; Bertot et al., 2010; Nordin et al., 2013). As mentioned previously in section 3.3, several international and local organisations have introduced guidance reports in order to promote transparency and integrity in public procurement. One of the most significant guidelines is the OECD (2009) principles for integrity in public procurement report. This report has been adopted in this research because of the recommendations based on project phases, which facilitate the identification of relevant recommendations. Furthermore, the OECD (2012) published an updated report that investigates in the progress of these recommendations, which in turn contributes to the identification of development priorities. The guide asserted that clear rules and guidance in government procurement procedures promote intact competitive processes. This guide further provides precautionary measures at each stage of the public procurement cycle to enhance the integrity, in particular, of exceptions to competitive tendering. Based on the review of those precautionary measures, the relevant measures can be summarised into:

1. Ensuring transparency for contractors' qualification processes.
2. Lowering the cost of bidding.
3. Ensuring project specifications are clear and comprehensive but not discriminatory.
4. Providing accurate project cost estimations.
5. Ensuring clearly and objectively defined award criteria.

In order to propose tendering attributes that need to be examine in the next stage, the developed research conceptual framework elements in Chapter-3 will be linked

to the main weakness points of reviewed in the context of Saudi public construction contracts below.

6.6.1 Ensuring transparency of contractors' qualification processes

Regulative proposition (PQR)

The prequalification phase is considered as a preliminary inspection by the owner, or their representatives, for the contractors before entering into tenders. This phase includes a predetermined set of criteria that are essential for contractors to run a certain project successfully, which in turn assesses the performance capabilities of these contractors (Stephen, 1984; Moore, 1985; Russell and Skibniewski, 1988). Hatush and Skitmore (1997) state that prequalification allows an owner to select a group of candidates who are most appropriate among those who are willing to participate in tenders for a particular field of projects. Therefore, this phase generates a list of potential contractors to be invited to bid for a particular project (Hatush and Skitmore, 2010). According to Clough et al. (2015), firms should not purchase bidding documents or submit a proposal unless they are prequalified.

Therefore,

P1: *Determining the permitted classifications for bidding on the tender announcement will promote contractors' participation in future tenders.*

Normative proposition (PQN)

Many researchers have further developed approaches to design those criteria (Hatush and Skitmore, 1998; Banaitiene and Banaitis 2006; Zavadskas et al., 2008; Fong and Choi, 2000; Wang et al., 2013; Safa et al., 2016). As for the local municipal road projects tenders in Saudi Arabia, the contractors' classification list that is updated periodically is what is relied on in determining a contractor's capabilities and suitability. In order to enhance the transparency of this step of public procurement, the OECD (2009, 2012) recommended that government authorities publish a tender declaration that includes a clear and complete description of the relevant evaluation

criteria that do not unreasonably restrict competition or reduce the number of potential qualified bidders. Nevertheless, the classification criteria and the conditions for obtaining a degree of classification are somewhat ambiguous and unclear (Al-Barrak, 1993).

Therefore,

P2: *The provision of objective contractors' classification criteria will promote contractors' participation in future tenders.*

Cognitive proposition (PQC)

The OECD (2009) encourages public procurement authorities to publish their 'law, regulation, judicial decision, administrative ruling, standard contract clauses mandated by law or regulation, and procedure regarding procurement, and any modifications thereof'. Nevertheless, many scholars emphasise that Saudi Arabian public construction projects suffer from poor coordination and communication between stakeholders (Al Ghafly, 1995; Falqi, 2000; Arain et al., 2006).

Therefore,

P3: *Publishing the contractors' classification criteria and their weighting scores will promote contractors' participation in future tenders.*

6.6.2 Lowering the cost of bidding

Regulative proposition (BCR)

The OECD (2012) emphasised that public procurement authorities can promote participation in their tenders by lowering the preparation costs of bidding. In achieving this objective, the tendering process should be streamlined, merging tenders where possible to distribute cost, as well as employing an electronic bidding system (OECD, 2012). During the tendering stage, different issues have arisen, including human errors in the production of documents, incomplete information or even tender documents, confused documents, insufficient copies and leaks of restricted information (Egan, 1998; Worthington, 2002; Pavlov and Aleksandrova,

2003; Du et al., 2004). The introduction of electronic documentation could address most of those issues (Nitithamyong and Skibniewski, 2007). In electronic tendering, the traditional paper-based bidding system is replaced by electronic means. By enhancing the use of electronic tendering, public procurement authorities ensure the availability of participation to a wider range of bidders, reducing the bidding preparation costs, shortening the bidding period and storing information that facilitates the screening of bidding behaviour (OECD, 2012).

Gunasekarana and Ngai (2008) added that electronic tendering increases organisational efficacy and promotes customer service. The consequences from the use of electronic tendering, particularly the reduction of the bids preparing costs, have been confirmed empirically by NIGP (2001). Another consequence of the electronic tendering is enhancing efficiency, fairness, transparency and accountability (Oliveira and Amorim, 2001; Yang et al., 2016). Additionally, electronic tendering is distinguished from the traditional procurement method by its secured, systematic and progressive method of working (Björk, 2003; Lou and Alshawi, 2009). However, the availability of an efficient centralised procurement office is critical to the adoption of e-procurement (Moon, 2005). This is consistent with what Heimler (2012) recommends for screening the bidding behaviour.

Therefore,

P4: *The imposition of electronic bidding in Government Tendering and Procurement Law will promote contractors' participation in future tenders.*

Normative proposition (BCN)

One of the procurement reform pillars in developing countries is standardised bidding documents (Agaba & Shipman, 2007). Many international organisations such as the World Bank follow standardised bidding documents despite the diversity of countries in which these projects are carried out. In the context of Saudi Arabian public construction projects, Al-Sinan (2004) concludes that local contractors consider poor tender documents as one of the major obstacles in the industry. Furthermore, Al

Saudi (2011) confirmed that this obstacle leads occasionally to failure to reach agreement on contractual terms.

Therefore,

P5: *A standardised bid document contents, based on the approved international standard, will promote contractors' participation in future tenders.*

Cognitive proposition (BCC)

To ensure the effective application of the electronic tendering system, public procurement authorities should make efforts to train, educate and support end-users by quickly responding to their inquiries (Croom & Brandon-Jones, 2007). In the same context, government authorities should increase the efficiency of communication with bidders in the same timeframe, in the same manner and on a formal basis, such as via the online posting of questions and answers to ensure prompt responses to bidders' inquiries. Nevertheless, many scholars emphasise that Saudi Arabian public construction projects suffer from poor coordination and communication between stakeholders (Al Ghafly, 1995; Falqi, 2000; Arain et al., 2006). Therefore, Ikediashi et al. (2014) suggested a clear channel of communication be established and developed to address this issue.

Therefore,

P6: *The provision of technical advice to tackle bidders' problems in electronic bidding will promote contractors' participation in future tenders.*

6.6.3 Ensure project specifications are clear and comprehensive but not discriminatory

Regulative proposition (CSR)

According to the OECD (2012), tender documents should contain clear and comprehensive specifications. The level of clarity in specifications influences the

number and type of rivals who desire to bid, thus influencing selection process efficiency. Indeed, this clarity increases the level of understanding of competitors of those specifications and, consequently, enhances their confidence during the preparation and submission of their bids. Therefore, public procurement authorities are advised by the OECD (2012) to avoid announcing tenders when the specifications are not fully completed. Additionally, in order to avoid disputes in key terms definition after the awarding stage and to ensure clarity and comprehensiveness, the OECD (2012) noted that specifications should be checked by an independent body before releasing the final version.

Nevertheless, this is not the case in the Saudi Arabian context. Al-Sinan (2004) concludes that contractors consider the poor specifications provided by the public procurement authorities influence the success of public construction projects. The researchers have noted that the specifications provided include several issues, including incomplete or inadequate details in the work drawings (Al-Hammad and Assaf, 1992; Asif, 2003; Arain et al., 2006; Assaf and Al-Hejji, 2006; Al Saudi, 2011), ambiguities in specifications (Al-Khalil & Al-Ghafly (2010); Ikediashi et al., 2014) and lack of accurate scope in work definitions (Jannadi, 1997; Asif, 2003; Al Saudi, 2011). Consequently, various changes to the main design (Assaf et al., 1995; Albogamy et al., 2012; Elawi et al., 2015) or even project scope (Al-Khalil & Al-Ghafly, 1999) have been generated. As a result of these design changes, the issue of frequent change orders commonly appears during the implementation stage (Alhazmi, 1987; Al Saudi, 2011; Alhammadi et al., 2015).

Therefore,

P7: *Accurate and detailed terms and technical specifications for the required works will promote contractors' participation in future tenders.*

Normative proposition (CSN)

The time limitations occasionally might force designers to provide those poor specifications (Al-Mansouri, 1988). In addition, the lack of unified building codes might be another reason for those poor specifications (Al-Hammad and Assaf, 1992). Building codes, in this regard, have played a vital role as an essential source of guidance in building structure design and construction for many decades (Banerjee, 2015).

Therefore,

P8: *A clear and neutral local code for municipal road project specifications will promote contractors' participation in future tenders.*

Cognitive proposition (CSC)

The OECD (2009) asserts that all 'law, regulation, judicial decision, administrative ruling, standard contract clauses mandated by law or regulation, and procedure regarding procurement, and any modifications thereof' must be published. Nevertheless, many scholars emphasise that Saudi Arabian public construction projects suffer from poor coordination and communication between stakeholders (Al Ghafly, 1995; Falqi, 2000; Arain et al., 2006).

Therefore,

P9: *The presence of an updated local municipal roads specifications guidebook will promote contractors' participation in future tenders.*

6.6.4 Provide accurate project cost estimations

Regulative proposition (CER)

Improving the accuracy of the project cost estimation, according to an appropriate estimate approach, is considered also as one of the preventive measures to promote integrity in the public procurement process (OECD, 2009). Furthermore, Chotibhongs and Arditi (2012a) stress the need to raise the level of accuracy, consistency and

reliability of those estimates to facilitate market economic screening. In contrast, inaccurate estimates are likely to cost contractors additional charges, thus reducing their expected profits (Ishii, 2014). In addition, loss of opportunities, wasted development efforts and failure to achieve expected returns are the consequences of inaccurate estimates of project costs (Oberlender & Trost, 2001).

However, many researchers have pointed out the poor cost estimation practices in the bidding stage in the context of Saudi Arabian public procurement which, in sequence, lead to contractors' failure (Al-Barrak, 1993; Al-Khalil & Al-Ghafly, 2010; Ikediashi et al., 2014). The estimates further depend on several factors that can influence their accuracy, such as the clarity of scope (Oberlender and Trost, 2001). Therefore, the OECD (2009) recommends that clear and reasonable timeframes be provided by the public procurement authorities for each phase of the procurement process.

Therefore,

P10: A reasonable timeframe to submit bids will promote contractors' participation in future tenders.

Normative proposition (CEN)

On the other hand, Ishii et al. (2016) stressed that cost estimating a project itself is a complex task because it relies on analysing client data at a specific time. Consequently, promoting highly efficient data will improve cost estimation accuracy (Kerzner, 2013). Analogous, the World Bank (2011) advised publishing cost estimates to ensure equality among bidders as well as to avoid authorities' leaking those estimates in favor of few closer bidders.

Therefore,

P11: *The presence of a cost estimation benchmark book will promote contractors' participation in future tenders.*

Cognitive proposition (CEC)

In addition, the experience and qualifications of the technical team involved in project cost estimation procedures influence the accuracy of those estimates (Pinto & Slevin, 1988; Trost & Oberlender, 2003; Ishii et al., 2016). Therefore, contractors should be careful to designate a qualified team with the expertise to perform cost estimation tasks and allocate a convenient time for such tasks (Ishii et al., 2016). Moreover, improving the accuracy of cost estimates requires adequate training of staff involved in the preparation of project cost estimates.

In the Saudi Arabian context, Al-Ojaimi (1989) Al Ghafly (1995) Al-Kharashi & Skitmore (2009), Al-Khalil & Al-Ghafly (2010) and Albogamy et al. (2012) confirmed that unqualified or untrained technical team lead to cost overruns in projects or even the failure of those projects. Al Saudi (2011) further considered the issue of unqualified technical teams as well as the absence of independent cost engineers to be among the major obstacles to the adoption of the design and construction procurement approach in the Saudi Arabian public construction industry.

Therefore,

P12: *The presence of certified costs engineers will promote contractors' participation in future tenders.*

6.6.5 Ensure clear and objectively defined award criteria

Regulative proposition (ECR)

The OECD (2009) emphasises that bid evaluation criteria should not deter bidders, particularly small and medium-sized enterprises, from participating in public tenders. The recommendation of favouring emerging firms in public procurement was made as well by scholars such as Froeb and McAfee (1988) and Dorée (2004). On the other hand, both of Al-Hammad and Assaf (1992) and Al-Sinan (2004) confirmed the difficulty to acquire construction works contract in the Saudi context. Accordingly, one of the proposed solutions by the World Bank (2011) is to split large projects into

bundles of small projects. Simultaneously, potential horizontal mergers among those small firms should be curbed strictly by public procurement authorities (Froeb and McAfee, 1988).

Therefore,

P13: *The presence of tenders evaluation criteria based on socio-economic objectives that give small firms opportunities to share in the market will promote contractors' participation in future tenders.*

Normative proposition (ECN)

The OECD (2009) recommends that all bid evaluation criteria should be distinctly defined and weighted adequately in advance. Subsequently, the relative weights of each criterion must be disclosed. Additionally, the OECD (2009) stresses the need to assess those criteria independently to ensure that all of them are objective and not biased. In the Saudi Arabian public procurement context, several researchers have indicated that bids evaluation criteria mainly rely on the bids' values and ignore other qualifications (Al Ghafly, 1995; Al-Khalil & Al-Ghafly, 1999 & 2010; Al Saudi, 2011; Albogamy et al., 2012; Alhammadi et al., 2015). Consequently, poorly performing contractors have probably been selected in the traditional Saudi procurement system (Alofi et al., 2015). Therefore, the he suggested the public procurement authorities in Saudi Arabian apply the Best Value Approach (BVA) and the Performance Information Procurement System (PIPS).

Therefore,

P14: *Standardising tender evaluation criteria will promote contractors' participation in future tenders.*

Cognitive proposition (ECC)

The OECD (2009) recommends that the bidding evaluation results be published in easily available means as well as informing unsuccessful bidders instantly of these results. Furthermore, the OECD (2009) asserts that all 'law, regulation, judicial decision, administrative ruling, standard contract clauses mandated by law or

regulation, and procedure regarding procurement, and any modifications thereof' must be published. In line with this recommendation, Al-Hazmi (1999) suggests that government authorities introduce seminars with consultants and contractors to explain internal works mechanisms. In those seminars, discussion of related issues as well as the exchange of experience and knowledge in an informal environment would be promoted.

Therefore,

P15: *The provision of training and development sessions to understand tender evaluation criteria and their weighting scores will promote contractors' participation in future tenders.*

6.7 Summary

This chapter discussed the key factors that local contractors consider to contribute to their failure to engage in this market. As a start, the only empirical study on the decision to participate in tenders within the Saudi context was reviewed. After exclusion of factors outside the study, these factors were grouped based on the five guiding principles of the OECD. Next, the empirical study finding was supported by reviewing the literature on the obstacles to the successful delivery of public works in Saudi Arabia. A list of the most frequent obstacles has been reached and divided, as well as the previous factors, based on these five principles. Accordingly, tendering phase attributes which might influence contractors' desire to participate bidding were developed to be examined in the subsequent stage.

Chapter 7: Tendering attributes - IPA results analysis & discussion

7.1 Introduction

By the end of the preceding chapter, fifteen tendering phase attributes that could lead to enhance contractors' desire to participate bidding were proposed. Accordingly, this chapter discusses findings and analysis of data collected based on the adopted research design to investigate the importance assessment of these proposed tendering phase attributes to the local contractors as well as the evaluation of current performance level of responsible stakeholders. These results will be the basic foundation for reaching both of the third and fourth objectives of this thesis. After presenting a brief reminder of the collected data purpose, this chapter is divided into three main parts. The results of the contractors' assessment of the attributes importance will be presented in the first part. Afterward, the results of the current performance evaluation will be reviewed based on the different perspectives. Finally, the final outcomes of the previous two parts will be collected and graphically presented on the IPA four quadrants plot.

7.2 Measuring attributes' importance

In order to determine the importance of these selected tendering phase attributes from the contractors' perspective, a (5-point Likert scale) questionnaire, contained in Appendix (B.3), was distributed to the local contractors classified in the municipal roads sector, in municipal zones; these have already been investigated in the indicators and incidents of potential collusion study. This quantitative tool has been utilized since the significance of these attributes to the contractors can be measured through direct rating (Bacon, 2003).

7.2.1 General findings

The respondents' profile

The questionnaire was answered by senior management personnel: presidents, general managers, project managers and technical department heads. Descriptive statistics of the sample were conducted to explore respondents' demographic

backgrounds in this study. Descriptive information about the respondents based on the (90) usable surveys in this research are presented in (Figure 7-1 to Figure 7-7). Overall, respondents exhibited reasonable variations in terms of their corporate characteristics, such as contractor classification, zones, the existence of branches outside their zones, the importance of municipal road projects, bidding participation rate, success rate, and participation outside their zones.

Firstly, as for contractors' classification, the distributions of the sample respondent companies were congruent to the population distribution (Figure 7-1), except for a decrease in representation from the fifth-class contractors, which raised the representation of upper-class contractors. Notwithstanding this decrease, the highest response was gathered from the fifth-class contractors (45.6 percent), followed by the fourth-class contractors (30.0 percent) and then the third class (12.2 percent) contractors. On the other hand, first-class and second-class contractors represented (12.2%) of respondents, while these upper class contractors they are just (5.4%) of the study sample size. Considering lower-class of contractors involved in this study were either Infinitesimal or small business according to the definition of the Saudi Small and Medium Enterprises Authority (Ministry of Commerce & Investment, 2016), unstable, and subsequently, under threat of closing their offices, it is conceivable that the response rate for the lower two classes of contractors would decrease.

Compared to the population distribution, (Figure 7-2) shows the distributions of the sample respondent companies in terms of headquarter zones, except for a slightly higher representation from the (Zone-3) contractors. The highest response was gathered from the (zone-1) contractors (38.9 percent), followed by the zone-2 (25.6 percent) contractors, the zone-3 (21.1 percent) contractors, the zone-4 (7.8 percent) contractors, and the zone-5 (7.8 percent) contractors. Therefore, it can be concluded that there was an adequate indication on the representativeness of the survey responses as compared to the sample population.

Respondents were requested to indicate the presence of branches outside of their headquarter zone. As seen in (Figure 7-3), the majority of companies (72.2 percent) do not have a branch outside of their headquarter zone at all and (20.0 percent) have branches, but not more than two, while only (7.8 percent) of contractors have three branches or more outside of their headquarter zone. This signifies that the sample respondent contractors concentrate their work within a certain zone without a desire for or capability of expansion.

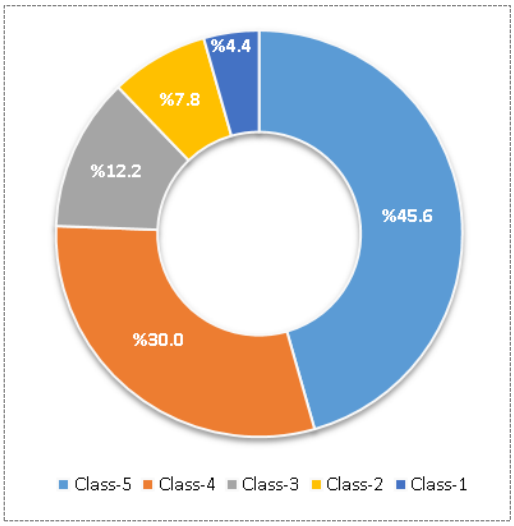


Figure 7-1 Respondents' classification

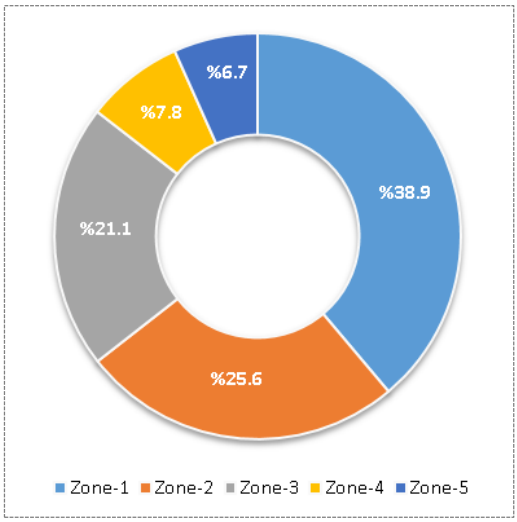


Figure 7-2 Respondents' zones

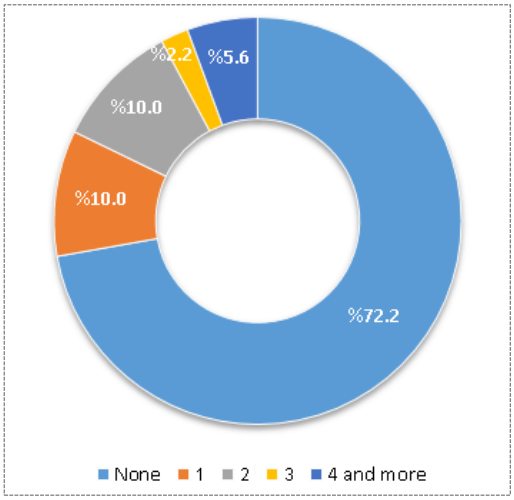


Figure 7-3 Presence of branches

As illustrated in (Figure 7-4), (26.7) percent of contractors rate municipal roads projects as not at all important to their firm's business activities. Whilst, (17.8) percent of contractors consider it as slightly important, followed by (14.4) percent of

contractors who see this kind of project as moderately important. On the other hand, (16.7) percent of contractors rate it as extremely important, while (24.4) percent rate it as very important. For analysis purposes, the 'extremely important' and 'very important' categories were merged into a single 'high-importance' category (41.4) percent. Similarly, the 'moderately important' and 'slightly important' categories were merged into a single 'low-importance' category (32.2) percent.

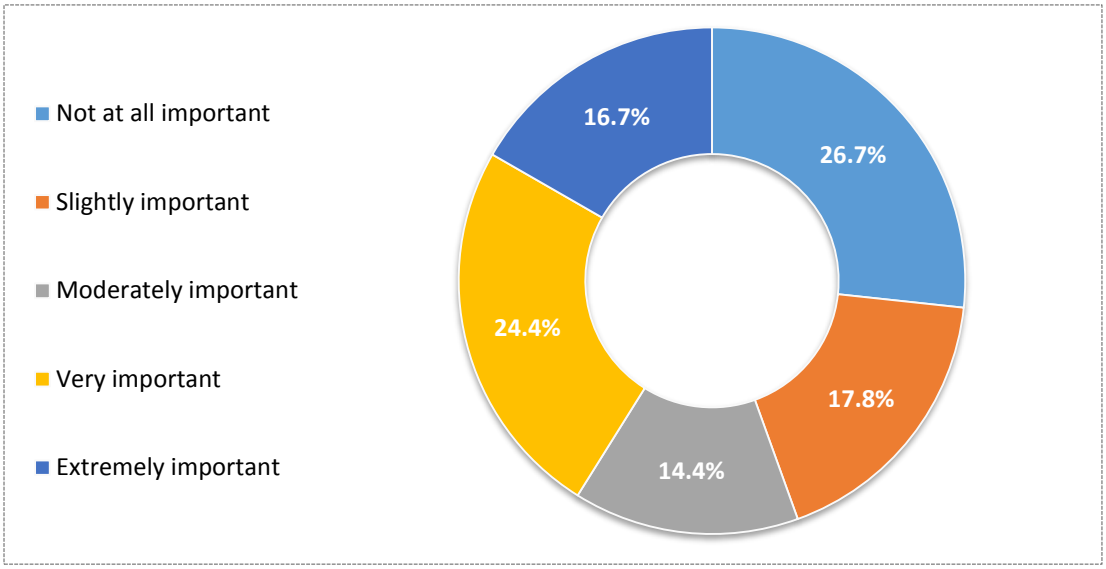


Figure 7-4 The importance of municipal roads projects

With respect to the number of municipal roads project bids their firms have participated in over the last five years, (Figure 7-5) indicates that (36.7) percent of respondents have not participated at all during this period. Conversely, (25.6) percent were highly active in participation (have participated with more than 10 bids). With regards to values in between these two categories, (15.6) percent of respondents have participated in three bids or less, while (12.2) percent of respondents have participated in four to six bids. Finally, (10.0) percent of respondents have participated in seven to ten bids.

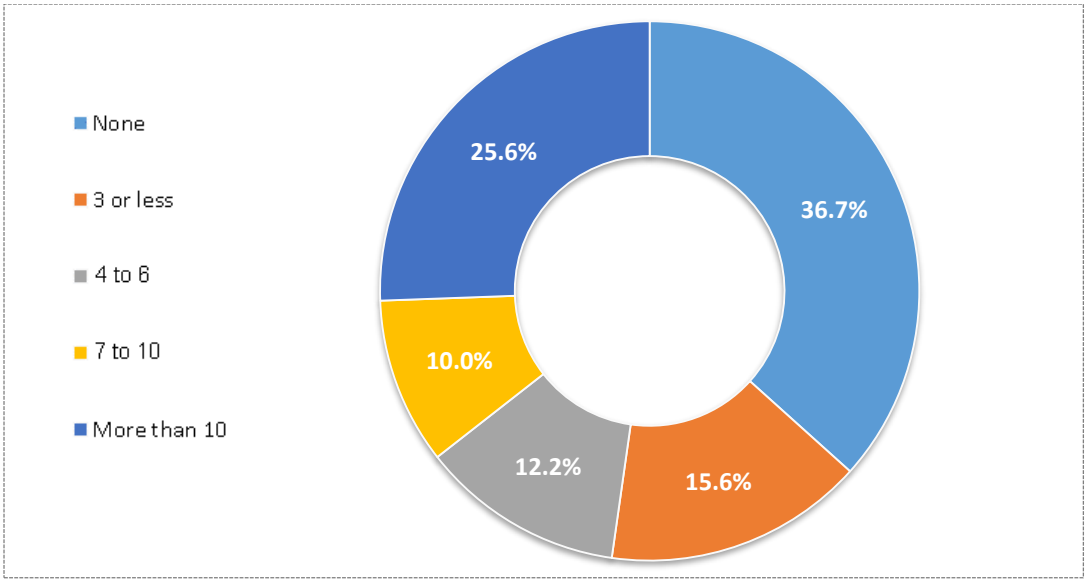


Figure 7-5 Numbers of the municipal roads bids firms participated in over 5 years

After the exclusion of those respondents who had not participated, respondents were requested to indicate their success rate by number of contracts awarded in the same period. (33.23) percent were not awarded any contract at all and (26.3) percent were awarded '2 or less', thus decreasing the percentage to (12.3) percent for contractors who were awarded more than 6 contracts. This confirms the findings from the previous phase of this research, which indicate that a small percentage of contractors participate and win tenders.

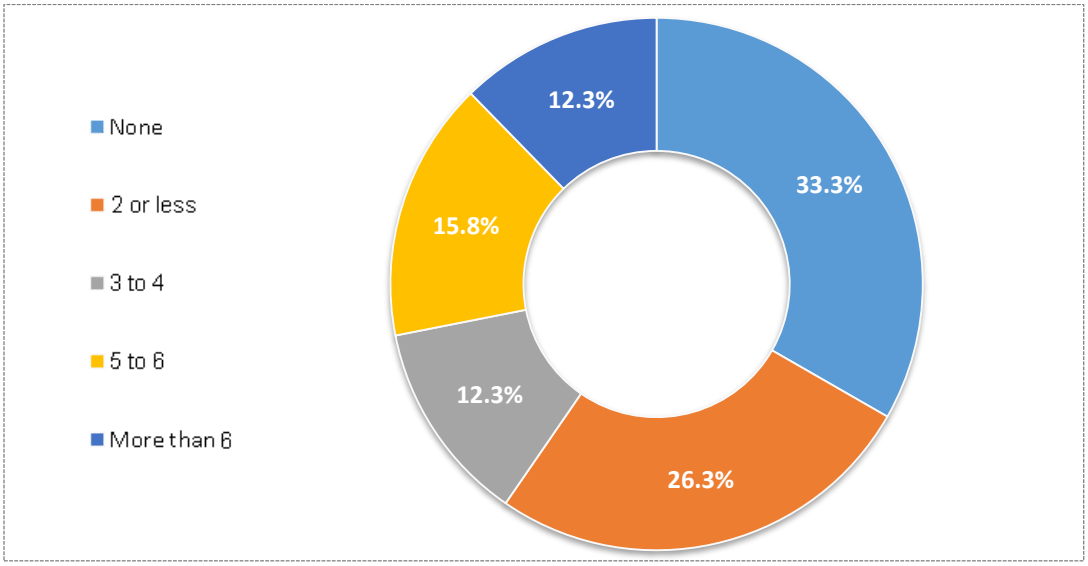


Figure 7-6 Numbers of municipal roads contracts awarded in the last 5 years

Respondents were also requested to indicate their participation in a tender bid outside their municipalities' zones. After the exclusion of the 'not-participated' category, respondents were divided into two almost equal groups (Figure 7-7). Almost half of them, (50.9) percent, have not participated in a tender bid outside their municipalities' zones, while the other half, (49.1) percent, have participated outside their municipality zones. This indicates that a large number of contractors concentrate their works within a certain zone, without a desire for or capability of expansion.

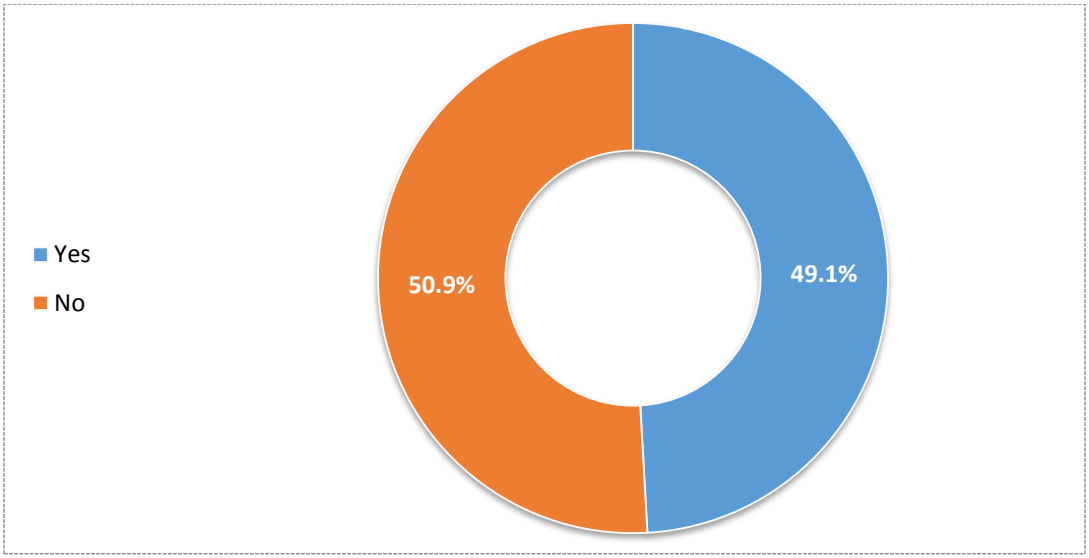


Figure 7-7 Firms' participation outside their municipalities' zones

Respondents, at the end of the first part of this questionnaire, were requested to indicate reasons for not bidding outside of their headquarter zone. As seen in Table 7-1, the most frequent responses were that 'the firm focuses on another type of contracts', (24.4) percent, followed by 'the firm focuses on the same zone for cost related purposes', (18.9) percent. However, as indicated on the following table, (20) percent of the targeted respondents left this question blank.

Not applicable	28	31.1%
Not response	18	20.0%
The firm focus on the same zone for cost related purposes	17	18.9%
The firm focus on another type of contracts	22	24.4%
Others	5	5.6%
Total	90	100%

Table 7-1 Firms' reasons for not bidding outside of their headquartered zone

On the other hand, with respect to the second part of the questionnaire, which evaluates the importance rank of the tendering phase attributes to increasing contractors' motivation to participate in future tenders. Table 7-2 shows a summary of responses.

Attributes	Extremely Influential	Very Influential	Moderately Influential	Slightly Influential	Not at all influential
C.E.R.	40	25	17	6	2
C.E.N.	41	21	14	5	9
C.E.C.	50	15	19	2	4
C.S.R.	83	5	2	0	0
C.S.N.	59	23	8	0	0
C.S.C.	43	33	12	2	0
B.C.R.	49	20	12	7	2
B.C.N.	46	32	7	4	1
B.C.C.	69	17	4	0	0
P.Q.R.	63	19	7	1	0
P.Q.N.	63	23	3	1	0
P.Q.C.	62	25	3	0	0
E.C.R.	44	18	17	6	5
E.C.N.	54	27	8	1	0
E.C.C.	54	28	8	0	0

Table 7-2 Respondents rank of attributes' importance

Correlation analysis

Firstly, correlation analysis, which is a measure of the linear relationship between variables in terms of its strength and direction (Field, 2013), were undertaken to examine the effect of the contractors' classification or their zones on their view of the importance of municipal roads contracts, as well as the impact on their participation rate in terms of bidding over the last five years. Furthermore, this created a solid base for understanding and comparing contractors to assess the degree of the impact the attributes presented in the second part of the questionnaire. This can also be linked to the results of the first phase of this thesis, 'collusion indicators and suspicious patterns', to confirm this relationship.

Since the ordinal data have violated parametric assumptions, the Spearman's (rho) coefficient correlation will be adopted. Correlation coefficients range from +1.00

(reflecting a 100% positive relationship) through 0.0 (for no relationship) to -1.00 (a totally negative relationship) (Polit and Beck, 2004). Table 7-10 shows the correlation strength rating based on the coefficient value. According to Ajzen (1991), the correlation analysis is used to assess the validity of the indirect measures' representation of the direct measures.

coefficient value	Correlation strength
0.00 to 0.19	Very weak
0.20 to 0.39	Weak
0.40 to 0.59	Moderate
0.60 to 0.79	Strong
0.80 to 1.00	Very strong

Table 7-3 Correlation strength rating

Relationship of *contractor's classification* and *the importance of municipal roads contracts*

Contractor's classification is negatively related to the importance of municipal roads contracts with a Spearman's correlation coefficient of ($r = -0.311$), and this is statistically significant ($p = .002$). Nevertheless, this correlation is weak, which means the drop in the classification does not necessarily cause the variation in the importance.

Relationship of contractors' classification and bidding participation

Contractor's classification is negatively related to the bidding participation rate with a Spearman's correlation coefficient of ($r = -0.378$), and this is statistically significant ($p = .000$). Nevertheless, this correlation is weak as well, which means the drop in the classification does not necessarily cause the variation in the participation rate.

Relationship of contractors' zones and the importance of municipal roads contracts

Contractor's zone is positively related to the importance of municipal roads contracts with a Spearman's correlation coefficient of ($r = 0.018$). However, the correlation is not statistically significant ($p = .865$). Furthermore, this correlation is weak, which means contractor's zone does not affect the variation in the importance assessment.

Relationship of contractors' zones and the bidding participation rate

Contractor's zone is positively related to the bidding participation rate with a Spearman's correlation coefficient of (r = 0.103). However, the correlation is not statistically significant (p = .326). Furthermore, this correlation is weak, which means contractor's zone does not affect the variation in the participation rate.

According to these correlation tests results, the factor of contractors' classification is taken on consideration for the subsequent analysis despite the weak influence on contrast to the factor of contractors' zones, which will be excluded.

7.2.2 Relative Importance Indices (RII) of attributes

In order to rank the attributes and determine the significance of each one of them, Relative Importance Index (RII), or weight, will be calculated. RII has been used for this analysis because it best fits the purpose of this study. RII is broadly facilitating to find the contribution a particular variable makes to the prediction of a criterion variable, both by itself and in combination with other predictor variables (Johnson and LeBreton, 2004). In the calculation of the RII, the formula below will be used.

$$RII = (\sum W) / (A * N) \quad \textbf{"0 < } \boldsymbol{RII} \textbf{ < 1"}$$

Where:

$\boldsymbol{W}$ = the weighting given to each attribute by the respondents (ranging from 1 to 5),
$\boldsymbol{A}$ = the highest weight (i.e. 5 in this case),
$\boldsymbol{N}$ = the total number of respondents.

After the significance indices of all attributes were calculated, statistical tests were conducted with the aid of the IBM Statistical Package for the Social Sciences (SPSS) 23.0. To verify whether significant differences exist among respondents, based on their class (Upper or Lower), the Wilcoxon-Mann Whitney test, which is the non-parametric equivalent of the independent t-test, was conducted and the significance level of (0.05) was adopted here. Similarly, in order to verify if significant differences exist among respondents, based on their participation and success receiving contracts (not participated at all, participated without contracts awarded, or

participated and awarded at least 1 contract), the Kruskal Wallis test, which is the non-parametric equivalent of the (one-way) independent ANOVA, was conducted and the significance level of (0.05) was adopted here.

On the other hand, in order to verify if significant differences exist among the institutionalism pillars in each element, the Friedman test, which is the non-parametric equivalent of the one-way related ANOVA, was conducted and the significance level of 0.05 was adopted here as well. This represents overview of the statistical tests conducted for this phase of the research; below the results for each attribute of the proposed tendering phase components will be presented.

7.2.3 Results analysis & discussion

The lowest important attribute recorded a relative importance index of 0.741, which is commonly considered in this measurement to be very important. Given the high importance of all these features, the role of analysis in the ranking of each attribute's importance has emerged. Frequently, there is a consensus among different categories of contractors on assessing the influence of these attributes. Nevertheless, some contractors' categories slightly differ in their assessing, and thereby ranking, the importance of these attributes from others. In the following subsections, the assessment of local contractors in Saudi Arabia of the influence of these attributes will be interpreted and discussed with other relevant research in order, based on the importance level of each of the five groups.

Transparent contractors' qualification processes

The attributes group of ensuring transparency in contractors' qualification processes is ranked according to the majority of contractors' categories as the most influential set of factors in stimulating the desire to participate in bidding. This group obtained an average (RII) of (0.922), which supports the findings of the OECD (2009), that governments, as a precautionary measure to enhance integrity in public procurement, should ensure transparent contractors' qualification processes. The ranking of this group of factors did not differ significantly among almost all of the

local contractors' categories in Saudi Arabia, regardless of their classes and their previous success rates.

This ranking and the great importance of this group of factors support the assumption of Miller et al. (2002) as well as Thompson and Lucko (2012) regarding the importance of the contractor selection process and its major impact on the success of subsequent project phases. Accordingly, local contractors in Saudi Arabia emphasised on the concentration of municipalities to ensure transparency in the qualification processes of contractors, thereby encourage more local contractors to enter the market and effectively participate in future municipal tenders. Furthermore, the Friedman test confirms that the mean rank of this group variables did not significantly change over the institutionalism pillars, (0.887), which does not support the presence of difference in importance among the attributes in this group.

The cognitive attribute (P.Q.C.), which is represented by publishing the contractors' classification criteria and their weighting scores, is ranked as the most influential factor in this group to stimulate the desire of contractors to participate in future tenders, with RII score of (0.927). Accordingly, local contractors in Saudi Arabia classify this factor in the top five list of factors that influence their desire to bid. The high-influence evaluation of this factor is generally corroborated by the suggestion in the OECD (2012) report that emphasised promoting transparency in the bidding stage process. The Wilcoxon-Mann-Whitney test and the Kruskal Wallis test confirm that the mean rank of this attribute importance did not significantly change over respondents, regardless of their classes and their previous success rates (0.262 & 0.118 respectively). As a summary, local contractors in Saudi Arabia insist that publishing contractors' classification criteria encompassing their weighting scores critically drives more participation in future municipal roads tenders.

The normative attribute (P.Q.N.), which is represented by the provision of objective contractors' classification criteria, is ranked second in this group of attributes in terms of its influence on enhancing participation in future municipal roads tenders, with RII

score of (0.924). Furthermore, local contractors in Saudi Arabia classify this factor as well in the top five list of factors that influence their desire to bid. Regardless of the variation in contractors' classes and their previous success rates, they mostly agree on both the ranking and the high importance level of this factor, based on the Wilcoxon Mann Whitney test (0.591) and the Kruskal Wallis test (0.490). This agreement on the importance level of this attribute supports the recommendation of the two OECD reports (2009, 2012) that public procurement authorities need to clarify the requirements and qualifications of contractors for submitting their bids, provided that such requirements are reasonable and do not reduce the participation of contractors. Therefore, we can suggest that local contractors in Saudi Arabia recognise that the provision of objective contractors' classification criteria by municipalities eliminates uncertainty in bidding requirements, thus enhancing their desire to bid in future.

The regulative attribute (P.Q.R.), which is represented by determining the allowed classification to bid on the tender announcement, is ranked by the local contractors the least influential factor in this group for stimulating the desire of contractors to participate in future tenders, with RII score of (0.915). According to the Wilcoxon Mann Whitney test (0.679) and the Kruskal Wallis test (0.434), the majority of local contractors in Saudi Arabia, regardless of their class and their previous success rate, agree on the ranking of this factor among the group for ensuring transparency in contractors' qualification processes. In spite of this late ranking among this group of factors, local contractors clearly still admit that determining the allowed classification to bid on the tender announcement is highly influential. This assessment is in line with an OECD (2012) report which encourages public procurement authorities to specify the sort of contractors required for contracts and that it should be announced in their tender declarations. Consequently, we can conclude that for local contractors in Saudi Arabia seeking to increase their participation rate in future municipal tenders, they can look forward to municipalities announcing their minimum allowed contractor class to participate in bidding in their tender declarations.

Lowering the cost of bidding

The attributes group of lowering the cost of bidding is ranked by the majority of contractors' categories as the third most influential set of factors in stimulating the desire to participate in the bidding. This group obtained an average (RII) of (0.873), which supports the assertion of the OECD (2012), that public procurement authorities can promote participation in their tenders by lowering the preparation costs of bidding. The ranking of this group of factors did not differ significantly among almost all of the local contractors' categories in Saudi Arabia, regardless of their classes and their previous success rates. Accordingly, local contractors in Saudi Arabia confirm that reducing the submitted bids preparation costs for contractors leads to minimising contractor expenditure during the tendering stage and thereby encouraging more local contractors to enter the market and effectively participate in future municipal tenders. Nevertheless, based on the Friedman test (0.000), they confirm that the provision of technical advice to tackle bidders' problems in electronic bidding will significantly promote contractors' participation in future tenders more than the other two attributes within this group.

The cognitive attribute (B.C.C), which represented by the provision of technical advice to tackle bidders' problems in electronic bidding, is ranked as the most influential factor in this group to stimulate the desire of contractors to participate in future tenders, with RII score of (0.944). The local contractors interestingly consider the obligation of municipalities to ensure providing quick responses to bidders' inquiries as being definitely more important than the two other factors in this group. The high-influence evaluation of this attribute is indeed in agreement with the suggestion by Croom and Brandon-Jones, (2007) that providing support to end-users will result in the efficient application of the electronic tendering system. There is a consensus on the great importance of this factor among all contractors' categories regardless of their classes and their previous success rates. Accordingly, local contractors in Saudi Arabia insist on establishing a clear channel of communication with municipalities to coordinate more professionally among stakeholders, which is further consistent with the suggestion by Ikediashi et al. (2014).

The normative attribute (B.C.N.), which is represented by the employment of standardised bid documents contents based on approved international standards, is ranked second in this group in terms of influence to enhance participation in future municipal roads tenders, with RII score of (0.862). Regardless of the variation in contractors' classes and their previous success rates, they mostly agree on both the ranking and the high importance level of this factor, based on the Wilcoxon Mann Whitney test (0.464) and the Kruskal Wallis test (0.886). This agreement on the importance level of this attribute supports the emphasis of Agaba and Shipman (2007) that standardised bidding documents play a vital role in public procurement reform. Therefore, we can suggest that local contractors in Saudi Arabia recognise that standardised bidding documents will eliminate uncertainty in contractual terms, thus enhancing their desire to bid in future. Moreover, this conclusion is in line with the findings of both Al-Sinan (2004) and Al Saudi (2011) that well-developed bidding documents contribute to a project's success.

The regulative attribute (B.C.R.), which is represented by the imposition of e-bidding in government Tendering and Procurement Law, is ranked by the local contractors as the least influential factor in this group for stimulating the desire of contractors to participate in future tenders, with RII score of (0.814). In spite of this late ranking, the majority of contractors distinctly still admit that the imposition of e-bidding in government tendering and procurement law is highly influential, according to the Wilcoxon Mann Whitney test (0.147) and the Kruskal Wallis test (0.803). This assessment is in line with the OECD (2012) report, which suggested that by employing an electronic bidding system, the availability of participation to a wider range of bidders is ensured, along with minimising bidding preparation costs, shortening the bidding duration and storing adequate information to facilitate bidding behaviour screening. Consequently, we can conclude that local contractors in Saudi Arabia, in anticipating increasing their participation rate in future municipal tenders, are looking forward to municipalities using electronic bidding to manage the tendering stage effectively as well as addressing most of the issues associated with this stage, such as human error and incomplete tendering documents. This conclusion is

consistent with the findings of both Gunasekarana and Ngai (2008) and Nitithamyong and Skibniewski (2007).

Clear, comprehensive and non-discriminatory project specifications

The attributes group of ensuring the clarity of project specifications is ranked by the majority of contractors' categories as the second most influential set of factors in stimulating the desire to participate in the bidding, with an average (RII) of (0.915). Interestingly, this group of attributes comes fourth in terms of impact according to the opinions of contractors who have not succeeded in winning any municipal roads contracts. This variation in ranking the influence here is due to this group of contractors considered both the group of bid evaluation criteria attributes and the group of lowering the costs of bidding attributes more influential than the group of ensuring the clarity of the attributes of project specifications. Nevertheless, the local contractors overwhelmingly assess the importance level of the set of ensuring the clarity of the attributes of project specifications as highly important, which supports the findings of an OECD (2012) report that recommended public procurement authorities ensure tender documents contain clear and comprehensive specifications. On the other hand, based on the Friedman test (0.000), they confirm that the presence of accurate and detailed terms and technical specifications for the required works will significantly promote contractors' participation in future tenders more than the other two attributes within this group.

The regulative attribute (C.S.R.), which represented by the presence of accurate and detailed terms and technical specifications for the required works, is ranked as the most influential factor in this group to stimulate the desire of contractors to participate in future tenders, with RII score of (0.975). Additionally, those local contractors, regardless of their classes and their previous success rates, rank this factor as the most influential one among all of the 15 tendering attributes in stimulating the desire of contractors to participate in future tenders. Notably, while the other two factors in this group are assessed as highly important, local contractors consider that urging municipalities to ensure providing accurate and clear

specifications are of much higher importance than the other two attributes in this group.

This high level of importance for this factor has led to increasing the rank of this group of factors as a whole among other groups of factors. The contractors' high assessment of this attribute's importance is consistent with the study by Bageis and Fortune (2009), which found that the clarity of specifications is one of the most important factors influencing contractors to decide to bid. Local contractors in Saudi Arabia confirm that municipalities ensuring accuracy and details in bidding documents, particularly specifications, lead the contractor to a greater understanding of these specifications, which is reflected in the increase in the number of those desiring to bid by raising the level of their certainty to do so.

The normative attribute (C.S.N.), which is represented by the presence of a clear and neutral local code for municipal road project specifications, is ranked second in this group in terms of influence to enhance participation in future municipal roads tenders, with RII score of (0.904). Despite the variation in contractors' classes and their previous success rates, they mostly agree on the high importance level of this attribute, based on the Wilcoxon Mann Whitney test (0.693) and the Kruskal Wallis test (0.523). This agreement on the importance level of this attribute supports the emphasis by Banerjee (2015) on the vital role played by those building codes. This finding is further consistent with the claim by Yakubu and Agapiou (2016) that construction processes, which are characterised frequently by complexity, demand compliance mechanisms such as building codes to ensure attaining the expected standards. In conclusion, local contractors in Saudi Arabia agree with Clemmensen's (2003) assertion that building codes define the concept of minimum acceptable requirements. Consequently, those building codes contribute to reducing the impact of the vagueness in specifications and provide a clear legal reference in conflict situations, thereby reducing the risk to contractors.

The cognitive attribute (C.S.C.), which is represented by the publishing of an updated local municipal roads specifications guidebook, is ranked by the local contractors as the least influential factor in this group for stimulating the desire of contractors to participate in future tenders, with RII score of (0.915). Despite this low ranking within this group, there is an agreement on the high importance of this factor among all contractors' categories regardless of their classes and their previous success rates, according to the Wilcoxon Mann Whitney test (0.397) and the Kruskal Wallis test (0.350). The importance evaluation of this factor corroborates the suggestion by Ishii (2014) that channels of communication among stakeholders in the construction processes should be developed, which in turn addresses deficiencies in the cognitive aspects of such processes. Therefore, we can point out that local contractors in Saudi Arabia are expecting municipalities to apprise them of the latest municipal road project specifications periodically or at least whenever a new amendment is introduced.

Provision of accurate project costs estimates

The attributes group of provision of accurate project costs estimates is ranked by the majority of contractors' categories as the least influential among the all five groups of attributes in stimulating the desire to participate in the bidding. The assertion of Oberlender and Trost (2001) that accuracy of cost estimates relies on several factors such as the clarity of scope might interpret the late ranking of this group. In spite of this ranking, the importance level of this group is remained high based on the relative importance index (0.794). The high assessment of this group importance is in line with confirmation of both OECD (2009) and Ishii (2014) that the accuracy, consistency, and reliability of engineer's cost estimate is critical in facilitating cash flow management. As the inaccuracy of cost estimates has been considered by the contractors, according to the literature, as one of the critical factors for projects failure in Saudi Arabia. Consequently, it is rational that the same contractors assess the importance of this factor at a high level.

The cognitive attribute (C.E.C.), which represented by the availability of certified cost engineers, is ranked as the most influential factor in this group to stimulate the desire of contractors to participate in future tenders, with RII score of (0.839). Based on the Wilcoxon-Mann Whitney test (0.618) and the Kruskal-Wallis test (0.332), there is an agreement on the high importance of this factor among all contractors' categories regardless of their classes and their previous success rates. The high assessment of this factor generally is consistent with the suggestion of Ishii et al. (2016) that contractors should be careful to designate a qualified team with the expertise to perform cost estimation task and allocate a convenient time for this task. Thus, we can infer that local contractors in Saudi Arabia broadly seek to be attentive in hiring a qualified technical team to perform cost estimates.

The regulative attribute (C.E.R.), which is represented by the provision of a reasonable time to bid, is ranked second in this group in terms of influence to enhance participation in future municipal roads tenders, with RII score of (0.803). Based on the Wilcoxon Mann Whitney test (0.049), the lower-classes contractors, more than other categories of contractors, are keen on the reasonability of this period, which is necessary to conduct their technical studies. This finding can be linked to the lack of adequate technical expertise within those contractors compared to other upper-classes contractors; thus, they need more time to perform a project cost estimate task. Nevertheless, contractors' overall assessment of the importance level of providing the reasonable time to study tenders is high, which is consistent with OECD's (2009) report which recommended clear and reasonable time frames to be provided by the public procurement authorities for each phase of the procurement process. Therefore, we can suggest that local contractors in Saudi Arabia, in particular, lower-classes contractors, are expecting that municipalities will ensure an adequate time to submit their bids so as to guarantee their participation in future tenders.

The normative attribute (C.E.N.), which is represented by the presence of a cost estimation benchmark book, is ranked by the local contractors as the least influential factor in this group for stimulating the desire of contractors to participate in future tenders, with RII score of (0.741). Interestingly, contractors who did not participate in biddings previously and lower-classes contractors, more than other categories of contractors, were more interested in having a cost estimation benchmark, based on the Kruskal Wallis test (0.034) and the Wilcoxon Mann Whitney test (0.007). This finding may indicate that one of the municipal roads construction market entry barriers in Saudi Arabia is the lack of knowledge of current market prices. Nevertheless, contractors' overall evaluation of the importance level for the presence of a cost estimation bench book is still high, which is consistent with Kerzner's (2013) point of view that cost estimation accuracy is promoted by providing highly efficient data. Consequently, the finding suggests that local contractors in Saudi Arabia, in particular, contractors who have not been involved in previous municipal roads tenders and lower-classes contractors, desire an updated cost estimation benchmark book.

Clear and objective definition of award (evaluation) criteria

The attributes group of ensuring a clear and objective definition of award criteria is ranked by the majority of contractors' categories as the fourth most influential set of factors in stimulating the desire to participate in the bidding, with an average RII of (0.863). Interestingly, this group of attributes comes joint first with the group of ensuring transparency in contractors' qualification processes in terms of impact, according to the opinion of contractors who never participated in any municipal roads tenders. This variation in ranking the influence is due to this group of contractors distinctly gave less importance, than other contractors did, to the group of ensuring clarity of project specifications attributes. This variation, furthermore, is reasonable, particularly in the absence of knowledge of the clarity level in municipal roads specifications since these contractors have not purchased any bidding document previously.

Nevertheless, the local contractors commonly assess the importance level of the set of ensuring a clear and objective definition of award criteria attributes as highly important, which supports the recommendation of a 2009 OECD report, which stated that awarded criteria should be distinctly defined and adequately weighted in advance. On the other hand, the Friedman test (0.000) confirm that the presence of tenders' evaluation criteria based on socioeconomic objectives that give small firms opportunities to share in the market significantly have less influential than the other two attributes within this group in promote contractors' participation in future tenders.

The cognitive attribute (E.C.C.), which represented by the provision of training and development sessions to understand tenders' evaluation criteria and their weighting scores, is ranked as the most influential factor in this group to stimulate the desire of contractors to participate in future tenders, with RII score of (0.925). According to the Wilcoxon Mann Whitney test (0. 369) and the Kruskal Wallis test (0.571), those local contractors, regardless of their classes and their previous success rates, classify this factor in the top five in the list of factors that influence their desire to bid. The contractors' high assessment of this attribute's importance is consistent with the suggestion by Al-Hazmi (1999) that government authorities, by introducing seminars with consultants and contractors, should explain internally their works mechanism. Accordingly, local contractors in Saudi Arabia confirm that the provision of training and development sessions to understand tenders' evaluation criteria and their weighting scores is reflected in the increasing number of those desiring to bid by raising the level of their perception of the inner process.

The normative attribute (E.C.N.), which is represented by standardising tenders' evaluation criteria among municipalities, is ranked second in this group in terms of influence to enhance participation in future municipal roads tenders, with RII score of (0.890). Based on the Kruskal Wallis test (0.040), unsuccessful contractors, more than others, considered this normative factor as more influential. Moreover, they ranked this factor as the most influential factor among all of the 15 factors.

Nevertheless, despite the variation in contractors' classes and their previous success rates, they mostly agree on the high importance level of this attribute. This agreement on the importance level of this attribute supports the emphasis in an OECD (2009) report on the vital role played by those criteria. In conclusion, local contractors in Saudi Arabia, in particular, those who have participated in municipal roads tenders previously and have never succeeded, agree with the assertion by Alofi et al. (2015) that public procurement authorities in Saudi Arabia should introduce an objective evaluation criteria system, which, in turn, would enhance contractors' participation in future tenders.

The regulative attribute (E.C.R.), which is represented by the presence of tenders' evaluation criteria based on socioeconomic objectives that give small firms opportunities to share in the market, is ranked by the local contractors as the least influential factor in this group for stimulating the desire of contractors to participate in future tenders, with RII score of (0.775). Despite this late ranking, there is an agreement on the high importance of this factor among all contractors' categories regardless of their classes and their previous success rates. Based on the Kruskal Wallis test (0.045), unsuccessful contractors distinctly considered this factor is one of the top list influential factors in promoting the desire to bid in future. The importance evaluation of this factor corroborates the suggestion of Froeb and McAfee (1988) as well as Dorée (2004) that small and medium firms should be favoured in some cases of public procurement while curbing potential horizontal mergers among them. Therefore, we can point out that local contractors in Saudi Arabia, particularly who have participated previously in municipal roads tenders and have never been succeeded, are expecting from municipalities to taking in account the socio-economic objectives in tenders' evaluation stage.

7.3 Measuring the attributes' current performance

To complete the first phase of analysis, we measured the current performance of the fifteen tendering phase elements through standardized open-ended interviews which helped to minimize variation, compare responses in analysis, and use interviewee time efficiently. There are a variety of tools and approaches in performance assessment, including customer satisfaction and self-assessment. These two approaches will be based on this research, where contractors' satisfaction will be evaluated in addition to the self-evaluation of government agencies. The logical flow of the interview has been taken into account. Thus, the five early stage components have been arranged in time order. In order to facilitate responses, prefatory statements been used. Since opinion and feeling are likely to be more grounded and meaningful once the respondent has verbally relived their experience, each section of the interviews has started with the experience question followed by opinion questions.

7.3.1 Results analysis & discussion

Transparent contractors' qualification processes

Local contractors in Saudi Arabia are predominantly dissatisfied with the municipalities' commitment to determining the allowable contractors class to bid through their tender announcements, where they stated that the municipalities' tendering announcements do not include this condition at all. Consequently, Lower-classes contractors, in particular, confirm that purchasing bidding documents has become one of the risks they face in these sorts of projects. This assertion is due to the recent increase in the bidding documents values, as well as the uncertainty of acceptance of their bids by municipalities in the case of inappropriate contractor classification, which only can be confirmed after purchasing and analysing those bidding documents by contractors. they further confirm that a bidding document price is not an indicator of the estimated contract value.

Few interviewed contractors mentioned that the only way to obtain this information is by contacting the department and asking for the contract's allocated budget, and not all contractors can gain access to that. What makes this matter even more suspicious is that one of the interviewed municipal procurement departments indicated that they verbally inform contractors who are interested in participation. On the other hand, just one of these interviewed contractors expressed his full satisfaction with the municipality's commitment to identifying the minimum required contractor class in their announcements. This satisfaction aligns with the confirmation by a (same-zone) interviewed municipal procurement department that they seek to ensure including the minimum required contractor class. Due to the purposes of the next stage of this study, the performance of municipalities as part of the obligation to ensure that the minimum contractor class required is included in their tender announcements is assessed commonly as a poor performance.

With regard to ensuring transparency in the processes of contractor qualifications through the provision of objective contractor classification criteria, local contractors unanimously agreed on the remarkable recent development of the Contractor Classification Agency's procedures, especially after the use of the e-portal. Based on the adopted procedures guidebook in the entire Contractors Classification Agency departments process, each classification request is separated into three different parts (technical, financial and legal). This separation is in line with the mentioned major prequalification criteria in other contexts (Hatush & Skitmore, 1997; Plebankiewicz, 2009; Jain et al 2014; Huang et al., 2014). It was obvious from the Saudi Contractors Classification Agency interview that they manage the classification arrangements systematically and objectively.

> "They actually investigate and visit both our office and projects sites and reviewing all aspects (financial, administrative, and technical)."
>
> **(ALP-04-044)**

Moreover, local contractors mostly confirm the presence of objective classification criteria within the agency's e-portal. This confirmation is in contrast with the recommendation by Alsugair and AbuThnain (2011) regarding the inefficiency of contractors' classification criteria in Saudi Arabia. The variation of respondents in the study of Alsugair and AbuThnain (2011) may explain the disagreement in the contractors' classification criteria assessment. They distributed their questionnaires to government administrators only, while this research conducts in-depth interviews with both Contractors Classification Agency officers and some contractors.

Interestingly, a number of contractors mentioned the difficulty of making compulsory visits to the agency headquarter to review and verify their submitted documents. The introduction of an electronic verification system has been suggested by these interviewed contractors. Additionally, one contractor indicated that the data details to be filled out on the forms were unclear, which sometimes led to forms being returned to be corrected. Accordingly, this regulative proposal might be taken into consideration for further investigation in a future study. In conclusion, the current performance of the Contractors Classification Agency in the provision of objective contractors' classification criteria can be assessed as a good performance.

On the other hand, the interviewed local contractors point out that although these criteria were available on the agency's e-portal, those criteria were suffering from a lack of clarity as well as difficult to ingest. In particular, they emphasise the lack of transparency of the method by which these criteria are measured. This contractor's opinion concurs with Al-Barrak's (1993) and Almutairi's (2017) assertions that the mechanisms of the current contractors' classification system in Saudi Arabia are somewhat ambiguous and unclear. The dissatisfaction of local contractors with the clarity of these mechanisms is moreover consistent with the same perception confirmed by Hosny et al. (2013) in the Egyptian context, which is somewhat comparable to the Saudi context.

> "We, as contractors, do not know how they got to the final assessment of the classification nor standards calculation method."
>
> **(BET-03-018)**

One of the expected consequences of this vagueness of the classification criteria is discouraging contractors (Almutairi, 2017), which, in turn, leads to the unwillingness of most of them to participate in future bids. Furthermore, this lack of clarity may reflect the poor assessment in previous studies which evaluated the contractors' classification system in Saudi Arabia. The interviewed from the Contractors Classification Agency referred to how these mechanisms are confidential and cannot be disclosed to prevent tampering. They acknowledge that the contractors had the right to know their weaknesses so they can avoid them in future classification applications, and plan to inform contractors of these verbally, with the intention of including them in a report alongside the final decision. In response, one contractor suggested that the agency at least should publish apparent minimum criteria for each classification, as followed by the Saudi Council of Engineers. Accordingly, the current performance of the Contractors Classification Agency in publishing classification criteria and their weighting score can be assessed as a poor performance.

Lowering the cost of bidding

All of the interviewed local contractors in were satisfied with the municipalities' commitment to adopt e-procurement in municipality construction contracts currently. They admit that most of the municipalities have been already switched to the electronic procurement system. Furthermore, municipalities' procurement departments indicate that the Ministry of Finance requests all government agencies to manage their procurement through the unified electronic government procurement portal (Tabadul). Through their experiences with this transformation, local contractors have endorsed the advantages of e-procurement as they can access bidding documents, even outside their zones, promptly and readily, unlike traditional procurement procedures. This confirmation of the contractors aligns with the suggestion of Nitithamyong and Skibniewski (2007) that electronic documentation

could address most of the human failures in the tendering phase, such as errors in documents and insufficient copies.

Moreover, these contractors further acknowledge that the e-procurement approach has directly contributed to lower preparation costs of their bids as they do not need to send their delegates to municipalities outside their zone to either get or submit their documents. Additionally, it expedites bidding documents delivery in contrary with the case of the traditional procurement processes. Therefore, the performance of municipalities in their commitment to introducing e-bidding in their construction work contracts is assessed commonly as a high performance.

With regard to ensuring lowering the cost of bidding through the employment of standardised bid documents contents based on approved international standards, despite the agreement of the interviewed local contractors on the similarity of these contents in municipal road tenders, they indicated to the vast differences in the contract terms and conditions, both general and special conditions sections. These differences in contract terms and conditions among municipalities lead to some ambiguity, which, in turn, might cost a contractor to pay unjust fines, thus seriously increasing the contract risk for contractors. These consequences are consistent with the assertions of both Al-Sinan (2004) and Al Saudi (2011) that the ambiguity of the contractual terms or tenders' documents in general is considered as an obstacle to any public construction work project success.

The Ministry of Municipal and Rural Affairs in Saudi Arabia appears to have made no effort to standardise these documents. Nevertheless, one of the interviewed municipalities took an internal step to achieve this target, in which they force all of their sub-municipalities to unify the contents of the tender documents and recruit a central technical committee in order to ensure congruence. In conclusion, the current performance of the Ministry of Municipal and Rural Affairs in standardising the bid documents' contents of municipal roads contracts based on approved international standards can be assessed as poor.

On the other hand, local contractors are considerably dissatisfied with the efficiency of the municipalities' response to their inquiries during the tendering phase in order to tackle their problems in e-procurement. The majority of these contractors indicate that municipalities utilise traditional means such as the fax in responding to bidders' inquiries. Despite municipalities admitting the use of this traditional method, they have confirmed the presence of other methods of communication, especially electronic, but local contractors are used to communicating by fax. Even worse, a municipal procurement department director endorsed the bidders' need to come personally to the municipalities in order to get a better response. The current level of communication between municipalities and bidders is in complete contradiction with the OECD's (2009) recommendation that public procurement authorities should increase the efficiency of communication with bidders simultaneously, using the same method and on a formal basis.

However, the method of communication was not the only observation of local contractors. Insufficient responses by municipalities as well as the length of the response period prompted some of them to withdraw from tenders. The interviewed municipalities were different in the way they determine the average time required to respond bidders' inquiries, yet they admitted that the response period could take days or even more than a week. This time required to respond explains the dissatisfaction of the contractors, especially taking into consideration the short duration of tender analysis, which is usually limited to 30 days. Accordingly, the current performance of the municipalities in the provision of technical advice to tackle bidders' problems in electronic bidding can be assessed as a very poor performance.

Clear, comprehensive and non-discriminatory project specifications

Local contractors show some satisfaction with the clarity of municipal roads project specifications initially when the bidding document is purchased. Nevertheless, they point out the inaccuracy of the bills of quantities, in particular with regard to drilling, cutting and filling works. Consequently, those quantities were often modified

considerably during the implementation phase. Contractors' assertions of these various changes to the main design are consistent with the findings of Assaf et al. (1995), Albogamy et al. (2012) and Elawi et al. (2015) in the same local context. In addition, local contractors indicate that the scope of work is subject to change commonly, thus increasing the financial risks in this sort of contracts. This observation is consistent with Jannadi's (1997), Al-Khalil and Al-Ghafly's (1999), Asif's (2003) and Al Saudi's (2011) mentioning that work specifications in public construction work contracts in Saudi Arabia suffer from a lack of an accurate scope of work definition.

> "However, modifications in such projects are usual. Therefore, there is a modified BOQ in which modification should not exceed (10%) of the entire project."
>
> **GAM-RPD-DPT**

According to the interviewed municipalities, each municipality takes the required steps in this process from the needs monitoring to the preparation of the specifications by consultants based on the specifications of the municipal road projects guidebook of the Ministry of Municipal and Rural Affairs. Yet, they suggest that these modifications were due to the amount allocated by the Ministry of Finance being insufficient occasionally, which in turn affects the final amounts of project items. Therefore, the current performance of the municipalities in committing to the provision of accurate and detailed terms and technical specifications for the required works is assessed as an average performance.

Although the Saudi Arabian local building code does not cover the specifications of municipal roads projects, local contractors often express satisfaction with the standard aspect of the specifications of these projects. This satisfaction is rooted in the existence of a guidebook of the municipal roads specifications, which was prepared by the Ministry of Municipal and Rural Affairs. This satisfaction reflects a remarkable development in this aspect, which was considered previously by Al-Hammad and Assaf (1992) as one of the obstacles to providing clear project specifications in Saudi Arabia.

On the other hand, despite the commitment of municipalities to the urban roads specifications guidebook, this guidebook suffers from a lack of coverage of few item specifications for municipal road projects. Therefore, in the absence of item specifications in the main guidebook, municipalities refer to other guidebooks, such as the Ministry of Transport guidebook (for asphalting works) or the Royal Commission of Jubail and Yanbu guidebook (for paving and lighting works). These references are mentioned in each bidding document under the section of the contractor responsibilities. In addition, municipalities also assume that every contractor interested in this sort of projects must be aware of those guidebooks. In conclusion, the current performance of the Ministry of Municipal and Rural Affairs in the provision of a clear and neutral local code for municipal road project specifications is assessed as a good performance.

On the other hand, the majority of local contractors are considerably dissatisfied with the efficiency of the municipalities' efforts in the publishing of an updated local municipal roads specifications guidebook. They suggest that the onus is on the contractors to communicate with the concerned municipality to get the updated guidebook. Municipalities admit that they do not have any mechanism through which they can publish those updates except by attaching them to their future bidding documents. As a result, contractors who participate frequently in tenders in this sort of project are the only ones who are able to recognise these updates.

Therefore, most of the interviewed local contractors consider this poor communication as unfair and that it facilitates the monopolising of municipal contracts by a small group of contractors. This contractor's opinion corresponds with the assertions of Al Ghafly (1995), Falqi (2000), and Arain et al. (2006) that poor coordination and communication among stakeholders is rampant in public construction projects in Saudi Arabia. Worse still, one of the interviewed municipalities explicitly indicated that they preferred to focus on dealing with a particular group of contractors who were fully aware of this sort of project requirements in order to contribute to completing the work successfully. Accordingly,

the current performance of the municipalities in the publishing of the latest specifications guidebooks is assessed as a poor.

Provision of accurate project costs estimates

The interviewed local contractors are quite satisfied with the municipalities' commitment to grant a reasonable timeframe to submit bids. Generally, they asserted that the contractor's specialisation in these sorts of projects makes this period reasonably sufficient. Furthermore, all municipalities show a full commitment to granting a bidding period that is limited to 30 days commonly, and to 60 days in the case of complex projects. This commitment complies with the OECD (2009) recommendation for clear and reasonable timeframes provided by public procurement authorities for each phase of the procurement process.

Local contractors, however, stress that the adequacy of this period is sometimes directly influenced by other related factors, such as the clarity of specification and the speed of municipal response to bidders' inquiries. In contrast, municipalities have recorded very rare cases of extending the period of tenders due to the need for further clarifications. Therefore, the current performance of municipalities in the obligation to grant a reasonable timeframe for bidders to submit their bids is commonly assessed as a high performance.

In spite of their recognition that there is no prices benchmark issued by the Ministry of Municipal and Rural Affairs, local contractors do not demonstrate any concerns about the current situation of the normative aspect of municipal road contracts cost estimates. The reason is that these contractors create their own prices benchmarks depending on their cost estimates teams. In order to prepare their own prices benchmark, contractors rely on various methods, including recording competitors' prices, analysing the actual cost of previous projects, and comparing the actual items prices of the ongoing projects with their initial costs estimates. Nevertheless, they indicate that materials prices, as well as labour prices, frequently change. With regard to the equipment, some take updated prices from their accounting departments

according to the latest leased equipment. Accordingly, they expect the Ministry of Municipal and Rural Affairs to create and update this price benchmark in the future.

The municipalities, in turn, admit that they do not have their own guided prices benchmark. Instead, they just review the average previous contracts prices of three years, taking into consideration any notable raise or reduction in materials prices. One municipality indicated that they referred to a reference prepared by the Council of Saudi Commercial and Industrial Chambers, which includes materials, labour, and equipment prices, and was last updated in 2007. These municipalities mechanisms for costs estimates do not promote high-efficiency data, which reduces the accuracy of the cost estimate, as recommended by Kerzner (2013). Therefore, the current performance of the municipalities in providing a cost estimation benchmark can be assessed as poor.

Despite none of the interviewed local contractors having hired certified cost engineers, they stressed that they carefully hire qualified cost estimators who have extensive experience in estimating similar construction projects costs, in particular, municipal road projects, according to their accumulation of work experience in this field. These assertions by contractors are in line with the recommendation by Ishii et al. (2016) that contractors should be keen to appoint a qualified team of experienced individuals to perform the task of cost estimates. These experienced teams, which include various disciplines engineers and quantitative surveyors, initially visit the project site after the bidding documents are purchased. Subsequently, the task of preparing preliminary project cost estimates is completed on the attached bill of quantities. In the final stage, the contractors' decision makers secretly calculate the acceptable profit and submit their bid in order to ensure confidentiality. Accordingly, the current performance of the contractors in the employment of professional cost engineers can be assessed as a good one.

Clear and objective definition of award (evaluation) criteria

Despite the variation in the local contractors' satisfaction with their past experiences in bid evaluation decisions. Local contractors overwhelmingly point out their lack of understanding of the municipalities' bids evaluation criteria, except for financial assessment. These contractors' opinions are implicitly in line with the assertions by Al Ghafly (1995), Al-Khalil & Al-Ghafly (1999 & 2010), Al Saudi (2011), Albogamy et al. (2012) and Alhammadi et al. (2015) that the concentricity of bid evaluation criteria in the Saudi Arabian public procurement on the bids values disregarding other qualifications. Some of them referred to cases where the lower bidder was forced to reduce their bid to reach the amount allocated by the Ministry of Finance. This is because of the poor accuracy of the cost estimate of the project by the municipality.

As an example of the lack of understanding of the mechanisms of this stage, one of the interviewed contractors referred to some cases in which a bid was excluded without explanation by the bids evaluation committee. This confirms that the municipalities do not comply with the OECD (2009) recommendation that bids evaluation committee outcomes must be published and unsuccessful bidders must be informed instantly. Accordingly, it is difficult for the contractors to objectivity evaluate the municipalities' performance in the regulative aspect of the award criteria. Nevertheless, they show some satisfaction with the decisions of the municipal bids evaluation committees in general.

On the other hand, the municipalities confirm that they are not at all obliged to consider socioeconomic objectives in evaluating submitted bids. they emphasised that bids are evaluated in three stages, respectively. Firstly, the initial evaluation stage, where the sealed bids are opened in the presence of all competitors. After which, minutes including a list of competitors and their bid prices are prepared. Next, bids are reviewed by the technical analysis team; financial files are also reviewed at this stage in terms of written and accounting errors. The decision is not taken here, but technical review minutes are forwarded to the evaluation committee. Finally, the bids evaluation committee will hold a meeting and study the technical analysis

minutes in addition to the comparison of the prices and the estimated price. Finally, they will make a decision. Therefore, the current performance of the municipalities in providing bid evaluation criteria based on socioeconomic objectives is assessed as a poor one.

With regard to ensuring a clear and objective definition of award criteria through standardising tenders' evaluation criteria among municipalities, local contractors expressed complete dissatisfaction with the current performance of the municipalities in this regard. They point out the lack of clarity as well as the variation of these criteria, the technical aspect in particular, among the municipalities. Local contractors further indicate their desire that the Ministry of Municipal and Rural Affairs establish a standard and updated report to measure contractors' performance on the previously implemented projects by them.

> "We need to be informed about updates on these criteria in order to keep on track and to update my references."
>
> **BET-03-018**

On the other hand, the municipalities confirm their lack of commitment to standardising these criteria. Even worse, the municipalities indicate that evaluation criteria frequently are not even prepared in advance, but are discussed when the evaluation committees meet. This confirmation is contrary to the OECD (2009) recommendation which encourages public procurement authorities to define and objectively weigh all of their bids evaluation criteria in advance. Municipalities further indicate the absence of a symmetrical approach to measuring the current performance of contractors. Furthermore, the municipalities admitted the emphasis of this phase is on the formal aspect, such as written errors in the tender and the contractor's documents, which include the financial guarantee, classification certificate, comparison with estimated price, etc.

"We evoke them during the analysis based on committee members' experiences"

GAM-EVA-COM

In addition, the municipalities consider that the current regulations on contractors' classification do not cover the total value of projects that are simultaneously tolerable to any contractor. Consequently, some municipalities refer to their reliance on their own reports regarding the performance of contractors in previous projects as well as the contractors' classification and labour and equipment ability, while other municipalities just focus on the administrative and financial aspects of the submitted bids. In conclusion, the current performance of the Ministry of Municipal and Rural Affairs to standardise tender evaluation criteria is assessed as a very poor performance.

Additionally, the local contractors show total dissatisfaction with the cognitive component of the bids evaluation stage, while the interviewed municipalities confirmed their negligence to communicate with contractors regarding the publishing of their bid evaluation methods. Nevertheless, the municipalities assert that these criteria are commonly included in their bidding documents in advance. Yet contractors point out that although these technical evaluation criteria were included in the bidding documents of some municipalities within the contract conditions and terms section, those criteria suffer from a lack of clarity as well as being difficult to ingest.

The interviewed local contractors further assert the lack of transparency of the weighting scores measurement. They point to the fact that municipalities do not communicate effectively with them to clarify the methods employed to evaluate submitted bids. Consequently, contractors need to build strong networking relationships within municipalities to avoid the lack of perception around these evaluation methods. This lack of communication should be addressed by introducing seminars with contractors to explain internal works mechanisms, as proposed by Al-

Hazmi (1999) in the same context. Accordingly, the current performance of the municipalities in training and development for understanding evaluation criteria and their weighting score is assessed as a very poor performance.

7.4 The Importance Performance Analysis matrix

The IPA approach is deemed a simple, valuable, and effective tool (Hansen and Bush, 1999; Sever, 2015; Lai and Hitchcock, 2015) that permits an intuitive assessment to visually identify gaps between stakeholders' perceptions of the importance of a specific attribute and the actual performance of a firm or destination on managing that attribute, allowing them to increase their usefulness in making strategic decisions (Martilla and James, 1977; Duke and Persia, 1996; Silva and Fernandes, 2011; Lopes and Maia, 2012). This can also help prioritize service quality improvements (Bacon, 2003). As indicated by Oh (2001), the same series of attributes should be applied in both importance and performance assessments. Furthermore, In order to reduce compounding and order impact, as advised by Martilla and James (1977), importance measures should be separate from performance measures. Although originally developed for marketing purposes, IPA application has extended to a wide range of fields. However, there has been very limited application of IPA in the construction industry to date.

In this study, respondents were asked about each attributes' importance and performance. Initially, the importance of these attributes was measured through the distribution of semi-structured questionnaires distributed to a proportional, stratified sample of classified roads contractors. The five-point Likert scale has been utilised for the importance assessment questionnaire, which was a commonly applied approach in previous IPA-related studies, where it was used to measure importance and performance (Chang et al., 2017). Subsequently, after analysing the results of the first phase statistically, the performance of these attributes was measured through personal interviews with contractors on the one hand and municipal departments on the other to avoid potential bias in performance assessment.

As observed in the (RII) results and the differences among respondents' category tests, there is no overall variant in the attributes' importance assessment from one group of respondents to the others, with the exception of slight differences in some of the accurate cost estimation and bidding evaluation criteria attributes for lower class or unsuccessful contractors. Therefore, the average importance assessment of the entire respondents of each attribute will be adopted for the subsequent step: (IPA) mapping.

Initially, and for the appropriate operation of the IPA mapping technique, performance and importance scales should be normalised (Sever, 2015), due to measuring these attributes importance and performance on different scales (Azzopardi & Nash, 2013). Therefore, (min-max) normalisation will be adopted in order to transform both scales to a value between 0.0 and 1.0, where the lowest (min) value is set to 0.0 and the highest (max) value is set to 1.0. Equation (7-1) illustrated the adopted normalization approach.

$$NV = (AAV - AMnV) \,/\, (AMxV - AMnV)$$

Where:

$\boldsymbol{NV}$ = the normalised value,
$\boldsymbol{AAV}$ = the average actual value,
$\boldsymbol{AMnV}$ = the average minimum value,
$\boldsymbol{AMxV}$ = the average maximum value.

Example of transferring E.C.R. scores:

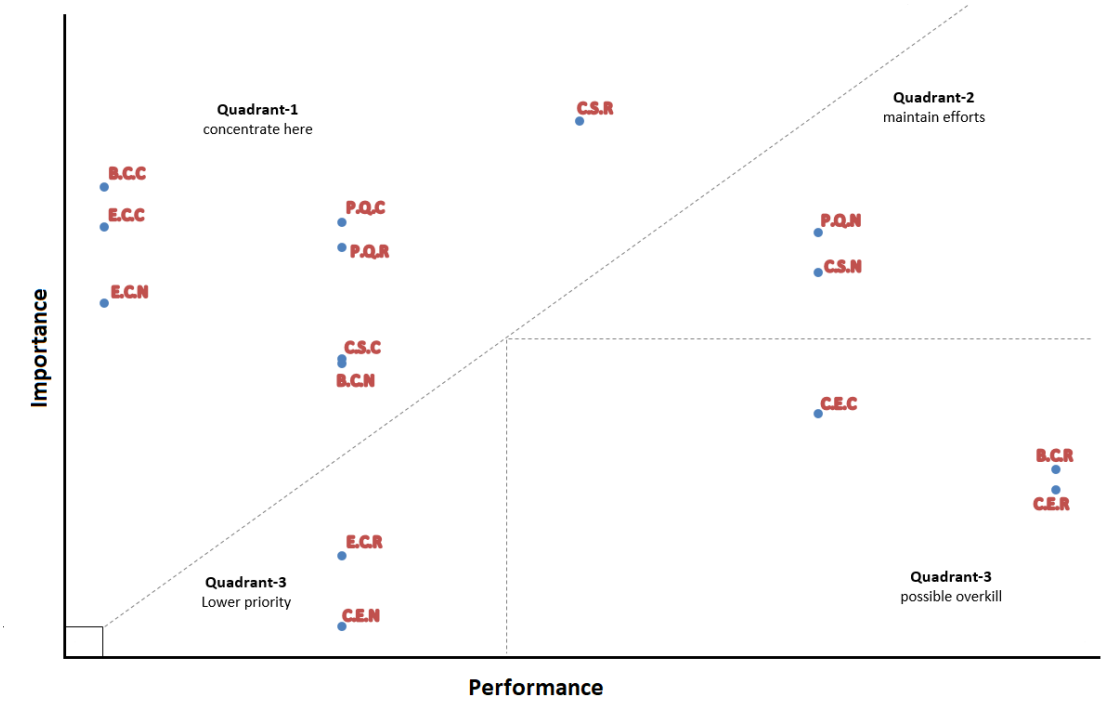
Importance =	(0.775-0.744)/(0.975-0.744)= 0.14	"0.775" transferred to "0.14"
Performance =	(2.00-1.00) /(5.00-1.00) = 0.25	"Poor" transferred to "0.25"

Accordingly, Table (7.3) shows the normalised values of the importance and performance evaluation of the attributes.

Attributes	Importance	Performance
PQR	0.75	0.25
PQN	0.78	0.75
PQC	0.80	0.25
BCR	0.31	1.00
BCN	0.52	0.25
BCC	0.87	0.00
CSR	1.00	0.50
CSN	0.70	0.75
CSC	0.53	0.25
CER	0.27	1.00
CEN	0.00	0.25
CEC	0.42	0.75
ECR	0.14	0.25
ECN	0.64	0.00
ECC	0.79	0.00
Mean	**0.57**	**0.42**

Table 7-4 Normalised values of the importance and performance for all attributes

Therefore, the Importance Performance Analysis matrix, using the information from their normalised assessment values, is represented in Figure (7.8). In order to interpret results properly, it is important to select appropriate locations for the discriminating thresholds – the vertical and horizontal lines that separate the quadrants. Alberty and Mihalik (1989), Guadagnolo (1985), and Hollenhorst et al. (1992) suggested that these axes should be located in the mean of each dimension, that is, performance and importance. Accordingly, the results are spread over four quadrants, forming the axis defined by the mean values (0.57; 0.42) for the attributes. Moreover, based on Bacon's (2003) suggestion, an ISO-priority line has been added, representing a perfect balance between importance and performance, with a zero performance gap. The 'flexible data-cantered diagonal line model' is more practical than the traditional rigid IPA models (Lai and Hitchcock, 2015). The discussion of the matrix outcomes will be presented below.



The matrix key:

PQR	Determining the permitted classifications for bidding on the tender announcement
PQN	The provision of objective contractors' classification criteria
PQC	Publishing the contractors' classification criteria and their weighting scores
BCR	The imposition of electronic bidding
BCN	A standardised bid document contents
BCC	Technical advice to tackle bidders' problems in electronic bidding
CSR	Accurate and detailed terms and technical specifications
CSN	A clear and neutral local code for municipal road project specifications
CSC	An updated local municipal roads specifications guidebook
CER	A reasonable timeframe to submit bids
CEN	Cost estimation benchmark
CEC	Certified costs engineers
ECR	tenders evaluation criteria based on socio-economic objectives
ECN	Standardising tenders evaluation criteria
ECC	training sessions to understand tenders evaluation criteria

Based on the evaluations analysis of the importance as well as the current performance of the designated tendering stage attributes in the Saudi Arabian municipal roads projects, an IPA matrix has been created in order to prioritise the proposed managerial attentions which promote contractors' inclination to participate in future municipal roads tenders. The mean values of both importance and performance, as well as a zero performance gap, were adopted in this IPA matrix

to identify the four different priority quadrants. Interestingly, most of those designated attributes have a performance gap, and consequently are located in quadrant (1), which refers to the concentration of the proposed efforts in developing those attributes. These four quadrants are enumerated in detail in this section, including the attributes located in each quadrant, the strategies needed to deal with each quadrant and the responsible stakeholders.

First of all, quadrant (1), which contains the attributes ranked by the local contractors, shows them as highly important for enhancing their desire to participate in future municipal roads tenders, while the current performance levels of the responsible stakeholders were relatively low. It is suggested that efforts should be concentrated here to make performance improvements. This quadrant comprises the following attributes: the provision of technical advice to tackle bidders' problems in electronic bidding; standardising tenders' evaluation criteria among municipalities; the provision of training and development sessions to understand evaluation criteria of tenders and their weighting score; publishing the contractors classification criteria and their weighting scores; determining the allowed classification to bid on the tender announcement; the publishing of an updated local municipal roads specifications guidebook; the employment of standardised bid documents contents based on approved international standards; and the presence of accurate as well as detailed terms and technical specifications for the required works.

Accordingly, the attributes in this quadrant are considered problematic for concerned stakeholders and require immediate managerial attention for enhancing contractors' participation in future tenders. It is noted that this quadrant includes almost all of the cognitive attributes, which indicates that in order to promote the participation of contractors in municipal roads tenders in future, the responsible stakeholders should primarily develop a level of communication with contractors to clarify the mechanisms of work so as to improve the perception of contractors.

Quadrant (2) contains attributes perceived by the local contractors to be very important in enhancing their desire to participate in future municipal roads tenders. At the same time, the responsible stakeholders' performance was relatively high. It is suggested here that efforts should remain the same. This quadrant comprises the following attributes: the provision of objective contractors' classification criteria, as well as the presence of a clear and neutral local code for municipal road project specifications. Accordingly, the attributes in this quadrant are considered the strengths of the concerned stakeholders and are required to keep up the good work for the purpose of promoting contractors' participation in future tenders. It is noted here that both of these two attributes are normative components, which suggest that despite the poor performance of the responsible stakeholders in some normative components, as noted in the first quadrant, they are working soundly on other normative components.

Quadrant (3) contains attributes of relatively less importance (below average), based on the local contractors' evaluation in enhancing their desire to participate in future municipal roads tenders as well as the current low performance of the responsible stakeholders. It is suggested here that the poor performance will not be considered as a priority, as these attributes are relatively unimportant. This quadrant comprises the following attributes: the presence of a cost estimation benchmark book and the presence of tenders evaluation criteria based on socioeconomic objectives for giving small firms opportunities to share in the market. Accordingly, the performance level of the attributes in this quadrant should be improved if the development of attributes in the quadrant (1) is completed.

Finally, quadrant (4) contains attributes of relatively less importance (below the average) based on the local contractors' evaluation in enhancing their desire to participate in future municipal roads tenders. However, the current performance of the responsible stakeholders was assessed at a high-performance level. It is suggested here that the responsible stakeholders have been expending too much effort compared to what was actually needed. This quadrant comprises the following

attributes: the availability of certified cost engineers within the contracting firms; the introduction of e-bidding in government tendering and procurement law; and providing a reasonable timeframe to bidders to submit their bids. Accordingly, the responsible stakeholders should have a balanced consideration. in which their efforts are not wasted excessively on those attributes.

7.5 The proposed framework

The proposed institutional framework to nudge municipal roads network rivals to bid competitively is discussed in this section, thereby meeting the main aim of this research. The tendering attributes' IPA findings have been discussed previously in this chapter mostly contribute to develop the framework which encompass 12 managerial actions (see Figure 7-9). The section initially provides a brief discussion on the roles of different stakeholders within the municipal roads network tenders which are: municipalities, the Ministry of Municipal and Rural Affairs, and the Contractors Classification Agency (CCA). It then discusses the allocation of those 12 managerial actions to these stakeholders.

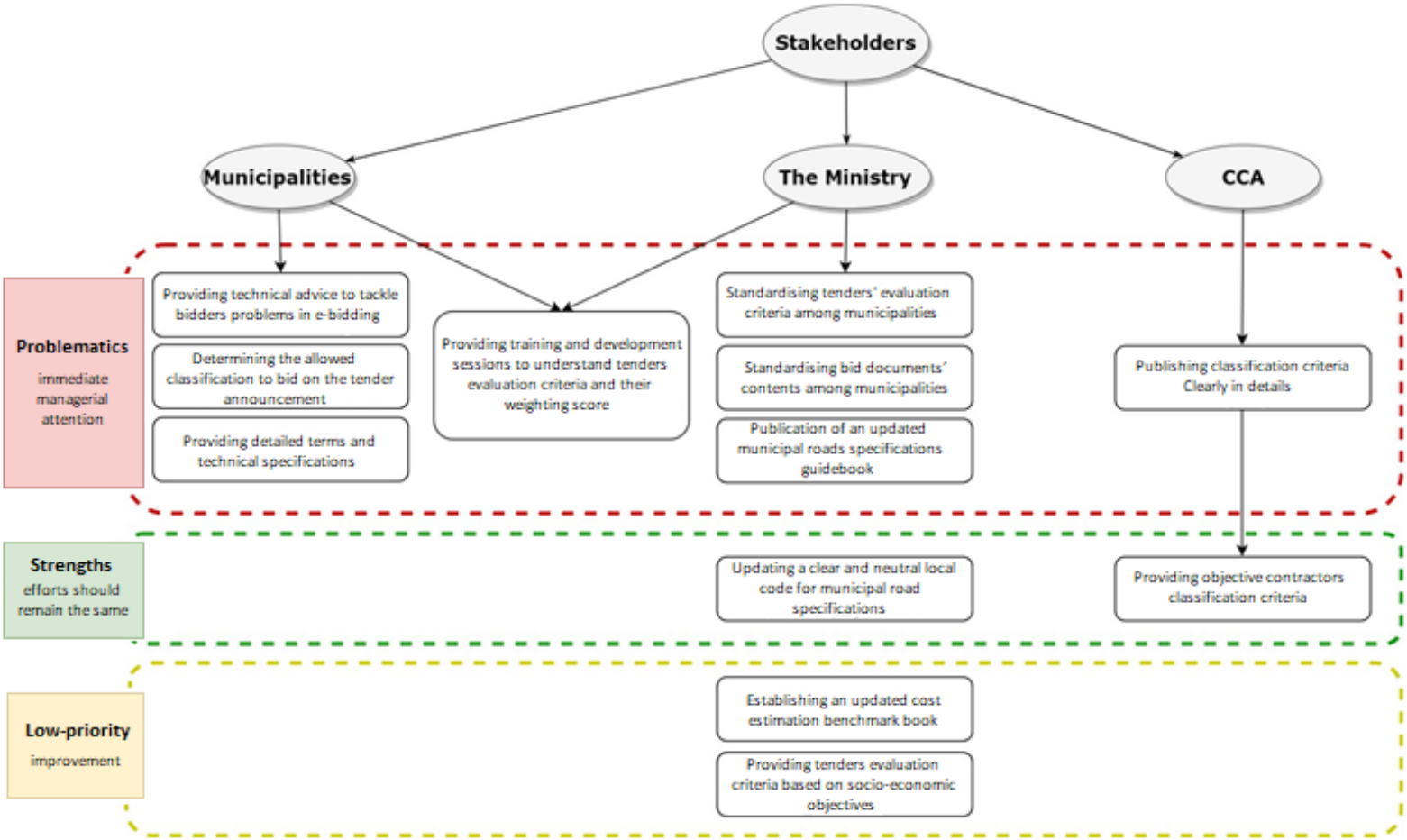


Figure 7-8 The proposed framework to nudge municipal road contractors to bid competitively

7.5.1 Stakeholders roles in the municipal roads network tenders

Municipalities responsibilities

Based on the Article No. (10-F) local Government Tenders and Procurement Law, "No particular category of classification may be specified". However, this article does not include the prohibition of establishing minimum requirements. After obtaining an approval of the Ministry of Finance, municipalities themselves play the key role in determining the allowable contractors class to bid through their tender announcements. On the other hand, according to the Article No. (1) from same law, which stated that "Prior to putting their works up for public tender or procuring their needs, government authorities shall, through their technical departments or by hiring a consultant, set accurate and detailed terms and technical specifications for the required works", technical departments within municipalities are responsible of the task of ensuring clear and comprehensive specifications. Furthermore, in response to Article No. (17), which requires government authorities that administer a public tender to furnish bidders with necessary clarifications and information, the action of providing technical advice to tackle bidders' problems in electronic bidding is under the municipalities responsibilities.

The Ministry of Municipal & Rural Affairs responsibilities

Most of the normative attributes are under the Ministry control due to the administrative dependency of all municipalities to this Ministry. Therefore, the actions of standardising bid document contents, tender evaluation criteria, and tenders evaluation criteria based on socio-economic objectives that give small firms opportunities to share in the market among municipalities are under the Ministry responsibilities. Similarly, the Ministry has the key role in providing a clear and neutral local code for municipal road project specifications, an updated local municipal roads specifications guidebook, and a cost estimation benchmark book. Accordingly, the Ministry is responsible of training programs provided to local contractors to understand those normative attributes. Nevertheless, municipalities can be involved in holding training sessions to facilitate attending these sessions for contractors.

The Contractors' Classification Agency (CCA) responsibilities

Finally, the contractors' classification responsibilities were designated by the ministerial resolution (22148) in 2006 to the Contractors Classification Agency, which follows the Ministry of Municipal and Rural Affairs administratively. Therefore, the actions of providing objective contractors classification criteria as well as publish them are allocated to this agency.

7.5.2 The required managerial actions

The proposed framework recommends that all municipalities in Saudi Arabia concentrate their efforts on developing performance in the provision of technical advice to tackle bidders' problems in electronic bidding, allowing the classified contractors to bid on tender announcements, and providing detailed terms and technical specifications. The municipalities further should cooperate with the Ministry of Municipal and Rural Affairs to provide training and development sessions to understand tenders' evaluation criteria and their weighting scores.

The Ministry of Municipal and Rural Affairs, in turn, should primarily focus on standardising tenders' evaluation criteria as well as bid documents contents among municipalities. In addition, the Ministry efforts should not neglect the publication of an updated municipal roads specifications guidebook. The Ministry of Municipal and Rural Affairs should further be urged to maintain the efficient efforts to update the clear and neutral local code for municipal road project specifications. After ensuring the improvement of these attributes is fulfilled, the ministry should establish an updated cost estimation benchmark book as well as consider socioeconomic objectives in the evaluation of submitted bids.

Meanwhile, it is recommended that the Contractors Classification Agency maintain efficient efforts in providing objective classification criteria for contractors. In this regard, they should promote a level of transparency in these criteria by publishing them clearly in detail and interpreting their weighting scores.

The relevant stakeholders of the municipal roads networks contracts will mostly ensure transparency and integrity within their tenders' procedures by adopting this proposed framework. It was emphasised by the local contractors in Saudi Arabia who are classified in the field of municipal roads that those transparent procedures will stimulate their desire to participate in future tenders. As a result of this stimulus, maximising players in this market will be assured, thereby reducing the opportunities of regulate bid-rigging arrangements due to the difficulty in communicating and coordinating large numbers of members (Shapiro, 1989; Mankiw, 2014).

7.6 Framework external validity results:

The purpose of this section is to present the results which pertaining to the validation of the developed managerial actions framework. A discussion highlighting the main outcomes of the validation is presented, after which implications for future reform are succinctly drawn. Having established that there is an insistent need to develop the attributes of the municipal road tenders in Saudi Arabia according to the analysis of their importance and current performance level, a panel of expert in this field of projects evaluated the proposed managerial action framework. In total, ten of the invited experts expressed their interest in receiving the summary of the research outcomes comprising the proposed managerial action framework. This panel of expert was composed of three firm owners, two of project managers, two roads engineers, a technical department head, a general manager, and a quality and safety manager (see Table 7-4 and Figure 7-10 to Figure 7-13).

No.	Organisation	position	Years of experience	Involvement in municipal roads tenders
1	Municipality	Roads engineer	15-19	More than 10
2	Municipality	Roads engineer	10 to 14	More than 10
3	Municipality	Technical dpt. head	20 and more	More than 10
4	Contractor	General manager	20 and more	More than 10
5	Contractor	Firm owner	20 and more	More than 10
6	Contractor	Q&S manager	10 to 14	More than 10
7	Contractor	Firm owner	10 to 14	4 to 6
8	Consultant	Firm owner	10 to 14	None
9	Consultant	Project manager	10 to 14	None
10	Semi-government	Project manager	10 to 14	None

Table 7-5 External validity - the panel of experts

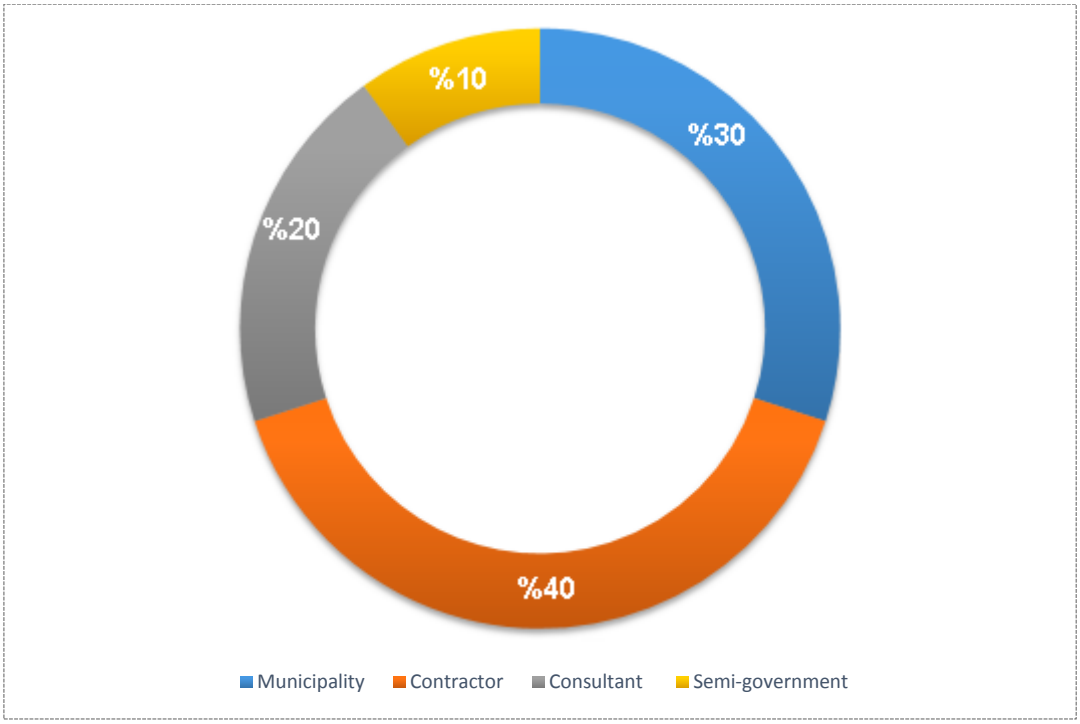


Figure 7-9 The panel organisations

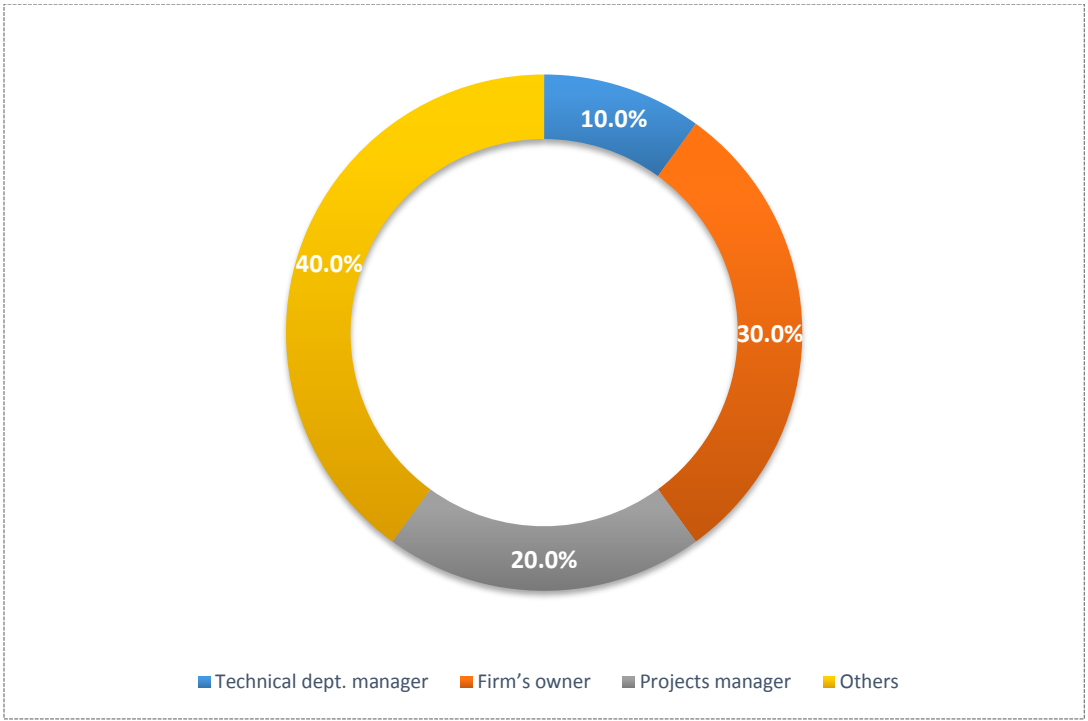


Figure 7-10 The panel positions

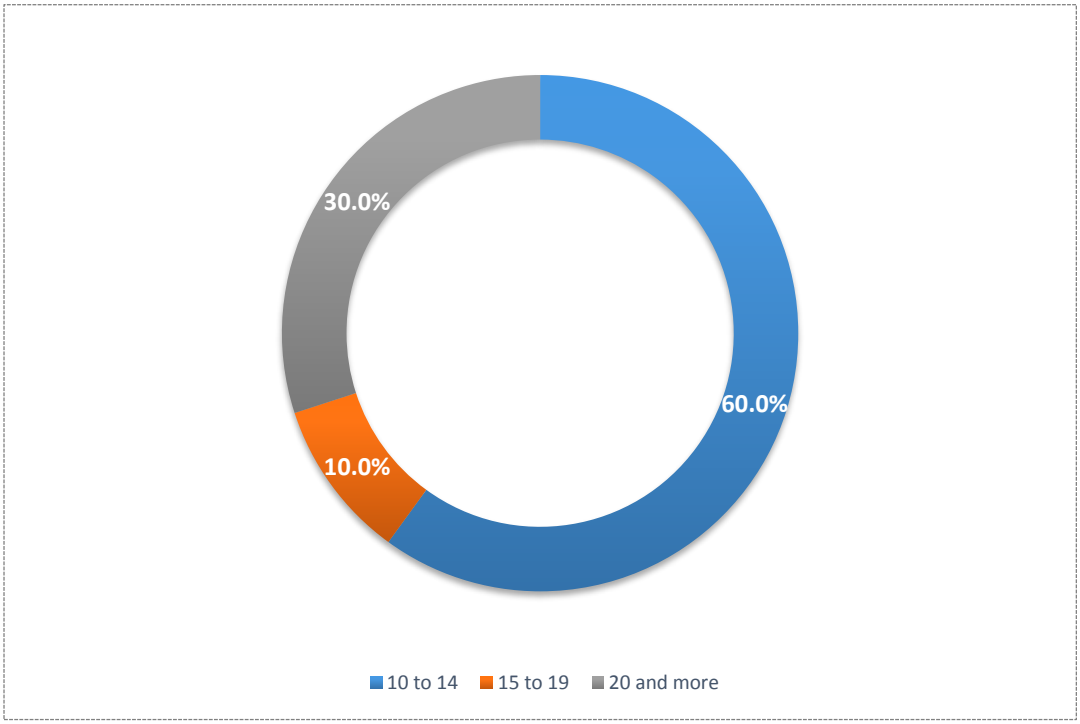


Figure 7-11 The panel years of experience

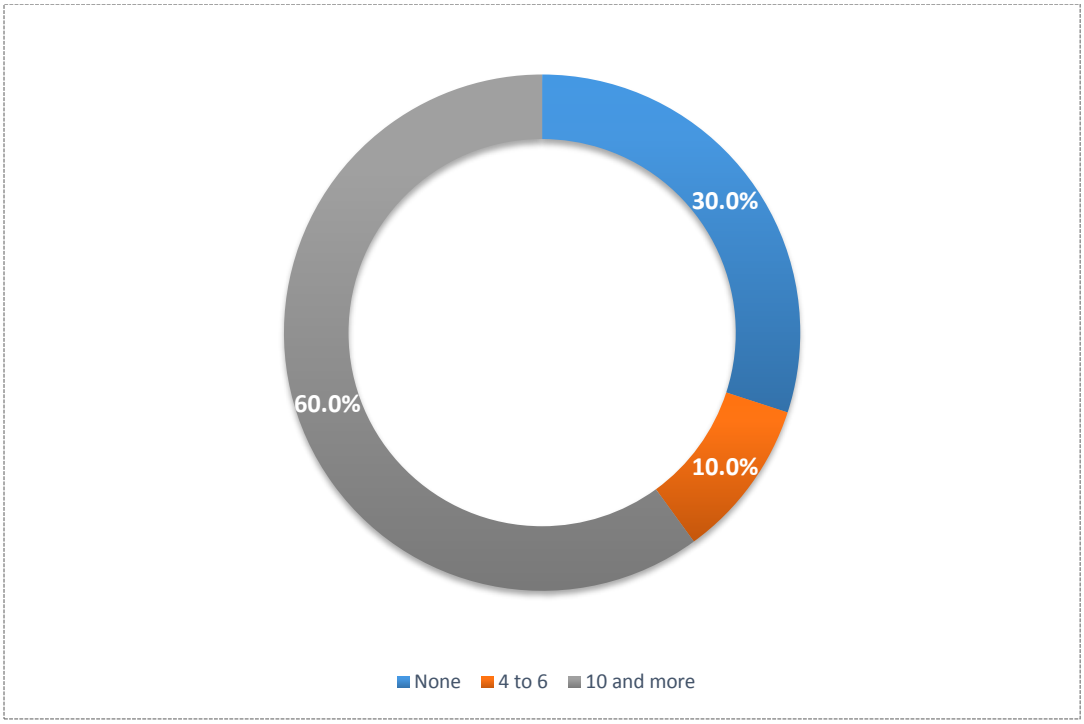


Figure 7-12 The panel involvement in municipal roads tenders

The results pertaining to the evaluation of the proposed actions indicated that the panel overwhelmingly agreed on the clarity of the framework (see Figure 7-14), where half of them evaluated the framework as (Very clear), while the other half's evaluation was (Clear). As for the completeness of the framework (see Figure 7-15), one of the panel members assessed the proposed framework (somewhat incomplete) and in a review of the causes of this evaluation, he stressed that the framework did not discuss the delay caused by the lack of underground utility maps, as well as citizens' objections on property expropriation. Both observations are worthwhile, yet can't be added to the proposed framework since both of them in the planning phase, which means they are beyond the scope of this study which concentrate on tendering phase. However, the rest of experts' panel agreed on the completeness of the framework.

On the other hand, all of experts' panel confirmed the conciseness of the framework (see Figure 7-16), as they all assessed the framework as (very concise). Furthermore, the majority of panel highly agreed with the framework correctness (see Figure 7-17), while the rest less agreed. However, they didn't add any observations, on the

correctness of the framework, to be considered in improving the proposed framework.

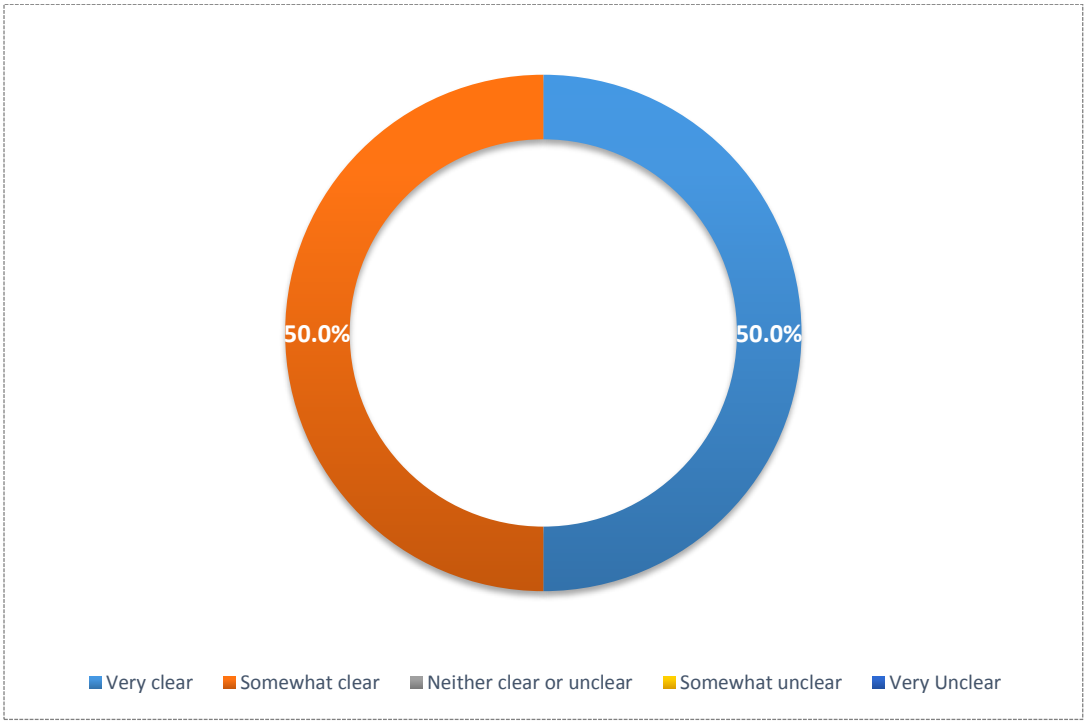


Figure 7-13 The framework clarity assessment

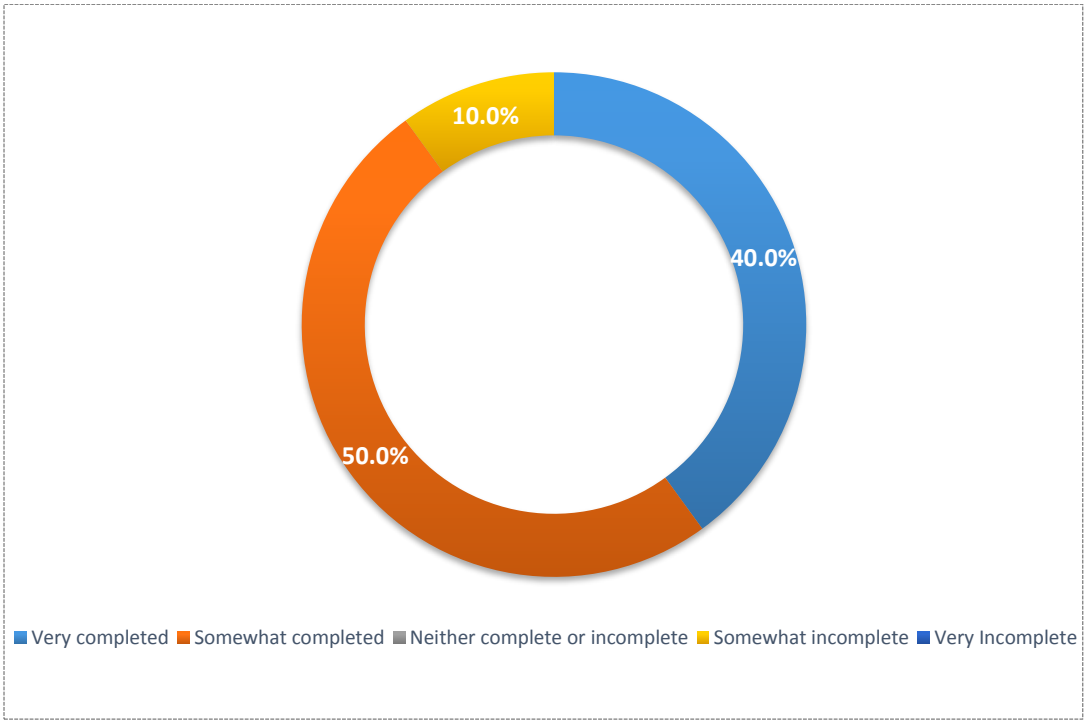


Figure 7-14 The framework completeness assessment

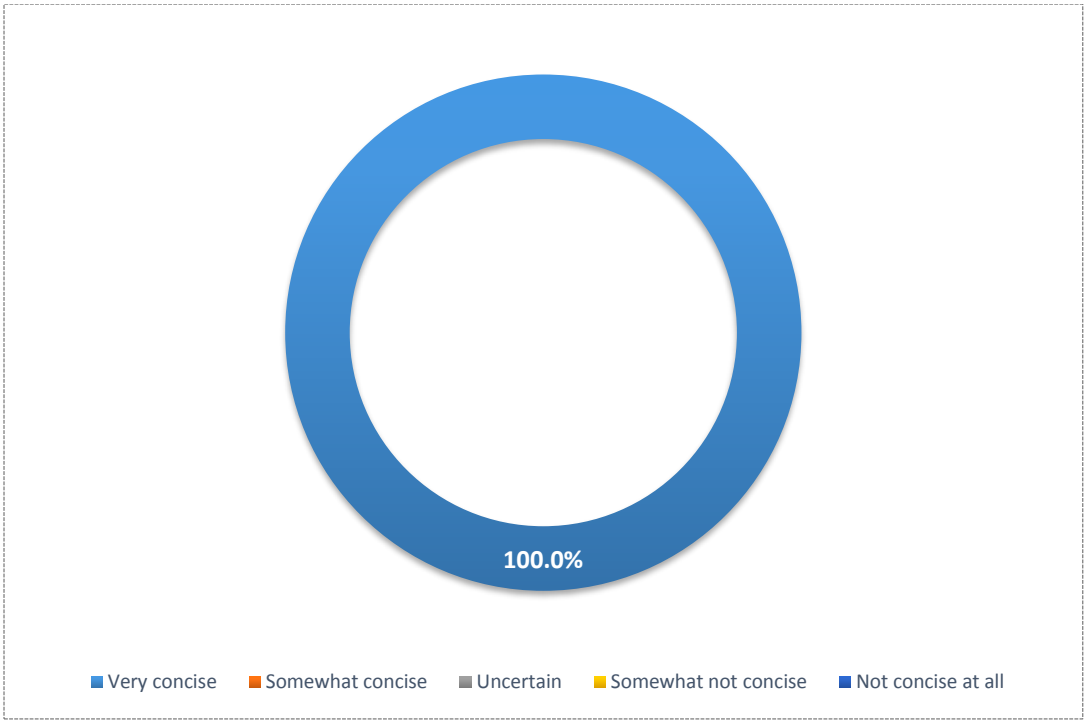


Figure 7-15 The framework conciseness assessment

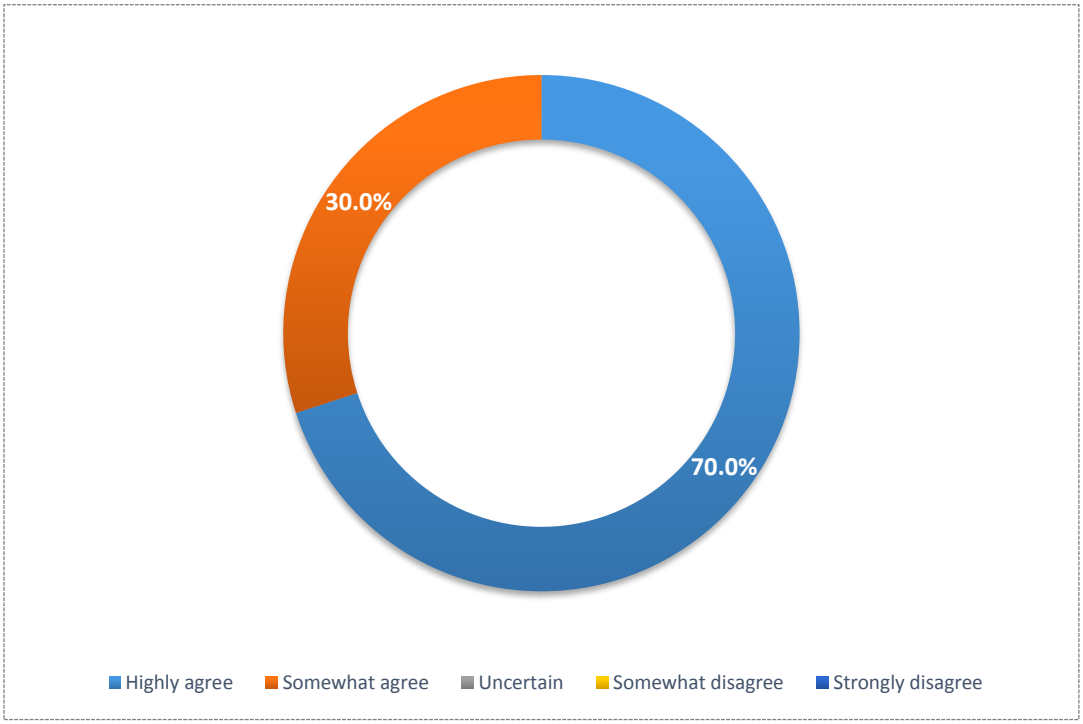


Figure 7-16 The framework correctness assessment

7.7 Summary

This chapter mainly aims to present findings and analysis of the collected data from questionnaires as well as in-depth interviews which assessed respectively importance and performance levels of the tendering phase attributes. Furthermore, it comprehensively discussed the key findings in the light of relevant research.

The analysis of questionnaires data on assessing the influence of these attributes showed an expected consensus among local contractors in their view on the ability of these attributes to stimulate their future participation. Despite this consensus on the impact level, some categories of contractors such as lower-class contractors as well as contractors who did not have an opportunity to win any municipal road contract assessed the impact level of some attributes slightly higher than other contractors. These attributes include a reasonable timeframe to submit bids, the presence of certified costs engineers, standardising tender evaluation criteria among municipalities, and tenders' evaluation criteria based on socio-economic objectives that give small firms opportunities to share in the market.

On the other hand, the assessment of the relevant stakeholders' performance in these features was diversified. In the analysis of in-depth interviews, it was noted that distinct current efforts of relevant stakeholders were demonstrated in some attributes while the performance level was poor in others. Based on the findings analysis of these two phases, an (Importance Performance Analysis) matrix was plotted, which assisted to propose the managerial actions framework. Finally, the external validity process of IPA outcomes were further presented. The next chapter will present the concluding remarks, as well as refer to the research limitations, original contributions, and recommendations for future research.

Chapter 8: Conclusion

8.1 Introduction

This chapter concludes the research study by summarising the research findings and the proposed managerial actions. The research limitations, as well as recommendations for future research, are discussed.

8.2 Conclusions of the thesis

This research discusses the development of an institutional framework which will be adopted by stakeholders involved in municipal roads construction work tenders; the framework fundamentally seeks to maximise the number of players in the market by nudging them to bid in future tenders, thereby minimising the opportunities for bid-rigging arrangements. To achieve this aim, this research was conducted through four main stages of data collection with a designated objective for each stage. Therefore, this section will be structured around these research objectives.

8.2.1 Indicators of potential bid-rigging in the Saudi municipal roads construction works market based on the nature of local contractors' participation

Responding to research objective (1), the local market structures of the municipal roads construction works within five main municipal zones have been analysed using a proposed model encompassing the following economic screening tools:

- Market concentration;
- Number of members;
- Participation rate; and
- Prices volatility.

This analysis has demonstrated that during the five years under consideration, the majority of lower-classes contractors had never participated in bidding for municipal roads tenders. Additionally, small towns recorded a lower rate of bidders than main cities. This scarcity of local contractors' participation contributed to the emergence

of some suspicious oligopoly market cases, where a few players controlled these markets. The tenders for asphalting and paving works and bridges and tunnels, more than other type of municipal roads tenders, revealed most of these oligopoly cases, despite the availability of these tenders to the lower-classes contractors. The high success rate of a few contractors in winning contracts, in addition to the absence of participation by other players, might indicate the potential for applying a market allocation approach in some zones by employing the bid suppression concept. Therefore, the local contractors' reasons for not participating in bidding were subsequently investigated.

8.2.2 The key factors of local contractors' failure to engage in this market

In response to research objective (2), the literature on the rational decision to participate in tenders was reviewed in the same context. In order to enrich this review, a further review was conducted of barriers to delivering public construction works successfully, from the contractors' point of view. Due to the scope of this research, both reviews concentrated on tendering phase attributes. The reviews arrived at the following list of impediments:

Prequalification

- Poor classification criteria.
- Inefficient classification system.

Bidding cost

- Poor contract documents.
- Contractual clauses not standardised.

Specifications

- Inadequate or incomplete specifications.
- Changeable project scope.
- Lack of unified building codes.

Cost estimates

- Poor cost estimating.

Awarding criteria

- Awarding contracts based on the lowest bidder.
- Difficulty of acquiring work.
- Fluctuation in demand.

Moreover, some of those impediments were confirmed while conducting the in-depth interviews. Local contractors, particularly upper-classes contractors, did not consider those projects attractive to their firms' overall business activities, due to the uncertainty of municipalities' procedures including specification, cost estimates and prequalification. After linking those impediments to the research conceptual framework, a list of fifteen attributes in the tendering phase of the municipal roads network contracts was proposed; these attributes might encourage the rationale of decision-makers in contracting firms to bid in future tenders.

8.2.3 The influence of the proposed tendering phase attributes in enhancing the desire to participate in future municipal tenders.

Addressing research objective (3), local contractors were given the opportunity to assess the influence of these proposed attributes in enhancing their desire to bid in future, through the distribution of a 5-point Likert questionnaire. The majority of contractors agreed on the potential influence of all these attributes on future participation, although there were slight differences in influence assessment by contractors according to their classification or success in previous bids. Broadly, the five most influential attributes were as follows: the availability of accurate and detailed terms and technical specifications for the required works; the provision of technical advice to tackle bidders' problems with electronic bidding; publishing the contractors' classification criteria and their weighting scores; the provision of training and development sessions to understand the evaluation criteria of tenders and their weighting scores; and the provision of objective contractors' classification criteria.

Interestingly, lower-classes contractors rated the importance of adequate time to submit their bids more highly than other contractors. This finding can be linked to their lack of adequate technical expertise compared to the upper-classes contractors; thus, they would need more time to perform a project cost estimate task. Furthermore, contractors who had not previously participated in biddings were more interested than other categories of contractors in having a cost estimation benchmark book. This finding may indicate that one of the municipal roads construction market entry barriers in Saudi Arabia is lack of knowledge of current market prices.

In agreement with the assertion by Alofi et al. (2015), contractors who had previously participated in municipal roads tenders but without success distinctly considered objective evaluation criteria as more influential than the other contractors did. They ranked this factor as the most influential among all of the 15 factors. Similarly, they gave a higher ranking than other contractors to the importance of socio-economic objectives in tender evaluation, which would give small firms opportunities to share in the market.

8.2.4 The current level of stakeholders' performance on the proposed attributes

To address research objective (4), 12 standardised open-ended interviews were conducted with both contractors and relevant government authorities, to assess the current performance level of these attributes. Both the customer satisfaction approach and the self-assessment approach were employed to reach the final performance assessment. A deductive category assignment procedural mode was adopted in coding the interview responses. Various levels of performance were observed for stakeholders involved in these attributes. Key attributes that showed poor performance from the relevant stakeholders were:

- Provision of technical advice to tackle bidders' problems in electronic bidding by municipalities.
- Standardising bids evaluation criteria by the Ministry of Municipal & Rural Affairs.

- Provision of training and development sessions to understand tender evaluation criteria and their weighting scores by both the Ministry and municipalities.

On the other hand, key attributes that recorded relatively high stakeholders' performance were:

- The imposition of electronic bidding in Government Tendering and Procurement Law.
- A reasonable timeframe to submit bids.

8.2.5 The proposed institutional framework targeting an increase in the number of potential bidders

Based on the key findings of the Importance-Performance Analysis of the tendering phase attributes, an institutional framework has been developed to nudge municipal roads network rivals to bid competitively. The proposed framework contains twelve required actions from different municipal roads projects stakeholders. The summary of the order of these actions according to their priorities was as follows:

Attributes with a gap in performance; stakeholders' efforts need to be concentrated here to improve performance level:

- Provision of technical advice to tackle bidders' problems in e-procurement.
- Standardising tenders' evaluation criteria.
- Provision of training and development sessions to understand tenders' evaluation criteria and their weighting score.
- Publishing the contractors' classification criteria and their weighting scores.
- Determining the classifications that are allowed to bid in any tender announcement.
- Publication of an updated local municipal roads specifications guidebook.
- Standardised bid documents, based on the approved international standard.

- Accurate and detailed terms and technical specifications for the required works.

Relatively high-importance attributes; these showed a high level of performance but at the same time suggested that efforts should remain the same:

- Provision of objective contractors' classification criteria;
- A clear and neutral local code for municipal road project specifications.

Attributes with a relatively lower level of importance and performance at the same time:

- Availability of a cost estimation benchmark book.
- Evaluation criteria for tenders based on socio-economic objectives to give small firms opportunities to share in the market.

8.3 Original contributions to knowledge

This section addresses how the findings of this thesis can advance the existing body of knowledge on bid-rigging in terms of research and practical contributions. Broadly, this study makes several contributions to the body of knowledge, especially when one takes into consideration the very limited studies on bid-rigging in the emerging economies. Accordingly, the main research contributions that have been established are as follows:

First, in terms of the conceptual framework developed, the risk of bid-rigging was addressed in this research according to an approach that depends on stimulating the appropriate behaviour of contractors, as opposed to most studies in this field, which have concentrated on power of deterrence to mitigate these illicit arrangements. Therefore, nudge theory was employed to develop the research conceptual framework. The empirical findings, subsequently, proved the feasibility of introducing this theory based on the high assessment of the influence of all proposed attributes in enhancing local contractors' desire to participate in future tenders. Therefore, this

study could help other researchers to expand their approach in addressing collusion in the public construction industry and could trigger important areas that could be further studied for the benefit of the industry. Moreover, by introducing the three institutional pillars (regulative, normative, and cognitive) to the developed conceptual framework, the research expands the OECD Guidelines to a practical scope to ensure public procurement authorities' compliance in implementing those recommendations.

Second, this study further contributes to the bid-rigging literature in the local context by providing evidence and indicators of potential bid-rigging in Saudi Arabia construction projects, thereby establishing a base for future researches in the same context or other similar contexts. It has provided evidence on the extent of illicit behaviour among bidders, through drawing a detailed picture of the local municipal road projects market structure in Saudi Arabia. This evidence informed and supported this thesis in constructing the further stages of this research. Furthermore, the developed investigation model, which integrates four main market screening tools, contributes to establishing and developing a tool to detect potential collusion arrangements, which will be appropriate for similar contexts that may lack evidence of previously detected bid-rigging cases.

Third, regarding the contributions of the research in industry, while most existing studies have focused on identifying Saudi Arabian public construction issues without examining implementation measures to mitigate those issues, this study took a step further by proposing a framework of remedial actions. In this regard, this study initially provides feedback to the public procurement authorities involved on the current level of performance of their departments. The empirical evidence showed a misalignment between the extent of stakeholders' performance in the proposed tendering attributes and the degree of importance of those attributes as perceived by the local contractors, which contributed to prioritising remedial actions. Moreover, designating the stakeholders involved in these remedial actions

contributes in delivering these proposals distinctly to the relevant policy makers in the sector.

Overall, it can be argued that this study extends the current understanding and knowledge pertaining to preventive measures against bid-rigging, particularly in the context of emerging economies.

8.4 Research limitations

Because of the time constraints, the initial part of this research focused on contractors' behavioural patterns in five out of the sixteen municipalities covered in the Saudi Arabia area. Moreover, the small number of executed contracts in some types of municipal road projects, such as bridges and tunnels projects, inhibited the conducting of a sufficient comparative analysis study, which would require extending the study period to more than five years. It should also be noted that the scarcity of detected cases of bid-rigging in Saudi Arabian public procurement has somewhat contributed to the uncertainty of the validity of the proposed model in detecting suspected cases. Nevertheless, this model helped to establish potential bid-rigging indicators in this context.

The conceptual framework of the research was mainly based on the development of tendering stage attributes only, without any consideration being given to the other stages of the construction projects, despite their significance. However, contractors referred to some other influencing factors, such cash flow, during their response to the importance assessment questionnaire. Consequently, these influential factors were excluded from further investigation due to the specified scope of this research.

During the quantitative phase of the research (questionnaires to assess importance), difficulties were encountered in accessing some contractors, especially class-5 contractors, which led to some reduction in their representation rate. The reason for this difficulty is that the data available for these contractors at the Contractors Classification Agency website is no longer valid. Therefore, a Google search was

conducted to access the updated information for these contractors as much as possible, which gave some positive results in addressing this issue.

Giving the nature of the in-depth interviews as well as the time limitations, a small diversified sample was adopted. Nevertheless, the findings obtained, while not generalizable, rather complement the other parts of this research. Only five contractors volunteered to participate in these interviews, which consequently might not reflect the views of other contractors. Moreover, in addition to the Contractors Classification Agency, we were able to complete interviews with the departments of only two out of the five municipalities under study. Therefore, the results of these in-depth interviews might not be reflected in other municipalities. Accordingly, an external validity test was held on the proposed framework (final outcomes) to examine the ability to extend these findings beyond the respondents' range.

Finally, no reference was found which clearly sets the current performance evaluation criteria for the stakeholders in the tendering process, particularly in the 15 proposed attributes. To obtain objective results as much as possible, the analysis of the interview findings was based on combining two common management research tools, namely customers' assessment and self-assessment. The performance assessment, therefore, is mostly deliberate at the level of consensus of both assessments.

8.5 Future research recommendations

This research presented substantial insights into the stimulating of local contractors' participation in bidding for municipal road contracts in Saudi Arabia, which consequently has a major influence in reducing the chances for bid-rigging through maximising the number of players in the market. Nevertheless, the research journey does not stop here. The thesis findings open up new research areas for future investigation. These new prospects for future research can be summarised as follows:

- Adopting the same research conceptual framework in another context rather than municipal road projects in Saudi Arabia.
- Conducting action research to empirically assess the impact of a section of the proposed framework, or the entire framework recommendations.
- Conducting qualitative research to update these attributes as well as develop new attributes.
- Considering other construction phases, such as an implementation stage, in investigating factors that stimulate contractors to make a rational decision to enter the market.

Furthermore, it would be possible to conduct a comparative study on the appropriateness of current local procedures and sanctions for reducing the risk of such illicit practices in public procurement.

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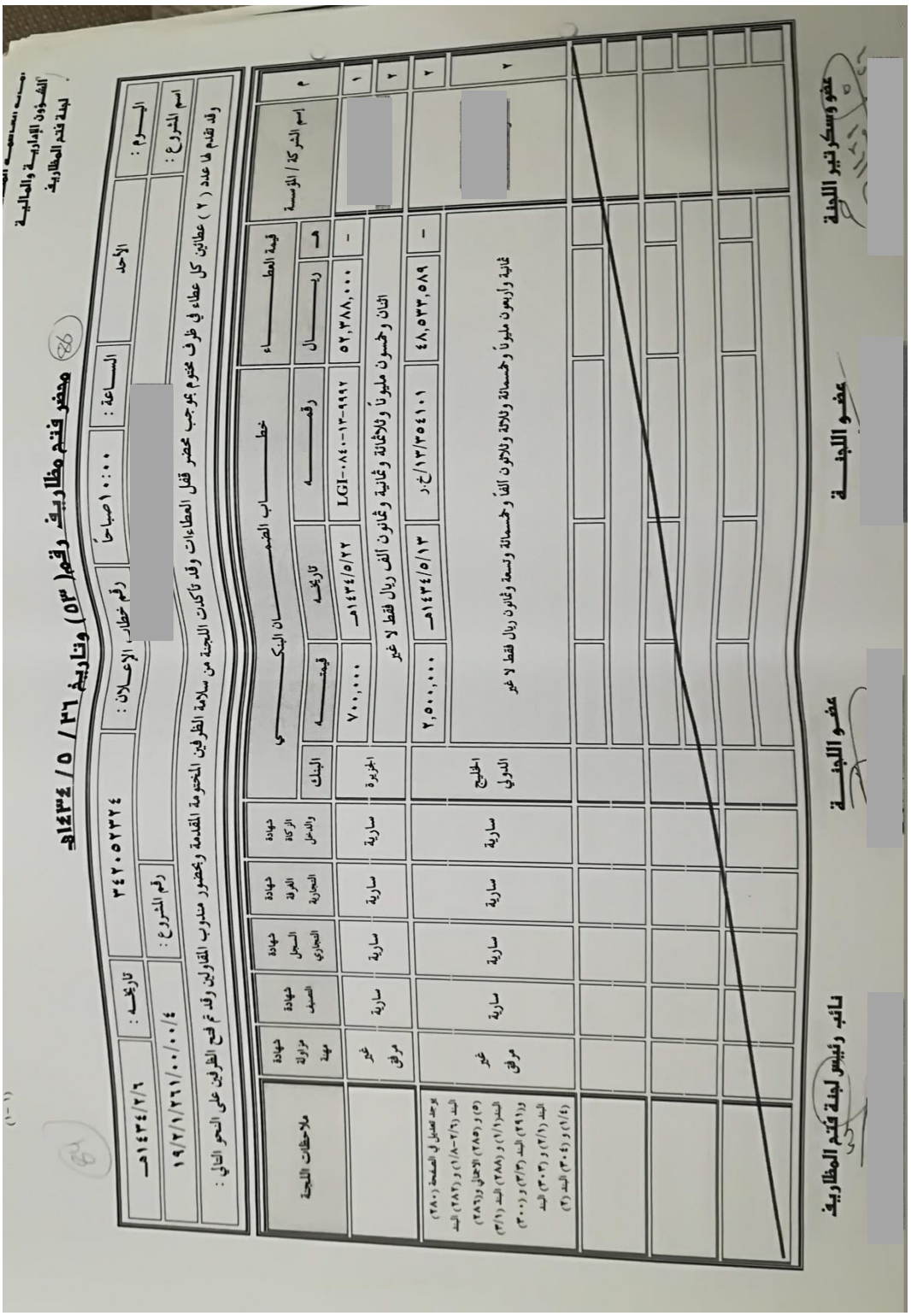
Appendices

A. Preliminary data collection

Appendix (A-1) One of Alpha municipality's minutes of bids opening



المشؤون الإدارية والمالية
لجنة فتح المظاريف

محضر فتح مظاريف رقم (٥٣) وتاريخ ٢٦ / ٥ / ١٤٣٤هـ

اليوم: الأحد | الساعة: ١٠:٠٠ صباحاً | رقم خطاب الإعلان: | تاريخه: ١٤٣٤/٢/٩هـ

اسم المشروع: | رقم المشروع: ٣٤٢٠٥٢٣٢٤ | ١٩/٢/١/٢٦١/٠٠/٠٤

ولقد تقدم لها عدد (٢) عطاءين كل عطاء في ظرف مختوم بموجب محضر قفل العطاءات ولقد تأكدت اللجنة من سلامة الظرفين المختومة المقدمة وبحضور مندوب المقاولين ولقد تم فتح الظرفين على النحو التالي:

م	اسم الشركة / المؤسسة	خطاب الضمان البنكي			قيمة العطاء		شهادة الزكاة والدخل	شهادة الغرفة التجارية	شهادة السجل التجاري	شهادة تصنيف	شهادة مزاولة مهنة	ملاحظات اللجنة
		البنك	قيمته	تاريخه	رقمه	ريال هـ						
١	[redacted]	الجزيرة	٧٠٠,٠٠٠	١٤٣٤/٥/٢٢هـ	LGI-٠٨٤-١٣-٩٩٩٢	٥٢,٣٨٨,٠٠٠	ساري	ساري	ساري	ساري	غير مرفق	
		الثمان وخمسون مليوناً وثلاثمائة وثمانية وثمانون ألف ريال فقط لا غير										
٢	[redacted]	الخليج الدولي	٢,٥٠٠,٠٠٠	١٤٣٤/٥/١٣هـ	ر.خ/١٣/٣٥٤١٠١	٤٨,٥٣٣,٥٨٩	ساري	ساري	ساري	ساري	غير مرفق	يوجد تعديل في الصفحة (٢٨٠) البند (٢/٦-٢/١) و (٢٨٢) البند (٥) و (٢٨٥) الاجمالي و(٢٨٦) البند (١/١) و (٢٨٨) البند (٣/١) و (٢٩١) البند (٢/١) و (٣٠٠) و (٣٠٠) البند (١/٤) و (٣٠٤) البند (٢)
		ثمانية وأربعون مليوناً وخمسمائة وثلاثة وثلاثون ألفاً وخمسمائة وتسعة وثمانون ريال فقط لا غير										

نائب رئيس لجنة فتح المظاريف — عضو اللجنة — عضو اللجنة — عضو وسكرتير اللجنة

Appendix (A-2) One of Beta municipality's minutes of bids opening

المملكة العربية السعودية
وزارة الشئون البلدية والقروية
[redacted]
الادارة العامة للشئون الادارية والمالية/ ادارة المشتريات

[redacted]

[redacted]

تاريخ فتح المظاريف :- ٠٩-٠٧-١٤٣٣هـ

بيانات الصحف	اسم الجريدة	أم القرى	الوطن	المدينة
	مرات النشر	٣	١	٣

اسم المقــــاول	قيمة العرض الأساسي	قيمة العرض بعد التدقيق	قيمة العرض النهائية
[redacted]	٣,٧٧٣,٧١٠	٣,٧٧٣,٧١٠	٣,٧٧٣,٧١٠
[redacted]	١,٧٦٢,٧٥٩	١,٧٦٢,٧٥٩	١,٧٦٢,٧٥٩

بالإطلاع على محضر لجنة فتح المظاريف يتضح أنه تقدم لمشروع تحسين وتجميل المداخل للأمانة والبلديات التابعة بمنطقة [redacted] [redacted] عطائين وبتحليل اوراق العطاءات المقدمة للمنافسة اتضح الاتي :

١/ العطائين المقدمة مطابقة للشروط والمواصفات.

٢/ اقل العطاءات المقدمة هو عطاء مؤسسة [redacted] للمقاولات بمبلغ إجمالي وقدرة (١,٧٦٢,٧٥٩) فقط مليــون وسبعمائة واثنــين وستون ألف وسبعمائة وتسعة وخمسون ريال لاغير ، والذي يقل بنسبة (١١.٨%) عن الاسعار التقديرية للمشروع والبالغ قدرها (١,٩٩٩,٩٠٠) فقط مليون وتسعمائة وتسعة وتسعون ألف وتسعمائة ريال لاغير.

٣/ التكاليف المعتمدة للمشروع قدرها (٤٠,٠٠٠,٠٠٠) فقط أربعون مليون ريال لاغير .

٤/ إنفاق على المشروع بنسبة [redacted]

بناءً على ماتضمنه محضر اللجنة الفنية لتحليل العطاءات وبعد الدراسة والمناقشة فإن لجنة فحص العروض توصي بما يلي :-

١/ ترسية مشروع تحسين وتجميل المداخل للأمانة والبلديات التابعة بمنطقة [redacted] على مؤسسة [redacted] [redacted] للمقاولات بمبلغ إجمالي وقدرة (١,٧٦٢,٧٥٩) فقط مليون وسبعمائة واثنين وستون ألف وسبعمائة وتسعة وخمسون ريال لاغير.

وذلك للأسباب التالية :-

باعتبار عطاءها مناسباً من الناحية الفنية والمالية وحسب الأسعار السائدة ومطابقة للشروط والمواصفات وجرى الارتبــــاط بقيمــة المنافسة على المشروع رقم (٤-٠٠-٤٠-٣-٠٦٠٠٣-٠٠١-٣-١٩٩) ومسماه تحسين وتجميل المداخل للأمانة والبلديات التابعة والمعتمد بميزانية أمانـة منطقـة المدينة المنورة للعام المالي ١٤٣٣/١٤٣٤هـ ومدة التنفيذ ١٢ شهرا هجرياً .

هذا وتعتبر أوراق المناقصة من إعلانات وعطاءات ومحاضر وشروط ومواصفات جزء لا يتجزأ من هذا المحضر.

عضو اللجنة	عضو اللجنة	عضو اللجنة	عضو اللجنة	رئيس اللجنة
مدير الإدارة العامة التقنية المعلومات	مدير إدارة المشتريات	مدير ادارة المتابعة	المراقب المالي	مدير عام الشئون الادارية والمالية

[redacted]

يعتمد

[redacted]

[redacted]

Appendix (A-3) One of Gamma municipality's minutes of bids opening

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بسم الله الرحمن الرحيم

المملكة العربية السعودية
وزارة الشئون البلدية والقروية
[redacted]
لجنة فتح المظاريف

محضر فتح مظاريف مناقصة [redacted]

لعام ١٤٣٠هـ/ ١٤٣٠هـ

في صباح يوم [illegible] الموافق [illegible] الساعة العاشرة صباحاً اجتمعت لجنة فتح المظاريف المكونة من :-

١- [redacted] .... رئيساً
٢- [redacted] .... عضواً
٣- [redacted] .... عضواً
٤- [redacted] .... عضواً
٥- .... سكرتيراً

وقد قامت اللجنة بفتح مظاريف المناقصة والمعلن عنها بجريدة أم القرى بالعدد رقم ٤٤٦٠
وتاريخ ٢٩/٦/١٤٣٤هـ للمرة الأولى والعدد رقم ٤٤٦١ وتاريخ ٣٠/٦/١٤٣٤هـ
للمرة الثانية وذلك بناء على خطاب [redacted] رقم [illegible] وتاريخ [illegible]/٦/١٤٣٤هـ
والمرفق صورته وكانت العطاءات المقدمة كالتالي :-

رقم العطاء	[illegible] | مقدم العطاء | [redacted]
قيمة العطاء	٣٫٨٩٥٫٦٠٠ [illegible]
إيضاحات	☐ الأسعار موضحة ☐ بخطابه ☑ بجدول الكميات خطاب الضمان البنكي رقم B 163446 وتاريخ [illegible] صادر من [redacted] ساري المفعول حتى [illegible] بمبلغ [illegible] وهو ☐ يعادل ☐ أقل من ☐ أكثر من ٪ من قيمة العطاء ☑ قدم صورة من السجل التجاري ☑ ساري المفعول ☐ غير ساري المفعول ☑ قدم صورة من شهادة التصنيف ☑ سارية المفعول ☐ غير سارية المفعول ☑ قدم صورة من اشتراك الغرفة التجارية ☑ قدم صورة من شهادة الزكاة والدخل ☑ سارية المفعول ☐ غير سارية المفعول
ملاحظات	[illegible]

Appendix (A-4) One of Delta municipality's minutes of bids opening

المملكة العربية السعودية
وزارة الشئون البلدية والقروية
[redacted]
المشتريات

بسم الله الرحمن الرحيم

محضر فتح مظاريف رقم (١) في ١٤٣٥/٠٦/٠١هـ

بعون الله تعالى في يوم الثلاثاء الموافق ١٤٣٥/٠٧/٠١هـ اجتمعت لجنة فتح المظاريف وقامت بفتح مظاريف مناقصات مناقصة

م	اسم مقدم العطاء	مبلغ العطاء الأساسي	مبلغ الضمان	رقم الضمان	تاريخ سريانه	نسبة العطاء	السجل التجاري ساري لغاية	شهادة الزكاة والدخل سارية لغاية	شهادة الاكتتاب والغرفة التجارية سارية لغاية	شهادة التأمينات الاجتماعية سارية لغاية	شهادة سعودة سارية لغاية	نسخة الكتروني والمواصفات
١	[redacted]	٢٤٩٠٧٠٠	٢٩٠٠٠	Md1408600007	١٤٣٥/١٠/١٠هـ	٧١,١٩	١٤٣٨/٠٤/١١هـ	١٤٣٥/١٠/٢٩هـ	م١٤٣٤/١٢/٣١	١٤٣٥/١٠/٢٤هـ	١٤٣٥/٠٨/٢٦هـ	مرفق
٢	[redacted]	٢٤٩٥٠٠	٣٠٠٠٠	14ogte488042287	١٤٣٥/١٠/٢٥هـ	٧١,٢	١٤٣٧/٠٧/٠٨هـ	١٤٣٥/١١/٠٨هـ	م١٤٣٧/١٢/٣١	١٤٣٥/٠٧/١٠هـ	١٤٣٥/٠٨/٢٦هـ	مرفق

كما اطلعت اللجنة على جميع المظاريف ولا يوجد ملاحظات

أعضاء لجنة فتح المظاريف

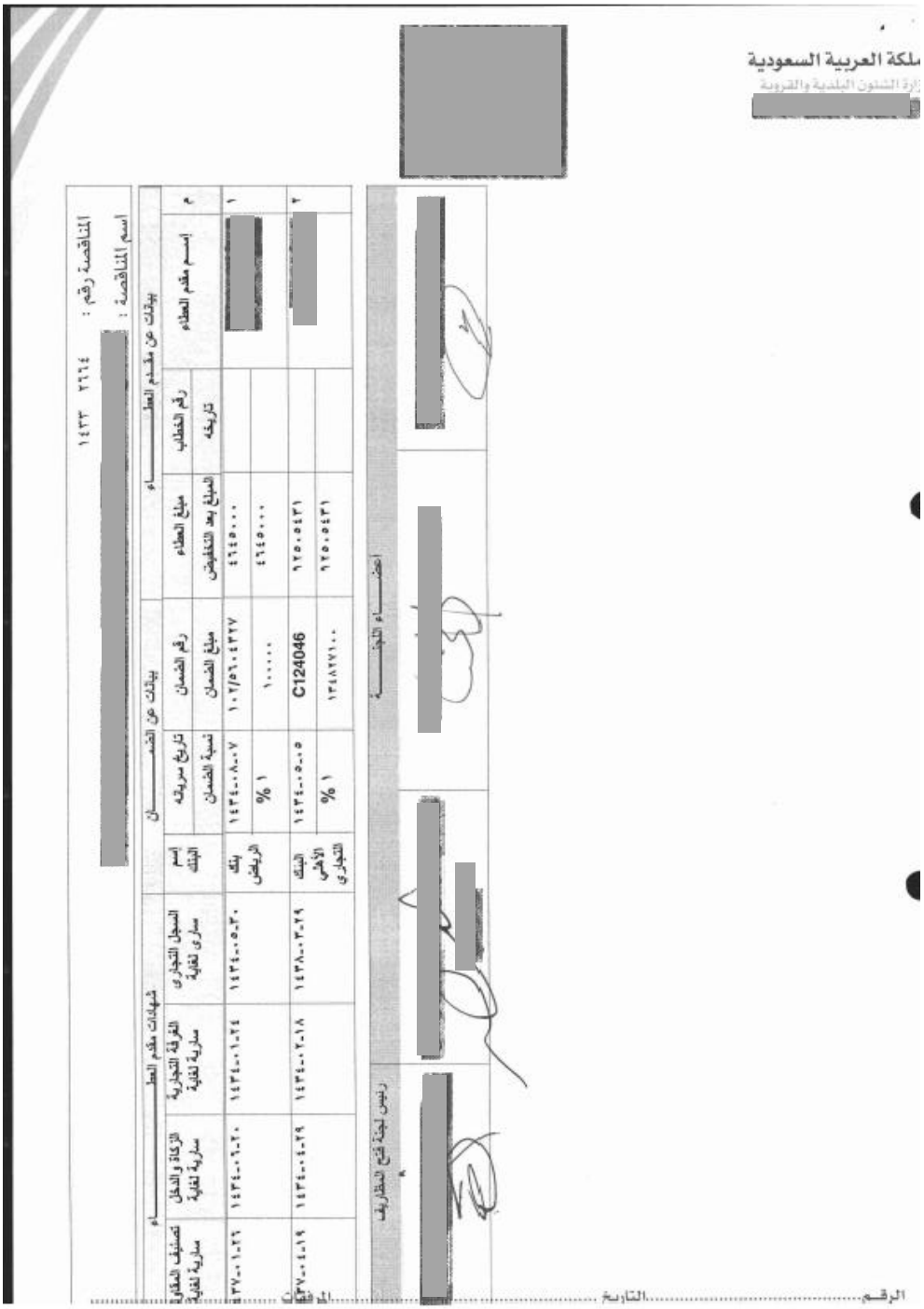
الاسم	الوظيفة	التوقيع
[redacted]	عضو اللجنة	
[redacted]	عضو اللجنة	
[redacted]	عضو احتياطي	

رئيس اللجنة

الاسم : [redacted]

التوقيع :

Appendix (A-5) One of Omega municipality's minutes of bids opening



نوع الوثيقة فتح المظاريف عدد الصفحات ٢

المملكة العربية السعودية

المناقصة رقم : ٢٦٦٤ ١٤٣٣

اسم المناقصة :

م	اسم مقدم العطاء	بيانات عن مقدم العطاء		مبلغ العطاء	بيانات عن الضمان			شهادات مقدم العطاء			
		رقم الخطاب وتاريخه		المبلغ بعد التخفيض	رقم الضمان ومبلغ الضمان	تاريخ سريانه ونسبة الضمان	اسم البنك	السجل التجاري سارى لغاية	الغرفة التجارية سارية لغاية	الزكاة والدخل سارية لغاية	تصنيف المقاول سارية لغاية
١				٤٦٤٥٠٠٠	١٠٢/٥٦٠٤٣٧ ١٠٠٠٠٠	١٤٣٤٠٠٨٠٠٧ ١ %	بنك الرياض	١٤٣٤٠٠٥٠٣٠	١٤٣٤٠٠١٠٢٤	١٤٣٤٠٠٦٠٢٠	٣٧٠٠١٠٢٩
٢				٩٢٥٠٥٤٣١ ٩٢٥٠٥٤٣١	C124046 ١٣٨٨٧١٠٠	١٤٣٤٠٠٥٠٠٥ ١ %	البنك الأهلي التجاري	١٤٣٨٠٠٣٠٢٩	١٤٣٤٠٠٢٠١٨	١٤٣٤٠٠٤٠٢٩	٣٧٠٠٤٠١٩

اعضاء اللجنة

رئيس لجنة فتح المظاريف

الرقم التاريخ

B. Quantitative data collection

Appendix (B-1) Participants Information Sheet

Participant Information Sheet

Department: Architecture

The compliance with the public procurement process in municipal road project sector in Saudi Arabia

I am currently a PhD Architecture student of The University of Strathclyde Glasgow, United Kingdom. I am researching compliance with the public procurement process among Contracting Firms within municipal road projects in Saudi Arabia. My Doctoral Studies are supervised by Dr. Andrew Agapiou, a Senior Lecturer within the School, who has expertise in Construction Law.

The purpose of the survey is to investigate the nature and extent of participation of Contracting Firms within municipal road projects in Saudi Arabian. Local road projects classified contractors will take part in this investigation. Stratified sampling method was used to select research sample.

The researcher believes the questionnaire survey take less than 20 minutes to complete satisfactorily. Kindly follow the instructions for each question before responding with satisfactory answer. When fully completed, try and review your responses before the researcher comes for collection. Please when in doubt, do not hesitate to contact me for clarification on:

All the information provided by you in this survey will be treated as STRICTLY private & confidential and used only for analysis purposes. Data that may be reported in academic publication will not include any information that identifies you as a participant in the study.

If you are happy to be involved in the project, you will be asked to sign a consent form to confirm this.

Researcher contact details
Nawaf Hasan Alahmadi
Ph.D. Student
Dept. Architecture,
Faculty of Engineering,
James Weir Building 75 Montrose Street,
University of Strathclyde, G1 1XJ,
Glasgow, United Kingdom.
Phone#: +966568865696
Email: nawaf.alahmadi@strath.ac.uk

Chief Investigator details:
Dr. Andrew Agapiou
Senior Lecturer
Dept. Architecture,
Faculty of Engineering,
James Weir Building 75 Montrose Street,
University of Strathclyde, G1 1XJ,
Glasgow, United Kingdom.
Phone#: +441415483067
Email: andrew.agapiou@strath.ac.uk

This investigation was granted ethical approval by the University of Strathclyde Ethics Committee. If you have any questions/concerns, during or after the investigation, or wish to contact an independent person to whom any questions may be directed or further information may be sought from, please contact:

Secretary to the University Ethics Committee
Research & Knowledge Exchange Services
University of Strathclyde
Graham Hills Building
50 George Street
Glasgow
G1 1QE

Telephone: 0141 548 3707
Email: ethics@strath.ac.uk

Appendix (B-2) Consent Form

Oral Consent Script

I am currently a PhD Architecture student of The University of Strathclyde Glasgow, United Kingdom. I am researching compliance with the public procurement process among Contracting Firms within municipal road projects in Saudi Arabia. My Doctoral Studies are supervised by Dr. Andrew Agapiou, a Senior Lecturer within the School, who has expertise in Construction Law.

The purpose of the survey is to investigate the nature and extent of participation of Contracting Firms within municipal road projects in Saudi Arabian. Local road projects classified contractors will take part in this investigation. Stratified sampling method was used to select research sample.

The researcher believes the questionnaire survey take less than 20 minutes to complete satisfactorily. Kindly follow the instructions for each question before responding with satisfactory answer. When fully completed, try and review your responses before the researcher comes for collection. Please when in doubt, do not hesitate to contact me for clarification on:

All the information provided by you in this survey will be treated as STRICTLY private & confidential and used only for analysis purposes. Data that may be reported in academic publication will not include any information that identifies you as a participant in the study.

- Would you please confirm that you understood the information provided for the above project and the researcher has answered any queries to my satisfaction.
- Could you please consent to being a participant in the project.

Appendix (B-3) The questionnaire

Section 1: General Demographic information

Kindly answer the following general questions about your firm:

1. How your firm classified under the municipal road projects classification criteria?

☐ 1st class ☐ 2nd class ☐ 3rd class ☐ 4th class ☐ 5th class

2. In which municipality does your firm operate its headquarters?

☐ Makkah ☐ Jeddah ☐ Madinah ☐ Hassa ☐ Hail

3. Do you have branches outside this municipality area?

☐ Yes ☐ No

3. b. If your answer with Yes, in which municipalities does your firm have branch offices?

☐ Makkah ☐ Baha ☐ Aseer ☐ Najran ☐ Jizan
☐ Riyadh ☐ Jeddah ☐ Madinah ☐ Hassa ☐ Hail
☐ Tabouk ☐ Qassem ☐ Sharqiyah ☐ Jouf ☐ Taif
☐ Northern borders

4. In term of the value of work, how important are municipal road projects to your firm's business activities?

☐ Extremely important ☐ Very important ☐ Moderately important ☐ Slightly important ☐ Not at all important

5. How many municipal road project bids has your firm participated in over the last 5 year?

☐ None ☐ 3 and less ☐ 4-6 ☐ 7-10 ☐ 10 or more

5.b. Of these bids, how many have been awarded to your firm?

☐ None ☐ 2 and less ☐ 3-5 ☐ 5-7 ☐ 7 or more

6. Has your firm ever participated in a tender bid outside your municipality?

☐ yes ☐ No

6.b. A. If your answer with Yes, in which municipalities your firm has participated?

☐ Makkah ☐ Baha ☐ Aseer ☐ Najran ☐ Jizan
☐ Riyadh ☐ Jeddah ☐ Madinah ☐ Hassa ☐ Hail
☐ Tabouk ☐ Qassem ☐ Sharqiyah ☐ Jouf ☐ Taif
☐ Northern borders

6. B. If your answer with No, what are reasons of not bidding outside:

Section 2:

Rate your desire to participate in municipal roads tendering with respect to influence of the statements below:

1	2	3	4	5
Extremely Influential	Very Influential	Moderately Influential	Slightly Influential	Not at all influential

		1	2	3	4	5
Cost estimation						
1)	The opportunity provided to submit of Tender documentation within a reasonable time frame	☐	☐	☐	☐	☐
2)	The presence of annual cost estimation benchmark book	☐	☐	☐	☐	☐
3)	The presence of certified costs engineers in your teams	☐	☐	☐	☐	☐
Specifications						
4)	The Municipal Authority's commitment to establish accurate and detailed terms and technical specifications for the required works	☐	☐	☐	☐	☐
5)	The application of a clear and neutral local building code for municipal road project specifications	☐	☐	☐	☐	☐
6)	The presence of an updated local municipal roads specifications guidebook	☐	☐	☐	☐	☐
Bidding cost						
7)	The imposition of e-bidding in government Tendering & Procurement Law	☐	☐	☐	☐	☐
8)	The use of standardize bid documents contents based on approved international standards (for example, ISO-10854-2:2011)	☐	☐	☐	☐	☐
9)	The provision of technical advice to tackle user problems in e-procurement.	☐	☐	☐	☐	☐
Bid qualification						
10)	Determine the allowed classification to bid in the tender announcement	☐	☐	☐	☐	☐
11)	The provision of objective contractors classification criteria	☐	☐	☐	☐	☐
12)	Published classification criteria & their weighting score	☐	☐	☐	☐	☐
Evaluation criteria						
13)	criteria based on socio-economic objectives	☐	☐	☐	☐	☐
14)	Published standard tender evaluation criteria	☐	☐	☐	☐	☐
15)	Training & development to understand evaluation criteria & their weighting score	☐	☐	☐	☐	☐

Section 3:

Please state any additional comments regarding the entire questionnaires and kindly write down your phone number for the researcher to contact you if interested to participate in further interview.

Thank you for your time in completing this survey

Appendix (B-4) The ethical application form

OFFICE USE ONLY
UEC
//14
Paper

Ethics Application Form

Please answer all questions

1. Title of the investigation

The compliance with the public procurement process in Saudi Arabia

Please state the title on the PIS and Consent Form, if different:

2. Chief Investigator (must be at least a Grade 7 member of staff or equivalent)

Name: Dr. Andrew Aqapiou
☐ Professor
☐ Reader
☒ Senior Lecturer
☐ Lecturer
☐ Senior Teaching Fellow
☐ Teaching Fellow
Department: Architecture
Telephone: 0141 548 3067
E-mail: andrew.agapiou@strath.ac.uk

3. Other Strathclyde investigator(s)

Name: Nawaf Hasan Alahmadi
Status (e.g. lecturer, post-/undergraduate): PhD student
Department: architecture
Telephone: 07522725178
E-mail: nawaf.alahmadi@strath.ac.uk

4. Non-Strathclyde collaborating investigator(s) (where applicable)

Name:
Status (e.g. lecturer, post-/undergraduate):
Department/Institution:
If student(s), name of supervisor:
Telephone:
E-mail:
Please provide details for all investigators involved in the study:

5. Overseas Supervisor(s) (where applicable)

Name(s):
Status:
Department/Institution:
Telephone:
Email:
I can confirm that the local supervisor has obtained a copy of the Code of Practice: Yes ☐ No ☐
Please provide details for all supervisors involved in the study:

6. Location of the investigation

At what place(s) will the investigation be conducted
Saudi Arabia

If this is not on University of Strathclyde premises, how have you satisfied yourself that adequate Health and Safety arrangements are in place to prevent injury or harm?
very satisfied

7. Duration of the investigation

Duration(years/months) : 3 months

Start date (expected): 30 / 05 / 2016 Completion date (expected): 26 / 08 / 2016

8. Sponsor

Please note that this is not the funder; refer to Section C and Annexes 1 and 3 of the Code of Practice for a definition and the key responsibilities of the sponsor.

Will the sponsor be the University of Strathclyde: Yes ☐ No ☒
If not, please specify who is the sponsor: Saudi National Anti-Corruption Commission

9. Funding body or proposed funding body (if applicable)

Name of funding body:
Status of proposal – if seeking funding (please click appropriate box):
☐ In preparation
☐ Submitted
☐ Accepted
Date of submission of proposal: / / Date of start of funding: / /

10. Ethical issues

Describe the main ethical issues and how you propose to address them:

11. Objectives of investigation (including the academic rationale and justification for the investigation)
Please use plain English.

The purpose of the survey is to investigate the factors that influence compliance with the public procurement process among Contracting Firms within municipal road projects in Saudi Arabia

12. Participants

Please detail the nature of the participants:
Directors & top managers of municipal roads classified contractors
Summarise the number and age (range) of each group of participants:
Number: 200 Age (range) 30-50
Please detail any inclusion/exclusion criteria and any further screening procedures to be used:
classified contractors included in Ministry of municipalities list @ https://contractors.momra.gov.sa/

13. Nature of the participants
Please note that investigations governed by the Code of Practice that involve any of the types of participants listed in B1(b) must be submitted to the University Ethics Committee (UEC) rather than DEC/SEC for approval.

Do any of the participants fall into a category listed in Section B1(b) (participant considerations) applicable in this investigation?: Yes ☐ No ☒
If yes, please detail which category (and submit this application to the UEC):

14. Method of recruitment

Describe the method of recruitment (see section B4 of the Code of Practice), providing information on any payments, expenses or other incentives.
Random surveys using contractors details listed @ https://contractors.momra.gov.sa/

15. Participant consent

Please state the groups from whom consent/assent will be sought (please refer to the Guidance Document). The PIS and Consent Form(s) to be used should be attached to this application form.
Participant consent will be taken orally after providing them with a copy of Information Sheet

16. Methodology
Investigations governed by the Code of Practice which involve any of the types of projects listed in B1(a) must be submitted to the University Ethics Committee rather than DEC/SEC for approval.

Are any of the categories mentioned in the Code of Practice Section B1(a) (project considerations) applicable in this investigation? ☐ Yes ☒ No
If 'yes' please detail:

Describe the research methodology and procedure, providing a timeline of activities where possible. Please use plain English.
Stratified sampling would be employed to conduct questionnaire survey of 200 contractors out of 430 based on

(Krejcie & Morgan,1970). the questionnaire will be translated to Arabic before been distributed to participants

What specific techniques will be employed and what exactly is asked of the participants? Please identify any non-validated scale or measure and include any scale and measures charts as an Appendix to this application. Please include questionnaires, interview schedules or any other non-standardised method of data collection as appendices to this application.

Where an independent reviewer is not used, then the UEC, DEC or SEC reserves the right to scrutinise the methodology. Has this methodology been subject to independent scrutiny? Yes ☐ No ☒
If yes, please provide the name and contact details of the independent reviewer:

17. Previous experience of the investigator(s) with the procedures involved. Experience should demonstrate an ability to carry out the proposed research in accordance with the written methodology.

None

18. Data collection, storage and security

How and where are data handled? Please specify whether it will be fully anonymous (i.e. the identity unknown even to the researchers) or pseudo-anonymised (i.e. the raw data is anonymised and given a code name, with the key for code names being stored in a separate location from the raw data) - if neither please justify.
questionnaires will be scanned after been answered, data will be confidential

Explain how and where it will be stored, who has access to it, how long it will be stored and whether it will be securely destroyed after use:
Data will be stored @ university's server will be destroyed by end of PhD study

Will anyone other than the named investigators have access to the data? Yes ☐ No ☒
If 'yes' please explain:

19. Potential risks or hazards

Describe the potential risks and hazards associated with the investigation:
None

Has a specific Risk Assessment been completed for the research in accordance with the University's Risk Management Framework (Risk Management Framework)? Yes ☐ No ☐
If yes, please attach risk form (S20) to your ethics application. If 'no', please explain why not:

20. What method will you use to communicate the outcomes and any additional relevant details of the study to the participants?

None

21. How will the outcomes of the study be disseminated (e.g. will you seek to publish the results and, if relevant, how will you protect the identities of your participants in said dissemination)?
publish the results on academic journal and include them on PhD thesis

Checklist	Enclosed	N/A
Participant Information Sheet(s)	☒	☐
Consent Form(s)	☒	☐
Sample questionnaire(s)	☒	☐
Sample interview format(s)	☐	☒
Sample advertisement(s)	☐	☒
Any other documents (please specify below)		
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐

22. Chief Investigator and Head of Department Declaration
Please note that unsigned applications will not be accepted and both signatures are required

I have read the University's Code of Practice on Investigations involving Human Beings and have completed this application accordingly. By signing below, I acknowledge that I am aware of and accept my responsibilities as Chief Investigator under Clauses 3.11 – 3.13 of the Research Governance Framework and that this investigation cannot proceed before all approvals required have been obtained.

Signature of Chief Investigator

Please also type name here:

I confirm I have read this application, I am happy that the study is consistent with departmental strategy, that the staff and/or students involved have the appropriate expertise to undertake the study and that adequate arrangements are in place to supervise any students that might be acting as investigators, that the study has access to the resources needed to conduct the proposed research successfully, and that there are no other departmental-specific issues relating to the study of which I am aware.

Signature of Head of Department

Please also type name here

Date: / /

23. Only for University sponsored projects under the remit of the DEC/SEC, with no external funding and no NHS involvement

Head of Department statement on Sponsorship
This application requires the University to sponsor the investigation. This is done by the Head of Department for all DEC applications with exception of those that are externally funded and those which are connected to the NHS (those exceptions should be submitted to R&KES). I am aware of the implications of University sponsorship of the investigation and have assessed this investigation with respect to sponsorship and management risk. As this particular investigation is within the remit of the DEC and has no external funding and no NHS involvement, I agree on behalf of the University that the University is the appropriate sponsor of the investigation and there are no management risks posed by the investigation.

If not applicable, tick here ☐

Signature of Head of Department

Please also type name here

Date: / /

For applications to the University Ethics Committee, the completed form should be sent to ethics@strath.ac.uk with the relevant electronic signatures.

24. Insurance
The questionnaire below must be completed and included in your submission to the UEC/DEC/SEC:

Is the proposed research an investigation or series of investigations conducted on any person for a Medicinal Purpose? Medicinal Purpose means: ▪ treating or preventing disease or diagnosing disease or ▪ ascertaining the existence degree of or extent of a physiological condition or ▪ assisting with or altering in any way the process of conception or ▪ investigating or participating in methods of contraception or ▪ inducing anaesthesia or ▪ otherwise preventing or interfering with the normal operation of a physiological function or ▪ altering the administration of prescribed medication.	Yes / No

If "**Yes**" please go to **Section A (Clinical Trials)** – all questions must be completed
If "**No**" please go to **Section B (Public Liability)** – all questions must be completed

Section A (Clinical Trials)

Does the proposed research involve subjects who are either: i. under the age of 5 years at the time of the trial; ii. known to be pregnant at the time of the trial	Yes / No

*If "**Yes**" the UEC should refer to Finance*

Is the proposed research limited to: iii. Questionnaires, interviews, psychological activity including CBT; iv. Venepuncture (withdrawal of blood); v. Muscle biopsy; vi. Measurements or monitoring of physiological processes including scanning; vii. Collections of body secretions by non-invasive methods; viii. Intake of foods or nutrients or variation of diet (excluding administration of drugs).	Yes / No

*If "**No**" the UEC should refer to Finance*

Will the proposed research take place within the UK?	Yes / No

*If "**No**" the UEC should refer to Finance*

Title of Research	
Chief Investigator	
Sponsoring Organisation	

Does the proposed research involve:	
a) investigating or participating in methods of contraception?	Yes / No
b) assisting with or altering the process of conception?	Yes / No
c) the use of drugs?	Yes / No
d) the use of surgery (other than biopsy)?	Yes / No
e) genetic engineering?	Yes / No
f) participants under 5 years of age(other than activities i-vi above)?	Yes / No
g) participants known to be pregnant (other than activities i-vi above)?	Yes / No
h) pharmaceutical product/appliance designed or manufactured by the institution?	Yes / No
i) work outside the United Kingdom?	Yes / No

If **"YES"** to **any** of the questions a-i please also complete the **Employee Activity Form** (attached).
If **"YES"** to **any** of the questions a-i, and this is a follow-on phase, please provide details of SUSARs on a separate sheet.
*If "**Yes**" to any of the questions a-i then the UEC/DEC/SEC should refer to Finance (aileen.stevenson@strath.ac.uk).*

Section B (Public Liability)	
Does the proposed research involve :	
a) aircraft or any aerial device	Yes / No
b) hovercraft or any water borne craft	Yes / No
c) ionising radiation	Yes / No
d) asbestos	Yes / No
e) participants under 5 years of age	Yes / No
f) participants known to be pregnant	Yes / No
g) pharmaceutical product/appliance designed or manufactured by the institution?	Yes / No
h) work outside the United Kingdom?	Yes / No

*If **"YES"** to any of the questions the UEC/DEC/SEC should refer to Finance(aileen.stevenson@strath.ac.uk).*

For NHS applications only - Employee Activity Form

Has NHS Indemnity been provided?	Yes / No
Are Medical Practitioners involved in the project?	Yes / No
If YES, will Medical Practitioners be covered by the MDU or other body?	Yes / No

This section aims to identify the staff involved, their employment contract and the extent of their involvement in the research (in some cases it may be more appropriate to refer to a group of persons rather than individuals).

Chief Investigator		
Name	**Employer**	**NHS Honorary Contract?**
		Yes / No
Others		
Name	**Employer**	**NHS Honorary Contract?**
Nawaf Hasan Alahmadi	University of Strathclyde	Yes / No
		Yes / No
		Yes / No
		Yes / No

Please provide any further relevant information here:

Appendix (B-5) SPSS tests results

Correlation tests

Correlations

			Contractor class	The importance of roads contracts
Spearman's rho	Contractor class	Correlation Coefficient	1.000	-.311**
		Sig. (2-tailed)	.	.002
		N	93	93
	The importance of roads contracts	Correlation Coefficient	-.311**	1.000
		Sig. (2-tailed)	.002	.
		N	93	93

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

			Contractor class	Number of bids participated in last 5 years
Spearman's rho	Contractor class	Correlation Coefficient	1.000	-.378**
		Sig. (2-tailed)	.	.000
		N	93	93
	Number of bids participated in last 5 years	Correlation Coefficient	-.378**	1.000
		Sig. (2-tailed)	.000	.
		N	93	93

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

			Contractor Headoffice	The importance of roads contracts
Spearman's rho	Contractor Headoffice	Correlation Coefficient	1.000	.018
		Sig. (2-tailed)	.	.865
		N	93	93
	The importance of roads contracts	Correlation Coefficient	.018	1.000
		Sig. (2-tailed)	.865	.
		N	93	93

Correlations

			Contractor Headoffice	Number of bids participated in last 5 years
Spearman's rho	Contractor Headoffice	Correlation Coefficient	1.000	.103
		Sig. (2-tailed)	.	.326
		N	93	93
	Number of bids participated in last 5 years	Correlation Coefficient	.103	1.000
		Sig. (2-tailed)	.326	.
		N	93	93

Summary of (comparing mean ranking) test

	Wilcoxon-Mann Whitney test				
		Lower		Upper	
Code	P- value	Mean rank	Sum of ranks	Mean rank	Sum of ranks
C.E.R.	0.049	42.60	2896.50	54.48	1198.50
C.E.N.	0.007	41.51	2822.50	57.84	1272.50
C.E.C.	0.618	44.79	3046.00	47.68	1049.00
C.S.R.	0.307	44.64	3035.50	48.16	1059.50
C.S.N.	0.693	46.07	3132.50	43.75	962.50
C.S.C.	0.397	46.75	3179.00	41.64	916.00
B.C.R.	0.147	43.40	2951.50	51.98	1143.50
B.C.N.	0.464	44.47	3024.00	48.68	1071.00
B.C.C.	0.363	44.32	3013.50	49.16	1081.50
P.Q.R.	0.679	46.06	3132.00	43.77	963.00
P.Q.N.	0.591	44.81	3047.00	47.64	1048.00
P.Q.C.	0.262	44.07	2996.50	49.93	1098.50
E.C.R.	0.105	43.15	2934.00	52.77	1161.00
E.C.N.	0.291	44.08	2997.50	49.89	1097.50
E.C.C.	0.369	44.16	3003.00	49.64	1092.00

	Kruskal-Wallis test			
		Mean Rank		
Code	P- value	Not participated at all	Participated without awarded	participated and awarded at least 1 contract
C.E.R.	0.210	42.39	40.32	50.79
C.E.N.	0.034	38.44	42.42	53.17
C.E.C.	0.332	44.39	52.55	42.93
C.S.R.	0.945	46.11	44.32	45.57
C.S.N.	0.523	42.59	49.71	45.92
C.S.C.	0.350	41.27	51.11	46.37
B.C.R.	0.803	47.11	42.55	45.58
B.C.N.	0.886	45.53	43.29	46.58
B.C.C.	0.257	48.67	39.53	45.74
P.Q.R.	0.434	48.88	45.84	42.39
P.Q.N.	0.490	42.82	44.11	48.53
P.Q.C.	0.118	50.80	38.37	44.46
E.C.R.	0.045	43.79	35.45	52.01
E.C.N.	0.040	49.39	33.89	47.92
E.C.C.	0.571	48.86	43.55	43.55

	Friedman test			
	All			
Code	P- value	Mean Ranks	P- value	Mean Ranks
C.E.R.		2.04		2.01
C.E.N.	0.618	2.06	0.789	1.94
C.E.C.		1.90		2.05
C.S.R.		1.65		1.67
C.S.N.	0.000	2.05	0.000	2.07
C.S.C.		2.30		2.26
B.C.R.		2.16		2.17
B.C.N.	0.000	2.13	0.000	2.13
B.C.C.		1.71		1.70
P.Q.R.		2.02		2.09
P.Q.N.	0.887	1.98	0.242	1.90
P.Q.C.		1.99		2.01
E.C.R.		2.27		2.13
E.C.N.	0.000	1.86	0.103	1.87
E.C.C.		1.88		2.01

C. Qualitative data collection

Appendix (C-1) Participants Information Sheet

Participant Information Sheet

Department: Architecture

Compliance with the public procurement process in Saudi Arabia

I am currently a PhD Architecture student of The University of Strathclyde Glasgow, United Kingdom. I am researching compliance with the public procurement process among Contracting Firms within municipal road projects in Saudi Arabia. My Doctoral Studies are supervised by Dr. Andrew Agapiou, a Senior Lecturer within the School, who has expertise in Construction Law.

The purpose of the survey is to measure the current performance of preparatory stage of the municipal road projects in Saudi Arabian. Local road projects classified contractors will take part in this investigation as well as some of municipalities' staff.

The researcher believes the interview survey take 30-45 minutes to complete satisfactorily. We don't anticipate that there are any risks associated with your participation, but you have the right to stop the interview or withdraw from the research at any time. All the information provided by you in this interview will be treated as STRICTLY private & confidential and used only for analysis purposes. Data that may be reported in academic publication will not include any information that identifies you as a participant in the study.

To certify we would inform you the following:

- The interview will be recorded and a transcript will be produced
- You will be sent the transcript and given the opportunity to correct any factual errors
- The transcript of the interview will be analysed by Nawaf H. Alahmadi as research investigator
- Access to the interview transcript will be limited to Nawaf H Alahmadi.
- Any summary interview content, or direct quotations from the interview, that are made available through academic publication or other academic outlets will be anonymized so that you cannot be identified, and care will be taken to ensure that other information in the interview that could identify yourself is not revealed
- The actual recording will be (kept or destroyed state what will happen).
- Any variation of the conditions above will only occur with your further explicit approval.
- The interview will be recorded and a transcript will be produced
- You will be sent the transcript and given the opportunity to correct any factual errors
- The transcript of the interview will be analysed by (name of the researcher) as research investigator
- Access to the interview transcript will be limited to (name of the researcher) and academic colleagues and researchers with whom he might collaborate as part of the research process.
- Any summary interview content, or direct quotations from the interview, that are made available through academic publication or other academic outlets will be anonymized so that you cannot be identified, and care will be taken to ensure that other information in the interview that could identify yourself is not revealed
- The actual recording will be (kept or destroyed state what will happen).
- Any variation of the conditions above will only occur with your further explicit approval

Please when in doubt, do not hesitate to contact me for clarification on:

Researcher contact details
Nawaf Hasan Alahmadi
Ph.D. Student
Dept. Architecture,
Faculty of Engineering,
James Weir Building 75 Montrose Street,
University of Strathclyde, G1 1XJ,
Glasgow, United Kingdom.
Phone#: +966568865696
Email: nawaf.alahmadi@strath.ac.uk

Chief Investigator details:
Dr. Andrew Agapiou
Senior Lecturer
Dept. Architecture,
Faculty of Engineering,
James Weir Building 75 Montrose Street,
University of Strathclyde, G1 1XJ,
Glasgow, United Kingdom.
Phone#: +441415483067
Email: andrew.agapiou@strath.ac.uk

This investigation was granted ethical approval by the University of Strathclyde Ethics Committee. If you have any questions/concerns, during or after the investigation, or wish to contact an independent person to whom any questions may be directed or further information may be sought from, please contact:

Secretary to the University Ethics Committee
Research & Knowledge Exchange Services
University of Strathclyde
Graham Hills Building
50 George Street
Glasgow
G1 1QE

Telephone: 0141 548 3707
Email: ethics@strath.ac.uk

Appendix (C-2) Consent Form

Oral Consent Script

I am currently a PhD Architecture student of The University of Strathclyde Glasgow, United Kingdom. I am researching *Compliance and the public procurement process* among Contracting Firms within municipal road projects in Saudi Arabia. My Doctoral Studies are supervised by Dr. Andrew Agapiou, a Senior Lecturer within the School, who has expertise in Construction Law.

The purpose of the survey is to measure the current performance of preparatory stage of the municipal road projects in Saudi Arabian. Local road projects classified contractors will take part in this investigation as well as some of municipalities' staff.

The researcher believes the interview survey take 30-45 minutes to complete satisfactorily. We don't anticipate that there are any risks associated with your participation, but you have the right to stop the interview or withdraw from the research at any time. All the information provided by you in this interview will be treated as STRICTLY private & confidential and used only for analysis purposes. Data that may be reported in academic publication will not include any information that identifies you as a participant in the study.

Thank you for agreeing to be interviewed as part of the above research project. And,

- Would you please confirm that you understood the information provided for the above project and the researcher has answered any queries to my satisfaction?
- Could you please consent to being a participant in the project?

Appendix (C-3) Contractors' Interviews

1. We will start our discussion with the Pre-qualification stage:
▪ Through your scan of the previous tendering announcements in this sector, how do you measure your successful rate in knowledge of contractor class required? In other words, have you purchased a bid documents you notify later it is not within your class financial limit? ▪ How was your experience during the last classification of your firm? ▪ Based on this experience, how obvious were the procedures and standards? ▪ Tell us how easy was accessibility to these procedures and standard? ▪ What do you recommend Contractors Classification Agency in order to facilitate the accessibility to the classification procedures and standard?
2. Let's move the discussion to another substantial issue which is reducing bidding cost in the following questions:
▪ How was your experience with the municipalities which utilized e-procurement last 5 years? ▪ From this experience, how do you evaluate the transition progress from traditional to e-procurement within municipalities you have participated in? ▪ How do you rate the extent of the similarity of bidding documents in different municipalities you have participated in? ▪ During a tender study period, some of contractors need technical advice to tackle user problems in e-procurement, evaluate municipalities response to concerns during this period? ▪ What do you recommend in order to reduce bidding cost?
3. Purchasing the bidding documents followed by specifications study, in the following questions we will discuss clarity of the specifications:
▪ From those bidding documents you have purchased, how do you see the level of clarity (including details attached) in specifications? ▪ How do you evaluate the current application of the local building code? ▪ How do you measure the current communication with municipalities in term of clarifying municipal roads specifications, the scope of work, and requirements through their periodic publications? ▪ What do you recommend in order to to clarify the specifications?
4. After the purchase and studying the specifications, the discussion will be moved to how accurate cost estimation was?
▪ Who are the individuals, in your firm, the task of project cost estimation entrusted to them? Tell us about their previous experiences and qualifications? ▪ What is price benchmark that is being consulted? ▪ What do you think of the adequacy of the period stipulated according to Government Tendering and Procurement Law? ▪ What do you recommend in order to increase cost estimation accuracy?
5. After submission of your tender and opining bids stage, Bids evaluation criteria will be our last part in our discussion:
▪ Tell us about your experience, during the last five years, in the evaluation your bids after opening bids phase. ▪ From your point of view, what is your assessment of the intelligibility of the current bid evaluation criteria? ▪ What is your assessment of the current performance of municipalities (including workshops and training session) to clarify these criteria for contractors? ▪ Tell us how easy was accessibility to these criteria? ▪ What do you recommend in order to facilitate the accessibility to the bid evaluation criteria?
6. Finally, is there any other point, recommendation, or opinion you would like to share?

Appendix (C-4) Public officers' Interviews

1. Contractors Classification Committee	Proposed number of interviews = 1
▪ What procedures that been followed for a contractor classification, from receiving an application of classification till granting classification certificate? ▪ What methods that have been utilising to enable contractors have fully knowledge of your procedures and standards of classification?	
2. Procurement Department:	Proposed number of interviews = 3
▪ What is the policy provided by your municipality to enable a tenderer to observe the classification of works subject of the tender? ▪ How do you evaluate the progress of transferring municipal tendering to e-procurement within your municipality? ▪ What is the current level of communication with the ministry to standardise municipal roads bidding documents to ensure congruence and symmetry with other municipalities? ▪ What sort of services provided by your municipality in order to help solving bidders issues of e-procurement and to answer questions	
3. Municipal roads Department:	Proposed number of interviews = 3
▪ How do you prepare a bidding documents, including specifications, of municipal roads contracts? ▪ What are the procedures that been followed to ensure the application of the Saudi Building Code in bidding documents preparation to be referred to in case the lack of clarity of a contract item? ▪ What are the methods used to explain the specification updates of municipal road projects to contractors? ▪ How do you prepare an estimated guidance price of the tender contained in GTPL? ▪ How do you document these estimated guidance prices periodically?	
4. Bidding Evaluation Committee:	Proposed number of interviews = 3
▪ What are bid evaluation criteria do you conduct? ▪ What methods that have been utilising to enable contractors have fully knowledge of these criteria? ▪ How do you ascertain that the price of the lowest bid guide by previous price, market prices, and estimated guidance prices?	

Appendix (C-5) The ethical application form

OFFICE USE ONLY
UEC
//14
Paper

Ethics Application Form

Please answer all questions

1. Title of the investigation

Compliance and the Public Procurement Process

Please state the title on the PIS and Consent Form, if different:

2. Chief Investigator (must be at least a Grade 7 member of staff or equivalent)

Name: Dr. Andrew Aqapiou
☐ Professor
☐ Reader
☒ Senior Lecturer
☐ Lecturer
☐ Senior Teaching Fellow
☐ Teaching Fellow
Department: Architecture
Telephone: 0141 548 3067
E-mail: andrew.agapiou@strath.ac.uk

3. Other Strathclyde investigator(s)

Name: Nawaf Hasan Alahmadi
Status (e.g. lecturer, post-/undergraduate): PhD student
Department: Architecture
Telephone: 07522725178
E-mail: nawaf.alahmadi@strath.ac.uk

4. Non-Strathclyde collaborating investigator(s) (where applicable)

Name:
Status (e.g. lecturer, post-/undergraduate):
Department/Institution:
If student(s), name of supervisor:
Telephone:
E-mail:
Please provide details for all investigators involved in the study:

5. Overseas Supervisor(s) (where applicable)

Name(s):
Status:
Department/Institution:
Telephone:
Email:
I can confirm that the local supervisor has obtained a copy of the Code of Practice: Yes ☐ No ☐
Please provide details for all supervisors involved in the study:

6. Location of the investigation

At what place(s) will the investigation be conducted
Saudi Arabia

If this is not on University of Strathclyde premises, how have you satisfied yourself that adequate Health and Safety arrangements are in place to prevent injury or harm?
very satisfied

7. Duration of the investigation

Duration(years/months) : 2 months

Start date (expected): 09 / 01 / 2017 Completion date (expected): 24 / 02 / 2017

8. Sponsor

Please note that this is not the funder; refer to Section C and Annexes 1 and 3 of the Code of Practice for a definition and the key responsibilities of the sponsor.

Will the sponsor be the University of Strathclyde: Yes ☐ No ☒
If not, please specify who is the sponsor: Saudi National Anti-Corruption Commission

9. Funding body or proposed funding body (if applicable)

Name of funding body:
Status of proposal – if seeking funding (please click appropriate box):
☐ In preparation
☐ Submitted
☐ Accepted
Date of submission of proposal: / / Date of start of funding: / /

10. Ethical issues

Describe the main ethical issues and how you propose to address them:

11. Objectives of investigation (including the academic rationale and justification for the investigation)
Please use plain English.

The purpose of the survey is to measure the current performance of the proposals presented in the previous phase that influence compliance with the public procurement process among Contracting Firms within municipal road projects in Saudi Arabia

12. Participants

Please detail the nature of the participants:
Selected directors & top managers of municipal roads classified contractors who approve to participate in this phase of the research as well as some of the municipalities staff
Summarise the number and age (range) of each group of participants:
Number: 20 Age (range) 30-50
Please detail any inclusion/exclusion criteria and any further screening procedures to be used:
classified contractors included in Ministry of municipalities list @ https://contractors.momra.gov.sa/

13. Nature of the participants
Please note that investigations governed by the Code of Practice that involve any of the types of participants listed in B1(b) must be submitted to the University Ethics Committee (UEC) rather than DEC/SEC for approval.

Do any of the participants fall into a category listed in Section B1(b) (participant considerations) applicable in this investigation?: Yes ☐ No ☒
If yes, please detail which category (and submit this application to the UEC):

14. Method of recruitment

Describe the method of recruitment (see section B4 of the Code of Practice), providing information on any payments, expenses or other incentives.
Contractors: it will go to those who gave the approval during the previous phase. Municipalities staff: I will conduct interviews with staff by their roles

15. Participant consent

Please state the groups from whom consent/assent will be sought (please refer to the Guidance Document). The PIS and Consent Form(s) to be used should be attached to this application form.
Participant consent will be taken orally after providing them with a copy of Information Sheet

16. Methodology
Investigations governed by the Code of Practice which involve any of the types of projects listed in B1(a) must be submitted to the University Ethics Committee rather than DEC/SEC for approval.

Are any of the categories mentioned in the Code of Practice Section B1(a) (project considerations) applicable in this investigation? ☐ Yes ☒ No
If 'yes' please detail:

Describe the research methodology and procedure, providing a timeline of activities where possible. Please use plain English. the interviews will be translated into Arabic before been conducted
What specific techniques will be employed and what exactly is asked of the participants? Please identify any non-validated scale or measure and include any scale and measures charts as an Appendix to this application. Please include questionnaires, interview schedules or any other non-standardised method of data collection as appendices to this application.
Where an independent reviewer is not used, then the UEC, DEC or SEC reserves the right to scrutinise the methodology. Has this methodology been subject to independent scrutiny? Yes ☐ No ☒ If yes, please provide the name and contact details of the independent reviewer:

17. Previous experience of the investigator(s) with the procedures involved. Experience should demonstrate an ability to carry out the proposed research in accordance with the written methodology.
None

18. Data collection, storage and security
How and where are data handled? Please specify whether it will be fully anonymous (i.e. the identity unknown even to the researchers) or pseudo-anonymised (i.e. the raw data is anonymised and given a code name, with the key for code names being stored in a separate location from the raw data) - if neither please justify. Interviews will be transcripted, translated, and data will be confidential
Explain how and where it will be stored, who has access to it, how long it will be stored and whether it will be securely destroyed after use: Data will be stored @ university's server will be destroyed by end of PhD study
Will anyone other than the named investigators have access to the data? Yes ☐ No ☒ If 'yes' please explain:

19. Potential risks or hazards
Describe the potential risks and hazards associated with the investigation: None
Has a specific Risk Assessment been completed for the research in accordance with the University's Risk Management Framework (Risk Management Framework)? Yes ☐ No ☐ If yes, please attach risk form (S20) to your ethics application. If 'no', please explain why not:

20. What method will you use to communicate the outcomes and any additional relevant details of the study to the participants?
None

21. How will the outcomes of the study be disseminated (e.g. will you seek to publish the results and, if relevant, how will you protect the identities of your participants in said dissemination)?
publish the results on academic journal and include them on PhD thesis

Checklist	Enclosed	N/A
Participant Information Sheet(s)	☒	☐
Consent Form(s)	☒	☐
Sample questionnaire(s)	☐	☒
Sample interview format(s)	☒	☐
Sample advertisement(s)	☐	☒
Any other documents (please specify below)		
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐

22. Chief Investigator and Head of Department Declaration
Please note that unsigned applications will not be accepted and both signatures are required

I have read the University's Code of Practice on Investigations involving Human Beings and have completed this application accordingly. By signing below, I acknowledge that I am aware of and accept my responsibilities as Chief Investigator under Clauses 3.11 – 3.13 of the Research Governance Framework and that this investigation cannot proceed before all approvals required have been obtained.

Signature of Chief Investigator	Andrew Agapiou
Please also type name here:	Andrew Agapiou

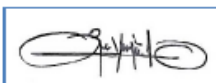
I confirm I have read this application, I am happy that the study is consistent with departmental strategy, that the staff and/or students involved have the appropriate expertise to undertake the study and that adequate arrangements are in place to supervise any students that might be acting as investigators, that the study has access to the resources needed to conduct the proposed research successfully, and that there are no other departmental-specific issues relating to the study of which I am aware.

Signature of Head of Department	
Please also type name here	Professor Ashraf Salama
Date:	20 / 12 / 2016

23. Only for University sponsored projects under the remit of the DEC/SEC, with no external funding and no NHS involvement

Head of Department statement on Sponsorship
This application requires the University to sponsor the investigation. This is done by the Head of Department for all DEC applications with exception of those that are externally funded and those which are connected to the NHS (those exceptions should be submitted to R&KES). I am aware of the implications of University sponsorship of the investigation and have assessed this investigation with respect to sponsorship and management risk. As this particular investigation is within the remit of the DEC and has no external funding and no NHS involvement, I agree on behalf of the University that the University is the appropriate sponsor of the investigation and there are no management risks posed by the investigation.

If not applicable, tick here ☐

Signature of Head of Department	
Please also type name here	Professor Ashraf Salama
Date:	20 / 12 / 2016

For applications to the University Ethics Committee, the completed form should be sent to ethics@strath.ac.uk with the relevant electronic signatures.

24. Insurance
The questionnaire below must be completed and included in your submission to the UEC/DEC/SEC:

Is the proposed research an investigation or series of investigations conducted on any person for a Medicinal Purpose? Medicinal Purpose means: ▪ treating or preventing disease or diagnosing disease or ▪ ascertaining the existence degree of or extent of a physiological condition or ▪ assisting with or altering in any way the process of conception or ▪ investigating or participating in methods of contraception or ▪ inducing anaesthesia or ▪ otherwise preventing or interfering with the normal operation of a physiological function or ▪ altering the administration of prescribed medication.	Yes / No

If "**Yes**" please go to **Section A (Clinical Trials)** – all questions must be completed
If "**No**" please go to **Section B (Public Liability)** – all questions must be completed

Section A (Clinical Trials)

Does the proposed research involve subjects who are either: i. under the age of 5 years at the time of the trial; ii. known to be pregnant at the time of the trial	Yes / No

*If "**Yes**" the UEC should refer to Finance*

Is the proposed research limited to: iii. Questionnaires, interviews, psychological activity including CBT; iv. Venepuncture (withdrawal of blood); v. Muscle biopsy; vi. Measurements or monitoring of physiological processes including scanning; vii. Collections of body secretions by non-invasive methods; viii. Intake of foods or nutrients or variation of diet (excluding administration of drugs).	Yes / No

*If "**No**" the UEC should refer to Finance*

Will the proposed research take place within the UK?	Yes / No

*If "**No**" the UEC should refer to Finance*

Title of Research	
Chief Investigator	
Sponsoring Organisation	

Does the proposed research involve:	
a) investigating or participating in methods of contraception?	Yes / No
b) assisting with or altering the process of conception?	Yes / No
c) the use of drugs?	Yes / No
d) the use of surgery (other than biopsy)?	Yes / No
e) genetic engineering?	Yes / No
f) participants under 5 years of age(other than activities i-vi above)?	Yes / No
g) participants known to be pregnant (other than activities i-vi above)?	Yes / No
h) pharmaceutical product/appliance designed or manufactured by the institution?	Yes / No
i) work outside the United Kingdom?	Yes / No

If **"YES"** to **any** of the questions a-i please also complete the **Employee Activity Form** (attached).
If **"YES"** to **any** of the questions a-i, and this is a follow-on phase, please provide details of SUSARs on a separate sheet.
*If "**Yes**" to any of the questions a-i then the UEC/DEC/SEC should refer to Finance (aileen.stevenson@strath.ac.uk).*

Section B (Public Liability)	
Does the proposed research involve :	
a) aircraft or any aerial device	Yes / No
b) hovercraft or any water borne craft	Yes / No
c) ionising radiation	Yes / No
d) asbestos	Yes / No
e) participants under 5 years of age	Yes / No
f) participants known to be pregnant	Yes / No
g) pharmaceutical product/appliance designed or manufactured by the institution?	Yes / No
h) work outside the United Kingdom?	Yes / No

*If **"YES"** to any of the questions the UEC/DEC/SEC should refer to Finance(aileen.stevenson@strath.ac.uk).*

For NHS applications only - Employee Activity Form

Has NHS Indemnity been provided?	Yes / No
Are Medical Practitioners involved in the project?	Yes / No
If YES, will Medical Practitioners be covered by the MDU or other body?	Yes / No

This section aims to identify the staff involved, their employment contract and the extent of their involvement in the research (in some cases it may be more appropriate to refer to a group of persons rather than individuals).

Chief Investigator		
Name	**Employer**	**NHS Honorary Contract?**
		Yes / No
Others		
Name	**Employer**	**NHS Honorary Contract?**
Nawaf Hasan Alahmadi	University of Strathclyde	Yes / No
		Yes / No
		Yes / No
		Yes / No

Please provide any further relevant information here:

D. Framework (external validity) test

Appendix (D-1) Participants Information Sheet

Department: Architecture

Participant Information Sheet

Please read the following carefully

Title: Compliance and the Public Procurement Process

What is the study about?

The main purpose of the overall study it to develop an institutional framework applied by the municipalities in tendering phase to enhance the desire of the roads classified contractors of participation in future municipal roads projects tenders and, therefore, improve the compliance with public procurement process. This study is a part of a PhD research supported by the National Anti-Corruption Commission and supervised by Dr. Andrew Agapiou, a Senior Lecturer within the department of Architecture – University of Strathclyde, who has expertise in Construction Law.

The purpose of this survey is to provide the opportunity for various stakeholders in municipal roads projects market to provide feedback on what they see about the proposed framework. Following a series of questionnaires, a Delphi study will be undertaken to generate consensus regarding the framework's clarity, completeness, correctness, and conciseness. You are being asked to participate in the Delphi study, which involve a group of experts completing sequential questionnaire, developed from shared responses. You have been asked to participate because you are an acknowledged expert in this field. Approximately 20 people like you will be recruited to participate in Delphi survey for the validation stage of the study.

What does the process involve and what will you be asked to do?

If you agree to participate, you will be asked to complete three stages as follows:

Stage 1	Complete a questionnaire responding to specific question on the framework's clarity, completeness, and conciseness. This should take around 20 minutes to complete
Stage 2	Complete a second questionnaire, developed from participant's responses to the first questionnaire. In order to measure the framework's correctness, you will be asked to rate your agreement of each statement on a 1 to 5 scale (strongly disagree to strongly agree) and to optionally comment on each statement. This should take around 15 minutes to complete.
Stage 3	Review the summary results from **Stage 2** and you will have the chance to modify your ratings from **Stage 2** based on the responses of the other participants. This should take around 15 minutes to complete.

The responses from **Stage** 3 of the process will be analyzed to determine if there is an emerging consensus on the proposed framework. All responses will be anonymous to other participants as this technique does not require that participants meet face-to-face. All the information provided by you in this survey will be treated as STRICTLY private & confidential and used only for analysis purposes. Data that may be reported in academic publication will not include any information that identifies you as a participant in the study.

Your participation in this study is voluntary. You are under no obligation to participate or to continue with the study if you do not wish and you can therefore withdraw without penalty. Your decision to participate (or otherwise) will not be communicated to anyone.

Please when in doubt, do not hesitate to contact me for clarification on:

Researcher contact details
Nawaf Hasan Alahmadi
Ph.D. Student
Dept. Architecture,
Faculty of Engineering,
James Weir Building 75 Montrose Street,
University of Strathclyde, G1 1XJ,
Glasgow, United Kingdom.

Phone#: +966568865696

Email: nawaf.alahmadi@strath.ac.uk

This investigation was granted ethical approval by the University of Strathclyde Ethics Committee. If you have any questions/concerns, during or after the investigation, or wish to contact an independent person to whom any questions may be directed or further information may be sought from, please contact:

Secretary to the University Ethics Committee
Research & Knowledge Exchange Services
University of Strathclyde
Graham Hills Building
50 George Street
Glasgow
G1 1QE

Telephone: 0141 548 3707
Email: ethics@strath.ac.uk

Appendix (D-2) Consent Form

Consent Form

Department: Architecture

Title: Compliance and the Public Procurement Process

I confirm that I have read and understand the information sheet for the above project and the researcher answered any queries to my satisfaction. I understand that my participation is voluntary and that I am free to withdraw from the project at any time, without having to give a reason and without any consequences. I understand that any information recorded will remain confidential and no information that identified me will be made publicly available.

Appendix (D-3) The questionnaire

Section A: Respondent Background

Kindly answer the following general questions about you:

I. Your organisation:

☐ Contractor ☐ Consultant ☐ Municipality ☐ University ☐ Other (specify)

II. Your position:

☐ Firm's owner ☐ Projects manager ☐ Technical dept. manager ☐ Purchasing manager ☐ Other (specify)

III. Years of experience in municipal roads projects:

☐ 10-14 ☐ 15-19 ☐ 20 or more

IV. How many municipal road project tendering phase have you participated in?

☐ None ☐ 3 and less ☐ 4-6 ☐ 7-10 ☐ 10 or more

Section B: The proposed framework

Kindly find below the proposed framework. Read it carefully to answer the next section questions:

Q1: Concentrate here

represents attributes of high importance while the current performance levels are relatively low, indicating that efforts should be concentrated here to make performance improvements. Therefore, the attributes in this quadrant are considered problematic for municipalities and require immediate attention for enhancing contractors participation in future tenders.

1 The provision of technical advice to tackle bidders problems in e-procurement

2 Standardize tenders evaluation criteria

3 The provision of training and development sessions to understand tenders evaluation criteria and their weighting score

4 Publishing the contractors classification criteria and their weighting scores

5 Determine the allowed classification to bid in any tender announcement

6 The presence of an updated local municipal roads specifications guidebook

7 A standardized bid documents' contents, based on the approved international standard

8 Accurate and detailed terms and technical specifications for the required works

Q2: Keep up the good work

represents attributes were perceived to be very important to contractors, and at the same time were rated as having a high level of performance. Quality of service is the key driver of customer satisfaction. Thus, municipalities must keep up the good work.

9 The provision of objective contractors classification criteria

10 A clear and neutral local code for municipal road project specifications

Q3: Lower priority

represents attributes with both low importance and performance scores. Indicating that there is not an issue and the poor performance will not be considered as a priority, as these attributes are relatively unimportant. The performance level should be improved if there are no often attributes in the Q1.

11 The presence of a cost estimation benchmark book

12 the presence of tenders evaluation criteria based on socio-economic objectives give small firms opportunities to share in the market

Q4: Possible over kill

attributes in this quadrant are relatively unimportant to the contractors though the performance level is high. indicating that municipalities expended too much effort compared to what was actually needed.

13 The presence of certified costs engineers

13 The imposition of e-bidding in Government Tendering and Procurement Law

15 The reasonable time frame to submit bids

Section C: The framework evaluation

I. How do you rate the clarity of this framework?

☐ Very clear ☐ Somewhat clear ☐ Neither clear or unclear ☐ Somewhat unclear ☐ Very Unclear

If the answer is earthier neither clear or unclear , Somewhat unclear, or very Unclear at, what do you want to add/modify to improve the framework clarity?

II. How do you rate the completeness of this framework?

☐ Very completed ☐ Somewhat completed ☐ Neither complete or incomplete ☐ Somewhat incomplete ☐ Very Incomplete

If the answer is earthier neither complete or incomplete , Somewhat incomplete, or Incomplete at all, what do you want to add/modify to improve the framework completeness?

III. How do you rate the conciseness of this framework?

☐ Very concise ☐ Somewhat concise ☐ Uncertain ☐ Somewhat not concise ☐ Not concise at all

If the answer is earthier Uncertain, Somewhat not concise, or Not concise at all, what do you want to add/modify to improve the framework conciseness?

I. How do you agree with the correctness of this framework?

☐ Highly agree ☐ Somewhat agree ☐ Neither agree or disagree ☐ Somewhat disagree ☐ Strongly disagree

If the answer is earthier Uncertain, Somewhat disagree, or Disagree at all, kindly rate below your agreement with the priorities guidance of the proposed framework:

1 Highly agree	2 Somewhat agree	3 Neither agree or disagree	4 Somewhat disagree	5 Strongly disagree

		1	2	3	4	5
Q1: Concentrate here						
represents attributes of high importance while the current performance levels are relatively low, indicating that efforts should be concentrated here to make performance improvements. Therefore, the attributes in this quadrant are considered problematic for municipalities and require immediate attention for enhancing contractors participation in future tenders.						
1	The provision of technical advice to tackle bidders problems in e-procurement	☐	☐	☐	☐	☐
2	Standardize tenders evaluation criteria	☐	☐	☐	☐	☐
3	The provision of training and development sessions to understand tenders evaluation criteria and their weighting score	☐	☐	☐	☐	☐
4	Publishing the contractors classification criteria and their weighting scores	☐	☐	☐	☐	☐
5	Determine the allowed classification to bid in any tender announcement	☐	☐	☐	☐	☐
6	The presence of an updated local municipal roads specifications guidebook	☐	☐	☐	☐	☐
7	A standardized bid documents' contents, based on the approved international standard	☐	☐	☐	☐	☐
8	Accurate and detailed terms and technical specifications for the required works	☐	☐	☐	☐	☐
Q2: Keep up the good work						
represents attributes were perceived to be very important to contractors, and at the same time were rated as having a high level of performance. Quality of service is the key driver of customer satisfaction. Thus, municipalities must keep up the good work.						
9	The provision of objective contractors classification criteria	☐	☐	☐	☐	☐
10	A clear and neutral local code for municipal road project specifications	☐	☐	☐	☐	☐
Q3: Lower priority						
represents attributes with both low importance and performance scores. Indicating that there is not an issue and the poor performance will not be considered as a priority, as these attributes are relatively unimportant. The performance level should be improved if there are no often attributes in the Q1.						
11	The presence of a cost estimation benchmark book	☐	☐	☐	☐	☐
12	the presence of tenders evaluation criteria based on socio-economic objectives give small firms opportunities to share in the market	☐	☐	☐	☐	☐
Q4: Possible over kill						
attributes in this quadrant are relatively unimportant to the contractors though the performance level is high. indicating that municipalities expended too much effort compared to what was actually needed.						
13	The presence of certified costs engineers	☐	☐	☐	☐	☐
14	The imposition of e-bidding in Government Tendering and Procurement Law	☐	☐	☐	☐	☐
15	The reasonable time frame to submit bids	☐	☐	☐	☐	☐

Thank you for your time in completing the first round of the survey

Appendix (D-4) The ethical application form

OFFICE USE ONLY
UEC
//14
Paper

Ethics Application Form

Please answer all questions

1. Title of the investigation

Compliance and the public procurement process: exploiting Nudge Theory principals in the case of Contracting Firms within municipal road projects in Saudi Arabia

Please state the title on the PIS and Consent Form, if different:

2. Chief Investigator (must be at least a Grade 7 member of staff or equivalent)

Name: Dr. Andrew Aqapiou
☐ Professor
☐ Reader
☒ Senior Lecturer
☐ Lecturer
☐ Senior Teaching Fellow
☐ Teaching Fellow
Department: Architecture
Telephone: 0141 548 3067
E-mail: andrew.agapiou@strath.ac.uk

3. Other Strathclyde investigator(s)

Name: Nawaf Hasan Alahmadi
Status (e.g. lecturer, post-/undergraduate): PhD student
Department: architecture
Telephone: 07522725178
E-mail: nawaf.alahmadi@strath.ac.uk

4. Non-Strathclyde collaborating investigator(s) (where applicable)

Name:
Status (e.g. lecturer, post-/undergraduate):
Department/Institution:
If student(s), name of supervisor:
Telephone:
E-mail:
Please provide details for all investigators involved in the study:

5. Overseas Supervisor(s) (where applicable)

Name(s):
Status:
Department/Institution:
Telephone:
Email:
I can confirm that the local supervisor has obtained a copy of the Code of Practice: Yes ☐ No ☐
Please provide details for all supervisors involved in the study:

6. Location of the investigation

At what place(s) will the investigation be conducted
Saudi Arabia

If this is not on University of Strathclyde premises, how have you satisfied yourself that adequate Health and Safety arrangements are in place to prevent injury or harm?
very satisfied

7. Duration of the investigation

Duration(years/months) : 1 month

Start date (expected): 15 / 06 / 2017 Completion date (expected): 14 / 07 / 2017

8. Sponsor

Please note that this is not the funder; refer to Section C and Annexes 1 and 3 of the Code of Practice for a definition and the key responsibilities of the sponsor.

Will the sponsor be the University of Strathclyde: Yes ☐ No ☒
If not, please specify who is the sponsor: Saudi National Anti-Corruption Commission

9. Funding body or proposed funding body (if applicable)

Name of funding body:
Status of proposal – if seeking funding (please click appropriate box):
☐ In preparation
☐ Submitted
☐ Accepted
Date of submission of proposal: / / Date of start of funding: / /

10. Ethical issues

Describe the main ethical issues and how you propose to address them:
The main ethical issue pertaining to the study is privacy of responses. every effort will be made to protect the privacy of the participants. Two ways of protecting privacy are through confidentiality and anonymity. data will be anonymised by using questionnaire code numbers instead of asking participants to identify their names. Data will be destroyed by the end of PhD study.

11. Objectives of investigation (including the academic rationale and justification for the investigation)
Please use plain English.

The purpose of this survey is to provide the opportunity for various stakeholders in municipal roads projects market to provide feedback on what they see about the proposed framework.

12. Participants

Please detail the nature of the participants:
Municipal Roads Projects' stakeholders who pass 10 years of experince in this field
Summarise the number and age (range) of each group of participants:
Number: 10 - 15 Age (range) 35 and above
Please detail any inclusion/exclusion criteria and any further screening procedures to be used:

13. Nature of the participants
Please note that investigations governed by the Code of Practice that involve any of the types of participants listed in B1(b) must be submitted to the University Ethics Committee (UEC) rather than DEC/SEC for approval.

Do any of the participants fall into a category listed in Section B1(b) (participant considerations) applicable in this investigation?: Yes ☐ No ☒
If yes, please detail which category (and submit this application to the UEC):

14. Method of recruitment

Describe the method of recruitment (see section B4 of the Code of Practice), providing information on any payments, expenses or other incentives.

Recruitment method(s): Participants will be recruited into one of two stakeholder groups:

1. Engineers who registered in the Saudi Council of Engineers with experience in the field of municipal roads projects.
2. Contractors who classified by Contractors classification Agency in the field of municipal roads project.

The recruitment method will be employed for both groups is an invitation email sent to a coordinator in each body who will farrowed the invitation to their lists.

15. Participant consent

Please state the groups from whom consent/assent will be sought (please refer to the Guidance Document).
The PIS and Consent Form(s) to be used should be attached to this application form.
Participant consent will be taken electronically by clicking the accpte to participate button after the PIS

16. Methodology

Investigations governed by the Code of Practice which involve any of the types of projects listed in B1(a) must be submitted to the University Ethics Committee rather than DEC/SEC for approval.

Are any of the categories mentioned in the Code of Practice Section B1(a) (project considerations) applicable in this investigation? ☐ Yes ☒ No
If 'yes' please detail:

Describe the research methodology and procedure, providing a timeline of activities where possible. Please use plain English.
Describe the method of recruitment (see section B4 of the Code of Practice), providing information on any payments, expenses or other incentives.

The design of this phase will be primarily a Delphi survey with carefully selected expert/major stakeholders from the local municipal roads projects market. This technique does not require that participants to meet face-to-face.

The Delphi survey will involve three rounds of questionnaires, which will be sent via email to each expert. Round1 will present the prosed framework and include specific questions on the framework's clarity, completeness, correctness, and conciseness. Round 2 will be developed from the participant's responses in Round1. Input will be in the form of numerical rating and written comments. In Round3 experts will have the opportunity to review the summary result s of Round2 and modify or maintain their ratings from Round2 in an attempt to achieve consensus.

Due to nature of the study, just Round1 questionnaire will be attached with this application form while the next two questionnaires will be developed based on the results of Round1, and the sequential elements of the Delphi study itself, therefore Round2 and Round3 questionnaires are not currently available to append to this application form.

What specific techniques will be employed and what exactly is asked of the participants? Please identify any non-validated scale or measure and include any scale and measures charts as an Appendix to this application. Please include questionnaires, interview schedules or any other non-standardised method of data collection as appendices to this application.

Where an independent reviewer is not used, then the UEC, DEC or SEC reserves the right to scrutinise the methodology. Has this methodology been subject to independent scrutiny? Yes ☐ No ☒
If yes, please provide the name and contact details of the independent reviewer:

17. Previous experience of the investigator(s) with the procedures involved. Experience should demonstrate an ability to carry out the proposed research in accordance with the written methodology.

The researcher previously carried out questionnaires as well as interviews.

18. Data collection, storage and security

How and where are data handled? Please specify whether it will be fully anonymous (i.e. the identity unknown even to the researchers) or pseudo-anonymised (i.e. the raw data is anonymised and given a code name, with the key for code names being stored in a separate location from the raw data) - if neither please justify.
Data will be handled via Qualtrics

Explain how and where it will be stored, who has access to it, how long it will be stored and whether it will be securely destroyed after use:
Data will be stored @ university's server will be destroyed by the end of PhD study

Will anyone other than the named investigators have access to the data? Yes ☐ No ☒
If 'yes' please explain:

19. Potential risks or hazards

Describe the potential risks and hazards associated with the investigation:
None

Has a specific Risk Assessment been completed for the research in accordance with the University's Risk Management Framework (Risk Management Framework)? Yes ☐ No ☐
If yes, please attach risk form (S20) to your ethics application. If 'no', please explain why not:

20. What method will you use to communicate the outcomes and any additional relevant details of the study to the participants?

None

21. How will the outcomes of the study be disseminated (e.g. will you seek to publish the results and, if relevant, how will you protect the identities of your participants in said dissemination)?

publish the results on academic journal and include them on PhD thesis

Checklist	Enclosed	N/A
Participant Information Sheet(s)	☒	☐
Consent Form(s)	☒	☐
Sample questionnaire(s)	☐	☒
Sample interview format(s)	☐	☒
Sample advertisement(s)	☐	☒
Any other documents (please specify below)		
Stage-1's questionnaire of the Delphi survey	☒	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐

22. Chief Investigator and Head of Department Declaration
Please note that unsigned applications will not be accepted and both signatures are required

I have read the University's Code of Practice on Investigations involving Human Beings and have completed this application accordingly. By signing below, I acknowledge that I am aware of and accept my responsibilities as Chief Investigator under Clauses 3.11 – 3.13 of the Research Governance Framework and that this investigation cannot proceed before all approvals required have been obtained.

Signature of Chief Investigator	Andrew Agapiou
Please also type name here:	Dr. Andrew Aqapiou

I confirm I have read this application, I am happy that the study is consistent with departmental strategy, that the staff and/or students involved have the appropriate expertise to undertake the study and that adequate arrangements are in place to supervise any students that might be acting as investigators, that the study has access to the resources needed to conduct the proposed research successfully, and that there are no other departmental-specific issues relating to the study of which I am aware.

Signature of Head of Department	
Please also type name here	Professor Ashraf M. Salama
Date:	5 / 6 / 2017

23. Only for University sponsored projects under the remit of the DEC/SEC, with no external funding and no NHS involvement

Head of Department statement on Sponsorship
This application requires the University to sponsor the investigation. This is done by the Head of Department for all DEC applications with exception of those that are externally funded and those which are connected to the NHS (those exceptions should be submitted to R&KES). I am aware of the implications of University sponsorship of the investigation and have assessed this investigation with respect to sponsorship and management risk. As this particular investigation is within the remit of the DEC and has no external funding and no NHS involvement, I agree on behalf of the University that the University is the appropriate sponsor of the investigation and there are no management risks posed by the investigation.

If not applicable, tick here ☐

Signature of Head of Department	
Please also type name here	Professor Ashraf M. Salama
Date:	5 / 6 / 2017

For applications to the University Ethics Committee, the completed form should be sent to ethics@strath.ac.uk with the relevant electronic signatures.

24. Insurance
The questionnaire below must be completed and included in your submission to the UEC/DEC/SEC:

Is the proposed research an investigation or series of investigations conducted on any person for a Medicinal Purpose? Medicinal Purpose means: ▪ treating or preventing disease or diagnosing disease or ▪ ascertaining the existence degree of or extent of a physiological condition or ▪ assisting with or altering in any way the process of conception or ▪ investigating or participating in methods of contraception or ▪ inducing anaesthesia or ▪ otherwise preventing or interfering with the normal operation of a physiological function or ▪ altering the administration of prescribed medication.	Yes / No

If "**Yes**" please go to **Section A (Clinical Trials)** – all questions must be completed
If "**No**" please go to **Section B (Public Liability)** – all questions must be completed

Section A (Clinical Trials)

Does the proposed research involve subjects who are either: i. under the age of 5 years at the time of the trial; ii. known to be pregnant at the time of the trial	Yes / No

*If "**Yes**" the UEC should refer to Finance*

Is the proposed research limited to: iii. Questionnaires, interviews, psychological activity including CBT; iv. Venepuncture (withdrawal of blood); v. Muscle biopsy; vi. Measurements or monitoring of physiological processes including scanning; vii. Collections of body secretions by non-invasive methods; viii. Intake of foods or nutrients or variation of diet (excluding administration of drugs).	Yes / No

*If "**No**" the UEC should refer to Finance*

Will the proposed research take place within the UK?	Yes / No

*If "**No**" the UEC should refer to Finance*

Title of Research	
Chief Investigator	
Sponsoring Organisation	

Does the proposed research involve:	
a) investigating or participating in methods of contraception?	Yes / No
b) assisting with or altering the process of conception?	Yes / No
c) the use of drugs?	Yes / No
d) the use of surgery (other than biopsy)?	Yes / No
e) genetic engineering?	Yes / No
f) participants under 5 years of age(other than activities i-vi above)?	Yes / No
g) participants known to be pregnant (other than activities i-vi above)?	Yes / No
h) pharmaceutical product/appliance designed or manufactured by the institution?	Yes / No
i) work outside the United Kingdom?	Yes / No

If "**YES**" to **any** of the questions a-i please also complete the **Employee Activity Form** (attached).
If "**YES**" to **any** of the questions a-i, and this is a follow-on phase, please provide details of SUSARs on a separate sheet.
*If "**Yes**" to any of the questions a-i then the UEC/DEC/SEC should refer to Finance (aileen.stevenson@strath.ac.uk).*

Section B (Public Liability)	
Does the proposed research involve :	
a) aircraft or any aerial device	Yes / No
b) hovercraft or any water borne craft	Yes / No
c) ionising radiation	Yes / No
d) asbestos	Yes / No
e) participants under 5 years of age	Yes / No
f) participants known to be pregnant	Yes / No
g) pharmaceutical product/appliance designed or manufactured by the institution?	Yes / No
h) work outside the United Kingdom?	Yes / No

*If "**YES**" to any of the questions the UEC/DEC/SEC should refer to Finance(aileen.stevenson@strath.ac.uk).*

For NHS applications only - Employee Activity Form

Has NHS Indemnity been provided?	Yes / No
Are Medical Practitioners involved in the project?	Yes / No
If YES, will Medical Practitioners be covered by the MDU or other body?	Yes / No

This section aims to identify the staff involved, their employment contract and the extent of their involvement in the research (in some cases it may be more appropriate to refer to a group of persons rather than individuals).

Chief Investigator		
Name	**Employer**	**NHS Honorary Contract?**
		Yes / No
Others		
Name	**Employer**	**NHS Honorary Contract?**
Nawaf Hasan Alahmadi	University of Strathclyde	Yes / No
		Yes / No
		Yes / No
		Yes / No

Please provide any further relevant information here:

E. Published papers:

Appendix (E-1) COBRA 2016 – Toronto, Canada

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INDICATORS AND INCIDENTS OF POTENTIAL COLLUSION AMONG MAIN CONTRACTING FIRMS IN MUNICIPAL ROAD NETWORK PROJECTS: THE SAUDI ARABIAN CONTEXT

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ABSTRACT

The development of legal and regulatory instruments to address suspected collusive practices in the Saudi Arabian public works sector will hasten the demand for baseline evidence on the extent of illicit behaviour among bidders. Currently, there is scant knowledge and little empirical analysis of the scope and scale of such uncompetitive practices in the Saudi Arabian construction industry. This paper aims to establish the indicators and incidents of potential bid rigging in the Saudi Arabian public works sector through a two-step historical analysis of bidding data. This analysis examines market concentration metrics and measures of the volatility of bidders' prices during tender bid submissions for municipal road network projects over the past five years in three main municipalities of the country. The preliminary results of the two-stage analysis indicate evidence for collusion among bidders in the less-populated, geographically dispersed regions of the country, which are under less government control, oversight, and supervision than the more populous, central regions of the Kingdom. This analysis provides market intelligence to enable further investigations into potential collusion among contracting firms in the future.

Keywords: bid rigging, collusion, corruption, public procurement, Saudi Arabia.

INTRODUCTION

The public construction works industry is currently considered a key driver of the Saudi Arabian economy, with total government expenditure over the last decade exceeding $400 billion (Ministry of Finance, 2014), and in 2014 it comprised 5.47% of the enational GDP (CDSI, 2014). However, Bowen, Edwards, and Cattell (2013), Osei-Tutu, Badu, and Owusu-Manu (2010), and Kenny (2007), have revealed that construction activities are prone to corrupt practices, particularly in relation to the procurement of projects in developing market economies.

Among other collusive practices, bid rigging in public works procurement has emerged as a key target for national and international competition watchdogs. The Office of Fair Trading (OFT) in the UK noted a drop in prices of the order of 30% after OFT action against hard-core cartels. Two potential victims of anticompetitive behaviour by bidding companies in public tendering are the contracting authority as

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the direct purchased and business participants in the tender that choose not to join a cartel (Maci, 2012).

Based on the Competition and Market Authority (CMA, 2014), bid rigging occurs when a group of bidders agree to limit competition in the procurement process, thereby denying a customer a fair price; this involves cover bidding, bid suppression, bid rotation, and market allocation contracts. Recent studies on this practice illustrate the significant economic damage caused by bid rigging, where recurrence, overcharge, and duration are the three most important factors in determining the amount of harm caused by collusion (Huschelrath, 2013). Inefficiency is a negative economic outcome of collusion on the market (Asker, 2010), which consequently increases standard market costs to the monopoly level and creates a non-competitive bidding environment (Zarkada-Fraser and Skitmore, 1998; Huschelrath, 2013).

In the Saudi Arabian context, the Competition Law (2014) aims to protect and encourage fair competition, including public works procurement and compact monopolistic practices that affect lawful competition. This is achieved through an independent council, the Competition Protection Council; however, there has been little empirical analysis of the scope and scale of uncompetitive practices in the Saudi Arabian context. Therefore this paper investigates suspicious bid rigging patterns in the Saudi Arabian construction industry, encompassing municipal road construction and maintenance contracts programmes, and presents some of the core findings of the indicators and incidents of potential collusion among main contracting firms in municipal road network projects.

CONTEXT

Recent studies in the field focus on three main themes: collusion patterns and mechanisms, detection methods, and how to prevent the market. However, this paper aims to identify indicators and incidents of potential collusion in order to underline suspected local bid rigging mechanisms and thereby facilitate the proposed detection methods. Consequently, the literature on bid-rigging mechanisms and detection will be reviewed here.

Heimler (2012) listed several characteristics of cartels that may facilitate collusion mechanisms as follows:

- The agreement among competitors must be secret.
- The objective of the agreement must be to significantly weaken the rivalry among competitors.
- The cartel must operate by raising prices over the normal competitive level and restricting output.

Ishii (2014) described the methods of coordination used by ring members in their bids; either ring members would determine a value called the 'reference price' in a meeting, with the winner assigned to bid below the reference price and the losers assigned to bid above it, or the winner would first decide on his bid and then communicate that bid to other ring members, who would bid above it.

With regard to methods for the detection of collusion, competition authorities can choose from various reactive and proactive methods to detect hard core-cartels (Huschelrath, 2013). To detect bid-rigging, antitrust enforcers can use a leniency

program, which is currently the most effective reactive means and instrument; however, collusion in public construction works is less affected by such programmes (Chotibhonhs & Arditi, 2013). Several recent studies have utilised a proactive method based upon evidence of bid rotation agreements, which can be found by collecting data across bids, although the generation of such information can be difficult. Porter and Zona (1993) proposed a regression model to investigate abnormalities for state highway construction contracts, and in the same context, Pesendorfer (2000) investigated differences in cost structures, whilst Bajari and Ye (2003) used a regression model to predict collusion in highway contracts by considering bid independency and exchangeability. Chotibhongs and Arditi (2012) proposed statistical tests to permit owners to identify suspected cartel bidders given sufficient historical bidding data. They confirmed that bids by potential cartel bidders cluster more densely than those by non-cartel bidders, because cartel bidders try to regulate and control the competitive bidding environment by forcing other bidders to bid higher, but not too much higher, than their offer. In a related context, Suntharanurak (2012) analysed the structure of the rural road market by measuring market concentration using the Herfindahl-Hirschman Index (HHI), and found that an increased number of bidders could reduce the opportunities for collusion in the procurement market.

Most researchers have reflected upon the difficulty of using a single tool to detect potential collusion practices. However, as bidding procedures regularly create the necessary information for behavioural evaluations, bid-rigging practices are amenable to the application of screening tools (Huschelrath, 2013). An in-depth behavioural study of suspicious industries is the second of two steps in a screening method that aims to collect evidence for real-world collusion (Huschelrath, 2009).

METHODOLOGY

The above literature review has revealed a lack of empirical analysis of the Saudi Arabian public construction industry and the scope of suspected collusion. In this paper, we propose a model for conducting the second step of a screening process that establishes the indicators and incidents of potential bid rigging in the Saudi Arabian public works sector. The intention is to explore the market structure of the local municipal roads construction market, and thereby to facilitate future detection of collusive bidding by competition authorities. On the recommendation of Kashiwagi (2015), which stipulates that a deductive logic based approach and mixed methods should be used to identify research data and reach a conclusion, a deductive logic approach has been implemented in this research. We consider local municipal road network projects because of the high rate of recurrent contracts, a lack of product differentiation, and the stable demand in local procurement practices, which are considered significant factors in motivating bidders to collude. Suspicious forms of bid rigging, such as market allocation, bid suppression, and bid rotation, are all investigated.

Municipal road projects are administered by 16 Kingdom-wide major municipalities, with each comprising many sub-municipalities of major cities and affiliated smaller towns. The Ministry of Finance provides financing for these projects according to the municipality budget, which is approved annually. Local municipal road projects in Saudi Arabia fall into four categories:

- Asphalting and paving roads, and lighting.

- Improving and beautifying entrances and roundabouts.
- Construction of bridges and tunnels.
- Restoration of older roads.

The Ministry of Municipalities separates contractors for roads projects into five classes, each of which has a contractual financial limit that cannot be exceeded (Table 1). This includes the consideration of contractor capabilities and technical possibilities, which include management and technical expertise, equipment, and performance on previous projects. Likewise, they evaluate the financial status of each contractor, including their budget, profit and loss account, cash flow, and sources of funding.

Contractor Class	Contract Financial Limit Saudi Arabian Riyal (million)
Class A	>420
Class B	420
Class C	140
Class D	42
Class E	14
Unclassified	4.4

Table 1: Classification of municipal roads contractors (Ministry of Municipalities)

The purpose of this study is to establish the indicators and incidents of potential collusion within this market. A two-step historical analysis of tender bid submission patterns, encompassing municipal road construction and maintenance contracts, is adopted. Due to the time limitations for data collection, a convenience sampling strategy is employed whereby three municipalities are selected from all the municipalities in Saudi Arabia. In order that these municipalities remain anonymous, the phonetic alphabet coding system has been adopted to identify each of them.

Municipality	Population (million)	Geographic	Municipal Road Contracts	
			Number	Value Saudi Arabian Riyal (billion)
Alpha	1.77	Mountainous terrain	102	3.01
Beta	1.06	Desert area	111	2.08
Gamma	4.03	Coastal area	114	4.67

Table 2: Characteristics of the selected municipalities

An oligopoly is considered one of the outcomes of collusion (Doree, 2004), and is similar to the goal of some market mergers. Therefore, we measured the market concentration index (HHI) of our sample, which includes 320 contracts, in order to identify in which contracts collusion is likely. The HHI is a primary concentration measure which is utilised as a part of the antitrust examination, and is calculated as the sum of the squared market shares of all market participants. The United States Department of Justice Agencies consider markets with an HHI under 1500 points to be non-concentrated, markets with an HHI between 1,500 and 2,500 points to be moderately concentrated, and markets with an HHI above 2,500 points to be highly concentrated (US Department of Justice, 2010). Consequently, the size of the monopolist class will be examined, as Heimler (2012) observed that the number of

players in a collusion agreement is almost never higher than ten and is very often lower than five. In this study, we assume that there is a collusion agreement between the same class of contractors in order to reduce the level of competition and to increase the barriers to entering the market.

In the second step the participation rate will be analysed for the suspected markets before measuring the volatility of the bidder prices for the market controlled by a small number of players. Volatility of bidder prices is computed as the standard deviation of the percentage change in the offers' prices. It is reasonable to expect a reduction in price volatilities after the effective execution of a bid rigging scheme (Huschelrath, 2013). If the participation rate reduces bidding variation, then this is an indication of successful collusion (Fraser and Skitmore, 2000). This detection method has been utilised by the Swiss Competition Commission. Unlike other detection methods, both the HHI and price volatility do not need disclosed collusion cases to be utilised, which makes them suitable for the available Saudi Arabian road contracts data, which has never revealed any cases of collusion within the public procurement market. Hence, we will obtain an in-depth understanding of the composition and features of suspected collusion, and consequently be able to develop indicators and incidents of potential collusion practices among the main contracting firms bidding for municipal road network projects.

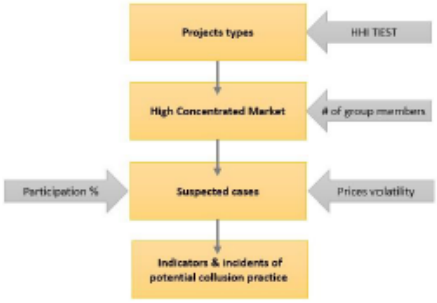

Figure 1: Proposed model to investigate collusion in public procurement

An eight-digit coding system has been implemented to identify contractors in this research. The first three digits identify the location of a contractor's headquarters, while the middle two digits identify a contractor's class, and the last three digits represent a contractor's number on the Ministry of Municipalities list.

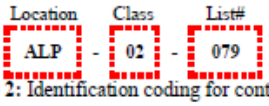

Figure 2: Identification coding for contractors

DISCUSSION

Alpha Municipality

This domain includes a major city, which has a population of 1 million, and an urban area of 15,159.3 hectares, as well as two large towns and various villages with populations not exceeding 100,000. Mountainous terrain is the distinguishing feature of this municipality. High values for the market concentration index (HHI) were found for the municipal road projects in this municipality (Table 3).

Project Type	Local					Outer					HHI
	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th	5th	
Asphalting	0.0	36.7	20.4	34.7	8.2	0.0	0.0	0.0	0.0	0.0	3061.23
Bridges	40.0	10.0	0.0	5.0	0.0	40.0	0.0	0.0	0.0	5.0	3375.00
Restoration	5.3	26.3	31.6	10.5	21.1	5.3	0.0	0.0	0.0	0.0	2324.17
Roundabouts	0.0	22.2	0.0	66.7	0.0	0.00	0.0	0.0	0.0	11.1	5086.73

Table 3: HHI test results for the Alpha municipality

Local second-class contractors shared 36.73% of the asphalting, paving, and lighting projects in this municipality, whilst local fourth-class contractors shared 34.96% of these projects. First-class local contractors shared 40.00% of ongoing bridge and tunnel projects, and 66.67% of town entrances and roundabout projects were shared by local fourth-class contractors.

Table 4 shows the group sizes of each contractor class in the Alpha municipality. On the basis of this table, we excluded local fourth-class contractors from further investigations because this group contains a very high number of members (73), which would make coordination among them difficult and inhibit the collusion mechanisms described in the literature review. We also excluded the 5th class for the same reason.

Classification	1st class	2nd class	3rd class	4th class	5th class
Members	6	10	19	73	121

Table 4: Classification sizes of the Alpha contractor groups

The volatility of prices for asphalting projects shared by local second-class contractors is lower than for those shared by the other classes (Figure 3).

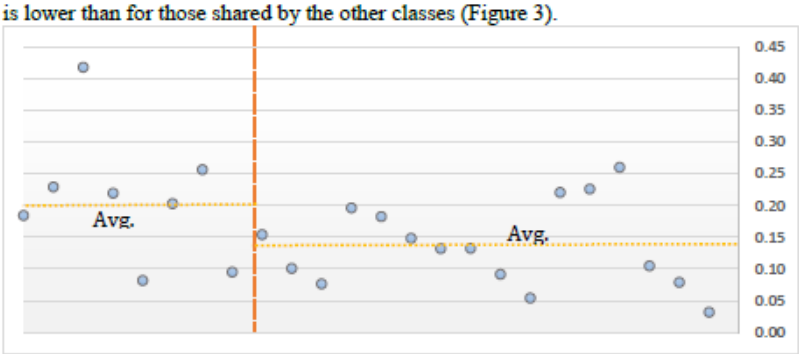

Figure 3: Price volatility of asphalting projects in the Alpha Municipality

The average number of contractors participating in these bids exceeds six; however, only three of the local second-class contractors participated in all of the bids. The fourth- and fifth-class contractors (194 in total) generally did not participate, although the majority of the projects were available to them. Among the local second-class contractors bidding, Contractor ALP-02-006 achieved a bidding success rate of 100% for projects sited outside the major city, but did not succeed in any projects within the city. Meanwhile, Contractor ALP-02-002 achieved a success rate of 81.81% for projects sited within the major city and did not win any projects in towns and villages. This suggests the possibility of bid rigging among the group of local second-class contractors to monopolise asphalt, paving, and lighting municipal road projects using the market allocation form. With respect to bridge and tunnel projects, price volatility

was slightly higher (0.23), and Contractor ALP-01-001 was the only local first-class participant in all of the tenders, achieving a success rate of 100%. Therefore, this does not indicate probable collusion among the local first-class contractors.

Beta Municipality

This municipality includes a major city and number of smaller towns, which together have a population of 1.06 million. An analysis of the market concentration index (HHI) for municipal road projects in this municipality (Table 5) shows high HHIs in some project types.

Project Types	Local					Outer					HHI
	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th	5th	
Asphalting	0.0	12.2	31.7	14.6	0.0	9.8	9.8	17.1	4.9	0.0	1873.9
Bridges	14.3	0.0	0.0	14.3	0.0	71.4	0.0	0.0	0.0	0.0	5510.2
Restoration	14.3	14.3	28.6	11.4	5.7	2.9	20.0	0.0	2.9	0.0	1804.1
Roundabouts	0.0	5.3	10.5	15.8	52.6	0.0	0.0	0.0	15.8	0.0	3407.2

Table 5: HHI test results for the Beta Municipality

Local third-class contractors shared 31.7% of asphalting, paving, and lighting projects, whilst outer first-class contractors shared 71.4% of ongoing bridge and tunnel projects. Additionally, local fifth-class contractors shared 52.6% of town entrance and roundabout projects. From the group sizes of each contractor class in this municipality (Table 6), we have excluded local fifth-class contractors from further investigations because this group has 107 contractors, making coordination unlikely. Additionally, bridge and tunnel projects shared by the outer first-class group are excluded.

Classification	1st class	2nd class	3rd class	4th class	5th class
Members	13	9	14	68	107

Table 6: Classification sizes of the Beta contractor groups

The price volatility of asphalting projects shared by local second-class contractors was lower than for other asphalting projects (Figure 4).

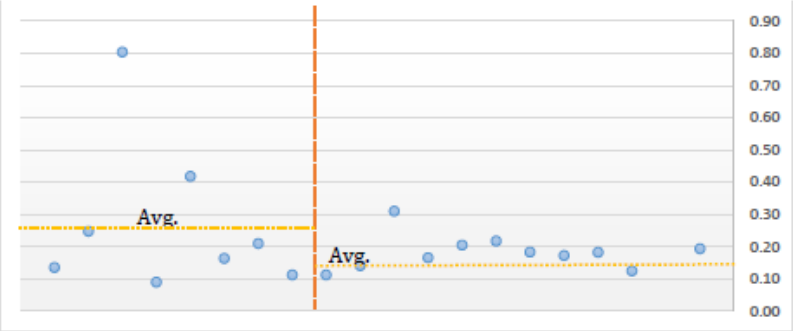

Figure 4: Price volatility of asphalting projects in the Beta Municipality

With regard to rates of participation in bids for these asphalting projects, the average number of participating contractors was five in the main city and three in the smaller towns. Contractor BET-03-001 participated in the majority of these bids, whilst local fourth- and fifth-class contractors (175 in total) did not, despite the availability of the projects; Contractor BET-03-001 subsequently achieved a success rate of 90.7%. Out of the road restoration projects shared by local third-class contractors, Contractor BET-03-008 was awarded 100% of the seven bids in which he participated, whilst Contractor BET-03-001 was awarded three out of the four in which he participated; notably, these two contractors rarely bid against each other.

Gamma Municipality

The Gamma Municipality encompasses a metropolitan city and several small coastal towns. As with the other municipalities examined, the market concentration index (HHI) for municipal road projects is high for some project types (Table 7).

Project types	Local					Outer					HHI
	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th	5th	
Asphalting	25.6	18.6	27.9	7.0	7.0	9.3	0.0	2.3	2.3	0.0	1974.04
Bridges	39.1	0.0	0.0	8.7	0.0	43.5	0.0	0.0	4.3	4.3	3534.97
Restoration	20.0	15.0	10.0	20.0	20.0	0.0	5.0	5.0	5.0	0.0	1600.00
Roundabouts	35.7	0.0	21.4	35.7	7.1	0.0	0.0	0.0	0.0	0.0	3061.22

Table 7: HHI test results for the Gamma Municipality

Local first-class contractors shared 39.1%, and outer first-class contractors shared 43.5% of bridge and tunnel projects. In addition, local first-class contractors shared 35.7% of ongoing town entrance and roundabout projects. This region contains six local first-class contractors, but only three were awarded contracts. Contractors GAM-01-004, GAM-01-005, and GAM-01-006 did not compete against each other. Contractor GAM-01-004 achieved a success rate of 46.2% for bridge and tunnel projects within the metropolitan city, and faced competition from some international contractors, whilst Contractor GAM-01-006 achieved a success rate of 100% for bridge and tunnel projects outside the metropolitan city. Meanwhile, Contractor GAM-01-005 achieved a 100% success rate for town entrance and roundabout projects. The price volatility of bridge and tunnel contracts awarded by the first-class contractors within the metropolitan city was higher than the price volatility for the same contracts outside the metropolitan city. However, the rate of participation in bids for contracts outside the metropolitan city was less than three.

CONCLUSIONS

The aim of the paper was to ascertain the indicators and incidents of potential bid rigging in the Saudi Arabian municipal road development sector through incorporating a deductive, two-step historical analysis of bidding data. The analysis has examined market concentration metrics and measures of the volatility of bidders' prices in tender bid submissions for municipal road network development projects, encompassing Saudi Arabia's three main administrative regions over a five-year period. This research has demonstrated a scarcity of local fourth- and fifth-class participation in bidding, despite the availability of the project value limits. Moreover, industry participation in the bidding rate overwhelmingly decreased among projects in small

towns and villages. Consequently, some top-class contractors won a suspiciously high proportion of these contracts, most of which were for asphalting, paving, and lighting projects. This suggests that these contractors may have applied the market allocation approach by employing the bid suppression concept, which is indicated by the low rate of participation in tenders. As already mentioned in the literature review, price volatility can be utilised to detect bid rotation, but is inadequate for the detection of bid suppression with a low rate of participation in tenders. Due to data collection time limitations this paper has presented the analysis outcomes of 320 contracts from the selected municipalities over the past 5 years, consequently further investigations needs to be conducted for other municipalities as part of the process of verification.

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