Department of Marketing

Open Innovation Adoption from Strategy to Practice: Implications from Organizational Ambidexterity and Dynamic Capabilities

by

Lu Huang

A thesis presented in fulfilment of the requirements

for the degree of Doctor of Philosophy

2019

Copyright Statement

Signed:

Date:

Acknowledgement

When I was admitted as a PhD with a full scholarship in University of Strathclyde, the feeling was like winning a sweepstake. It is a luxury for me to spend my best years of life at a place I like and to pursue something of interest and value. The title of PhD is interesting: 'philosophy' makes me wise and 'doctor' earns me respect. I'm grateful for my supervisors, the Department of marketing, the University of Strathclyde and the Scotland, who afford me the opportunity to be here. Embedding all my thankfulness in every effort of my research, I'm more than happy that my findings can help make a difference to the advancement of innovation in Scotland.

First and foremost, I would like to extend all my thanks to my supervisor Professor Beverly Wagner. Nothing can happen without her. She instructs as a teacher, guides as a mentor as well as cares like a mother along the journey. I appreciate the opportunity to follow the Scottish Enterprise Open Innovation Project, which allows me to learn with the cohort companies and some smartest scholars. The biggest lesson has been: it is alright to explore and make mistakes, but learn the lesson and keep moving forward. I would also like to thank Professor Anne Marie Doherty for her constructive feedback and Dr Nusa Fain for her support.

Besides, I am thankful for colleagues and administrative staffs at the Department of Marketing for their help. Hundreds of gratitude goes to the interviewees, for offering great insights on the topic of understanding. There are some more people that I want to thank, such as my first English teacher, my former boss, my friends, to name but a few. Lastly, thousands of thanks is owed to my family. Nothing compares to their unconditional love. They are listening, understanding, supporting and encouraging at all times. They remind me of my origin and existence as well as shape my 'to be or not to be' in the future. Every kindness, big or small, is valued and remembered for life!

Abstract

Innovation has long been considered critical to firm success. As one major topic of innovation, open innovation attracts increasing scholarly attention by offering a practical paradigm to organize open ways of innovation. Open innovation accommodates diverse collaborative innovation processes accompanying knowledge exchange at multiple levels within and outside the organization. However, excessive attention on the knowledge exchange aspect of open innovation eclipses the opportunity to investigate organization-level strategic deployment of open innovation. The aim of research is set to explore *'How to adopt open innovation from strategy to practice?'* Drawing on concepts of organizational ambidexterity and dynamic capabilities, strategic and structured adoption of open innovation is shown to follow the logic from strategy to practice: organizational ambidexterity as strategy, open innovation as practices and dynamic capabilities as the bridge in between.

To investigate how the logic works, this research conceives the organization as an organism and systematically applies qualitative business research strategy. Abductive reasoning is adopted to facilitate interation between theory and data. Finding and discussion provide empirical evidences to elaborate the logic of open innovation adoption from strategy to practice: 1) strategy and practice, 2) capability and process and 3) from strategy to process through capability. Organizational evolutaion is additiaonlly discussed. This research boasts triple-fold contributions. Theoretically, the original integration of the three concepts addresses the gap of organization-level strategic adoption of open innovation. Methodologically, the adoption of the metaphor of organism offers insightful understanding of organizational reality. Practically, the open innovation adoption framework offers a viable guidance to manage structured adoption of open innovation in the real-world context.

Table of Contents

Copyright statement ii

Aknowledgement iii

Abstract iv

Chapter 1 Introduction 1

1.0 Chapter overview 1

1.1 Theoretical background 1

1.2 Research aim and questions 4

1.3 Research approach 5

1.4 Contribution 6

1.5 Summary and thesis outline 9

Chapter 2 Literature Review 12

2.0 Chapter overview 12

2.1 Open innovation 14

2.1.1 The concept of open innovation 15

2.1.2 Directions of knowledge flow 19

2.1.3 Levels of analysis 24

2.1.4 Open innovation, strategy and business model 29

2.1.5 (Open) innovation process 35

2.1.6 Summary 46

2.2 Dynamic capabilities 49

2.2.1 The concept of dynamic capabilities 49

2.2.2 Dynamic capabilities as higher-order capabilities 52

2.2.3 Current categories of dynamic capabilities 53

2.2.4 Architecture of dynamic capabilities 67

2.2.5 Summary 68

2.3 Organizational ambidexterity 70

2.3.1 The concept of organizational ambidexterity 71

2.3.2 Modes of balancing 73

2.3.3 Alternative ways to deconstruct ambidexterity 75

2.3.4 Additional practices of ambidexterity 81

2.3.5 Logic of organizational ambidexterity 82

2.3.6 Summary ... *84*
2.4 Theoretical integration ... 86
2.4.1 Theoretical origins ... *86*
2.4.2 Theoretical framework ... *90*
2.4.3 Integration of dynamic capabilities and supportive micro-foundations ... *94*
2.4.4 Research aim and questions ... *113*
Chapter 3 Methodology ... 116
3.0 Chapter overview ... 116
3.1 Research aim and research design ... 117
3.1.1 Research aim and questions revisited ... *117*
3.1.2 Research philosophy ... *119*
3.1.3 Research strategy ... *122*
3.2 Research context ... 124
3.3 Data collection ... 128
3.3.1 Methods of data collection ... *129*
3.3.2 Semi-structured interview with interview guide ... *132*
3.3.3 Documents ... *146*
3.4 Data analysis and display ... 150
3.5 Summary and evaluation ... 156
Chapter 4 Finding and Discussion ... 159
4.0 Chapter overview ... 159
4.1 Open innovation and organizational ambidexterity ... 161
4.1.1 Open innovation ... *161*
4.1.1.1 The scene and perception of open innovation ... 162
4.1.1.2 Open innovation activities ... 167
4.1.2 Organizational ambidexterity ... *175*
4.1.2.1 The paradox of organizational ambidexterity ... 176
4.1.2.2 Current balancing actions ... 180
4.1.3 Role of open innovation in organizational ambidexterity ... *184*
4.1.4 Summary ... *188*
4.2 Dynamic capabilities and open innovation activities ... 195
4.2.1 Strategy and leadership ... *195*
4.2.1.1 Vision and strategy ... 196
4.2.1.2 Senior management ... 200

4.2.2 Culture and communication ... *203*
4.2.2.1 General culture for innovation ... 203
4.2.2.2 Entrepreneurial risk-taking ... 206
4.2.2.3 Organizational intelligence ... 209
4.2.2.4 Communication ... 211
4.2.2.5 Capabilities of people ... 216
4.2.3 Innovation process ... *219*
4.2.3.1 General innovation process ... 219
4.2.3.2 Open innovation process ... 222
4.2.3.3 Process integration of open innovation ... 227
4.2.4 Structure and governance ... *230*
4.2.4.1 Organizational structure ... 231
4.2.4.2 Systems and intermediaries ... 233
4.2.4.3 Governance ... 237
4.2.4.4 Infrastructure ... 240
4.2.5 Summary ... *241*
4.3 Orchestrate the logic of open innovation adoption ... 254
4.4 Organizational evolution and (biological metaphor) ... 258
Chapter 5 Conclusion ... 264
5.0 Chapter overview ... 264
5.1 Reflection on theoretical elaboration ... 264
5.2 Reflection on research approach ... 268
5.3 Answers and contributions ... 270
5.3.1 Open innovation and organizational ambidexterity ... *270*
5.3.2 Open innovation and dynamic capabilities ... *272*
5.3.3 Logic orchestration from strategy to practice ... *274*
5.3.4 Relevance of organizational evolution ... *276*
5.4 Limitation and future research ... 276
5.5 Summary ... 282
References ... 287
Appendices ... 308
Appendix 1: Participant information sheet ... 308

List of Tables

Table 2-1: Index of Literature 13

Table 2-2: Components and underlying processes of absorptive capacity for OI (Excerpt from Zobel, 2017, p. 272) 22

Table 2-3: Mechanisms within archetypes (Summarized from Chesbrough and Bogers, 2014 and Stanko et al, 2017) 23

Table 2-4: Typologies of levels of analysis 25

Table 2-5: Levels of analysis, research objects, perspectives and emerging themes (Excerpt from Bogers et al, 2017, p. 12, 23-24) 26

Table 2-6: Overview of the categories in the excel tool and the spider web analysis (Enkel et al, 2011, p. 1176) 32

Table 2-7: A contingency framework for open innovation models (Saebi and Foss, 2015, p. 211) 34

Table 2-8: Brief description of stages and gates (Summarized from Phillips, 2018b) 38

Table 2-9: Summary of interventions and generative mechanisms by temporal category (Ellwood et al, 2017, p. 519) 43

Table 2-10: Nine elements for agile execution (Summarized from Cooper and Sommer, 2016, p. 171-174) 44

Table 2-11: Summary of literature on open innovation 47

Table 2-12: Typologies of categories of dynamic capabilities 55

Table 2-13: Typologies of dynamic capabilities for (open) innovation 61

Table 2-14: Summary of literature on dynamic capabilities 70

Table 2-15: A multi-level categorization of ambidexterity mechanisms (Turner et al, 2013, p. 322) 76

Table 2-16: Managerial practices of dynamic ambidexterity (Summarized from Chen, 2017) 77

Table 2-17: Higher-order capabilities for the three modes of adaptation (Summarized from Birkinshaw et al, 2016) 79

Table 2-18: Levels where dynamic capabilities are held (Excerpt from Birkinshaw et al, 2016, p. 55) 81

Table 2-19: Summary of literature on organizational ambidexterity 85

Table 2-20: Coverage of emergent dynamic capabilities in existing typologies 95

Table 2-21: Planning for growth (Summarized from Baghai et al, 1999) 96

Table 2-22: Dynamic capabilities on strategy and leadership 98

Table 2-23: Dynamic capabilities on culture and communication 102

Table 2-24: Dynamic capabilities on innovation process 106

Table 2-25: Dynamic capabilities on structure and governance 111
Table 2-26: Linking research questions to literature 114
Table 3-1: Philosophical assumptions and metaphors of organizations (Morgan and Smircich, 1980; Morgan, 2006; Cunliffe, 2011) 120
Table 3-2: Metaphor adoption of the three concepts 121
Table 3-3: Quantitative and qualitative methods (Excerpt from Creswell, 2014, p. 17) .. 124
Table 3-4: Cohort meeting planning of the SE project (Annual review, 2016) 126
Table 3-5: Qualitative data collection types, options, advantages and limitations (Creswell, 2014, p. 191-192) 130
Table 3-6: Variations in interview instrumentation (Patton, 2002, p. 349) 134
Table 3-7: Theory-based interview guide 138
Table 3-8: Profile of interviewees and schedule of interviews 142
Table 3-9: List of documents in this research 148
Table 3-10: Deduction, induction and abduction: from reason to research (Saunders et al, 2016, p. 145) 151
Table 3-11: Approaches of qualitative data analysis 152
Table 3-12: Thematic framework around the concept of 'organizational ambidexterity' 154
Table 3-13: Key decisions within each step of research 157
Table 4-1: Index of findings in relation to research questions and literature 159
Table 4-2: Parallel tools of innovation intermediary and internal collaboration (Summarized from Lee and Shin, 2017, p. 28-30) 169
Table 4-3: Open innovation activities in the research context 170
Table 4-4: Key findings and relevant literature of Section 4.1.1 189
Table 4-5: Key findings and relevant literature of Section 4.1.2 190
Table 4-6: Key findings and relevant literature of Section 4.1.3 192
Table 4-7: Collaborative-based HRM practices and open innovation (Excerpt from Hong et al, 2018, p. 16) 202
Table 4-8: Management roles and underlying activities (Excerpt from Ollila and Yström, 2017, p. 246) 218
Table 4-9: Key findings, additional insights and relevant literature in Section 4.2.1 242
Table 4-10: Key findings, additional insights and relevant literature in Section 4.2.2 244
Table 4-11: Key findings, additional insights and relevant literature in Section 4.2.3 247
Table 4-12: Key findings, additional insights and relevant literature in Section 4.2.4 249
Table 5-1: Metaphors of organization (Summarized from Morgan, 2006) 278
Table 5-2: Dictionary meaning of words to describe practice level of understanding (Oxford English Dictionary, 2019) 281

List of Figures

Figure 2-1: Typology of inbound open innovation strategies (Saebi and Foss, 2015, p. 206) 35
Figure 2-2: Interactive model of innovation (Trott, 2012, p. 24) 36
Figure 2-3: The open innovation model (Chesbrough and Bogers, 2014, p. 18) 37
Figure 2-4: Idea-to-launch Stage-Gate® (Phillips, 2018b, p. 44) 38
Figure 2-5: The integrated Agile-Stage-Gate Hybrid model (Cooper and Sommer, 2016, p. 169) 42
Figure 2-6: Scalable stage-gate system (Phillips, 2018b, p. 45) 42
Figure 2-7: Overlapping edges of the three concepts 91
Figure 2-8: Theoretical framework 93
Figure 2-9: DIY guide for running sprint (Knapp et al, 2016, p. 17) 105
Figure 2-10: The integrated theoretical framework 114
Figure 3-1: An outline of the main steps of qualitative research (Bryman and Bell, 2015, p. 395) 117
Figure 4-1: Fail fast and take the leap (Company D – Meeting material of open innovation programme, p. 9) 167
Figure 4-2: Visual of stakeholders (Company reporting of open innovation programme cohort meeting 9, 2018, p. 10) 174
Figure 4-3: Innovation partnerships (Company C – OI presentation, p. 12) 175
Figure 4-4: Building the vision: select the principles (Company reporting of open innovation programme cohort meeting 9, 2018, p. 11) 204
Figure 4-5: Levers to support entrepreneurial culture (Enkel, 2018a, p. 16) 205
Figure 4-6: Company E's innovation process (Company E – Divisional innovation strategy, 2018, p. 26) 221
Figure 4-7: The InnoCentive@Work process (InnoCentive@Work, 2018, p. 2) 224
Figure 4-8: Building the how: Detailing the process and prioritizing innovation tools (Company reporting of open innovation programme cohort meeting 9, 2018, p. 15) 226
Figure 4-9: Our product ecosystem (Solverboard, 2018b) 237
Figure 4-10: Open innovation adoption from strategy to practice 256
Figure 4-11: Characteristics of proactive strategy archetypes of innovation management (Bader and Enkel, 2014, p. 175) 258

Chapter 1 Introduction

1.0 Chapter overview

The aim of the research is to explore *'How to adopt open innovation from strategy to practice?'* The logic of open innovation adoption is completed by drawing upon organizational ambidexterity as the strategic orientation and dynamic capabilities as the structured guidance. This chapter starts with theoretical background and demonstrates theoretical elaboration, thereof the research aim and questions are formulated. To address the research aim and questions, coherent adoption of research methods is considered. Next, contributions to address the research aim and questions are noted. Finally, a chapter summary is provided, followed by the structure of the thesis.

1.1 Theoretical background

Innovation has long been regarded as the engine of growth, macro-level economy and micro-level firm success alike (Trott, 2012). With benefits of lower costs, faster commercialization and risk-sharing (Chesbrough, 2006a), open innovation as one major topic in the field of innovation attracts increasing scholarly attention (Antons et al, 2016; Bogers et al, 2017). **Open innovation** envelops distributed innovation processes accompanying outside-in, inside-out and coupled directions of knowledge flow (Gassmann and Enkel, 2004; Enkel et al, 2009; Chesbrough and Bogers, 2014), which occurs at multiple levels within and outside the organization, namely intra-organizational, organizational, inter-organizational, extra-organizational as well as in wider context of industry, regional innovation system and society (Chesbrough and Bogers, 2014; Bogers et al, 2017). Compared with deconstruction for understanding, this research prioritizes integration of open innovation processes for business purposes. Different directions of knowledge flow are combined (West and Bogers, 2014) and cross-level adoption is considered (Chesbrough and Bogers, 2014; Bogers et al, 2017; Gupta et al, 2007).

To grasp the more general opportunity of organization-level adoption (Bogers et al, 2017), gaps of investigation of practical mechanisms (Stanko et al, 2017), strategic adoption (Vanhaverbeke and Cloodt, 2014) and missing guidance of management (Gassman et al, 2010; Huizingh, 2011) are aligned.

As a potential guidance of open innovation management (Gassman et al, 2010; Huizingh, 2011), the concept of dynamic capabilities is drawn upon to enlighten coherent adoption (Vanhaverbeke and Cloodt, 2014). **Dynamic capabilities** are dynamic firm-level capabilities with subsets of micro-foundations, which help firms respond to dynamic environment (Teece, 1997). The mainstream way to deconstruct micro-foundations of dynamic capabilities is along organizational processes of sensing, seizing, transforming (Teece, 2007; Day and Schoemaker, 2016). Open innovation is embedded in processes of sensing, seizing and transforming, more implicit than explicit (Teece, 2007; Day and Schoemaker, 2016). Oversight of culture and bottom-up micro-foundations are major weaknesses of such deconstruction (Teece, 2007; Hosseini et al, 2017). The weakness is overcome by alternative categorization of dynamic capabilities according to themes of relevance, which may or may not follow the processes of knowledge learning (e.g. Verona and Ravasi, 2003; Anand et al, 2009). Similarly, dynamic (open) innovation capabilities can be deconstructed into themed categories (Lawson and Samson, 2001; O'Connor, 2008; Slater et al, 2014; Hosseini et al, 2017). To demonstrate the logic of deconstruction, open innovation capabilities are put into categories of strategic alignment, governance, methods, information technology, people and culture (Hosseini et al, 2017). Such categorizations are used to assist analysis rather than impose consensus (Lawson and Samson, 2001).

Dynamic capabilities are only capable of coordinating actions around strategic intent, with the presence of a good strategy (Teece, 2014). Similarly in open innovation studies, the connection between strategy and open innovation is

regarded as a central topic (Vanhaverbeke and Cloodt, 2014). Considering organizational ambidexterity is enabled by micro-foundations of dynamic capabilities (Teece, 2007; O'Reilly and Tushman, 2013) and processes of open innovation (Lavie and Rosenkopf, 2006; Lavie et al, 2010; Raisch et al, 2009), this research sets organizational ambidexterity as the targeted strategic paradox to resolve. **Organizational ambidexterity** targets at managing the strategic paradox of exploration and exploitation to survive both mature and new markets through the development of organizational capabilities (Benner and Tushman, 2003; O'Reilly and Tushman, 2008; O'Reilly III and Tushman, 2013; Benner and Tushman, 2015). Three modes of balancing are the dominant way to articulate viable solutions with respective micro-foundations, namely sequential, structural and contextual ambidexterity (O'Reilly III and Tushman, 2013; Benner and Tushman, 2015). However, each mode is a necessary but insufficient means to achieve the end of organizational ambidexterity (Kauppila, 2010; Chen, 2017). An alternative way to deconstruct micro-foundations of organizational ambidexterity is to categorize by themes of relevance similar to dynamic capabilities (e.g. Birkinshaw et al, 2016; Chen, 2017). For example, dynamic capabilities to render organizational ambidexterity consist of vision, culture and people management (Birkinshaw et al, 2016).

As is shown above, all three concepts are associated with micro-foundations of adoption: open innovation as distributed innovation processes (Chesbrough and Bogers, 2014), dynamic capabilities with subsets of micro-foundations (Teece, 2007; Day and Schoemaker, 2016) and organizational ambidexterity resulting from explorative and exploitative activities (Benner and Tushman, 2003; Trott, 2012). Besides, recent bibliographic reviews of all three concepts acknowledge the potential linkages between each other: 1) organizational ambidexterity and dynamic capabilities as research streams heavily utilized with most-cited articles of open innovation (Randhawa et al, 2016), 2) dynamic capabilities as the most central cluster and open innovation as context to study organizational

ambidexterity (Wilden et al, 2018), and 3) organizational ambidexterity as potential strategy and open innovation as context in the field of dynamic capabilities (Wilden et al, 2016). Despite the recognition of the linkages (Randhawa et al, 2016; Wilden et al, 2016; Wilden et al, 2018), the three concepts have not yet been formally and effectively explored as an integrated system. The opportunity of systematic investigation of the three concepts as a whole paves the way for this research.

1.2 Research aim and questions

Answering to the call of systematic investigation, the three concepts are integrated by applying the logic from strategy to practice. Organizational ambidexterity is set as the strategic challenge of organizations to balance exploration and exploitation (Benner and Tushman, 2003; O'Reilly III and Tushman, 2013; Benner and Tushman, 2015). Translating abstract strategic intent into actionable details (Teece, 2014), dynamic capabilities provide organization-level capabilities with subsets of social and behavioural micro-foundations (Teece, 2007; Day and Schoemaker, 2016). Open innovation provides rich micro-foundations as supportive micro-foundations of dynamic capabilities, constituting innovation processes accompanying different directions of knowledge flow at multiple levels within and outside the organization (Chesbrough and Bogers, 2014; Bogers et al, 2017).

Therefore, structured open innovation adoption can be achieved following the logic from strategy to practice: organizational ambidexterity as strategy, open innovation as micro-foundations, and dynamic capabilities as the bridge in between. Emphasis is put on how the logic applies from higher-level strategy all the way down to lower-level micro-foundations through medium-level capabilities. The asking of how the logic applies in general comprises the major focus of this research. The ***aim of research*** is expressed as *'How to adopt open*

innovation from strategy to practice?' Under the over-arching aim of research, three research questions are further designed to capture delicate interactions among the three concepts.

RQ1: *What is the relationship between ambidextrous strategy and open innovation?*

This question intends to tentatively link open innovation to ambidextrous orientation of the organization. Open innovation is going to be explicitly and/or implicitly link to strategic planning and implementation of organizational ambidexterity.

RQ2: *What are open innovation related processes under categories of dynamic capabilities?*

This question thoroughly explores categories of dynamic capabilities with open innovation related micro-foundations to support strategic implementation. The framework of dynamic capabilities facilitates the integration of micro-foundations of all three concepts.

RQ3: *How does ambidextrous strategy facilitate structured open innovation adoption through dynamic capabilities?*

This question captures the logic from strategy to practice: organizational ambidexterity as strategic orientation, open innovation as practice and dynamic capabilities as the bridge in between. A practical way is revealed to structurally adopt open innovation.

1.3 Research approach

The research approach is designed to suffice the research aim to explore details of how to adopt open innovation from strategy to practice: organizational ambidexterity as strategy, open innovation as micro-foundations, and dynamic

capabilities as the bridge in between. Philosophically, this research conceives the image of organization as an organism – an open system with processes responding to environment (Morgan, 2006), which confirms the exploration side of organizational ambidexterity while challenges the dominant metaphor of brain in open innovation and dynamic capabilities emphasizing knowledge learning. To scope out details of reality as process under the metaphor of organism (Morgan and Smircich, 1980; Cunliffe, 2011), qualitative research methods with emphasis on richness of data that reveals the complex real-world context are applied (Miles et al, 2014; Bryman, 2008; Bryman and Bell, 2015).

Main steps of qualitative business research are followed to ensure systemic adoption of methods (Bryman and Bell, 2015). After the justification of research aim and questions, relevant research context is selected: large Scottish companies involved in the project of 'Open Innovation Programme: Monitoring and Evaluation Framework'. Two main methods are used in data collection: interviews and documents. Semi-structured interview is applied to focus attention and allow leeway to probe (Saunders et al, 2009; Bryman, 2008; Bryman and Bell, 2015). An interview guide is employed to tie the answers of interviewees to the theoretical framing and the capturing of emergent insight at the same time. Sampling and ethical issues are demonstrated as well. Another type of data is documents, which provide comparative and contextual data to help answer the research questions (Saunders et al, 2009). In data analysis, abduction serves as the line of reasoning and thematic analysis as the process. Overall validity, reliability and limitation are discussed additionally.

1.4 Contribution

This research brings about several contributions to theory, method and practice. First and foremost, theoretical contributions are described in short narratives in accordance with research aim and questions. The general **aim of research** – *'How*

to adopt open innovation from strategy to practice?' intends to grasp the opportunity of organization-level adoption of open innovation (Bogers et al, 2017), through investigating strategic adoption of open innovation (Vanhaverbeke and Cloodt, 2014). The concepts of organizational ambidexterity and dynamic capabilities are drawn upon to generate insight (Vanhaverbeke and Cloodt, 2014; Randhawa et al, 2016).

RQ1: *What is the relationship between ambidextrous strategy and open innovation?*

Linkages between open innovation and organizational ambidexterity are made, implicit and explicit. The strategic paradox of organizational ambidexterity is addressed in the context of open innovation (Gupta et al, 2006; Bogers et al, 2017). Concrete evidences are captured to confirm that organizational ambidexterity can be achieved within and across organizational boundaries (Lavie and Rosenkopf, 2006; Lavie et al, 2010; Raisch et al, 2009).

RQ2: *What are open innovation related processes under categories of dynamic capabilities?*

Answering this research question, open innovation is explicitly embedded as micro-foundations in categories of dynamic capabilities, compared with more implicit linkages documented in current literature (Teece, 2007; Day and Schoemaker, 2016). The concept of dynamic capabilities is shown to be a useful guidance to professionally manage open innovation (Gassman et al, 2010; Huizingh, 2011) and investigate practical mechanisms of open innovation (Stanko et al, 2017). Dynamic capabilities provide potential to combine directions of knowledge flow (West and Bogers, 2014) and multiple levels of analysis in open innovation (Chesbrough and Bogers, 2014; Bogers et al, 2017; Gupta et al, 2007), meanwhile representing an alternative to capture explorative and exploitative

activities beyond modes of balancing (Birkinshaw et al, 2016; Chen, 2017). Besides, theme of relevance provides a viable alternative to categorize dynamic capabilities, departing from current categorization following processes of knowledge learning with weaknesses of oversight of culture and bottom-up micro-foundations (Teece, 2007; Hosseini et al, 2017). Therefore, the categorization of themed dynamic capabilities serves as a promising framework to merge and reintegrate micro-foundations of all three concepts.

RQ3: *How does ambidextrous strategy facilitate structured open innovation adoption through dynamic capabilities?*

Acknowledging the relations between open innovation and organizational ambidexterity in RQ1 and open innovation and dynamic capabilities in RQ2, the logic of open innovation from strategy to practice is completed by further considering the enabling role of dynamic capabilities to realize dual orientations of organizational ambidexterity (Teece, 2007; O'Reilly and Tushman, 2013). The logic of open innovation adoption is orchestrated as follows: organizational ambidexterity as strategic orientation, implemented through categories of dynamic capabilities, with supportive micro-foundations of open innovation. The integration of the three concepts in the field of open innovation acknowledges their closed linkages, referring to recent bibliographic reviews of all three concepts (Randhawa et al, 2016; Wilden et al, 2016; Wilden et al, 2018).

Methodologically, the research applies the interesting metaphor of organism to investigate the organizational reality for insight. Practically, the logic from strategy to practice provides a way to manage structured adoption of open innovation. More importantly, the emergent framework of dynamic capabilities with key themes and supporting micro-foundations provides a comprehensive guidance, allowing for organization to choose from various open innovation processes among wider organizational activities to support strategy implementation. The

framework can serve as a diagnostic tool for organizations to consider own requirements as well as to benchmark competitors, regarding development of dynamic capabilities and experimentation of open innovation. Moreover, the framework may be temporarily frozen for coherent adoption, but it is subject to renew, change and restructure in the longer run. Rather than imposing a universal best solution for all, this research proposes the creation of a prototype for organization to consider contextualized adoption contingent on idiosyncratic environments.

1.5 Summary and thesis outline

This chapter (**Chapter 1 Introduction**) briefs theoretical background, research aim and questions, methods adoption as well as contributions, which serves as an index of the following chapters. A simple and clear format is adopted to investigate the complication of the research topic. Indexes and/or summary tables are always presented at the beginning and/or end of each chapter to assist overall understanding and allow for information retrieving to make comparison between chapters. The rest of the thesis is structured into four chapters, namely literature review, methodology, finding and discussion and conclusion. A short summary of each chapter is given as follows.

Chapter 2 Literature review reviews extant literature on all three concepts: open innovation, dynamic capabilities and organizational ambidexterity. Most recent bibliographic reviews are looked at to guarantee the comprehensiveness of coverage as well as to identify gaps of current academic conversation. The boundary of review is the alignment with theoretical perspective of process, coherent with the metaphor of organism. More specifically on content, the nature of each concept is first demonstrated, followed by more relevant arguments on abstraction levels of strategy, capability and practice. In theoretical elaboration, theoretical roots are traced back to position this research within existing bodies of

knowledge and an integrated theoretical framework is put forward to demonstrate the logic from strategy to practice through capability. Research aim and questions are derived accordingly.

Answering to the research aim and questions deeply rooted in literature, **Chapter 3 Methodology** describes aspects of research design. This research philosophically adopts the metaphor of organism to investigate organizational reality and practically follows the steps of qualitative business research to ensure systematic application. Several key decisions along the steps include identification of research context, methods of data collection and tools of data analysis. Alternative options are presented, before final decision is made. Methods adoption are checked against the criteria of validity and reliability concerning qualitative research.

Chapter 4 Finding and discussion highlights the interaction between theory and data. The first three sections are arranged to answer the three research questions. Section 4.1 explores the relationships between organizational ambidexterity and open innovation. Section 4.2 figures out the relationships between dynamic capabilities and open innovation. This section demonstrates the convergence of the three concepts at the level of micro-foundation. Processes of open innovation are shown to support, challenge or complement current micro-foundations of dynamic capabilities that assists strategy implementation. Section 4.3 integrates the three concepts and orchestrates the logic from strategy to practices, thus comprising the main source of managerial implication. In addition, Section 4.4 offers some satellite finding on organizational evolution and (biological metaphor).

Chapter 5 Conclusion closes the thesis by reflecting the whole logic on the way to address the aim of research. Formal answers of the three research questions are given, with theoretical contributions and managerial Implications demonstrated.

Moreover, limitations and recommendations are outlined. To summarize, this research is based on collective wisdom of scholars in the past, focuses on problem-solving at present, but more importantly, attempts to unlock opportunities for the future. Following the structure of research, the next chapter reviews the most relevant literature pertaining to the research aim and questions.

Chapter 2 Literature Review

2.0 Chapter overview

The aim of the research is to reveal "*How to adoption open innovation from strategy to practice?"* To answer the research aim, this chapter draws on literature from three concepts: Section 2.1 Open innovation, Section 2.2 Dynamic capabilities and Section 2.3 Organizational ambidexterity. The three concepts form the backbones to construct the theoretical framework. Open innovation is explored to set the scene, and practices of open innovation are audited as micro-foundations to support strategy implementation. The combination of dynamic capabilities and organizational ambidexterity is posed as the potential solution to address the strategic challenge of open innovation. Dynamic capabilities serve as the structure to organize organizational practices, and organizational ambidexterity as the targeted strategic problem. Section 2.4 demonstrates theoretical elaboration. The origins of the three concepts are traced back to show the position of this research within wider academic context. More importantly, a theoretical framework is put forward to inform open innovation adoption from strategy to practice: organizational ambidexterity as strategy, open innovation as practices, and dynamic capabilities as medium-level structure in between.

The process perspective sets the boundary of literature review, which is coherent with philosophical considerations to view the organization as organism, as is described the methodology chapter. All three concepts converge on their potential to be deconstructed into processes. The criterion to include or exclude a particular article is determined by its relevance to processes/practices/activities/actions/micro-foundations. Literature of the three concepts are arranged in categories of strategy, capability, practice and outcome. Table 2-1 provides an index to trace the relevant topics under each concept, with additional information in format of *grey*. Besides, a table is provided at the

summary section of each concept to facilitate holistic understanding regarding key themes and theoretical gaps.

Table 2-1: Index of Literature

	Open innovation	Dynamic capabilities	Organizational ambidexterity
Strategy	2.1.4 Open innovation, strategy and business model	*In support of strategic management.*	2.3.1 The concept of organizational ambidexterity
Capability	2.1.4 Open innovation, strategy and business model *Implied as design elements of business model.* 2.2.3 Current categories of dynamic capabilities	2.2.1 The concept of dynamic capabilities 2.2.2 Dynamic capabilities as higher-order capabilities 2.2.3 Current categories of dynamic capabilities	2.3.2 Modes of balancing 2.3.3 Alternative ways to deconstruct ambidexterity *Implied as alternative categorizations.*
Practice/ process/ activity/ action/ micro-foundation	2.1.1 The concept of open innovation 2.1.2 Directions of knowledge flow 2.1.3 Levels of analysis 2.1.5 (Open) innovation process 2.2.3 Current categories of dynamic capabilities *Thoroughly illustrated with respective micro-foundations.*	2.2.3 Current categories of dynamic capabilities *Thoroughly illustrated with respective micro-foundations.*	2.3.2 Modes of balancing 2.3.3 Alternative ways to deconstruct ambidexterity *Thoroughly illustrated with respective micro-foundations.* 2.3.4 Additional practices of ambidexterity
Outcome	N/A*: Outcomes are expressed as innovations themselves, instead of organizational evolution.*	2.2.4 Architecture of dynamic capabilities *In relation to organizational evolution.*	2.3.5 Logic of organizational ambidexterity *In relation to organizational evolution.*

Further guidance on format and logic:

- Key concepts and terms are highlighted in **bold**.
- Generally, the logic of argument is provided ***from general to specific*** as well as ***from mainstream to alternatives*** of most relevance to this research.

2.1 Open innovation

Innovation has long been considered as the engine of growth, which is observed in cyclic waves of economic growth accelerated by technological progress (macro view) as well as firm success achieved by managing knowledge and capabilities to develop new products (micro view) (Trott, 2012). In the context of organization, innovation is concerned with the management of all the activities in the process of idea generation, technology development and commercial exploitation of new/improved products/services or process or systems of operation for organizational growth (Trott, 2012). Considering increasing environmental uncertainty characterized by freer flow of skilled workforce, rising venture capital market, increased market opportunities for shelved ideas, more capable universities, as well as the globalized economy, the logic of innovation itself requires innovating: from closed to open (Chesbrough, 2003; Chesbrough and Bogers, 2014).

Open innovation suggests companies make greater use of external knowledge through opening up their business models to allow for more free inflow and outflow of knowledge, for benefits of lower costs for innovation, faster time to market and the chance to share risks with others (Chesbrough, 2006a). According to the most recent bibliographic review on innovation research in *Journal of Product Innovation Management*, open innovation is included as one major topic under the trajectory of "Codevelopment and Alliances" witnessing the steepest increase in scientific impact, and the trajectory of "Cross-cutting themes" represents one hottest body of knowledge on the rise (Antons et al, 2016, p. 740-741). This research looks to link open innovation to some other trajectories: "Strategy, Planning and Decision-making" "People, Teams, and Culture" and "Process, Execution and Metrics", which are more prevalent and longstanding bodies of knowledge along the evolution of innovation research (Antons et al, 2016, p. 741-742).

Understanding the role of open innovation within wider innovation, this section on open innovation starts with tracing the evolution of the concept of open innovation and clarifying its nature. Processes of open innovation are then deconstructed according to directions of knowledge flow (Gassmann and Enkel, 2004) and levels of analysis (Bogers et al, 2017). Emphasis on external knowledge sourcing (R&D alliances and technology partnerships) eclipses the opportunity for strategic deployment of practices of open innovation (Vanhaverbeke and Cloodt, 2014; Randhawa et al, 2016). Therefore, it is important to link open innovation to higher-level organizational strategy, business model and capabilities to support structured implementation. (Open) innovation process is next discussed as an enabler of adoption, which potentially constitutes one emergent category of dynamic capabilities. A summary of theoretical elaboration is provided in the end.

2.1.1 The concept of open innovation

Open innovation was first coined as "a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology" (Chesbrough, 2003, p. xxiv). The argument was based on evidences from large innovative companies (Chesbrough, 2003; Chesbrough, 2006b). The definition remains the most commonly used to date (Dahlander and Gann, 2010; Stanko et al, 2017; Tynnhammar, 2017). Open innovation requires companies to understand the permeability of firm boundaries, that is, to open up the funnel of product innovation to embrace smart people, best ideas, and IP from within and outside the organization (Chesbrough, 2003). Openness is observed in terms of inflow and outflow of knowledge as well as alternative paths to market (Chesbrough, 2003; Chesbrough, 2006a; Chesbrough, 2006b). Two traditional schools of innovation are brought together: 1) resource-based view that focuses on firms' resources, capabilities and skills to achieve competitive advantage, and 2) market-based view

which emphasizes the ability to capitalize on opportunities in the marketplace (Trott, 2012).

Since Chesbrough's (2003) original conceptualization, open innovation has evolved to take on multiple meanings (Chesbrough, 2012). Different perspectives with respective re-definitions are observed (Gassmann et al, 2010; Gianiodis et al, 2010; Tynnhammar, 2017). For example, some adopt an organizational learning perspective, emphasizing knowledge flow enabled by processes with partners (Gassmann and Enkel, 2004; Lichtenthaler, 2008). Others take transactional cost economics perspective, focusing on difference of monetary or non-monetary logic of exchange (Dahlander and Gann, 2010). Alternatively, some studies consider open innovation from a user perspective, more specifically, the involvement of users in innovation (von Hippel, 2005). Examples above are not intended to be exhaustive, but to show many research areas have emerged by departing from the original funnel view of product innovation (Gassmann et al, 2010). Besides, research contexts have spread from high-tech to low-tech industries as well as from large companies to SMEs (Gassmann et al, 2010). These examples are given to show the opportunity to contextualize definitions to answer different research objectives.

To integrate more elements and more recent conceptualizations of open innovation, Chesbrough and Bogers (2014, p. 17) renew the definition of **open innovation** as "distributed innovation processes based on purposely managed knowledge flows across organizational boundaries, using pecuniary or non-pecuniary mechanisms in line with the organization's business model." The definition is beneficial in terms of taking into consideration different directions of knowledge flow, different types of innovation, as well as the business model as integrator of innovation process (Chesbrough and Bogers, 2014). Knowledge flow takes place in two directions: leveraging external knowledge through internal processes as well as commercialize internal knowledge through external

commercialization (Chesbrough and Bogers, 2014). As the result of open knowledge flow, outputs of innovation can include new or improved products, processes, or services (Chesbrough and Bogers, 2014). More importantly, business model integrates distributed innovation processes into organization-wide value creation and capture (Chesbrough and Bogers, 2014). Open innovation is thus recognized as a means to help attain organizational goals (Chesbrough and Crowther, 2006), which implies the gap to explore linkages between open innovation and organizational strategy.

All the definitions converge on 'collaboration', with different emphasis on knowledge flow (what) and/or collaborators (who) and /or business model (how) (Tynnhammar, 2017). Some emphasize directions of knowledge flow along the innovation process as the content of collaboration, which are outside-in, inside-out or coupled (Gassmann and Enkel, 2004; Dahlander and Gann, 2010). Some emphasize the diversity of partners, which may involve customers, suppliers, research institutions, competitors as well as foreign organizations (Greco et al, 2015). Others argue for the establishment of open business models to channel distributed innovation processes into architectures and systems for coherent adoption (Chesbrough, 2006a; Chesbrough, 2006b). Open innovation thus involves cross-boundary knowledge sharing with diverse partners along the innovation processes as part of the business model (Tynnhammar, 2017). In this way, scattered open innovation processes are coordinated by higher-order businesses models for more systematic adoption.

The business model perspective confirms another congruent theme of open innovation: 'firm-centric approach to innovation' (Randhawa et al, 2016; Stanko et al, 2017). Strategic deployment and business model management are gaps to pursue at the organizational level (Vanhaverbeke and Cloodt, 2014; Randhawa et al, 2016). Open innovation can drive either incremental adjustment or radical change of an organization. As firms look to adopt open innovation, they can layer

practices of open innovation onto existing processes rather than create new ones (Chesbrough and Crowther, 2006; Huizingh, 2011). For more transformative change, firms need to look for disruption, experiment alternatives, get quick success and seek scale-up by business model adjustment (Chesbrough, 2006a). Open innovation would finally turn from 'business as unusual' to 'business as usual' (Huizingh, 2011). The future of open innovation witnesses increasingly extensive collaboration, engaging with various partners (Chesbrough, 2012). Thus, Chesbrough (2012) suggests organizations should engage in collaborative exchanges with, and extend open innovation practices to, participants from a wider network in order to build innovation capabilities.

Open innovation is criticized for claiming open innovation as an absolute truth to overcome limitations of closed innovation, which considers open and closed models of innovation as mutually exclusive alternatives faced by firms (Trott and Hartmann, 2009). Without claiming the absence of open elements within existing research, open innovation is positioned as a novel synthesis of previous disparate points to facilitate insights in managing innovation (Chesbrough and Bogers, 2014; Stanko et al, 2017; Gassmann et al, 2010; Huizingh, 2011). Traditional logic of innovation holds that research and development are tightly coupled and internally focused along the funnel of product development (Chesbrough, 2003). Rather than denying the funnel view of innovation, open innovation extends the view by formally encompassing different directions of knowledge flow across organizational boundaries (Gassmann and Enkel, 2004) as well as highlighting downstream commercialization in addition to upstream R&D (Bogers and Lhuillery, 2011). The emphasis is put on the holistic consideration of all activities along the innovation funnel from start to finish for value creation and capture (Chesbrough, 2006a; West and Bogers, 2014; Chesbrough and Bogers, 2014). Recognizing the existence of both closed and open innovation activities, open innovation proposes coherent managing activities to increase the openness of current innovation for the purpose of value generation.

To further clarify the nature of open innovation, it is not a paradigm in the scientific sense (Tynnhammar, 2017). Paradigms are models of scientific practices (exemplar observation and experiments) with shared rules and standards that are applied in a given scientific field (Kuhn, 1962). In other words, legitimate problems and methods of a research field should be defined within paradigms (Kuhn, 1962). Neither legitimate problems nor methods adoption are clearly formulated in the field of open innovation. The concept of open innovation needs further developing (Bogers et al, 2017), thus legitimate problems for investigation are still yet to be formed. And there has been no consensus on methods adoption (detailed in Section 3.1.3). Chesbrough and Bogers' (2014) argument of open innovation as a scientific paradigm is thus not supported. Although open innovation is not a scientific paradigm, it could be a practical paradigm that accommodates open ways of organizing innovation (Chesbrough, 2012; Tynnhammar, 2017). Investigation of practical mechanisms that are absent from academic research has been suggested (Stanko et al, 2017). The following sections provide an overview of mechanisms of open innovation within existing literature.

2.1.2 Directions of knowledge flow

There are two mainstream ways to deconstruct distributed open innovation processes in existing literature, which are directions of knowledge flow (Gassmann and Enkel, 2004; Enkel et al, 2009; Chesbrough and Bogers, 2014) and levels of analysis (Bogers et al, 2017). Directions of knowledge flow are more concerned with processes accompanying knowledge flow (Gassmann and Enkel, 2004; Enkel et al, 2009; Chesbrough and Bogers, 2014), while levels of analysis emphasize auditing theoretical perspectives across multiple levels of organization (Bogers et al, 2017). This section deals with the deconstruction by directions of knowledge flow, while the next section addresses levels of analysis. Three archetypes of open innovation processes have been identified, namely outside-in, inside-out and coupled (Gassmann and Enkel, 2004; Enkel et al, 2009; Chesbrough

and Bogers, 2014). These processes help to separate the locus of knowledge creation, innovation, and commercialization in open innovation research (Gassmann and Enkel, 2004; Enkel et al, 2009). Details are then given on meaning and mechanisms of three types of open innovation.

Outside-in open innovation is concerned with opening up the innovation process to allow the inflow of external partners contribution to enrich a company's knowledge base (Gassmann and Enkel, 2004; Enkel et al, 2009; Chesbrough and Bogers, 2014). Exemplar processes can be sourcing external ideas and knowledge or acquiring innovative solution already in market (Dahlander and Gann, 2010). West and Bogers (2014) come up with a process model for outside-in innovation by systematic literature review, which consists of a linear process of obtaining, integrating, and commercializing with interactive paths between collaborators. The model is a good way to integrate findings on the management of external sources of innovation, but weakness lies in its deliberate underestimation of perspectives of business models, competencies, and culture which are important concerns in integration and commercialization (West and Bogers, 2014).

External knowledge search has been particularly emphasized. Based on the assumption that not all smart people work in a single organization, external search is important for a company to win competition (Chesbrough, 2003). Sources of search can be suppliers, users, research institutions, and competitors (West and Bogers, 2014). Collaboration can be as narrow as several lead users but as wide as community or solution providers of many (Bogers et al, 2017). Thus, a firm needs to make decisions on where to search for knowledge and with whom to collaborate. Besides, firms need to make decision on breadth and depth of knowledge search (Laursen and Salter, 2006). Breadth is "the number of external sources or search channels that firms rely upon in their innovative activities"; while depth is "the extent to which firms draw deeply from the different external sources or search channels" (Laursen and Salter, 2006, p. 134-135). The two

search strategies help to understand how many partners to innovate with and how much collaboration to expect. Then processes governing knowledge management are revealed by the concept of absorptive capacity.

Absorptive capacity lies at the heart of outside-in open innovation (Vanhaverbeke and Cloodt, 2014), from a knowledge management perspective (Grant, 1996). Absorptive capacity refers to “a firm’s ability to recognize the value of new information, assimilate it, and apply it to commercial ends” (Cohen and Levinthal, 1990, p. 128). Following knowledge evolution cycle (Zollo and Winter, 2002), the knowledge processes are described as knowledge exploration, knowledge retention and knowledge exploitation (Lichtenthaler and Lichtenthaler, 2009; Lichtenthaler, 2011). The traditional absorptive capacity is extended to include the formal choice between internal and external along the knowledge management processes, which results in six firm-level knowledge capacities: inventive capacity, transformative capacity, innovative capacity, absorptive capacity, connective capacity and desorptive capacity (Lichtenthaler and Lichtenthaler, 2009; Lichtenthaler, 2011). Besides, organization-level mechanisms are believed to be enablers of absorptive capacity (Lichtenthaler and Lichtenthaler, 2009; Zobel, 2017). Zobel (2017) summarizes the underlying processes that facilitate components of absorptive capacity for open innovation, as is shown in Table 2-2.

Table 2-2: Components and underlying processes of absorptive capacity for OI

(Excerpt from Zobel, 2017, p. 272)

Original Components of Absorptive Capacity	Underlying Processes of Absorptive Capacity
Recognition: the capacity to explore, identify, and value external knowledge	1) **External scanning**: Broad external monitoring of emerging partners, technologies, and markets 2) **Strategic assessment**: organizational activities involved in evaluating external innovation sources and assessing their fit with the firm's businesses
Assimilation: the capacity to analyze, process, and diffuse external knowledge	1) **Coordinating**: formal and informal mechanisms for linking external knowledge resources with internal businesses 2) **Integrating**: activities and tools that stimulate the acceptance and implementation of external knowledge resources 3) **Knowledge management**: formal infrastructure for articulating, codifying, and disseminating external knowledge resources
Exploitation: the capacity to determine applications of the assimilated knowledge resources and to recombine them with internal knowledge resources	1) **Resource cognition**: active internal observation and monitoring to identify new problem spaces 2) **Recombining**: activities to match and bundle resources stemming from external and internal innovation sources

In addition to outside-in open innovation, **inside-out open innovation** is concerned with outflow knowledge processes, that is, to transfer unused or under-used internal idea, IP and technology to external others for profit (Gassmann and Enkel, 2004; Enkel et al, 2009; Chesbrough and Bogers, 2014). Processes involve selling or revealing inventions (Dahlander and Gann, 2010). Moreover, the **coupled open innovation** is a combination of both inflow and outflow of knowledge to cooperate with complementary external partners to develop and commercialize innovation (Enkel et al, 2009; Chesbrough and Bogers, 2014). Coupled process involves joint development and commercialization innovation with complementary partners, outside-in and inside-out (Gassmann and Enkel, 2004; Enkel et al, 2009). In other words, processes of coupled open innovation could be any combination of mechanisms in outside-in and inside-out

(Chesbrough and Bogers, 2014). Relevant mechanisms are summarized in the Table 2-3, which have been extracted from two very comprehensive articles (Chesbrough and Bogers, 2014; Stanko et al, 2017).

Table 2-3: Mechanisms within archetypes (Summarized from Chesbrough and Bogers, 2014 and Stanko et al, 2017)

	Outside-in	Inside-out	Coupled
Mechanisms	• Scouting • In-licensing IP • University research programmes/ University partnership • Funding start-up companies in one's industry • Collaborating with intermediaries, suppliers and customers (lead-user) • Utilizing non-disclosure agreement • Crowdsourcing/ Ideation • Competition/ Tournaments/ Contests • Communities • Spin-ins or spin-backs • Outsourcing/ Contracting • Individual open search	• Selling/Revealing • Out-licensing IP and technology • Donating IP and technology • Spin-outs/spin-offs • Corporate venture capital • Corporate incubators • Joint ventures • Alliances • Providing efforts to other's innovation	*Any combinations of mechanism for outside-in and inside-out* • Strategic alliances • Joint ventures • Consortia • Networks • Ecosystems • Platforms • Inter-organizational collaboration

Among the three archetypes of open innovation, outside-in process dominates existing research (Enkel et al, 2009; Gassmann et al, 2010; Chesbrough and Brunswicker, 2013; Chesbrough and Bogers, 2014; West and Bogers, 2014). This might result from the emphasis of external knowledge searching and sourcing in Chesbrough's (2003) original definition, easiness to measure (West and Bogers, 2014), or greater popularity among managers (West et al, 2014). To avoid

overemphasis on external knowledge sourcing, a holistic perspective to study the combination of outside-in, inside-out, and coupled open innovation has been suggested (West and Bogers, 2014). Besides, this section has emphasized the importance of organizational mechanism such as implicit culture and explicit systems and processes as enablers regarding the integration of external knowledge in organizational context (West and Bogers, 2014; Lichtenthaler and Lichtenthaler, 2009; Zobel, 2017). The next section addresses the embeddedness of open innovation activities at multiple levels of analysis in the wider organizational context.

2.1.3 Levels of analysis

Another way to deconstruct open innovation activities is by studying open innovation at different levels of analysis. The structure of this section is based on the article: *'The open innovation research landscape: established perspectives and emerging themes across different levels of analysis'* (Bogers et al, 2017). The article gives an excellent overview and clarifies major intellectual streams at each level of analysis (Bogers et al, 2017), adopting the multi-level typology by Chesbrough and Bogers (2014). There also exist alternative typologies on levels of analysis in some other researches (West et al, 2006; Gupta et al, 2007; Lichtenthaler, 2011). The typologies are of similar logic to differentiate levels of analysis. The reason to adopt Bogers et al's (2017) typology is the comprehensiveness of scope and content, which results from inputs from multiple leading open innovation scholars with diverse expertise. Table 2-4 shows all the typoloiges, with the adopted typology highlighted.

Table 2-4: Typologies of levels of analysis

West et al (2006)	Gupta et al (2007)	Lichtenthaler (2011)	Chesbrough and Bogers (2014) Bogers et al (2017)
Individual Organizational Value network Industry/Sector National institutions	Individual Group/Team Organizational	Individual Project Organizational	Intra-organizational Organizational Extra-organizational Inter-organizational Industry, regional innovation system and society

Open innovation activities are nested in multiple levels of analysis with diverse objects relating to various theoretical perspectives with emerging themes (Bogers et al, 2017). Demonstrations are given in Table 2-5. The framework maps out the research agenda for future open innovation research, and each emerging theme stands on itself as a unique lens of potential inquiry (Bogers et al, 2017). Because this research intends to comprehensively audit micro-foundations for re-integration to support strategy implementation rather than focusing on any single micro-foundation, dense explanation around a specific theme at a certain level as a micro-foundation is not included. However, this research is open to potential insight from any one of these themes from any level of analysis. The five levels are then covered from narrow to broad: intra-organizational, organizational, inter-organizational, extra-organizational, as well as industry, regional innovation systems, and society (Bogers et al, 2017). Due to no definition of each level explicitly given, some specific examples are shown for demonstrative purposes.

Table 2-5: Levels of analysis, research objects, perspectives and emerging themes (Excerpt from Bogers et al, 2017, p. 12, 23-24)

Level of analysis	Possible research object	Perspectives	Emerging themes
Intra-organisational	Individual Group/Team Project Functional area Business unit	Organisational behaviour	Commitment, resistance to change, identity, motivation, communication and learning of employees involved in OI
		Organisational design	Formal and informal organisational structures and managerial tools that support different forms of openness
Organisational	Firm Other (non-firm) organisation Strategy	Entrepreneurship	Quantity and quality (nature) of entrepreneurial opportunities identified, formed and enacted via OI
	Business model	Business models	Link between open knowledge flows and economic activities
Extra-organisational	External stakeholders Individual Community Organisation	Stakeholders	Different types of knowledge provided by stakeholders at different stages of the innovation process
		Users as innovators	Identification and leveraging knowledge produced by individual users with different abilities and motivations
		Communities	Structural and relational alignment, and interfaces between organisations and communities
Inter-organisational	Alliances Network Ecosystem	Innovation ecosystems	Interactions between various development and commercialisation actors, as well as the governance of such interactions
		Innovation platforms	Governance of digital platforms to align individual success with collective welfare
		Crowdsourcing	'Hard' (e.g. governance) and 'soft' (e.g. values) aspects of crowdbased search

Industry, regional innovation systems and society	Industry development Inter-industry differences Local region Nation Supra-national institution Citizens Public policy	Industry dynamics Spatial organisation Public management	Industrial characteristics that enable OI Management of spatial challenges at the intersection of virtual and real platforms New forms of democracy and managerial skills for collaborative public management in the context of cities, regions, governments

Intra-organizational level studies seek to explain individual behaviours as well as design elements of organization (Bogers et al, 2017), such as identify shift of professionals from problem solver to solution seeker (Lifshitz-Assaf, 2016), challenges and coping strategies of individuals in external engagement (Salter et al, 2014) and specialization of external knowledge absorption across functional areas including R&D, manufacturing and marketing (Bogers and Lhuillery, 2011).

Organizational level analysis addresses topics of entrepreneurship, organizational design, practices, processes and outcomes for adoption of external innovation (Bogers et al, 2017). For instance, Foss et al (2013) study the impact of organizational design on external knowledge exploitation. Chiaroni et al (2011) reveals four dimensions of open innovation adoption along processes of organizational change, which are networks, organizational structures, evaluation processes and knowledge management systems.

Extra-organizational level analysis focuses on users and communities in open innovation adoption (Bogers et al, 2017). Topics may include a reflection on users as innovators (Bogers et al, 2010), user-centred innovation process (von Hippel, 2005) and collaboration processes with different types of external individuals (defining, finding participants, collaborating and leveraging) (Pillers and West, 2014).

Inter-organizational level analysis is concerned with open innovation adoption in ecosystems and industry platforms (Bogers et al, 2017). Themes of past inquiry comprise overarching patterns of value-creation on the ecosystem level (van der Borgh et al, 2012), crowdsourcing from distant knowledge base for local problem-solving (Afuah and Tucci, 2012) and effective learning routines in dealing with intermediaries (Billington and Davidson, 2013).

Diverse and wider contexts beyond the scope of R&D need exploration, such as industry-specific contingencies, spacial aspects of organizing and uniqueness of public sector adoption (Bogers et al, 2017). Taking public sector innovation as an example, attention should be paid to "key trends (e.g., digital transformation), challenges (e.g., uncertainty), and potential solutions (e.g., EU funding programs)" (Bogers and Chesbrough, 2018, p. 5).

Among all levels of analysis, there has been extensive research at the organizational level (West et al, 2006; Chesbrough and Bogers, 2014; Randhawa et al, 2016; Bogers et al, 2017). This accords with the congruent theme of firm-centric approach to innovation (Randhawa et al, 2016; Stanko et al, 2017). However, "OI is a multi-faceted phenomenon that requires an understanding that cuts across various perspectives and levels of analysis. Indeed, as firm boundaries become more permeable in the context of OI, so do the boundaries between different levels of analysis." (Bogers et al, 2017, p. 29). Cross-level approach is thus suggested to capture interaction and integration between isolated research streams spanning across different levels (Chesbrough and Bogers, 2014; Bogers et al, 2017). Another promising research avenue would be to combine overlooked bottom-up supportive mechanisms to compare with imposed top-down implementation (Gupta et al, 2007; Bogers et al, 2017). Therefore, this research departs from the organization level the same as mainstream research, but looks to integrate practices of adoption at multiple levels from top-down and bottom-up.

Gaps at each level relevant to this research are highlighted in Table 2-5 and explained below. Multilevel adoption implies the prospect of examining practices to fill in some minor gaps at all levels: 1) intra-organizational employee engagement and enabling tools, 2) organizational level strategies and business models, 3) inter-organizational governance of crowdsourcing challenges, 4) extra-organizational stakeholder management along the innovation process, as well as 5) collaboration for public service delivery and spacial design (online and offline) (Bogers et al, 2017). The main gap is to study organization-level adoption of open innovation from perspectives of business model and organizational capabilities, which advances the understanding of how open innovation help shape business opportunities in a sustainable way (Bogers et al, 2017). Organization-level adoption is further contingent on conditions of different levels, such as structures and toolboxes within the organization as well as governance, IP management, infrastructure and citizen participation concerning external collaboration (Bogers et al, 2017).

Considering the richness of open innovation activities, the mix and match of open innovation activities should provide abundant opportunities for resolving a wide variety of organizational challenges. Next section elaborates current connections between open innovation practices and higher-level organizational strategy and business model.

2.1.4 Open innovation, strategy and business model

This section first explains the linkage between open innovation and strategy, followed by strategic adoption through the coherent design of elements (of business model). Open innovation practices need to be embedded in firms' strategy to get implemented (Vanhaverbeke and Cloodt, 2014). Several attempts are made to relate open innovation adoption to higher-level strategy. Chesbrough and Appleyard (2007) point out the importance of open strategy and open

business model for value creation and capture. Open strategy is not a one-off decision but rather a dynamic shift, in accordance with change in preference of either firm or customer (Appleyard and Chesbrough, 2017). Effectiveness of shift relies on firm-level competencies, more specifically, technology prowess and supportive processes (Appleyard and Chesbrough, 2017). Future research is suggested to explore open strategy, business model, and supportive organizational processes in other industries beyond the limited context of open source software (Appleyard and Chesbrough, 2017).

Apart from formulating a separate open strategy (Chesbrough and Appleyard, 2007; Appleyard and Chesbrough, 2017), it is imperative to find strategic approaches which can fully accommodate collaboration (Vanhaverbeke and Cloodt, 2014). The connection between corporate strategy and open innovation is yet to be explored in literature of open innovation (Vanhaverbeke and Cloodt, 2014). One point to connect may be the ambidextrous paradox of organization (Gupta et al, 2006; Randhawa et al, 2016; Bogers et al, 2017), which refers to the strategic choice between exploration and exploitation from an organizational learning perspective (March, 1991). Exploration and exploitation underlie dual motives of open innovation, which are offensive growth and defensive cost-cutting (Huizingh, 2011). Over-emphasis on external knowledge sourcing to develop new products in existing businesses eclipses other possibilities of strategic unitization of open innovation (Vanhaverbeke and Cloodt, 2014). Therefore, importance should be attached to develop new businesses through external collaboration in the long run, in addition to generate incremental growth of existing businesses (Vanhaverbeke and Cloodt, 2014).

Organizational ambidexterity is advocated in large diversified firms facing disruptive change, which facilitates developing competencies to ‘fit’ current strategy as well as envisioning new competencies to ‘stretch’ strategy for future competition (Vanhaverbeke and Peeters, 2005; O’Reilly and Tushman, 1996). To

build competencies for new business development, innovation needs to be embedded in strategic vision as a value driver, integrated into internal innovation process, as well as supported by a decision board in charge of both innovation and mainstream (Vanhaverbeke and Peeters, 2005). Integrated management of innovation is believed to be a dynamic capability to balance contradictory demands of exploration and exploitation, contributing to sustainability of organization (Vanhaverbeke and Peeters, 2005). It is a wise idea to develop a framework on integrated innovation management, but the solution documented is neither systematic nor supported by sufficient details.

“Only firms that have the right structures and processes in place can work effectively with external partners” (Vanhaverbeke and Cloodt, 2014, p. 275). However, a proper guidance to help professionally manage open innovation processes is still missing in literature (Gassman et al, 2010; Huizingh, 2011). The concept of dynamic capabilities enlightens open innovation adoption: “underlying micro-foundations of these dynamic capabilities offer interesting insights into organizational and managerial processes, procedures, systems, and structures to implement open innovation in the firm” (Vanhaverbeke and Cloodt, 2014, p. 267; Teece, 2007). Open aspects of dynamic capabilities are detailed in Section 2.2.1. Compared with high-level strategic challenge of organizational ambidexterity, dynamic capabilities serve as an optimal medium-level abstraction that provides a framework to systematically manage distributed processes of open innovation to support strategy implementation.

Systematic adoption through managing the totality of dimensions is then emphasized. The dimensions (managerial levers) for open innovation adoption consist of networks, organizational structures, evaluation processes and knowledge management systems (Chiaroni et al, 2010; Chiaroni et al, 2011). The focus is on clustering scattered activities along the change processes of un-freezing, moving and institutionalizing (Chiaroni et al, 2010; Chiaroni et al, 2011),

which forgoes the opportunity to thickly describe different themes within the dimensions. Alternatively, Enkel et al (2011) propose the use of spider web analysis to benchmark the excellence of open innovation. The three categories subject to measurement include climate for innovation, partnership capacity and internal processes, each of which is further deconstructed into smaller elements as is shown in Table 2-6. Instead of measuring the effectiveness of open innovation processes in themselves, the framework is regarded a means to achieve organizational goals (Enkel et al, 2011).

Table 2-6: Overview of the categories in the excel tool and the spider web analysis (Enkel et al, 2011, p. 1176)

Climate for innovation			
Leadership	Incentives	Mind set	
Clear strategy	Clear target	Initiative taking	
Communication of success stories	Assessment	Screening	
Partnership capacity			
Reputation	Partner selection	Training and Education	
Intensity of collaboration	Diversity in collaboration	Partnering	
Standardization	Network building		
Partner satisfaction	Selection process		
Internal processes			
Central coordination	Resources	Knowledge management process	Legal and IP system
Information gathering	Innovation facilities	Knowledge sharing	Attitude
Communication	Transaction currency	Knowledge absorption	
		Monitoring results	

Systematic adoption is also observed in the coherence of design elements of business model. Business model integrates technology advancement into regular economic activities of the firm for purpose of value creation and capture (Chesbrough, 2003; Chesbrough, 2006a; Zott et al, 2011; Smith et al, 2010; Bogers et al, 2017). A lot wider than the constrained topic of IP-enabled business models

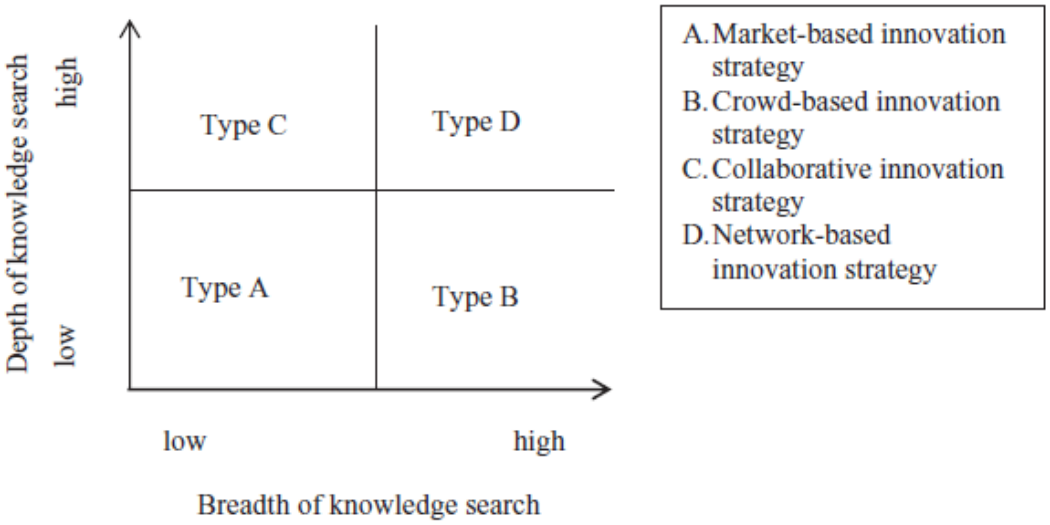
Chesbrough (2006a), business model is a system that organizes complex and interconnected activities to deliver value to internal and external stakeholders in product markets (Zott and Amit, 2010). Design elements of business model includes: 1) content – what activities are performed, 2) structure – how they are linked and sequenced, and 3) governance – who perform them and where (Zott and Amit, 2010). Coherent consideration of the design elements offers a conceptual toolbox to engage managers in system-level design rather than concentrating on optimisation of partial details (Zott and Amit, 2010).

Business model design may vary to suit different open innovation strategies (Chesbrough, 2006a; Saebi and Foss, 2015). Saebi and Foss (2015) applies the three design elements of business models to support different in-bound open innovation strategies differentiated according to breadth and depth of knowledge search. Figure 2-1 shows the typology of open innovation strategies, and Table 2-7 provides details on the design elements of business models in accordance with respective open innovation strategies. Besides, the business model is not only a vehicle for innovation but also a subject of innovation (Zott et al, 2011). The business model requires continuous experimentation, learning and adjustment, accounting for ever evolving business ecosystem (Teece, 2010). Each design element can potentially be renewed, namely performing new activities (content), combining activities in novel way (structure) and adopting new approach to manage relevant stakeholders (governance) (Amit and Zott, 2012). To summarize, only coupling careful strategic analysis and good business model design can make innovative technology commercially viable (Teece, 2010).

Table 2-7: A contingency framework for open innovation models (Saebi and Foss, 2015, p. 211)

	Four open innovation strategies			
	Market-based innovation strategy	Crowd-based innovation strategy	Collaborative innovation strategy	Network-based innovation strategy
Business model dimensions	Efficiency-centric open business model	User-centric open business model	Collaborative open business model	Open platform business model
Content	• Efficiency-centered value proposition, enabled by reduction in transaction and coordination costs	• User-centered value proposition, input from communities of users	• Radical innovations and opening up of new target segment	• Business model acts as open-innovation platform for multiple stakeholders
Structure	• Redefinition of role of internal R&D system • Efficiency-centered structure	• Ideation phase of innovation process "outsourced" to the crowd	• Users/ suppliers/ customers/ competitors become key partner in innovation process	• Re-organization of the production and distributional system • Need for complementary internal network
Governance	• Monetary remuneration for external knowledge provider • Use of "integration experts" to absorb market-available knowledge	• Monetary prizes or recognition for external knowledge providers • Incentives to engage and manage communities of users for own employees	• Contract based, sharing of rewards on organizational level with external knowledge provider • Incentives for own employees to engage with lead users and alliance partners	• Provide incentives for own employees to engage with multitude of knowledge partners (individuals, companies, communities) • Re-distribution of risks and rewards

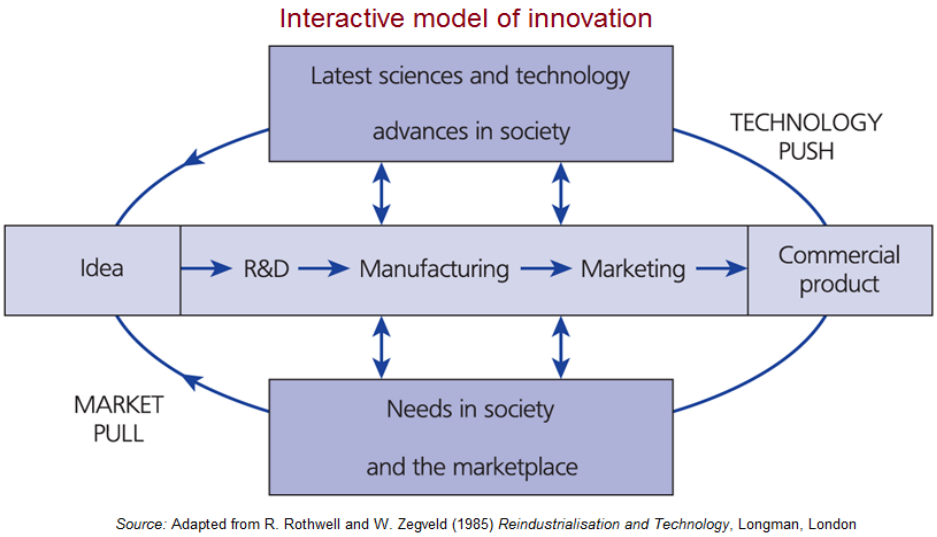
Figure 2-1: Typology of inbound open innovation strategies (Saebi and Foss, 2015, p. 206)



2.1.5 (Open) innovation process

After discussing high-level integration with strategy and business model, (open) innovation process is highlighted as one critical dimension regarding systematic adoption. There are two traditional linear models of innovation: 1) technology-push model assumes R&D are in charge of discovery, idea and prototyping, the fruits of which are then handed over to passive recipients of manufacturing, marketing and customers in the marketplace; 2) market-pull model is initiated with ideas from customers by marketing, which is then conveyed to R&D for design and manufacturing for production (Trott, 2012). These traditional models are good to capture the innovation process after idea initiation, but ignores the fact that the starting point of innovation is unpredictable (Trott, 2012). Therefore, the key to innovation lies in bringing together technology-push and market-pull models of innovation and integrating efforts of innovation into a logically sequential process with functionally distinct, but interacting stages with complex paths of knowledge transfer (Trott, 2012; Rothwell and Zegveld, 1985). Figure 2-2 illustrates technology-push and market-pull models of innovation.

Figure 2-2: Interactive model of innovation (Trott, 2012, p. 24)



Source: Adapted from R. Rothwell and W. Zegveld (1985) *Reindustrialisation and Technology*, Longman, London

Open innovation thrives on the funnel view of innovation, which provides a visualization tool to explain the openness of innovation process (Chesbrough, 2003; Vanhaverbeke and Cloodt, 2014). The open innovation model is shown in Figure 2-3. The model includes processes of not only upstream functions of research and development but also downstream manufacturing and marketing (Bogers and Lhuillery, 2011; Chesbrough and Bogers, 2014). On the one hand, the model accounts for different directions of knowledge flow in upstream research and development (Gassmann and Enkel, 2004; Enkel et al, 2009; Chesbrough and Bogers, 2014). On the other hand, the model addresses broadened marketplace (current and new) in downstream manufacturing and marketing (Chesbrough, 2006a; West and Bogers, 2014; Chesbrough and Bogers, 2014). An overview of all activities from beginning to end along the innovation process is captured and integrated to suffice the purpose of value creation and capture (Chesbrough, 2006a; West and Bogers, 2014; Chesbrough and Bogers, 2014). Understanding the overall impact, how these apparently scattered open innovation processes fit into the innovation funnel is then elaborated.

Figure 2-3: The open innovation model (Chesbrough and Bogers, 2014, p. 18)

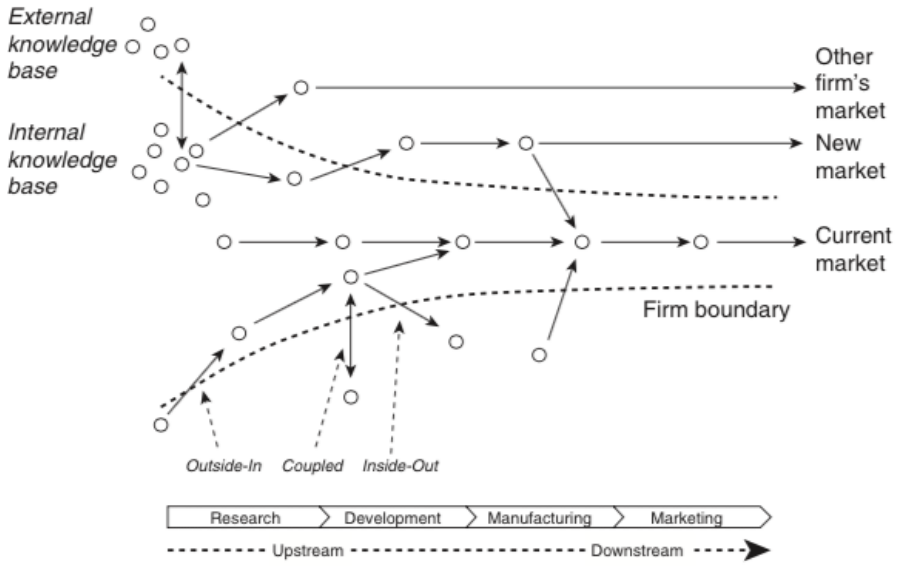


Figure 1.5 The open innovation model

The stage-gate process of product development is presented as a starting point to explain the potential integration of open innovation (Grönlund et al, 2010; Vanhaverbeke and Cloodt, 2014). The stage-gate process of product development is renowned as one of world's most well-known product innovation process (Phillips, 2018a). See Figure 2-4. From idea to successful product, innovation occurs in sequential stages and gates: gates are decision points of go and kill, and stages are subsets of project tasks between gates (Cooper, 2008; Cooper, 2014; Cooper and Sommer, 2016; Cooper, 2016; Phillips, 2018b). To elaborate, gates provide three-part assessment: readiness check of prescribed lists of key information and deliverables of the past stage, business rationale assessment of strategic alignment and investment potential, and reasonableness of forward action plan and resource commitment (Phillips, 2018b). Stages emphasize quality execution of project tasks, through orchestrating both prescribed and concurrent activities, benchmarking best practices of top performers, as well as

acknowledging holism of cross-functional efforts (Phillips, 2018b). A brief description of each stages and gates is given in Table 2-8.

Figure 2-4: Idea-to-launch Stage-Gate® (Phillips, 2018b, p. 44)

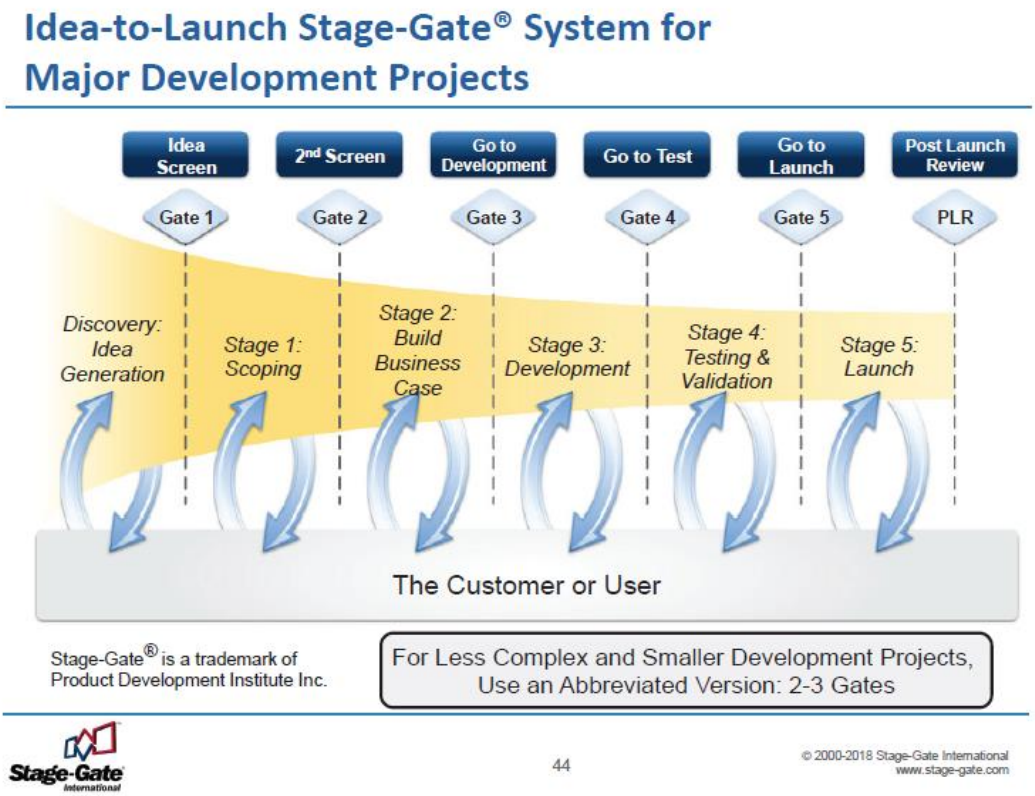


Table 2-8: Brief description of stages and gates (Summarized from Phillips, 2018b)

Stage/Gate	Description	Actions or decision criteria
Discovery : Idea generation	New ideas are generated from: • Multiple levels: top-down and bubble-up; and • Both internal and external sources: customers/users, competitors, technical groups, marketing groups, sales forces, creativity events, alliances and suppliers.	*Activities of idea generation:* • Brainstorming sessions • Events with customers • Idea contest or suggestion scheme • Scenario generation • MRG events • Lead user initiative
Gate 1: Idea screen	• Initial Go/KILL decision is made. • Tentative resource commitment is granted.	*Must meet criteria (Yes or no):* • Within strategic mandate • Minimum market size • No show-stoppers

		Should meet criteria (point count): • Strategic fit • Technical feasibility • Market attractiveness • Competitive advantage…
Stage 1: Scoping	Preliminary investigation: An inexpensive and quick set of activities to learn about the project.	*Key tasks:* • Preliminary market assessment • Preliminary technical assessment • Preliminary business analysis • Others: IP, Regulatory and safety *Gate deliverables:* • Preliminary product definition • Preliminary business case
Gate 2: Second screen	A second review of the project is conducted, to review and approve forward plan and resources.	*Must meet criteria/Should meet criteria:* • Strategic fit and importance • Competitive (product) advantage • Market attractiveness • Leverages core competencies • Technical feasibility • Risk and reward
Stage 2: Build business case	*It is a critical stage that makes or breaks the project* with detailed investigation.	*Key tasks:* • Market analysis and market research • Competitive analysis • Concept test with users • Proof of technical feasibility • Operations and source of supply appraisal • Legal/IP appraisal • Regulatory, health, environmental, safety reviews • Detailed financial analysis *Key deliverables:* • Integrated product definition: What, for whom? • Project justification: Why? • Project plan: How, when and how much?

Gate 3:
Go to development
	• *It is the 'money gate'*, where pivotal decision on finance is made.
	• It opens the door to full scale development and heavy commitment.
		Must meet criteria:
		• Readiness check of deliverables
		• Check *Should meet criteria:*
		  ○ Strategic fit and importance
		  ○ Competitive (product) advantage
		  ○ Market attractiveness
		  ○ Leverages core competencies
		  ○ Technical feasibility
		  ○ Risk and reward
		• Full financial review
		• Review and approval of action plan and resource requirement.

Stage 3: Development	Tasks of development is conducted in this stage.	*Key tasks:* • Implement development plan • Undertake in-house product testing

		• Conduct limited customer tests • Develop production (operations) process • Update financial analysis • Develop detailed test plans for Stage 4 • Develop launch plans for Stage 5
Gate 4: Go to testing	It opens the door to Stage 4, where the project goes 'semi-commercial'.	*Must meet criteria:* • Quality of activities in Stage 3 • Deliverables and readiness check • Consistency check of delivered prototype against Gate 3 definition • Revisit Gate 3 scored criteria • Review of financials • Review and approval of Test Plans
Stage 4: Testing and validation	It involves the final tests of the product, production/operations and marketing strategy prior to full commercialization.	*Key tasks:* • Execute Stage 4 tests • Update financial analysis • Prepare final Launch Plans for Stage 5: ○ Market Launch Plan ○ Production/Operations and Quality Assurance Plans • Develop Post Launch Plans: ○ Plan to Post Launch Review ○ Life Cycle Plan
Gate 5: Go to launch	It is the 'parade gate', where final GO/KILL decision is made.	*Must meet criteria:* • Deliverables readiness check • All test results positive • Purchase intent established • Financials meet hurdles • All launch plans in place
Stage 5: Launch	This stage executes the launch.	Key tasks: • Implement Production/Operations Plan • Implement Quality Assurance Plan • Implement Market Launch Plan • Implement Post Launch • Implement Product Life Cycle Plan
Post launch review(s)	It includes first review and final review.	First review: • Fixes and corrections • A complete retrospective analysis • Essential organizational learning Final review: • Terminates the 'new product project', which becomes a regular product • Accountability issues: actual versus projected results at Gate 3 and Gate 5 • The path forward: variations and improvements of the PLC plan

Considering innovation activities are flexible and cyclic in nature (Berkhout et al, 2010; Trott, 2012), the stage-gate process is criticized for being too linear, too rigid and too planned to address today's fast-changing environment (Cooper and Sommer, 2016). To overcome the rigidity of linearity, agility is built into the existing stage-gates, such as utilizing sprint to enable multiple iterations, adopting flexible deliverables regarding go/kill decision as well as creating venture team free from organizational bureaucracy (Cooper, 2014; Cooper and Sommer, 2016; Cooper, 2016). Therefore, the stage-gate process actually combines advantages of rigidity and agility: rigidity of the linear process offers overall efficiency and accountability, meanwhile agility allows improved communication and flexibility in execution of specific development tasks (Cooper and Sommer, 2016).

The agility of process is further elaborated, in terms of inputs from cross-collaboration, scalability of the process as well as essential elements for agile execution. First, the process enables cross-functional inputs (marketing, sales, and operations alongside technical) within the company as well as integrates voice of customer outside the company (Cooper and Sommer, 2016). See Figure 2-5. Second, the process is capable of scalability in specific contexts of application: 1) full stage-gate for major and high-risk development, 2) light version for moderate-risk projects (significant modifications, improvements and extensions), and 3) an express version for small developments (minor change requested by sales) (Cooper, 2014; Phillips, 2018b). See Figure 2-6. Acceleration of the innovation process is also achieved by considering deliberate interventions and generic mechanisms, as is documented in Table 2-9 (Ellwood et al, 2017). Third, nine essential elements are further emphasized for agile execution: three artefacts, three tools and three roles (Cooper and Sommer, 2016). Table 2-10 provides more detailed explanation. The whole of elements as an integrated system makes greater impact than a sum of parts (Cooper and Sommer, 2016).

Figure 2-5: The integrated Agile-Stage-Gate Hybrid model (Cooper and Sommer, 2016, p. 169)

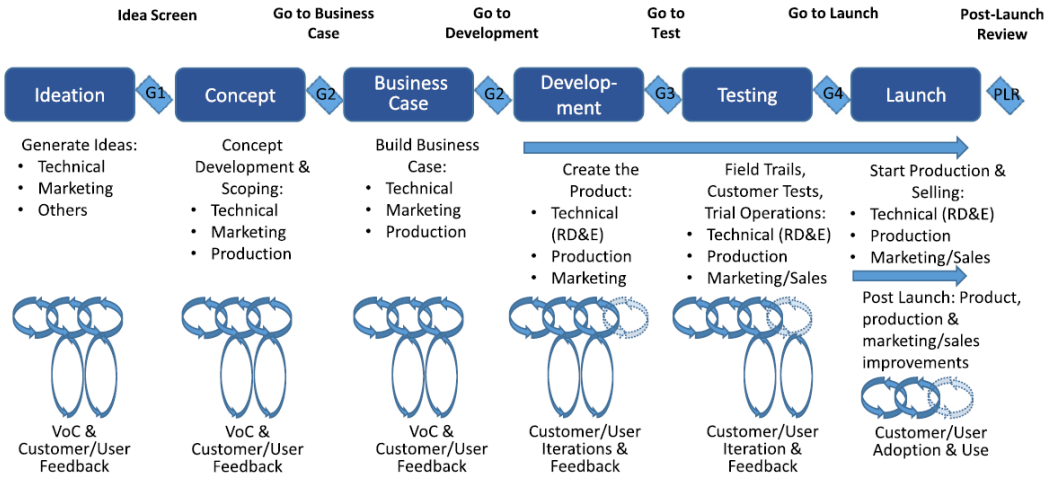


Figure 2-6: Scalable stage-gate system (Phillips, 2018b, p. 45)

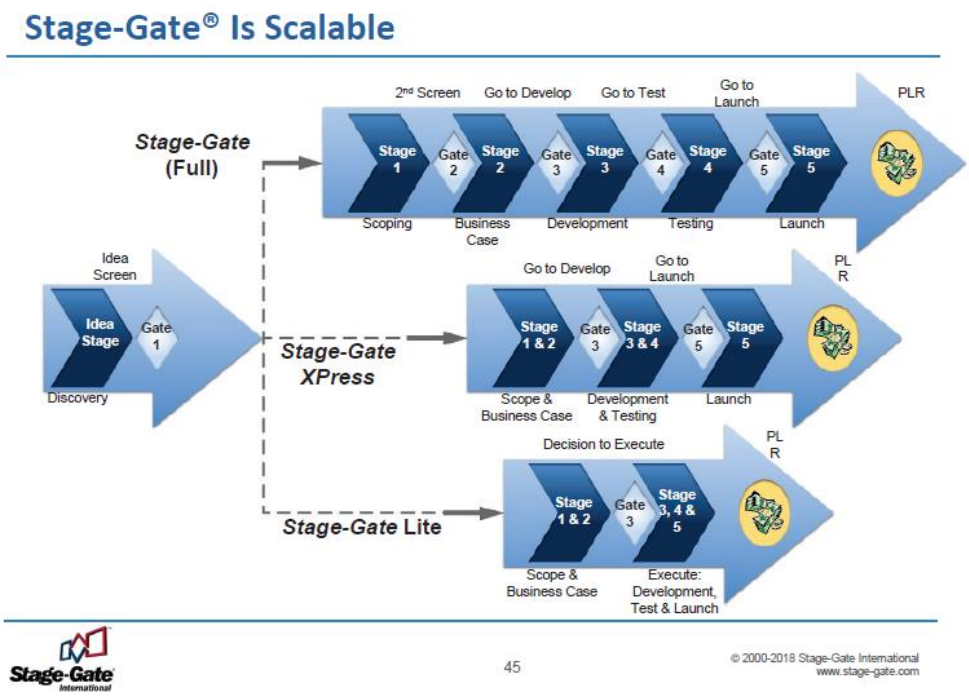


Table 2-9: Summary of interventions and generative mechanisms by temporal category (Ellwood et al, 2017, p. 519)

Generalizable context	Temporal uncertainty	
	Clock-time	Event-time
Scheduling interventions	Articulate well-defined product vision Set clear goals and milestones Adopt standardized routines and phase-gate processes Define schedule for product and market testing	Set flexible project milestones Allow teams to improvise necessary innovation activities Use technologies to communicate and compare different perspectives on progress (includes co-location)
Generative mechanism	The determination to realise defined time-related goals	The interchange of perspectives on progress in order to reduce uncertainty and to test improvised changes to plans
Generalizable context	Temporal conflict	
	Internal pacing	External pacing
Synchronisation Interventions	Design concurrent engineering of internal processes Integrate different functional strategies Share information in timely manner	Work with customers and suppliers during development stages Generate prototypes, and release of acceptable products Gather information related to external pace of change (e.g. roadmapping and benchmarking)
Generative mechanism	The 'compression' of the time allowed to accomplish innovation tasks within the firm	The responding to the pace and direction of the external environment
Generalizable context	Temporal scarcity	
	Linear progression	Cyclic progression
Allocation interventions	Leveraging expertise that is completely new to firm Recruit people with a wide breadth of experience	Ensure NPD teams are stable and have dedicated members Develop systems for capturing and making available learning from previous projects Key decisions based on knowledge and experience within the organisation
Generative mechanism	The exploration of innovation work unconstrained by firm's own experience in order to progress new ideas more quickly	The exploitation of past experience in order to save time by the avoidance of known issues

Table 2-10: Nine elements for agile execution (Summarized from Cooper and Sommer, 2016, p. 171-174)

	Elements	Description, application and benefits
Artefacts	Sprint	• A time-boxed effort of 2-4 weeks as a small part of project execution • Create a product prototype (something tangible) for customers and management to give feedback
	Daily scrum	• A short-meeting of 10-15 minutes at the start of each day (daily stand-up) to brief yesterday's accomplishment and today's expectation • Benefit instant-knowledge sharing and increased team motivation
	Retrospect meeting	• Challenging own performance, highlight success of internal collaboration, and improve ways to collaborate at the end of the sprint • Help institutionalize continuous improvement for high performance
Roles	Member	• Empowered members responsible for project's execution • Define necessary activities to achieve sprint goals, decide on application of tasks or activities and undertake tasks during the sprint
	Process manager	• Facilitate and support the team in all meetings during sprint • Ensure adherence to methods and properly utilization of tools • Remove impediments and roadblocks for quick execution
	Product owner	• Ensure the right product requirements are built into the sprints • Manage stakeholders to ensure managerial support and resource input
Tools	Product backlog	• Does not contain detailed specifications such as performance outcome but rather customer needs and preferences • Provide freedom within guidelines • Allow prioritize and dynamic prioritizing in the backlog
	Sprint board	• Contain the backlog of activities or tasks which are clustered into columns of 'to-do', 'doing' and 'done' • Create a continuous flow of activities during the sprint
	Burn-down chart	• Display finished activities according schedule (ahead or behind) • Have a constant flow (of performance) and plan the flow well

Open innovation is relevant to the stage-gate process in two ways: open criteria at gates and enabling methods within stages. For successful adoption of the stage-gate, "The resources must be in place!" (Phillips 2018a, p. 37). Internal or external,

resources and capabilities are required to move projects forward. The logic of innovation changes from research and development (R&D) to connect and development (C&D), which combines development efforts of proprietary as well as open network (Huston and Sakkab, 2006). Open innovation emphasizes immediate and extensive interaction with external partners throughout the process (Trott, 2012). One way to transform the stage-gate process is to include open innovation evaluation criteria to complement the closed ones regarding resource commitment decision-making at gates (Grönlund et al, 2010). At each gate, external knowledge are reviewed and external paths to market are assessed (Grönlund et al, 2010). The integration of open criteria facilitates the continuous renewal of organizational capabilities and business model for the future (Grönlund et al, 2010).

Except for the integration of open innovation criteria at gates, open innovation is useful as methods of tasks execution within stages (Cooper and Edgett, 2008). Six open innovation methods are recognized: 1) partners and vendors: reach partners and vendors for ideas with technical capabilities beyond own expertise; 2) accessing the external technical community: seek technology solutions online from external community; 3) scanning small businesses and start-ups: get ideas from these entrepreneurial firms to bet on next new product in the industry; 4) external product designs (crowdsourcing): ask for submission of finished product designs from customers, users, and some external others around the world; 5) external submission of ideas: ask for submission of new product ideas from the external world and managed through own innovation system; 6) external idea contest: hold an ideation contest and invite external submission of ideas (Cooper and Edgett, 2008).

Beyond stretching the processes of product development, distinct open innovation processes have been set up to govern a certain type of open innovation collaboration. For example, the Want, Find, Get, Manage Model

captures good practices to manage collaborative innovation alliances (Slowinski and Sagal, 2010). The four-staged process comprise: 1) outline internal and external assets needed and prioritize according to strategic intent, 2) assess internal knowledge and project the self-image as a promising partner, 3) continuously plan and negotiate to ensure a fair agreement among all stakeholders (internal and external), and 4) hold formal kick-off session to clarify management integration, operating principles, and conflict resolution (Slowinski and Sagal, 2010). Furthermore, Want Brief is the document that describes asset management in accordance with strategic intent as well as enables systematic feedback and clear communication to stakeholders (Slowinski and Sagal, 2010).

2.1.6 Summary

Open innovation is one major topic under one trajectory of general innovation, which is potentially linked to multiple trajectories of inquiry. The rationale to conduct open innovation is expressed in terms of environmental contingencies and prospective benefits. Table 2-11 summarizes themes and **theoretical gaps** (**bold** in colour purple) of open innovation on a section by section basis. Section 2.1.1 traces the evolution of the definition of open innovation and clarifies its nature as distributed innovation processes. Investigation of practical mechanisms of open innovation has been suggested (Stanko et al, 2017). Section 2.1.2 deconstructs mechanisms of open innovation according to directions of knowledge flow (Chesbrough and Bogers, 2014; Stanko et al, 2017) as well as points out organizational process as enablers of open innovation (West and Bogers, 2014; Stanko et al, 2017). Alternatively, Section 2.1.3 deconstructs processes of open innovation spanning across multiple levels in the wider organizational context, emphasizing the opportunity of organization-level adoption (top-down and bottom-up) (Bogers et al, 2017).

Section 2.1.4 elaborates the linkage between open innovation, strategy and business model. Gaps of strategic and systematic adoption of open innovation are revealed (Gassman et al, 2010; Huizingh, 2011; Vanhaverbeke and Cloodt, 2014), pointing out the potential to draw on literature of organizational ambidexterity (Vanhaverbeke and Peeters, 2005; Gupta et al, 2006; Randhawa et al, 2016; Bogers et al, 2017) and dynamic capabilities (Vanhaverbeke and Cloodt, 2014). Section 2.1.5 demonstrates the linkage between open innovation and the funnel view of innovation process (Chesbrough, 2003; Vanhaverbeke and Cloodt, 2014; Bogers and Lhuillery, 2011). Open innovation is contextualized into the stage-gate process of product development (Cooper, 2008; Cooper, 2014; Cooper and Sommer, 2016; Cooper, 2016; Phillips, 2018a; Phillips, 2018b; Ellwood et al, 2017). Roles of open innovation are emphasized as open criteria at gates (Grönlund et al, 2010), methods of task execution within stages (Cooper and Edgett, 2008) and distinct processes to govern external collaboration (Slowinski and Sagal, 2010).

After a thorough audit of micro-foundations of open innovation in this section, the next section draws on the concept of dynamic capabilities to inform structured adoption of open innovation.

Table 2-11: Summary of literature on open innovation

	Themes with key references and **theoretical gaps**
2.1.1 The concept of open innovation	• Evolution of definition (Chesbrough, 2003; Chesbrough, 2012; Chesbrough and Bogers, 2014) • Theme of collaboration in terms of what, who and how (Tynnhammar, 2017; Gassmann and Enkel, 2004; Dahlander and Gann, 2010; Greco et al, 2015; Chesbrough, 2006a; Chesbrough, 2006b) • Business model and firm-centric approach to innovation (Randhawa et al, 2016; Stanko et al, 2017; Chesbrough, 2006a) • Overcome criticism and clarify the nature of open innovation (Chesbrough and Bogers, 2014; Stanko et al, 2017; Gassmann et al, 2010; Huizingh, 2011; Chesbrough, 2012; Tynnhammar, 2017) • **Investigation of practical mechanisms of open innovation** (Stanko et al, 2017)
2.1.2 Directions of knowledge flow	• Archetypes of open innovation: outside-in, inside-out and coupled (Gassmann and Enkel, 2004; Enkel et al, 2009; Chesbrough and Bogers, 2014)

	• Emphasis on external knowledge search (Chesbrough, 2003; Laursen and Salter, 2006) • Absorptive capacity with enabling organizational processes (Lichtenthaler and Lichtenthaler, 2009; Lichtenthaler, 2011; Zobel, 2017) • An overview of mechanism within archetypes (Chesbrough and Bogers, 2014; Stanko et al, 2017) **• Combination of archetypes and organizational enablers** (West and Bogers, 2014)
2.1.3 Levels of analysis	• Intra-organizational level (Lifshitz-Assaf, 2016; Salter et al, 2014; Bogers and Lhuillery, 2011) • Organization level (Chiaroni et al, 2011; Foss et al, 2013) • Extra-organizational (Bogers et al, 2010; von Hippel, 2005; Pillers and West, 2014) • Inter-organizational (van der Borgh et al, 2012; Afuah and Tucci, 2012; Billington and Davidson, 2013) • Diverse and wider contexts (Bogers et al, 2017; Bogers and Chesbrough, 2018) **• Main gap: opportunities of organization-level adoption** (Bogers et al, 2017) **• Cross-level approach combining top-down and bottom-up** (Chesbrough and Bogers, 2014; Bogers et al, 2017; Gupta et al, 2007)
2.1.4 Open innovation, strategy and business model	• Open strategy in context of open source software (Chesbrough and Appleyard, 2007; Appleyard and Chesbrough, 2017) **• The relevance of organizational ambidexterity** (Vanhaverbeke and Peeters, 2005; Gupta et al, 2006; Randhawa et al, 2016; Bogers et al, 2017) **• The lack of a proper guidance to professionally manage open innovation** (Gassman et al, 2010; Huizingh, 2011) **• The relevance of dynamic capabilities** (Vanhaverbeke and Cloodt, 2014) • Systematic adoption of dimensions (of business model) (Chiaroni et al, 2010; Chiaroni et al, 2011; Enkel et al, 2011; Zott and Amit, 2010; Saebi and Foss, 2015) **• Strategic deployment of open innovation** (Vanhaverbeke and Cloodt, 2014)
2.1.5 (Open) innovation process	• Open innovation and the funnel view of innovation (Chesbrough, 2003; Vanhaverbeke and Cloodt, 2014; Bogers and Lhuillery, 2011) • The stage-gate process of product development (Cooper, 2008; Cooper, 2014; Cooper and Sommer, 2016; Cooper, 2016; Phillips, 2018a; Phillips, 2018b) • Cross-collaboration, scalability and agile execution (Cooper and Sommer, 2016; Cooper, 2014; Phillips, 2018b; Ellwood et al, 2017) • Open innovation as open criteria at gates and methods within stages (Grönlund et al, 2010; Cooper and Edgett, 2008) • The Want, Find, Get, Manage Model (Slowinski and Sagal, 2010)

2.2 Dynamic capabilities

Dynamic capabilities are firm's capability to integrate, build, and reconfigure internal and external competences to respond to changing environments (Teece et al, 1997). Dynamic capabilities can be further deconstructed into social and behavioural micro-foundations for analytical purposes (Teece, 2007; Day and Schoemaker, 2016). To illustrate the nature of dynamic capabilities, dynamic capabilities as higher-order capabilities are discussed against lower-order operational capabilities (Winter, 2003; Zahra et al, 2006; Tecce, 2012; Teece, 2014; Teece, 2016). Most importantly, current categorization of dynamic capabilities is reviewed, with a thorough audit of supporting micro-foundations. Next, linkage to performance outcome is discussed. Lastly, a summary is provided to reiterate main themes and gaps.

2.2.1 The concept of dynamic capabilities

"Winners in the global marketplace have been firms that can demonstrate timely responsiveness and rapid and flexible product innovation, coupled with the management capability to effectively coordinate and redeploy internal and external competences." (Teece and Pisano, 1994, p. 538; Teece et al, 1997) The word 'dynamic' refers to the renewal of competences that enables innovative responses to shifting environments (Teece et al, 1997). The word 'capabilities' emphasize the critical role of strategic management in coordination of capabilities (Teece et al, 1997). Implied is two-fold dynamism: dynamic environments as well as dynamic capabilities in themselves. The nature of dynamic capabilities is further demonstrated as transferable best practices with idiosyncratic details, with learning happening along the path of evolution (Eisenhardt and Martin, 2000). Collectively learning can happen from both within and outside (Teece et al, 1997). And firm's long-term competitive advantage is believed to lie in managers'

ability to reconfigure capabilities rather than the existence of capabilities themselves (Eisenhardt and Martin, 2000).

The most highly cited article defines **dynamic capabilities** as "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (Teece et al, 1997, p. 516). Despite the application of different wording, processes of dynamic capabilities are captured in a similar manner. For example, dynamic capabilities are "firm's processes that use resources – specifically the processes to integrate, reconfigure, gain and release resources – to match and even create market change" (Eisenhardt and Martin, 2000, p. 1107), "the capability of an organization to purposely create, extend, or modify its resource base" through opportunity identification, response formulation and action deployment to fit internal and external environment (Helfat et al, 2007, p. 4), or "(1) identification and assessment of an opportunity (*sensing*); (2) mobilization of resources to address an opportunity and capture value from doing so (*seizing*); (3) continued renewal (*transforming*)" (Teece, 2012, p. 1396; Teece, 2007).

For analytical purpose, Teece (2007) puts forward subsets of social and behavioural micro-foundations under firm-level dynamic capabilities of sensing, seizing and transforming. Sensing involve processes of scanning, filtering and interpreting opportunities, tapping into external science and technology, and seeking collaboration with suppliers and customers (Teece, 2007). Seizing comprises practices of delineating business model, selecting organizational boundary and platform to access resources, as well as culture and leadership (Teece, 2007). Moreover, transforming consists of adopting decentralized and multidivisional structure, embracing open innovation, and co-specialization of complementary assets, and development of proper governance mechanisms and knowledge management (Teece, 2007).

Similarly, but not identically, Day and Schoemaker (2016) paraphrase and summarize these processes into six component capabilities: ‘peripheral vision’ and ‘vigilant learning’ in sensing, ‘probe and learn’ and ‘flexible investing’ in seizing, and ‘organizational design’ and ‘external shaping’ in transforming. Managers as strategic leaders can tailor these components to fit environmental contingencies (Day and Schoemaker, 2016). Such deconstruction is fruitful in bridging the gap between theoretical framing and practical application. This justifies further deconstruction of meta-level organizational dynamic capabilities into smaller capabilities associated with specific actions. Therefore, open innovation practices can potentially be constituents of dynamic capabilities that help resolve problems for the organization.

It should be noted that an open environment poses great challenges to strategically manage dynamic capabilities (Teece, 2007). Elements of open innovation are either explicitly included or implied in these dynamic capabilities. In sensing, open aspects are implied in technical scouting from external sources and collaboratively deliver customer solution with external partners (Teece, 2007). In seizing, boundary selection is an active choice to make regarding asset management (Teece, 2007). In transforming, embracing open innovation is explicitly put forward as one micro-foundation (Teece, 2007), and the argument of co-evolution with external partners perfectly aligns with the ecosystem view of open innovation (Day and Schoemaker, 2016). Therefore, open innovation provides an interesting context where dynamic capabilities can thrive, and in turn, dynamic capabilities may provide a viable solution to structured adoption of open innovation (West and Bogers, 2017). Considering relatively implied linkages between the two concepts, this research intends to explicitly and systematically underwrite distributed open innovation activities as micro-foundations under firm-level dynamic capabilities.

2.2.2 Dynamic capabilities as higher-order capabilities

Dynamic capabilities have been conceptualized as meta-organizational capabilities – sensing, seizing, and transforming – with subunits of social and behavioural micro-foundations, to adapt to the environment (Teece, 2007; Day and Schoemaker, 2016). This section attaches more importance to dynamism of the capabilities themselves rather than dynamism of environments. Both as organizational capabilities, the line between operational capabilities and dynamic capabilities is drawn (Winter, 2003; Zahra et al, 2006; Tecce, 2012; Teece, 2014; Teece, 2016). Organization capabilities refers to "the capacity to perform a particular activity in a reliable and at least minimally satisfactory manner" by the organization (Helfat and Winter, 2011, p. 1244; Helfat et al, 2007). Operational capabilities are capabilities "that go into solving a problem or achieving an outcome", while dynamic capabilities are "the capabilities to reconfigure a firm's resources and routines in the manner envisioned and deemed appropriate by the firm's principle decision-maker(s)" (Zahra et al, 2006, p. 921-924). In other words, dynamic capabilities are higher-order organizational capabilities that act on operational capabilities (Winter, 2003; Zahra et al, 2006; Tecce, 2012; Teece, 2014; Teece, 2016).

Major differences between operational capabilities and dynamic capabilities are analysed. Objectives of operational capabilities are to encourage operational efficiency, while dynamic capabilities are to effectuate strategic change (Teece, 2012). Operational capabilities help do things right and dynamic capabilities do the right things (Teece, 2014). Managerial focus of operational capabilities is cost cutting, while attention of dynamic capabilities is attached to entrepreneurial asset orchestration and learning (Teece, 2016). These two types of organizational capabilities embody the dual strategic orientations of exploitation and exploration of an organization (Teece, 2012), implying the potential of an organization to be ambidextrous. Operational capabilities and dynamic capabilities are

complementary, because their reconciliation leads to one bigger, interconnected, and dynamic system for the organization (Di Stefano et al, 2014).

Moreover, the existence of other routes beyond the two categories of organizational capabilities to address organizational challenges is not denied. One such route is 'ad-hoc problem solving' (Winter, 2003). Faced with contingent and opportunistic environment, organizations might enter a 'firefighting' mode featuring creative behaviour (Winter, 2003). This route however, neither highly patterned nor repetitive, should not be claimed as a capability (Winter, 2003) thus beyond the scope of this study. Last but not least, it is necessary to reiterate that this research reckons dynamic capabilities as higher-order organization capabilities (Winter, 2003; Zahra et al, 2006; Tecce, 2012; Teece, 2014; Teece, 2016), with the potential to be deconstructed into relevant micro-foundations (Teece, 2007; Day and Schoemaker, 2016). The next section thoroughly audits current categories of dynamic capabilities with respective micro-foundations, which is prepared for the re-integration into emergent categories of dynamic capabilities according to theme of relevance at the end of the chapter.

2.2.3 Current categories of dynamic capabilities

After clarifying the logic to deconstruct, categories of (dynamic) capabilities in previous literature are reviewed. Criterion for inclusion of a certain typology to deconstruct dynamic capabilities depends on 1) nature of dynamic organizational capabilities and 2) comprehensiveness in coverage of different categories and micro-foundations. Different typologies are compared, according to concept and author, categorization of dynamic capabilities and micro-foundations. If summary tables are available in the articles, original wording is normally kept for categorization of capabilities and micro-foundations. There might be minor changes on wording, for example, change the word of 'patients' to 'customers' to

slightly release the context of original study (Verona and Ravasi, 2003). Where there is no summary table at all, micro-foundations are extracted from narratives.

Different typologies are put into two summary tables: ***Table 2-12 on categories of dynamic capabilities***, and ***Table 2-13 on dynamic capabilities of (open) innovation***. The rationale to have two separate table is because this research adopts the interesting metaphor of ***organism*** alternative to ***brain***, for insightful investigation of organizational reality. Detailed explanation on metaphor adoption is given in Section 3.1.2 Research philosophy. Table 2-12 reviews more general typologies to categorize dynamic capabilities, the majority of which conceives the organization as a brain engaged in knowledge learning. By comparison, Table 2-13 covers (open) innovation-specific typologies of dynamic capabilities, which connotes the organization as an organism comprising interactive processes. To view the organization as organism allows the transferability of micro-foundations confined in categories of sensing, seizing and transforming (Teece, 2007). Because the purpose of the audit is to collect and compare micro-foundations for re-combination in final theoretical integration, only brief introduction or comment is given to each typology without necessarily involving too much critique.

Typologies in Table 2-12 on categories of dynamic capabilities

- Verona and Ravasi's (2003) typology is interesting, because micro-foundations are deconstructed under themes of actors, physical resources, structures and systems and culture, along processes of knowledge evolution.
- Teece (2007) provides micro-foundations under firm-level dynamic capabilities of sensing, seizing and transforming. Teece (2007) identifies deliberate oversight of culture as a gap for future exploration and recognizes the need to consider bottom-up micro-foundations in addition to top-down mandate, if to arrive at a more comprehensive understanding.

- Anand et al (2009) deconstruct dynamic capabilities into decision areas of purpose, process and people within supporting micro-foundations, despite the study context of continuous improvement initiatives.
- Pavlou and El Sawy's (2011) typology of dynamic capabilities is very much limited to the perspective of knowledge and learning in the context of new product development.
- Based on the typology by Teece (2007), Day and Schoemaker (2016) not only deconstruct sensing-seizing-transforming into six sub-capabilities as components, but also emphasize the role of leadership to address internal and external contingencies.

Table 2-12: Typologies of categories of dynamic capabilities

Concept and author	Dynamic capabilities	Micro-foundations
Dynamic capabilities (Verona and Ravasi, 2003)	• Knowledge creation and absorption	• Actors: - Skilled researchers from universities - Long-term relationships with an extensive pool of customers - Collaboration with experts from international research centres and universities • Physical resources: - Separate research facility in attractive location - Comprehensive library of knowledge - Collection museum • Structures and systems: - Complete autonomy of the research centre director over the use of annual budget - Scientists at the research centre focused on base research • Culture: - Orientation to scientific rather than applied research - Unrestricted exploration of relevant knowledge - Open attitude toward the scientific community: willingness to share research results
	• Knowledge integration	• Actors: - Technical experts loosely affiliated with professional areas - Employees with eclectic skills, able to work in unconventional environment • Physical resources: - New workplace layout (open space offices, meeting points, coffee counters, etc.) - Mobile workstations - Easily accessible electronic archive

		• Structures and systems: - Cross-functional teams - Competence centres - Professional areas - Multi-job systems - Hiring mechanisms - Self-participation in projects • Culture: - Openness to creativity - Absence of departmental identification - Interaction and dialogue encouraged
	• Knowledge reconfiguration	• Actors: - Contributive and motivated employees - Experienced senior managers • Physical resources: - Flexible workplace design - Cogitate incognita on the company walls • Structure and systems: - Absence of departments - Development group - Continuous collection and evaluation of proposals - Free allocation of time and skills - Centralized allocation of financial resources • Culture: - Openness to individual proposals and individual creativity - Broad involvement in strategic processes
Dynamic capabilities (Teece, 2007)	• Sensing	• Processes to direct internal R&D and select new technologies • Processes to tap developments in exogenous science and technology • Processes to tap supplier and complementor innovation • Processes to identify target market segments, changing customer needs and customer innovation
	• Seizing	• Delineating the customer solution and the business model: - Selecting the technology and product architecture - Designing revenue architectures - Selecting target customers - Designing mechanisms to capture value • Selecting enterprise boundaries to manage complements and control platforms: - Calibrating asset specificity - Controlling bottleneck assets - Assessing appropriability - Recognizing, managing, and capturing co-specialization economies • Selecting decision-making protocols: - Recognizing inflexion points and complementarities - Avoiding decision errors and anti-cannibalization proclivities • Building loyalty and commitment: - Demonstrating leadership - Effective communicating

		- Recognizing non-economic factors, values and culture.
	• Transforming	• Decentralization and near-decomposability: - Adopting loosely coupled mechanisms - Embracing open innovation - Developing integration and coordination skills • Co-specialization: - Managing strategic fit so that asset combinations are value enhancing • Governance: - Achieving incentive alignment - Minimizing agency issues - Check strategic malfeasance - Blocking rent dissipation • Knowledge management: - Learning - Knowledge transfer - Know-how integration - Achieving know-how and intellectual property protection
Continuous improvement (CI) as a dynamic capability (Anand et al, 2009)	• Purpose	• Organizational direction and CI goals: - Multi-level steering committees with interlinked membership for cascading down organizational goals - Project selection focused on matching areas of opportunity that the business cares about with improvement frameworks - Projects required to have strategic implications 'Y's' relating intended process improvements to organizational goals - Governance systems to ensure legitimacy of targets and assess extent of achievement - CI initiatives blessed by top-management - Internal job postings referring to CI initiatives as metric for program relevance - Awards for participation and leadership roles in CI • Balanced innovation and improvement: - Different project protocols such as Design for Six Sigma, Lean Projects, and Kaizen Bursts - Mistake-proofing features built into processes as part of improvements to ensure long-term and uniform process control
	• Process	• Constant change culture: - Steering committees encouraging multilevel scanning of external environment - External benchmarking through interactions with similar businesses - Internal benchmarking through project tracking databases - Voice of the customer, a common feature of process improvement projects - Iterations of current and future state value stream maps encouraging sustained emphasis on change - CI champions created to act as change agents and to spread CI culture - Leadership, team involvement, and change management tools included in CI training

		• Parallel participation structures: - Superimpose lateral structures for cross-functional collaboration - Offline teams headed by team leaders functioning as internal CI methodology experts - Use of projects to target specific process improvement goals - Build-in adjustments for functional goals to tackle conflicts encountered in projects - Special emphasis placed on data to incorporate trade-offs of functional goals and in the interest of organizational performance - Supplier involvement in process improvement projects that span organizational boundaries • Standard processes: - Ensure measurement and comparison for improvement projects - Standardization of work practices accomplished and gradually dispersing as a result of process improvement - Mistake-proofing mechanism to design out problems • Standardised improvement method: - Specified sets of steps to search and implement process improvements - "Tollgate reviews" at transitional steps between project stages to ensure compliance
	• People	• Training and career paths: - Systematic initiatives for different levels of training in CI methodology - Selection of highly motivated employees as trainees - Internal expensing of training to maintain importance of CI methodology training - Front-line employees trained to work on improved processes by process improvement project leaders as part of project - Specific roles assigned to people with different levels of training in CI methodologies - Well defined paths for professional development of full-time CI members - Well defined grades and salary levels in human resource systems for CI participants • Information technology support: - Project tracking software to make real-time progress information available to team members and management - Information technology experts frequently included in process improvement teams
Dynamic capabilities (Pavlou and El Sawy, 2011)	• Sensing	• Generating market intelligence • Disseminating market intelligence • Responding to market intelligence
	• Learning	• Acquiring, assimilating, transforming, and exploiting knowledge
	• Integrating	• Contributing individual knowledge to the group

		• Representation of individual & group knowledge • Interrelation of diverse knowledge inputs to the collective system
	• Coordinating	• Assigning resources to tasks • Appointing right persons to right tasks • Identifying synergies among tasks, activities, and resources • Orchestrating activities
Dynamic capabilities (Day and Schoemaker, 2016)	• Sensing	• Peripheral vision: - Scoping: how widely to scan and what issues to address first Past: analyse blind spots or find inductive analogy from other industries Present: focus on signals emerging but not yet noticed or appreciated Future: envision new futures by scenario thinking - Active scanning: push the enquiry into the periphery • Vigilant learning - Foster a robust market orientation - Filtering out the filterers: empower people to speak - Suppressing biases: open minded interpretation of ambiguous information - Triangulating perspectives on a complex issue
	• Seizing	• Probe and learn: - Requires leaders to actively cultivate and support a culture in which mistakes are tolerated and even encouraged at times. - Foster a climate in which learning from failures is possible and experimentation is a norm. • Flexible investing: - Develop a portfolio of various types: Preserve and protect options Scouting options Exploratory options
	• Transforming	• Organizational redesign: - Adopt multi-divisional form for diversification - Organizational separation (physical, structural, funding and policies) to fully pursue innovative options • External shaping: - Renegotiate the environment and shape a company's ecosystem - Rely extensively on external networks and co-creation - Use the ecosystem as strategic radar system for pick up weak signals

Typologies in Table 2-13 on dynamic capabilities for (open) innovation

Table 2-13 reviews major typologies of (open) innovation-specific dynamic capabilities. Despite respective emphasis on general innovation, open innovation and radical innovation, all argue for systematically managing themed categories of dynamic capabilities for innovation (Lawson and Samson, 2001; O'Connor, 2008; Slater et al, 2014; Hosseini et al, 2017). A brief comment of each typology is given below:

- Lawson and Samson (2001) provide a conceptual model of seven-element innovation capabilities to manage innovation within organizations. Investment in innovation capabilities is considered as the dynamic engine for value creation rather than the static possession of assets (Lawson and Samson, 2001).
- O'Connor (2008) offers a systematic approach to manage elements of dynamic capabilities for new and radical innovation. It is suggested "all these elements must be brought into internal consistency and into alignment with the requirements of operating in a highly uncertain environment. Together, they make up a formidable system." (O'Connor, 2008, p. 327).
- Similarly, Slater et al (2014) propose a typology for radical product innovation with components of innovation capabilities as well as portray relationships between the components. For instance, the component of senior leadership impacts the component of culture by communicating values in storytelling, behaviours and decisions (Slater et al, 2014).
- Hosseini et al (2017) offer an overview framework more specific to open innovation capabilities, allowing for prioritization and selection to suit the context of an individual organization. Human side and culture implication are identified as under-investigated blind spot for future research (Hosseini et al, 2017).

Table 2-13: Typologies of dynamic capabilities for (open) innovation

Concept and author	Dynamic capabilities	Micro-foundations
Dynamic innovation capabilities (Lawson and Samson, 2001)	• Vision and strategy	• Clear articulate common vision and express strategic orientation • Create a vision for products to outperform and occupy a distinct market position, rather than benchmarking the best of the best • Have an innovation strategy to direct organizational attention
	• Harness the competence base	• Resource management: - Lever, combine and recombine knowledge and resources into disparate markets, technologies and products • Diverse funding channels: - Employ a variety of funding channels to encourage risk-taking and entrepreneurship • Innovation champions: - Support key individuals at various stages of the innovation process to act as gatekeepers, business innovators or organizational sponsors • E-business: - Adopt e-business to enhance innovation process and radically alter knowledge management within and outside
	• Organisational intelligence	• Learning about customers: - Aware of needs and problems of customers - Lead user innovation as a major approach • Learning about competitors: - Position diagnostic benchmarking (imitation) - Position advantage building (differentiation)
	• Creativity and idea management	• Divergent thinking of what is unrealised, unproven or untested - Knowledge-driven or vision driven • Creativity is viewed as the process of idea generation
	• Structures and systems	• Organizational structure: - The more permeable and organic the structure, the greater potential for innovative ideas to spring. • Reward systems - Dual ladder system - Suggestion schemes - Public recognition - Financial bonuses • Stretch goals for innovation - Set highly-difficulty stretch goals for employees to help employees to institutionalise the drive for innovativeness
	• Culture and climate	• Tolerance of ambiguity:

		- Tolerate ambiguity but reduce it to manageable levels by effective information management and tight control over project milestones - When failures and mistakes occur, do not hide but learn the lesson • Employee empowerment: - Respect, invest and empower in people • Expect creative time: - Sanction time to think, or creative slack - Provide time, funding, facilities and a creative environment • Communication: - Facilitate knowledge sharing by combining a wide variety of experiences, open dialogue, building on others' ideas and exploring issues relevant to innovation
	• Management of technology	• Alignment for competitive advantage: - Link core technological strategies with innovation strategy and business strategy • Effective forecasting: - Identify future development in technologies, products and markets
Dynamic capabilities for major innovation (MI, composed of both radical and really new) (O'Connor, 2008)	• A clearly identified organizational structure	• Clear roles and responsibilities to sustain attention and resources • Accumulate collective experience of group • Display internal consistency of elements without affecting mainstream organization • Established loosely coupled organizational unit to commercialize radical technology
	• Internal and external interface mechanisms	• External linkages: - Explicitly link between the focal firm and knowledge sources outside the firm through interactions, either informal personal relationships or formal alliances - Enhance variety of outside knowledge - Frequently interact with potential customers and external constituents - Build systems to enrich external networks • Internal linkages: - Communicate MI system's role throughout the organization - Tightly or reciprocally couple MI system objectives to the firm's strategic intent - Loosely couple MI with mainstream organization in terms of access to resources, networks and business unit systems - Decouple MI system's project management processes from those of mainstream system
	• Exploratory processes	• Utilize learning-oriented exploratory processes to manage project progress

	• Requisite skills	• Identify broadly skilled employees for flexible circumstances • Mentor, coach and apprentice to develop new capabilities
	• Appropriate governance and decision making mechanism and criteria	• Unique governance over the portfolio of MI projects with high-risks • Governance over specific projects within the portfolio, allowing for options mentality (reject simplistic financial analysis instead focusing on keep options open) and overseeing project expertise • Establish a mechanism for constant reflection and reconfiguration
	• Appropriate metrics	• Need both activity- and performance-based measures • May include accumulated new market connections, new technical capabilities and new partnerships or moved the firm into a new strategic domain
	• Cultural and leadership context	• Values and integrates MI into the larger system, through - Investment in strategic thinking and conversations about the future health of the firm - A vision of the firm's competency objectives, in terms of technology platforms or market domains - Investment in technology and human capital to build and exploit these capabilities
Radical product innovation capabilities (Slater et al, 2014)	• Senior leadership	• Passionate: - Exude passion • Strategic intent and market vision: - Articulate strategic intent and market vision as frame of reference • Customer value focus: - Imbue technologists with a customer value orientation • Physical and psychological projection: - Provide physical protection (insulate the radical innovation organization to minimize distractions and short-term pressures) - Provide psychological support and encouragement (to the radical innovation project team even during the inevitable low points of the project) • Provide resources: - Dedicate sufficient resources and apply appropriately different metrics to assess success than traditional innovation • HRM skills: - Recruit, develop and retain people who have the robust set of skills, knowledge and mind-set to drive radical innovation
	• Organizational culture	• An adhocracy culture (flexibility and risk-taking): - Values of entrepreneurship, innovation, adaptability, propensity for risk, as well as an external orientation • Components of adhocracy culture:

		- Customer orientation: responsive and proactive (ambidextrous) - Competitor orientation: in-depth assessment of existing and potential competitors - Technological orientation: have the ability to acquire substantial technological knowledge by regularly scanning for information and exploit it in product development activities - Learning orientation: values commitment to learning, open-mindedness and shared principles, and exploratory and exploitative market learning for radial and incremental innovation - Willingness to cannibalize: engage in creative destruction earlier in industry's evolution
	• Organizational characteristics	• Organizational structure: - Identifiable organizational group responsible for developing and maintaining radical innovation capability - Encourage organic structure to increase horizontal and vertical communication and rapidly respond to environment - Have clear reporting systems - Embed a radical product innovation should be embedded in an SBU with resources, networks and operating systems, which is loosely coupled to the mainstream organization • Reliance on partners: - Adopt open innovation to share risk and access new market and complementary knowledge, technologies and capabilities - Develop cooperative competency to coordinate the disparate skills involved in navigating new product development alliances • Cross-functional integration: - Organize cross-functional product development teams (marketing, R&D, manufacturing, engineering and purchasing) - High levels of cooperation between marketing and R&D during early stages of the innovation project • Performance measurement - Revenue growth due to the new products/services - Customer satisfaction due to the new products/services - Number of ideas or concepts in the pipeline - R&D spending as a percentage of sales - Percept of sales/profits from new products/services
	• Radical product innovation process	• Adopt Stage-Gate Lite process for radical product innovation: - Discovery stage: encourage organizational members to think big and conduct workshop and ideation sessions - Incubation: Cultivates and refines product by prospecting potential market opportunities, identifying complementary technologies/products and exploring potential partnership opportunities

		- Acceleration: refine projects with commercial potential to the point where they can be self-sustaining • Product champion: - Promote and sell a project internally to obtain resource and support
	• Product launch strategy	• Focus and timing: - Allow for differences in product innovativeness and desired speed of time-to-market • Marketing mix: - Market research, market segmentation, targeting, pricing, advertising and integration of marketing active • Bundling product: - Bundling product with high perceived fit enhance evaluation and purchase intention
Open innovation capabilities (Hosseini et al, 2017)	• Strategic alignment	• Business and OI strategy alignment: - Align OI strategy with business strategy • IT and OI strategy alignment: - Flexibility: IT-enabled breadth and depth of knowledge search - Integration: integrate communication technologies and collaboration platforms with external knowledge search • Responsiveness to environmental change - Be able to adjust not only business and IT strategies but also methods to manage knowledge processes
	• Governance	• OI decision making: - Decide when to use open forms (partnerships, innovation contests and communities) and closed forms of innovation (authority-based and consensus-based hierarchy). • OI rules and responsibilities: - Clearly defined OI roles and responsibilities regarding gate keeping, boundary spanning, promoting and championing • Partnership management: - Appropriate partner selection processes - Account for diversity regarding the portfolio of innovation partners • Intellectual property management: - Selectively reveal information to and exchange information with OI partners
	• Methods	• Knowledge exploration: - Absorptive capacity to acquire and assimilate external knowledge - Get assistance from external intermediaries • Knowledge retention: - Incorporate explored knowledge into internal knowledge base - Maintain knowledge in inter-organizational relationships • Knowledge exploitation:

		- Commercialize internal knowledge into products or services - Outward knowledge transfer such as out-licensing • Social integration: - Foster connectedness of innovation partners through integration methods, formal (coordinators) and informal (social networks)
	• Information technology	• Knowledge exploration: - Environmental scanning techniques or advanced data mining tools • Knowledge retention: - Knowledge repositories or organization memory systems • Knowledge exploitation: - Simulation tools or computer-based design applications • Social integration: - Formal: online conferencing tools and groupware systems - Informal: blogs and e-community
	• People	• Technology mastery: - Master tools and technologies relevant for OI, such as search engines, data mining tools, collaboration platforms or Web 2.0 technologies (wikis, blogs and multimedia online toolkits) • Personal peer leadership: - Motivate innovation partners in a coherent manner toward a common goal and ensure goal achievement through coordination • Social brokerage: - Connect the right actors to ensure utilization of external knowledge • Boundary spanning: - Cope with knowledge heterogeneity and facilitate dialogue between multiple worlds
	• Culture	• OI attitude and behaviour: - Overcome not-invented-here and not-connected-here • OI risk attitude: - Require an innovation culture that tolerates entrepreneurial risk-taking • Leadership attention: - Create a climate conductive to OI - Articulate visionary goals and top-down encouragement literally and verbally - Implement proper incentive to foster engagement • Intellectual property management - Legal and IP department adopt a supportive attitude to OI - Seek win-win solutions with innovation partners regarding knowledge revealing

2.2.4 Architecture of dynamic capabilities

Architecture of dynamic capabilities is revealed by using the metaphor of house (Wilden et al, 2016). The house of capabilities and *neighbourhood* competitors are exposed to the *weather* of competitive environment; *multi-level* dynamic capabilities (individual, business and organization) support *joists* of operational capabilities, with *foundations* of structure and culture; the *roof* of strategy acts as the unifying force of all capabilities to withstand the *storm* of environmental uncertainty; and *value* of the house is determined by performance of capabilities; variation in house *architecture* explains the idiosyncrasy of the capabilities development within different organizations (Wilden et al, 2016). The metaphor vividly demonstrates the dynamic industry ecosystem, multilevel nature of dynamic capabilities as well as interaction with operational capabilities (Wilden et al, 2016). More importantly, the metaphor points to the possibility to manipulate the structure of capabilities in support of strategic orientation (Wilden et al, 2016). Orchestrating processes of dynamic capabilities will lead to performance outcomes. Inconsistency to expresses outcomes is conspicuous.

According a most recent review, consequences of dynamic capabilities are summarized as: 1) performance: firm-level performance, domain/process specific performance, external fitness, survival, growth, flexibility and innovation outcomes; and 2) organizational change: resource-based change and learning (Schilke et al, 2018). Performance outcomes are either directly linked to competitive advantage or, indirectly through alteration knowledge base or, alteration of operational capabilities, which further lead to performance improvement (Baretto, 2010; Wilden et al, 2016). Thus, “higher-order dynamic capabilities generate value both directly and indirectly by enhancing lower-order dynamic capabilities” (Fainshmidt et al, 2016, p. 22). Coherent with the metaphor of organisation as organism, this research considers evolutionary fitness as the alternative way to express performance outcome of dynamic capabilities, which

describes the effectiveness of resources manipulation within organizational context where it operates (Helfat et al, 2007). And high evolutionary fitness then leads to organizational survival and growth (Wilden et al, 2016).

This evolutionary perspective links to the path dependence of dynamic capabilities of organizations (Vergne and Durand, 2011). There is not only self-reinforcement and lock-in of focal chosen path, but also coexistence of multiple paths as alternative opportunities (Vergne and Durand, 2011). Internal selection is determined by strategic management choice, while external selection occurs from market forces and nature of the industry beyond the control of managers (Vergne and Durand, 2011). It is bias to overemphasize the role of managerial capabilities in determining organizational path, because external environment counts as well (Vergne and Durand, 2011). It is also dangerous if managers prioritize building operational capabilities for short-term growth while sacrificing the chance to develop dynamic capabilities that benefits the longer term (Schilke et al, 2018). Effective dynamic capabilities are necessary but not sufficient conditions leading to outcome (Eisenhardt and Martin, 2000). Equifinality of paths is apparent (Vergne and Durand, 2011). Open environment and open innovation provide abundant micro-foundations to support dynamic capabilities, which contribute to equifinality of firm success.

2.2.5 Summary

The concept of dynamic capabilities is elaborated, in terms of concept, nature, categories and evolutionary outcome. Table 2-14 summarizes themes and **theoretical gaps** (**bold** in colour purple) within the sub-sections. Section 2.2.1 defines dynamic capabilities as “the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments” (Teece et al, 1997, p. 516) and justifies the deconstruction of firm-level dynamic capabilities (sensing, seizing and transforming) into smaller

capabilities associated with specific micro-foundations (Teece, 2007; Day and Schoemaker, 2016). Implied relevance of open innovation as micro-foundations are noted (Teece, 2007; Day and Schoemaker, 2016). Section 2.2.2 emphasizes dynamic capabilities as higher-order organizational capabilities that are able to alter operational capabilities (Winter, 2003; Zahra et al, 2006; Tecce, 2012; Teece, 2014; Teece, 2016), further pointing out that the two organizational capabilities work in complementary as a system to achieve dual strategic orientations (Teece, 2012; Di Stefano et al, 2014).

More importantly, Section 2.2.3 reviews current typologies of dynamic capabilities with supporting micro-foundations. The typologies are arranged into two tables: one on dynamic capabilities mainly from the knowledge and learning perspective (Verona and Ravasi, 2003; Teece, 2007; Anand et al, 2009; Pavlou and El Sawy, 2011; Day and Schoemaker, 2016), the other on typologies of dynamic capabilities for (open) innovation (Lawson and Samson, 2001; O'Connor, 2008; Slater et al, 2014; Hosseini et al, 2017). Oversight of culture and bottom-up micro-foundations are regarded as major gaps for future research (Teece, 2007; Hosseini et al, 2017). Section 2.2.4 points out the evolutionary perspective as a useful alternative perspective to express the outcome of dynamic capabilities (Helfat et al, 2007; Wilden et al, 2016; Vergne and Durand, 2011).

Additionally, dynamic capabilities require a good strategy to be effective, and a particular set of dynamic capabilities may help deliver ambidextrous strategic orientations of exploration and exploitation (Teece, 2014). The next section elaborates the concept of organizational ambidexterity as the target strategic paradox to resolve.

Table 2-14: Summary of literature on dynamic capabilities

	Themes with key references and **theoretical gaps**
2.2.1 The concept of dynamic capabilities	• Definition: "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (Teece et al, 1997, p. 516; Eisenhardt and Martin, 2000; Helfat et al, 2007; Teece, 2007; Teece, 2012) • Micro-foundations of sensing, seizing and transforming (Teece, 2007; Day and Schoemaker, 2016) • **Linkage between open innovation and dynamic capabilities** (Teece, 2007; Teece, 2014; Day and Schoemaker, 2016; West and Bogers, 2017)
2.2.2 Dynamic capabilities as higher-order capabilities	• Dynamic capabilities versus operational capabilities (Winter, 2003; Zahra et al, 2006; Tecce, 2012; Teece, 2014; Teece, 2016) • Complementarity of operational capabilities and dynamic capabilities (Teece, 2012; Di Stefano et al, 2014)
2.2.3 Current categories of dynamic capabilities	• Categories of dynamic capabilities (knowledge and learning) (Teece, 2007; Day and Schoemaker, 2016; Pavlou and El Sawy, 2011; Verona and Ravasi, 2003; Anand et al, 2009) • Categories of dynamic capabilities for (open) innovation (Lawson and Samson, 2001; O'Connor, 2008; Slater et al, 2014; Hosseini et al, 2017) • **Oversight of culture** and **bottom-up micro-foundations** (Teece, 2007; Hosseini et al, 2017)
2.2.4 Architecture of dynamic capabilities	• Alternative outcomes of dynamic capabilities (Baretto, 2010; Wilden et al, 2016; Schilke et al, 2018) • The evolutionary perspective (Helfat et al, 2007; Wilden et al, 2016; Vergne and Durand, 2011)

2.3 Organizational ambidexterity

The targeted strategic challenge is organizational ambidexterity. To survive and evolve, the organization needs to manage a balance of exploration and exploitation from the strategy level down to activities (Benner and Tushman, 2003; O'Reilly III and Tushman, 2013; Benner and Tushman, 2015). Modes of balancing as solutions to address the strategic paradox dominate current literature (Turner et al, 2013). The three modes are sequential, simultaneous/structural, and contextual (O'Reilly III and Tushman, 2013). Alternative ways to frame solution are then given, namely levels of analysis

(Turner et al, 2013; Andriopoulos and Lewis, 2009) and dynamic ambidexterity (Chen, 2017). Some additional practices of organizational ambidexterity are reviewed. Next, the impact of balancing actions are discussed in terms of organizational evolution (O'Reilly III et al, 2009; Lavie et al, 2010). Lastly, a summary of the section is provided, where major themes and gaps are recaptured.

2.3.1 The concept of organizational ambidexterity

This section introduces the organizational paradox of ambidexterity. The balance of exploration and exploitation is critical with regard to firm's survival and prosperity (March, 1991). Every firm confronts the dilemma of striving for efficiency by cost cutting and innovation by providing slackness to experiment (Trott, 2012). To define, "Exploitation is about efficiency, increasing productivity, control, certainty and variance reduction. Exploration is about search, discovery, autonomy, innovation and embracing variation" (Trott, 2012, p. 85; March, 1991). Considering complex competitive environment, the paradox is about being efficient in day-to-day operation in a stable environment meanwhile developing new products and services in a flexible environment (Trott, 2012). Regarding strategy, exploitation is to refine products to serve existing markets while exploration is to try out new products to shape new markets (Smith et al, 2010). Exploitation and exploration represent dual strategic orientations of an organization (Chen, 2017). In action, exploitation associates with specialization and experience while exploration diversity and experimentation (Lavie et al, 2010).

Despite the strategic value attached to address this paradox (Benner and Tushman, 2015), there is difficulty in resource allocation due to constrained organizational resources (March, 1991). Organizations have to choose between the two, either explicit or implicit (March, 1991). Focusing on any single one of the

two poses threat to firm survival. Excessive exploitation leads to 'success trap' and exploration 'failure trap' (March, 1991; Levinthal and March, 1993; Gupta et al, 2006; Junni et al, 2013). When the firm exploits existing competencies for short-term efficiency while sacrificing exploration as the opportunity cost, it falls into the 'success trap' (Levinthal and March, 1993). The inertia deprives the firm's ability to adapt to changing environment (Junni et al, 2013). In comparison, the cancellation of under-developed innovative ideas with limited short-term impact throws the firm to the 'failure trap', which dampens firm's innovative capacity in the long-run (Levinthal and March, 1993; Junni et al, 2013). Tendency to rest on laurels of exploitation and ever-lower expectation on exploration makes both traps self-reinforcing (Levinthal and March, 1993; Gupta et al, 2006; Junni et al, 2013). Therefore, the 'either/or' approach to resolve the ambidextrous paradox is inadequate in complex competitive environment (Smith et al, 2010).

The 'both/and' approach is more preferable to commit to a paradoxical strategy (Smith et al, 2010). An organization should be capable of doing both exploration and exploitation (O'Reilly III and Tushman, 2008; Trott, 2012; O'Reilly III and Tushman, 2013). An optimal mix is what companies ultimately strive for (March, 1991; O'Reilly III and Tushman, 2008; Junni et al, 2013; O'Reilly III and Tushman, 2013). "**Organizational ambidexterity** refers to the ability of an organization to both explore and exploit – to compete in mature technologies and markets where efficiency, control, and incremental improvements are prized and to also compete in new technologies and markets where flexibility, autonomy, and experimentation are needed." (O'Reilly III and Tushman, 2013, p. 324). Organizational ambidexterity is not merely about whether an organization can pursue efficiency and innovation simultaneously, but about how to develop essential capabilities to survive competition in multiple markets (O'Reilly and Tushman, 2008; O'Reilly III and Tushman, 2013). Current solutions regarding how to balance is reviewed below.

2.3.2 Modes of balancing

Organizations must take action, faced with unprecedented disruption in pace and scale (Anthony et al, 2017). To achieve the optimal balance between exploration and exploitation, three modes of ambidexterity have been identified, namely sequential ambidexterity, structural ambidexterity, and contextual ambidexterity (O'Reilly III and Tushman, 2013). The focus of the three modes is on structural shift over time, current alignment of designed elements and building supportive context respectively (O'Reilly III and Tushman, 2013). The three modes will be explained one by one.

Sequential ambidexterity refers to realignment of structure with strategy answering to environmental change (O'Reilly III and Tushman, 2013). Temporal shift of certain business units can be one possible route to be ambidextrous (O'Reilly III and Tushman, 2013). For example, firms can adopt semi-structures to balance organic and mechanistic structures (Brown and Eisenhardt, 1997). Organic structure allows extensive communication for improvisation, while mechanically defined responsibility guarantees project performance (Brown and Eisenhardt, 1997). Rhythmic oscillation over time permits prioritization of exploration and exploitation at certain time (Brown and Eisenhardt, 1997; O'Reilly III and Tushman, 2013). Timing and process of transition remain gaps to explore (O'Reilly III and Tushman, 2013).

Structural ambidexterity is conducting exploration and exploitation simultaneously by special structural arrangement (O'Reilly III and Tushman, 2013). Structurally separated sub-units are set up for either exploration or exploitation under common strategic intent, each of which has its alignment of competencies, systems, incentives, processes, and cultures (O'Reilly III and Tushman, 2013). Units designed for exploitation are able to concentrate on serving current market more efficiently, without diverting their attention to explorative tasks (Kauppila, 2010).

Besides, there is the possibility to engage multiple levels internally as well as partnerships externally for both exploration and exploitation (Kauppila, 2010). For example, alliance portfolios are managed to maintain the balance over time (Lavie and Rosenkopf, 2006; Lavie et al, 2010).

In addition, **contextual ambidexterity** means building supportive contexts to enable immediate individual adjustment as well as managing organizational identity shift over time (O'Reilly III and Tushman, 2013). In the short run, it's about context building to direct individual perceptions and behaviours, when individuals face conflicting demands of exploration and exploitation (Gibson and Birkinshaw, 2004; O'Reilly III and Tushman, 2013). With appropriate organizational characteristics, individuals should be able to make decisions on activities with both orientations of alignment and adaptability (Gibson and Birkinshaw, 2004). In the long run, how to manage organizational culture and identity change is pointed out as one fruitful stream for future research (O'Reilly III and Tushman, 2013; Gioia et al, 2013; Schultz and Hernes, 2013).

Structural separation is always referred to as a favourable solution (Benner and Tushman, 2015), due to manager's obsession with control and efficiency – the 'mechanistic approach' of managing (Morgan, 2006). Structural separation is a necessary but not sufficient condition for firms to be ambidextrous (Kauppila, 2010). Firms need 'organic systems' to adapt to more turbulent environment (Benner and Tushman, 2015). Besides, structural and contextual ambidexterity are complementary, and there may be vacillation regarding modes of balancing over long-run evolution of the firm (Benner and Tushman, 2015). Therefore, each mode of ambidexterity is useful but incomplete (Chen, 2017). Although all the three modes justify their viability to achieve ambidexterity, there is potential to re-combine different modes (Kauppila, 2010; O'Reilly III and Tushman, 2013; Chen, 2017). Re-combination accommodates both logics of exploration and exploitation and plans for exceling at both (Chen, 2017). Next section looks at

alternatives ways besides modes of balancing to reveal managerial practices and mechanisms that deliver organizational ambidexterity.

2.3.3 Alternative ways to deconstruct ambidexterity

One way to deconstruct is to differentiate by levels of analysis. It has been generally acknowledged that ambidexterity is nested at multiple levels of the organization (Turner et al, 2013; Andriopoulos and Lewis, 2009; Birkinshaw and Gupta, 2013; Junni et al, 2013; Raisch et al, 2009; Chen, 2017). According to Andriopoulos and Lewis (2009), routes to ambidexterity lie in 1) strategic intent: creating paradoxical vision and diversification of project portfolio; 2) customer project orientation: leveraging constraints and possibilities within current projects as well as between-project iteration and wider market landscaping; 3) personal driver: cultivating paradoxical identity and flexible work definition. More comprehensively, Turner et al (2013) offer a systematic categorization of mechanisms according to resources of organizational, social and human, spanning across levels of organization, group and individual, as is shown in Table 2-15. Turner et al (2013) extend current categorization of mechanisms of balancing into categories of sequential, structural and contextual ambidexterity which dominates current literature. Besides, both mandated top-down as well as emergent bottom-up mechanisms need to be taken into consideration (Raisch and Birkinshaw, 2008; Birkinshaw et al, 2016). Inherently interwoven mechanisms explain the complexion of operationalization of ambidexterity (Turner et al, 2013).

Table 2-15: A multi-level categorization of ambidexterity mechanisms (Turner et al, 2013, p. 322)

Levels of analysis	Intellectual capital resources		
	Organizational capital	Social capital	Human capital
Organization	Structural configuration and separation. Development and maintenance of inter-organizational relationships. Coexistence of formal and informal structures.	Knowledge-sharing relationships with new and existing external parties. HR practices supportive of ambidexterity.	Individuals reconcile and coordinate exploitative and exploratory functions. Management ability to reconfigure organizational assets. TMT behavioural integration and complexity.
Group	Reward systems to support ambidexterity. Processes for creating dense social relationships and informal coordination. Formal and informal managerial integration and control mechanisms.	Complex network of strong and weak ties for effective knowledge-sharing, supported by formal and informal behaviours. Relationships supportive of ambidexterity. Shared values and goals.	Strong, compelling vision. Participation in cross-functional interfaces. Transformational leadership.
Individual	Multiple cross-functional interfaces to accommodate formal and informal coordination. Use of both 'best-practice' and local managerial discretion and judgement.	Individuals creating and supporting the context for ambidexterity. Both relational- and task-focused leadership.	Taking the initiative; cooperative behaviour; multitasking; brokering.

Another way is to categorize managerial practices into a set of strategies, structures, and processes, which can accommodate both logics of exploration and exploitation and support all three forms of ambidexterity (Chen, 2017). The dimensions of managerial practices include strategy, structure, incentive, process, customer involvement, supply chain and acquisition (Chen, 2017). Each dimension has its unique managerial practices with different orientations, which are further linked to three modes of ambidexterity (Chen, 2017). The three modes of

ambidexterity are believed to be associated with a certain level of strategic implementation: 1) structural ambidexterity is achieved by dedicating business units either to explore or exploit at the corporate level; 2) contextual ambidexterity is concerned with creating a context where employees are able to explore and/or exploit at the business-unit level; and 3) sequential ambidexterity focus project level alignment, that is, to match projects with different features at different stages along the innovation process (Chen, 2017). These managerial practices are summarized in Table 2-16. Chen's (2017) deconstruction is good in terms of providing thorough audit of managerial practices, but the real-world evidences are limited due to merely referring to cases in literature.

Table 2-16: Managerial practices of dynamic ambidexterity (Summarized from Chen, 2017)

Dimensions	Managerial practices	Application according to modes of balancing
Strategy	Deliberate vs. emergent To exploit, firms can adopt deliberate strategies to guide prioritization and resource allocation. To explore, emergent strategies should be allowed by enabling small bets on multiple possibilities.	Structural ambidexterity Apply deliberate strategies in exploitative units and emergent strategies in explorative units. Contextual ambidexterity Have ambitious and ambiguous goals for business units to encourage exploration and exploitation. Sequential ambidexterity Use different strategies to guide projects at different stages.
Structure	Mechanistic vs. organic Mechanistic structures with well-established routines of action and coordination enable exploitation units to achieve efficiency. Organic structures with low formalization and standardization allow exploratory initiatives to emerge.	Structural ambidexterity Use mechanistic structure in exploitative units and organic structures in exploration units. Contextual ambidexterity Allow employees in exploitative functions as well as units to organically pursue side projects. Sequential ambidexterity Incubate moon-shot projects by using organic structure to explore. Later exploitation may happen in either established or new units.
Incentive	Pay for performance vs. tolerance of failure	Structural ambidexterity

	Exploitation is facilitated by pay for performance, which motivates employees to achieve goals and improve performance. To encourage exploration, early failures should be tolerated and long-term success rewarded.	Use pay for performance in exploitative units and tolerance of early failure and reward for long-term success in explorative units. Contextual ambidexterity To tolerate failures even in exploitative units to encourage efforts of exploration. Sequential ambidexterity Use different incentive structures to manage projects at different stages.
Process	Execution vs. search Exploitative projects are managed through execution-oriented processes like as new product development process. Explorative projects are managed by search-oriented processes with experimentation and feedback such as lean start-up method, design sprint and agile process.	Structural ambidexterity Use execution-oriented processes in exploitative units and search-oriented processes in explorative units. Contextual ambidexterity Allow employee in each business unit to try out different processes. Sequential ambidexterity Manage projects by execution-oriented and search-oriented processes at exploitative and explorative stages respectively.
Customer involvement	Mainstream customers vs. lead users Exploitative projects are conducted with mainstream customers to collect intelligence of existing markets. Explorative projects are carried out with lead users to identify latent market demands.	Structural ambidexterity Work with mainstream customers in exploitative units and lead users in explorative units. Contextual ambidexterity Allow employees to work with different customers if necessary. Sequential ambidexterity Work with mainstream customers and lead users in at exploitative and explorative stages respectively.
Supply chain	Efficient vs. responsive Efficient supply chains are used for exploitative projects with well-defined features and predictable demands. Responsive supply chains are used for explorative projects with changing features and unpredictable demands.	Structural ambidexterity Have efficient supply chains at exploitative units and responsive supply chains at explorative units. Contextual ambidexterity Allow employees to try out different supply chains for different projects. Sequential ambidexterity Adopt efficient and responsive supply chains at exploitative and explorative stages respectively.
Acquisition	Integration vs. autonomy From the lens of resources and capabilities, exploitative acquisitions are integrated with existing business for purpose of improvement.	Structural ambidexterity Give autonomy to explorative acquisitions while demand tight integration in exploitation acquisitions. Contextual ambidexterity Allow business units to pursue both explorative and exploitative acquisitions.

	Explorative acquisitions are run autonomously with their own strategies, structures and processes to develop new business.	Sequential ambidexterity Evolve strategies for acquisition and integration along evolution of businesses.

Similarly, Birkinshaw et al (2016) deconstruct higher-order dynamic capabilities into categories of vision, culture and people development as well as figure out relevant managerial practices in accordance with three modes of ambidexterity. Table 2-17 provides details on the managerial practices. According to Birkinshaw et al (2016, p. 43), the three modes of ambidexterity are: 1) structural separation: "Orchestrating the complex interplay of resources across differentiated organizational units"; 2) behavioural integration: "Shaping and reshaping a context in which the operating units can balance contradictory activities"; and 3) sequential alternation: "Shifting the strategic focus over time and managing tensions between front-line and top managers". Compared with Chen (2017), Birkinshaw et al (2016) hold a different understanding in terms of which modes of ambidexterity rest at which level of organization. Table 2-18 provides a summary table linking the three modes of ambidexterity to dynamic capabilities of sensing, seizing and reconfiguring, which may occur more flexibly at multiple levels of the organization (Birkinshaw et al, 2016).

Table 2-17: Higher-order capabilities for the three modes of adaptation

(Summarized from Birkinshaw et al, 2016)

Dimensions	Managerial practices according to modes of adaptation
Vision	Structural separation • Unifying corporate vision - Have a clear and understandable vision that states the essence of company • Complementary unit objectives - Have separate units to address emerging opportunities and mainstream business focus on driving profits in established markets Behavioural integration • Blended vision - Constant search for innovation as well as value performance • Scale and flexibility

	- Leverage scale at times, while be nimble and responsive at other times <u>Sequential alternation</u> • Long-term orientation - Ask about what our products would be in ten or fifteen years and use the insight to define strategic topics for innovation • Alignment - Develop a common view on things
Culture	<u>Structural separation</u> • Decentralization - Local units with considerable decision-making autonomy that targets local requirements • Company-wide collaboration - Develop capabilities for collaboration <u>Behavioural integration</u> • Entrepreneurial orientation - Focus on unit discovery, instead of centralized command-and-control • Commercial focus - Decide relative emphasis on research and commercial activities • Transparency - Need cross-pollination and don't put walls up <u>Sequential alternation</u> • Self-reflection - Constantly strive for asking questions that nobody has raised before • Asymmetric interest - Ensure good and consistent overall innovation solutions, with hidden conflicts with ambitions of others higher or lower in the hierarchy • Common identity - Strongly present the excitement for new technical solutions on all levels in the firm, which is the glue that holds people together
People development	<u>Structural separation</u> • Multiple career tracks - (Specialists) flow either the standard or entrepreneurial career track • Long-term career development - Do not want 'butterfly managers' but those witness the consequences <u>Behavioural integration</u> • Leaders with blended skills - Build a cadre of exceptional gifted individual - Pull in quite a few people from outside (scientists with commercial skills) • Accountability - Danger of owning a specific unit and only worry about future of that domain <u>Sequential alternation</u> • Formal networks - Formally develop a network-based organization, which has already worked well informally • Job rotation - Facilitate the change of people form innovation units into the regular business and vice versa - Make positions and hierarchical levels comparable across the organization

Table 2-18: Levels where dynamic capabilities are held (Excerpt from Birkinshaw et al, 2016, p. 55)

	Sensing Identification and assessment of threats and opportunities	**Seizing** Mobilization of resources to address threats and opportunities	**Reconfiguring** The continuous renewal of a firm's tangible and intangible assets
Structural separation	Explorative capability, help primarily at the front line in dedicated units	Exploitative capability, held primarily at the front line in dedicated units	Resource-linking capability, help primarily at the top-executive level
Behavioural integration	Explorative capability, help primarily at the front line across the entire organization	Exploitative capability, help primarily at the front line across the entire organization	Context-shaping capability, help primarily at the top-executive level
Sequential alternation	Explorative capability, sequentially held at the front line and the top-executive level	Exploitative capability, sequentially held at the front line and the top-executive level	Focus-shifting capability, help primarily at the top-executive level

This research does not support any single way to deconstruct practices and mechanisms due to the emergent nature of the typologies, instead it takes the opportunity to flexibily put practices and mechanisms into categories of dynamic capabilities. Next section will further cover some additional topics contributing to practices of ambidexterity, which are less comprehensive but each with a unique emphasis.

2.3.4 Additional practices of ambidexterity

Additional topics cover managerial actions and the relevance of open innovation. In terms of managerial actions, managers serve as the creative force of integration and help overcome current inertia toward exploitation, to achieve both explorative and exploitative objectives (O'Reilly III and Tushman, 2008; Birkinshaw and Gupta, 2013). Five essential managerial actions includes: 1) a clear strategic

intent emphasizing both exploration and exploitation, 2) over-arching vision and values to facilitate adoption, 3) consensus on ambidextrous strategy, corporate communication, and incentive system, 4) alignment of appropriate organizational architecture for subunits for either exploration or exploitation, and 5) tolerance and resolving conflicts of multiple alignments (O'Reilly III and Tushman, 2008).

Regarding the relevance of open innovation, open context poses challenge to traditional logic of innovation and organization evolution (Benner and Tushman, 2015). Cross-boundary perspective is suggested as an emerging research stream to inquire organizational ambidexterity (Nosella et al, 2012). Ambidexterity is realized from both within and across organizational boundaries (Lavie and Rosenkopf, 2006; Lavie et al, 2010; Raisch et al, 2009). For example, at the inter-firm level, ambidextrous firms tend to hold a central position in R&D collaboration networks (Riccaboni and Moliterni, 2009). Network diversity allows accessing and taking advantage of heterogeneous problem solutions and ways of working for purposes of exploration and exploitation (Simsek, 2009). Ambidexterity results from open cooperation with external suppliers, distributors, regulators and competitors both at home and broad (Nosella et al, 2012). In the era of open innovation, "firms should be extroverted in seeking resources and ideas outside the firm while at the same time being introverted in balancing exploration and exploitation within the firm" (Kauppila, 2010, p. 307). All these evidences demonstrate the relevance of open innovation.

2.3.5 Logic of organizational ambidexterity

Organizational ambidexterity occurs within certain contexts and lead to performance outcomes (Lavie et al, 2010). Contextual triggers involve: 1) environment: dynamism in technology, market and industrial competition; 2) organization: characteristics of capabilities, structure, culture, age and size; and 3) senior management: manager's cognitive and behavioural tendencies (Lavie et al,

2010). Within context, organizational ambidextrous tensions are conceptualized and modes to balance considered (Lavie et al, 2010). Senior management plays a key role in proactively managing the ambidextrous paradox through capabilities reconfiguration (Lavie, 2006b; O'Reilly III and Tushman, 2008; Lavie et al, 2010). Considering the linkage between conducts of ambidexterity and organizational performance is not straightforward in both short-term and long-term (Lavie et al, 2010), the outcome of ambidexterity is alternatively expressed in terms of organizational evolution.

Organizations can be thought of as organisms living in wider environment (Morgan, 2006). In nature, evolutionary logic explains organisms' transformation over time (O'Reilly III et al, 2009). Underpinning mechanisms include variation in traits, survival through selection, and retention of traits among generations (O'Reilly III et al, 2009). The logic of natural selection has been the fittest survive (O'Reilly III et al, 2009). Mimicking mechanisms of nature, multi-level selection and adaptation occur in organization (O'Reilly III et al, 2009). In terms of multi-level selection, the fitness of the organisation in environment depends on its designed ecological form; while the rise and fall of a certain business unit is determined by its capability fitness, either being exploitative or explorative, regarding its direct market competition (O'Reilly III et al, 2009). By comparison, adaptation is understood as senior management's ability to deliberately regulate the evolution processes across business units in an organization when facing external environment (O'Reilly III et al, 2009).

Adaptation is not about random variation and inefficiency tolerance, it introduces a deliberate approach to manage evolution processes through current capabilities exploitation and new capabilities development to deal with new opportunities (O'Reilly III and Tushman, 2008; O'Reilly III et al, 2009). This means the firm can learn to be proactive instead of being too reactive regarding organizational evolution (O'Reilly III et al, 2009). For example, IBM establishes Emerging Business

Opportunities to allow for the exploration of new opportunities (O'Reilly III et al, 2009). Variation refers to capturing ideas from within and outside and choosing promising ideas based on strategic analysis (O'Reilly III et al, 2009). Selection is about progress monitoring to ensure the hitting of milestones, with proper financial and resource support from senior management (O'Reilly III et al, 2009). Retention is moving Emerging Business Opportunities as explorative future business to growth business, that is, Emerging Business Opportunities is integrated into regular business (O'Reilly III et al, 2009).

2.3.6 Summary

The concept of organizational ambidexterity is elaborated, with aspects of concept, nature, practices of balancing and evolutionary outcome. Table 2-19 gives an overview of themes and **theoretical gaps** (**bold** in colour purple) within the sub-sections. Section 2.3.1 defines organizational ambidexterity as the ability of an organization to both explore and exploit to survive dynamic and steady markets (O'Reilly III and Tushman, 2013). To avoid 'success trap' of excessive exploitation and 'failure trap' resulting from ever-lower expectation on exploration (March, 1991; Levinthal and March, 1993; Gupta et al, 2006; Junni et al, 2013), the 'both/and' approach to manage the strategic paradox is advocated (Smith et al, 2010; O'Reilly III and Tushman, 2008; Trott, 2012; O'Reilly III and Tushman, 2013). The emphasis is not on whether but rather how to balance efficiency and innovation in multiple markets (O'Reilly III and Tushman, 2008; O'Reilly III and Tushman, 2013). Section 2.3.2 shows three viable modes to balance (sequential ambidexterity, structural ambidexterity, and contextual ambidexterity) (O'Reilly III and Tushman, 2013) as well as acknowledges the potential to recombine three modes of balancing (Kauppila, 2010; O'Reilly III and Tushman, 2013; Chen, 2017).

Section 2.3.3 provides details on two alternative ways to deconstruct mechanisms of organizational ambidexterity, with respective logics of levels of analysis (Turner et al, 2013; Andriopoulos and Lewis, 2009) and themed dynamic capabilities (Birkinshaw et al, 2016; Chen, 2017). Section 2.3.4 covers some additional practices of ambidexterity, namely managerial actions (O'Reilly III and Tushman, 2008) and open innovation activities (Nosella et al, 2012; Riccaboni and Moliterni, 2009; Simsek, 2009; Kauppila, 2010; Lavie and Rosenkopf, 2006; Lavie et al, 2010; Raisch et al, 2009). Section 2.3.5 shows context, conduct and performance of ambidexterity (Lavie et al, 2010). Evolutionary logic is applied to explain an organization's ambidextrous evolution over time (O'Reilly III et al, 2009). After separate discussion of all three concepts, theoretical integration is explained in the next section.

Table 2-19: Summary of literature on organizational ambidexterity

	Themes with key references and **theoretical gaps**
2.3.1 The concept of organizational ambidexterity	• Meaning of exploration and exploitation (March, 1991; Trott, 2012; Smith et al, 2010; Lavie et al, 2010; Chen, 2017) • 'Success trap' and 'failure trap' (March, 1991; Levinthal and March, 1993; Gupta et al, 2006; Junni et al, 2013) • More preferable 'both/and' approach (Smith et al, 2010; O'Reilly III and Tushman, 2008; Trott, 2012; O'Reilly III and Tushman, 2013) • Definition of organizational ambidexterity (O'Reilly III and Tushman, 2008; O'Reilly III and Tushman, 2013)
2.3.2 Modes of balancing	• Sequential ambidexterity (Brown and Eisenhardt, 1997; O'Reilly III and Tushman, 2013) • Structural ambidexterity (Kauppila, 2010; O'Reilly III and Tushman, 2013) • Contextual ambidexterity (Gibson and Birkinshaw, 2004; O'Reilly III and Tushman, 2013) • **The potential to recombine the three modes of balancing** (Kauppila, 2010; O'Reilly III and Tushman, 2013; Chen, 2017)
2.3.3 Alternative ways to deconstruct ambidexterity	• Multi-level categorization of ambidexterity mechanisms (Turner et al, 2013; Andriopoulos and Lewis, 2009) • Themed dynamic capabilities of organizational ambidexterity (Birkinshaw et al, 2016; Chen, 2017)

2.3.4 Additional practices of ambidexterity	• Managerial actions (O'Reilly III and Tushman, 2008) • **Relevance of open innovation** (Nosella et al, 2012; Riccaboni and Moliterni, 2009; Simsek, 2009; Kauppila, 2010; Lavie and Rosenkopf, 2006; Lavie et al, 2010; Raisch et al, 2009)
2.3.5 Logic of organizational ambidexterity	• Context, conduct and performance (Lavie et al, 2010) • The evolutionary logic (O'Reilly III et al, 2009)

2.4 Theoretical integration

Based on theoretical elaboration of all three concepts, namely open innovation, dynamic capabilities and organizational ambidexterity, this section addresses their theoretical integration. The structure of the section is arranged as follows. To begin with, Section 2.4.1 traces theoretical origins of the three concepts, so as to position this study in wider business and management research. Section 2.4.2 explains the overlapping edges of the three concepts, followed by a theoretical framework to visually demonstrate their theoretical connections. Furthermore, Section 2.4.3 integrates micro-foundations of all three concepts under four themed categories of dynamic capabilities. Mechanisms of open innovation is shown to merge with wider organizational activities, which form the building blocks of dynamic capabilities to support the implementation of organizational strategy. Finally, Section 2.4.4 puts forward research aim and questions, with justifications drawn from evidences of theoretical elaboration.

2.4.1 Theoretical origins

Theoretical origins are traced back to show where this research sits within wider business research. Theories of economics, organization, and strategic management are drawn upon. Theoretical convergence or complementarity is anticipated. The discussion begins with the **theory on the growth of the firm**

(Penrose, 1959). Firms administer pools of resources to generate products (Penrose, 1959; Augier and Teece, 2007). Firms grow by expanding scale on the supply side as well as diversifying to multiple markets on the demand side (Penrose, 1959). Although both routes can generate firm growth, firms may have to give up apparent profitable operations to release resource so as to seek diversification in prospective markets (Penrose, 1959). Firms thus need to strike "a balance between exploitation of existing resources and development of new ones" (Wernerfelt, 1984, p. 180; Penrose, 1959). The argument implies the choice between exploration and exploitation, which forms the basic paradox of organizational ambidexterity (O'Reilly III and Tushman, 2013).

Perceiving firms as sets of resources (Penrose, 1959), **resource-based view** argues for creating a favourable resource position characterized by value, rareness, inimitability, and non-substitutability for sustained competitive advantage (Wernerfelt, 1984; Barney, 1991). To overcome ill-conceptualized static competition in resource-based view, dynamic capabilities advance the theory by considering firms' capabilities to reconfigure resource responding to dynamic competitive environment (Teece, 2007). Moreover, an **extended resource-based view** is proposed to include inter-firm resource interaction through strategic alliances (Lavie, 2006a). Firms can benefit from preferential access to others' resources and capabilities (Lavie et al, 2010). Open innovation with diverse intra- and inter- organizational collaboration mechanisms (Chesbrough and Bogers, 2014) further provides opportunities to inform theory development, beyond constrained context of strategic alliances.

Organizations are not static sets of resources at a certain point in time as is portrayed in resource-based view (Wernerfelt, 1984) but evolve over time. According to **evolutionary theory**, organizations not only blindly evolve by self-maintenance but also engage in deliberate goal seeking (Nelson and Winter, 1982). Ambidextrous organization survive both external selection by environment

and internal change and adaptation (O'Reilly III and Tushman, 2008). Viable **organizational adaptation** strategies includes: 1) Defenders: serve today's relative stable market through mechanistic control; 2) Prospectors: tune for tomorrow's market through flexible and organic development; and 3) Analyzers: take advantage by combining the former two into a single system (Miles et al, 1978). Analyzers take a balanced approach to manage existing and new product-market, technological stability and flexibility, and stable and dynamic operation (Miles et al, 1978). Considering the balancing efforts, Analyzers are inherently ambidextrous.

Organizational learning happens along organization evolution and adaptation. Based on evolutionary logic, knowledge learning happens along a recursive cycle, which involves generative variation, internal selection, replication, and retention (Zollo and Winter, 2002). Generative variation and selection serve the purpose of exploration, while replication and retention concerns with exploitation (Zollo and Winter, 2002). The tension of organizational learning is framed as exploration of possibilities and exploitation of rigidities (March, 1991), which forms the immediate theoretical origin of ambidexterity. Besides, learning accounts for constancy and change witnessed in both internal and external organizational environment (Fiol and Lyles, 1985), which notes the relevance to open innovation. Moreover, the presence of lower-level learning for short-term problem solving as well as higher-level learning for long-term overall adjustment (Fiol and Lyles, 1985) justifies the division between operational capabilities and dynamic capabilities (Winter, 2003).

Framing from a practical perspective, all paradoxes noted above – exploitative and explorative route to growth (Penrose, 1959), existing resource exploitation and new resource development (Wernerfelt, 1984), self-maintenance and deliberate goal-seeking (Nelson and Winter, 1982) lower-level and higher-level learning (Fiol and Lyles, 1985) – converge on the contradiction between **operation and**

strategy. Operation focus on excellence of individual activities for effectiveness, while strategy concerns with combination of activities to achieve strategic positioning (Porter, 1996). Companies may fail due to busy chasing the productivity frontier for its own sake while ignoring competitive threats (as differentiation opportunities) from outside (Porter, 1996). Improving operational effectiveness is not a strategy, and firm needs to have a strategy that targets competition (Porter, 1996). Ambidextrous organization can preferably commit to a paradoxical strategy to accommodate both sides (Smith et al, 2010). Dynamic capabilities, as strategic processes, facilitates proactive organizational adaptation (Augier and Teece, 2008; Augier and Teece, 2009). Entrepreneurial managers are critical to orchestrate new combinations of process, according to **neo-Schumpeterian theory of the firm** (Teece, 2007; Winter, 2006).

From a higher philosophical perspective, the ambidextrous organization strides over two metaphors of organization, more specifically, 'organization as machine' for exploitation and 'organization as organism' for exploration (O'Reilly III and Tushman, 2013; Burns and Stalker, 1961; Morgan, 2006). **'Mechanistic' and 'organic' system of management** are two extremities of a dichotomy to interpret organizational reality, and elasticity and oscillation between the two means no single extremity absolutely overrides the other in all circumstances (Burns and Stalker, 1961). Juxtaposition of the two metaphors is thus advocated. One solution for ambidexterity is to establish dual structures separate for alignment and adaption (Duncan, 1976; Gibson and Birkinshaw, 2004). Adding to the dominant metaphor of bureaucratic machines, 'organic' organizations survive changing environment by embracing open systems with interactive processes (Morgan, 2006). Multi-level interaction and knowledge exchange outside milieu of the firm (Morgan, 2006), enables the open alternatives as firms look to innovate (Chesbrough and Bogers, 2014).

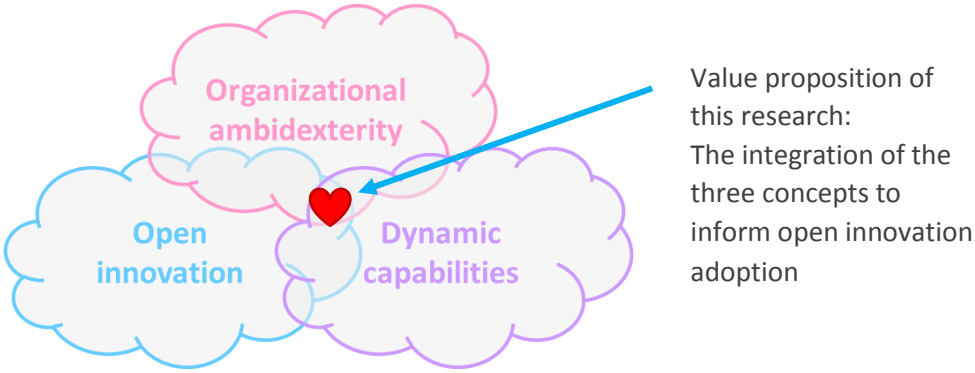
To summarize, theory on the growth of the firm (Penrose, 1959) forecasts the paradox of ambidexterity (O'Reilly III and Tushman, 2013) and forms the basis of resources based view (Wernerfelt, 1984; Barney, 1991). Extending resource-based view to account for dynamic environment, arrives at dynamic capabilities (Teece, 2007) and extended resource-based view (Lavie, 2006a). Diverse processes of open innovation (Chesbrough and Bogers, 2014; Stanko et al, 2017) provides fertile ground to access external capabilities. Organizations evolve (Nelson and Winter, 1982) and adapt (Miles et al, 1978), with learning happening along the way (Zollo and Winter, 2002; Fiol and Lyles, 1985). The paradoxes converge on the contradiction between operation and strategy practically (Porter, 1996) as well as the 'mechanistic' and 'organic' metaphors of organization philosophically (Burns and Stalker, 1961; Morgan, 2006). In addition, neo-Schumpeterian theory of the firm acknowledges entrepreneurial managers' leading new ways of doing (Winter, 2006; Teece, 2007). Organizational ambidexterity and dynamic capabilities root steadfastly in traditional theories of economics, organization, and strategic management. By comparison, open innovation serves as a prosperous context to pursue theory advancement. After rationalizing the combination in terms of theoretical origins, the next section elaborates the actual theoretical integration.

2.4.2 Theoretical framework

Theoretical integration is achieved by not only weaving respective gaps of each concept but also paying special attention on cross-concept gaps. Figure 2-7 depicts the three concepts as clouds with overlapping edges as well as demonstrates the value proposition of this research. The overlapping edges of the three concepts are explained, starting with the relevance of dynamic capabilities and organizational ambidexterity to open innovation. Cross-concept linkages presented in recent bibliographic reviews of all three concepts further rationalize their combination. Understanding the theoretical linkages, the originaliy of this

research lies in the orchestration of the three concept as an integrated system to inform open innovation adoption. More details are provided below.

Figure 2-7: Overlapping edges of the three concepts



The concept of open innovation constitutes distributed innovation processes accompanying different directions of knowledge flow, which are nested at multiple levels within and outside the locus of organization (Gassmann and Enkel, 2004; Enkel et al, 2009; Chesbrough and Bogers, 2014; Bogers et al, 2017). Considering open innovation as a practical paradigm to accommodate open ways of organizing innovation (Chesbrough, 2013; Tynnhammar, 2017), it is imperative to thoroughly investigate practical mechanisms of open innovation (Stanko et al, 2017). Current research on practical mechanisms of open innovation attaches more importance to deconstruction for understanding than integration for business purposes. The weakness of deconstruction merely for understanding can be overcome by combining different archetypes of knowledge flow (West and Bogers, 2014) as well as adopting a cross-level approach (Chesbrough and Bogers, 2014; Bogers et al, 2017; Gupta et al, 2007). The necessity to integrate processes of open innovation for business purposes is expressed in gaps of strategic adoption (Vanhaverbeke and Cloodt, 2014) with the aid of a professional guidance (Gassman et al, 2010; Huizingh, 2011).

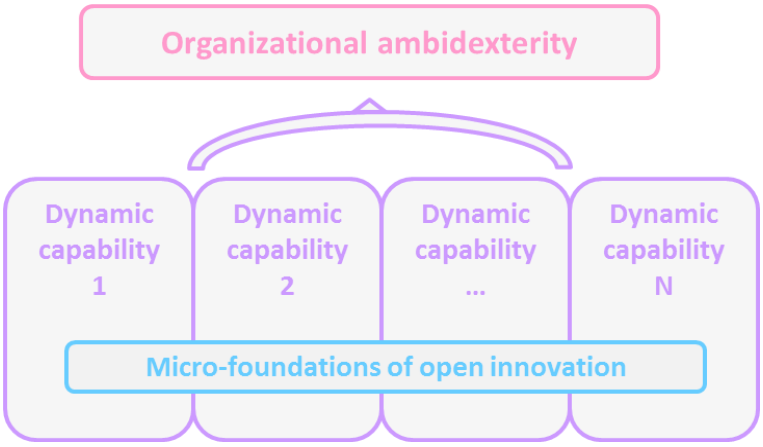
Corresponding the two gaps of open innovation, organizational ambidexterity is proposed as the strategic paradox (Gupta et al, 2006; Bogers et al, 2017) and dynamic capabilities as the professional guidance for structured adoption (Vanhaverbeke and Cloodt, 2014; West and Bogers, 2017). Organizational ambidexterity can be realized from both within and across the boundary of organization (Lavie and Rosenkopf, 2006; Lavie et al, 2010; Raisch et al, 2009). Dynamic capabilities embrace processes of open innovation as micro-foundations, despite mainly in an implicit way (Teece, 2007; Day and Schoemaker, 2016). After explaining their connection with open innovation, the relationship between organizational ambidexterity and dynamic capabilities are revealed. On the one hand, dynamic capabilities are rooted in both exploitative and explorative activities (Benner and Tushman, 2003). On the other hand, dynamic capabilities help formulate details to effectively implement strategic intent (Teece, 2014). The attainment of organizational ambidexterity relies on dynamic capabilities to source, integrate and renew business opportunities (Teece, 2007; O'Reilly and Tushman, 2013).

Confirmatively, recent bibliographic reviews of all three concepts are referring to each other, which justifies their combination. First, in the field of open innovation, both organizational ambidexterity and dynamic capabilities are research streams heavily utilized with most-cited focal articles (Randhawa et al, 2016). Second, research trends on organizational ambidexterity acknowledge 'dynamic capabilities and knowledge management' as the most central cluster and open innovation as a context for future study (Wilden et al, 2018). Third, dynamic capabilities research shows firm strategy as the cohesive force that holds together all capabilities to withstand environmental uncertainty, with organizational ambidexterity pointed out as one fruitful linkage (Wilden et al, 2016). Moreover, open innovation is shown to be a context to study the micro-foundations of dynamic capabilities (Teece, 2007; Wilden et al, 2016). Despite the demonstration

of linkages among the three concepts, they have not been formally and effectively applied as an integrated system.

To facilitate systematic adoption, this research integrates the three concepts and demonstrates the logic from strategy to practice. Organizational ambidexterity is set as the strategic challenge of organizations, which targets at addressing the paradoxical duality of exploration and exploitation (Benner and Tushman, 2003; O'Reilly III and Tushman, 2013; Benner and Tushman, 2015). For successful effectuation of organizational strategy (Teece, 2012), dynamic capabilities provide organization-level capabilities that can be further deconstructed into subsets of social and behavioural micro-foundations (Teece, 2007; Day and Schoemaker, 2016). Distributed processes of open innovation accompanying different directions of knowledge flow at multiple levels within and outside the organization (Chesbrough and Bogers, 2014; Bogers et al, 2017), are linked to categories of dynamic capabilities explicitly than more implicitly connoted in current literature (Teece, 2007; Day and Schoemaker, 2016). Figure 2-8 illustrate the logic of structured open innovation adoption from strategy to practice: organizational ambidexterity as strategy, open innovation as micro-foundations, and dynamic capabilities as a medium level of abstraction to bridge the linkage.

Figure 2-8: Theoretical framework



2.4.3 Integration of dynamic capabilities and supportive micro-foundations

Following the theoretical framework, this section looks to elaborate the critical linkage between dynamic capabilities and supportive micro-foundations related to open innovation. All three concepts are associated with certain micro-foundations of adoption, namely open innovation as distributed innovation processes (Chesbrough and Bogers, 2014), dynamic capabilities as organizational capabilities with subsets of micro-foundations (Teece, 2007; Day and Schoemaker, 2016), and the realization of organizational ambidexterity through explorative and exploitative activities (Benner and Tushman, 2003; Trott, 2012). Based mainly on typologies to deconstruct micro-foundations of all three concepts and some additional evidences, processes of open innovation are re-integrated into wider organizational activities, which are categorized under themed dynamic capabilities to support strategy implementation. The originality of such re-integration rationalises the emergent nature of the category names of the dynamic capabilities.

Synthesizing similar themes of different typologies of all three concepts, emergent categories of dynamic capabilities consist of 1) strategy and leadership, 2) culture and communication, 3) innovation process, and 4) structure and governance. The framework is developed to aid analysis rather than imposing a universal consensus (Lawson and Samson, 2001). This research intends to create a simple and flexible system of dynamic capabilities to accommodate micro-foundations of all three concepts. Table 2-20 exhibits the coverage of the emergent categorization of dynamic capabilities in relation to existing typologies, which allows easy spotting of similarities, differences and gaps. Besides, no formal descriptor is imposed on the categories of dynamic capabilities, because the supportive micro-foundations as a whole collectively define the nature of each category. The four emergent categories of dynamic capabilities are elaborated one by one as follows.

Table 2-20: Coverage of emergent dynamic capabilities in existing typologies

Current typologies relevant to all three concepts	Strategy and leadership	Culture and communication	Innovation process	Structure and governance
Dynamic capabilities in Table 2-12				
Verona and Ravasi, 2003		×		×
Teece, 2007	×	×		×
Anand et al, 2009	×	×	×	×
Pavlou and El Sawy, 2011		×		
Day and Schoemaker, 2016	×	×		×
Dynamic capabilities for open innovation in Table 2-13				
Lawson and Samson, 2001	×	×		×
O'Connor, 2008	×		×	×
Slater et al, 2014	×	×	×	×
Hosseini et al, 2017	×	×		×
Dynamic capabilities for organizational ambidexterity in Table 2-16 and 2-17				
Chen, 2017	×	×	×	×
Birkinshaw et al, 2016	×	×		

Strategy and leadership

First and foremost for successful adoption, open innovation needs to be aligned with corporate strategy as well as business strategy (Hosseini et al, 2017). Firms need to have an ambidextrous common vision embracing both exploration and exploitation (O'Reilly and Tushman, 2008; Birkinshaw et al, 2016). To facilitate strategic exploration, innovation should be emphasized and clearly articulated in common vision and strategic intent (Lawson and Samson, 2001; Andriopoulos and Lewis, 2009; Slater et al, 2014; Hosseini et al, 2017). An appropriate open innovation aim should also be defined in accordance with strategy (Hosseini et al, 2017). The ambidextrous strategy of organization is then translated into strategies of business units: complementary objectives of separate business units are formulated to drive profits in established market (exploitative mainstream) and to address emerging opportunity for market development (explorative new stream) (Lawson and Samson, 2001; Vanhaverbeke and Cloodt, 2014; Birkinshaw et al,

2016; Chen, 2017). In addition, the strategy should be adaptive to dynamic environment and flexible to incorporate new learning over time (Brown and Eisenhardt, 1997; Kelly, 2009; O'Reilly III and Tushman, 2013; Appleyard and Chesbrough, 2017; Birkinshaw et al, 2016).

Strategy mandate needs to balance short-term and long-term efforts (Kelley, 2009). Literature on open innovation suggests utilization of external knowledge to fill gaps of current projects on the roadmap as well as recognize new business opportunities that may transform the industry for the future (Chesbrough, 2003). To consider the wider organization beyond knowledge searching, in the short term, entrepreneurial activities should be embedded to increase immediate strategic alignment with current businesses; in the longer term, portfolio outlook is advocated to accommodate projects with different risk profiles and plan balance for aggregate-level result (Kelley, 2009). More important, companies should see their future as portfolios of opportunities. Strategy for growth is forward-looking, by maintaining a portfolio of short-term core business (Horizon 1), medium-term emerging business (Horizon 2), and long-term viable options (Horizon 3) (Baghai et al, 1999; Kelley, 2009). The three horizons of business are compared in Table 2-21. Additionally, a portfolio is created for different degrees of uncertainty of technology and market: 1) preserve option for manageable uncertainty (familiar technology and market), 2) scouting option for high uncertainty (either new technology or new market), and 3) exploratory option for high uncertainty (new technology and new market) (Day and Schoemaker, 2016).

Table 2-21: Planning for growth (Summarized from Baghai et al, 1999)

	Horizon 1	Horizon 2	Horizon 3
Definition	Extend and defend core businesses	Building emerging businesses	Create viable options
Focus	Executing to defend, extend and increase profitability of existing business	Resourcing initiatives to build new businesses	Uncovering options for future opportunities and placing bets on selected options

Planning discussions	Execution: Improving quality, sales force effectiveness, productivity, asset turnover and customer satisfaction	Business model review: To design capability-building programmes, to orchestrate the project management and to design contingency plans	Promising options: The more distant future, the evolution of their industry and opportunities that may emerge
Outputs	Annual operating plan: tactical plans, resourcing decisions, budgets	Business building strategies: investment budget, detailed business plans for new ventures	Decisions to explore: initial project plan, project milestone

Effective resource management and capability development are critical considerations in planning horizons of businesses (Baghai et al, 1999). Knowledge and resources are levered, combined, and recombined into disparate markets, technologies and products (Lawson and Samson, 2001). Capabilities are developed to address old problems in new ways as well as solve new problems in new ways, which supports company's dual transformation – to reinvent today as well as to create tomorrow (Anthony et al, 2017). Moreover, capabilities are cultivated within and outside the boundary of organizations in accordance with strategy (Vanhaverbeke and Cloodt, 2014). It is important to manage the fit so that co-specialization serves the intended effort of value-enhancing (Teece, 2007). Managers should be capable of identifying investment opportunities of co-specialization and further effectuating the integration of co-specialized capabilities (Teece, 2007). Attention is then paid to versatile roles and far-reaching impact of managers.

Managers empower, support and encourage strategy implementation. Managers lead by creating a climate for open innovation, articulate visionary goals and facilitate top-down engagement (Day and Schoemaker, 2016; Hosseini et al, 2017; Chen, 2017). Certain human resource management (HRM) skills are further required, such as identifying and investing in relevant skills for flexible circumstances, developing new capabilities through training and coaching as well as planning career paths and incentives to retain participants in innovation

(O'Connor, 2008; Anand et al, 2009; Slater et al, 2014; Birkinshaw et al, 2016; Chen, 2017). Besides, managers are responsible for coherent adoption. In a narrower sense, managers set the tone for innovation (Slater et al, 2014). Managers play a central role in organizing the processes of innovation to make use of business opportunities (Berkhout et al, 2010; Trott, 2012). In the wider organization, managers are responsible for maintaining proper connection between innovation activities and a wide variety of other activities within an organization over time (Kelley, 2009). Table 2-22 summaries dynamic capabilities on strategy and leadership.

Table 2-22: Dynamic capabilities on strategy and leadership

Sub-categories	Key micro-foundations
Vision & strategy	• Develop a common vision emphasizing both exploration and exploitation (O'Reilly and Tushman, 2008; Birkinshaw et al, 2016) • Embed (open) innovation within strategy (Lawson and Samson, 2001; Andriopoulos and Lewis, 2009; Slater et al, 2014; Hosseini et al, 2017) • Formulate exploitative and explorative strategies for business units (Lawson and Samson, 2001; Vanhaverbeke and Cloodt, 2014; Birkinshaw et al, 2016; Hosseini et al, 2017) • Have an adaptive and flexible strategy over time (Brown and Eisenhardt, 1997; Kelly, 2009; O'Reilly III and Tushman, 2013; Birkinshaw et al, 2016; Appleyard and Chesbrough, 2017; Hosseini et al, 2017) • Think the future as portfolios (horizons of businesses) (Baghai et al, 1999; Kelley, 2009)
Senior management	• Manage resources and develop capabilities within and outside (Baghai et al, 1999; Lawson and Samson, 2001; Teece, 2007; Vanhaverbeke and Cloodt, 2014; Anthony et al, 2017) • Empower, support, encourage (Day and Schoemaker, 2016; Hosseini et al, 2017; Chen, 2017) • Consider relevant HRM skills – select, develop and retain employees (O'Connor, 2008; Anand et al, 2009; Slater et al, 2014; Birkinshaw et al, 2016; Chen, 2017) • Facilitate coherent adoption and integration of innovation (Berkhout et al, 2010; Trott, 2012; Kelley, 2009)

Culture and communication

Non-economic factors, values and culture require consideration (Teece, 2007), thus a culture of innovation needs nurturing. An adhocracy culture is encouraged, with core values of entrepreneurship, innovation, adaptability, propensity for risk, as well as an external orientation (Slater et al, 2014). The adhocracy culture is capable of tolerating several ambidextrous orientations: responsive and proactive customer orientation (explorative and explorative market learning for radical and incremental innovation), entrepreneurial orientation versus centralized command-and-control, upstream R&D focus versus downstream commercial focus (Slater et al, 2014; Birkinshaw et al, 2016). Besides, divergent thinking for creativity is promoted to account for ambiguity – what is unrealised, unproven or untested (Lawson and Samson, 2001). Vigilant learning is further required to triangulate diverse perspectives on complex issues and to supress biases in order for open interpretation of ambiguous information (Day, 2011; Day and Schoemaker, 2016). To scale from individual creativity to collective learning, practices of open sharing of practices and open interaction for peer learning are encouraged within and across boundaries of organization (Lawson and Samson, 2001; Verona and Ravasi, 2003; Day, 2011; Birkinshaw et al, 2016; Day and Schoemaker, 2016).

Following the explanation on general condition, importance is attached to entrepreneurial risk-taking as one unique feature of the culture for innovation (Lawson and Samson, 2001; Slater et al, 2014; Hosseini et al, 2017). Adaptive market experimentation is critical (Day, 2011). Creative slack needs to be granted for employees to explore opportunities, together with funding and facilities (Lawson and Samson, 2001; Day, 2011). Small investment and diverse funding channels are promoted to try out what might work in order for fast learning (Lawson and Samson, 2001; Day, 2011; Day and Schoemaker, 2016). Other good practices to incentivise include telling encouraging success stories, training and

empowering employees, as well as rewarding employees by providing financial bonus, dual ladder system, public recognition, job rotation between innovation and mainstream (Lawson and Samson, 2001; Birkinshaw et al, 2016; Day and Schoemaker, 2016; Hosseini et al, 2017). More important, tolerance of failure is essential for innovation (Lawson and Samson, 2001; Marsh and Stock, 2003; Day, 2011; Day and Schoemaker, 2016; Chen, 2017). Failure is commonplace in new product development with high uncertainty (Marsh and Stock, 2003). Failure can provide valuable insight about marketing and technological factors that determine success of subsequent projects (Marsh and Stock, 2003). Instead of hiding failure from corporate view, companies should take the opportunity to learn the lesson (Lawson and Samson, 2001; Day, 2011; Day and Schoemaker, 2016). Trial-and-error learning happens at a time when experimentation becomes a norm and failures are not fearful any more (Day, 2011; Day and Schoemaker, 2016).

To allow the cultural practices to thrive, supporting intelligence and communication are then discussed. Scoping set the boundary of organizational intelligence: analyse blind spots and induce analogy of the past, focus on emerging signals of the present, as well as envision the scenario of the future; and active scanning further pushes the enquiry into the periphery (Day and Schoemaker, 2016). Attention is further paid to effective forecasting of future development in technologies, products and markets (Lawson and Samson, 2001). Organizational intelligence can come from internal R&D as well as external innovations of research institutions, customers, suppliers and competitors (Verona and Ravasi, 2003; Teece, 2007; Anand et al, 2009). Internally, project tracking databases enables benchmarking good practices (Anand et al, 2009). Complementary external information comes from tapping into exogenous science and technology of research institutions, learning about customer needs (mainstream customers and lead users), integrating component innovation of upstream suppliers, as well as interacting with competitors for diagnostic benchmarking and competitive differentiation (Lawson and Samson, 2001; Verona

and Ravasi, 2003; Teece, 2007; Anand et al, 2009; Chen, 2017). Hence, organizational intelligence allows learning from internal and diverse external sources, spanning across time horizons of past, present and future.

Intelligence generation is followed by dissemination (Pavlou and El Sawy, 2011). Argument on communication has been limited to topics of knowledge sharing and enabling tools. Innovative firms facilitate cross-functional, cross-hierarchical, cross-cultural and cross-technological knowledge through open dialogue, experience sharing, and collaborative exploration on issues of innovation within and across the boundary of the firm (Lawson and Samson, 2001). Some enabling tools of information and communication technology comprise environmental scanning techniques, data mining tools, organizational memory systems, simulation tools, computer-aided design, online conferencing, blogs and e-community (Hosseini et al, 2017). Adding to literature, techniques of marketing communications are considered to help design an innovation experience. Applying principles of customer experience design (Pine and Gilmore, 1998) and experiential marketing (Schmitt, 1999), companies should devise a concise and compelling theme of innovation, manage reference frames coherently and consistently, harmonize impression by introducing positive cues while eliminating negative ones, provide take-away memorabilia as incentive to innovation, as well as engage different senses to strengthen the experience. Companies may further consider the market as a forum (Prahalad and Ramaswamy, 2004), where value is co-created with various stakeholders at dispersed locus with the background of open innovation (Jaakkola et al, 2015).

Furthermore, several capabilities of people are critical in facilitating the adoption of innovation: 1) technological mastery of tools and technologies such as search engines, data mining tools and collaboration platforms ensures maximum effectiveness; 2) social brokerage involves identifying and connecting with right partners to leverage knowledge from external sources; 3) peer leadership helps

motivate and coordinate actions of innovation partners toward a common goal; and 4) boundary spanning capabilities address the challenge of knowledge heterogeneity by bridging dialogue of multiple worlds (Hosseini et al, 2017). Moreover, champions serve as agents of change who spread the culture (Anand et al, 2009). Innovation champions are the indispensable lubricating oil that get things rolling. They induce and support smooth integration of open innovation into existing product development process (Chesbrough and Crowther, 2006). Moreover, rather than honing current problem-solving capabilities, professionals engaging in open innovation should become 'solution seekers' that integrate brains of external 'problem solvers' potentially from anywhere in the world (Lifshitz-Assaf, 2016). Table 2-23 provides a summary of dynamic capabilities on culture and communication.

Table 2-23: Dynamic capabilities on culture and communication

Sub-categories	Key micro-foundations
General culture for innovation	• Balance ambidextrous orientations (Slater et al, 2014; Birkinshaw et al, 2016) • Encourage an advocacy culture (Slater et al, 2014) • Engage in divergent thinking and vigilant learning (Lawson and Samson, 2001; Day, 2011; Day and Schoemaker, 2016) • Promote open sharing and open interaction (Lawson and Samson, 2001; Verona and Ravasi, 2003; Day, 2011; Birkinshaw et al, 2016; Day and Schoemaker, 2016)
Entrepreneurial risk-taking	• Allow experimentation by granting time, money and other incentives (Lawson and Samson, 2001; Day, 2011; Birkinshaw et al, 2016; Day and Schoemaker, 2016; Hosseini et al, 2017) • Tolerance of failure and encourage trial and error learning (Lawson and Samson, 2001; Marsh and Stock, 2003; Day, 2011; Day and Schoemaker, 2016)
Organizational intelligence	• Scope past, present and future and scan the periphery (Lawson and Samson, 2001; Day and Schoemaker, 2016) • Learn from internal and external to allow benchmarking and differentiation (Lawson and Samson, 2001; Verona and Ravasi, 2003; Teece, 2007; Anand et al, 2009; Chen, 2017)

Communication	• Facilitate open knowledge exchange within and outside (Lawson and Samson, 2001) • Consider enabling tools of information and communication technology (Hosseini et al, 2017) • Design the innovation experience (Pine and Gilmore, 1998; Schmitt, 1999) • Consider value co-creation with various stakeholders (Prahalad and Ramaswamy, 2004; Jaakkola et al, 2015)
Capabilities of people	• Pay attention to people capabilities, namely technological mastery, social brokerage, peer leadership and boundary spanning (Hosseini et al, 2017) • Have innovation champions to smooth integration of open innovation (Anand et al, 2009) • (Professional identity) shift from problem-solvers to solution seekers (Lifshitz-Assaf, 2016)

Innovation process

Innovation process has been one under-researched dimension in current typologies of dynamic capabilities. There are only sparse conversations around topics of Stage-Gate Lite, cross-functional cooperation (Slater et al, 2014) and some explorative processes (O'Connor, 2008; Chen, 2017). Literature on processes of (open) innovation is drawn upon to fill in this devoid. General characteristics of (open) innovation process is first considered. Two traditional models of innovation – technology-push and market-pull – are brought together to calibrate activities into a sequential process with complex interactions (Trott, 2012; Rothwell and Zegveld, 1985). The funnel view of innovation is taken to visualize the innovation process (Chesbrough, 2003; Vanhaverbeke and Cloodt, 2014), which accommodates both upstream functions of research and development and downstream manufacturing and marketing (Bogers and Lhuillery, 2011; Chesbrough and Bogers, 2014). Upstream processes emphasize across-boundary knowledge exchange (Gassmann and Enkel, 2004; Enkel et al, 2009; Chesbrough and Bogers, 2014), while downstream processes acknowledge diversified marketplace for commercialization (Chesbrough, 2006a; West and Bogers, 2014; Chesbrough and Bogers, 2014). Throughout the innovation process, all activities

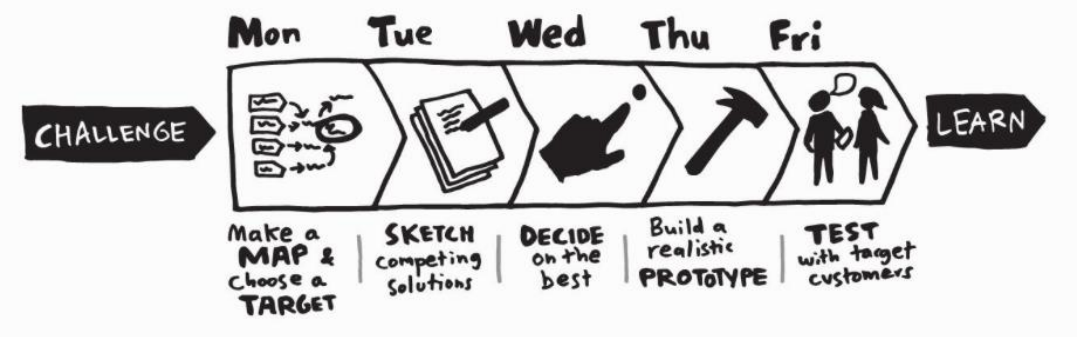
are integrated and calibrated for value creation and capture (Chesbrough, 2006a; West and Bogers, 2014; Chesbrough and Bogers, 2014).

Processes of innovation occur in sequential stages and gates, which focus on quality execution of project tasks and assessment of past, present and future respectively (Cooper, 2008; Cooper, 2014; Cooper and Sommer, 2016; Cooper, 2016; Phillips, 2018b). According to Table 2-8 in Section 2.1.5, Stage 2 and Stage 3 are emphasized as key steps to transform a project from fiction to fact: Stage 2 scrutinize key tasks and key deliverables to establish a solid business case, which followed by Gate 3 as the money gate to make pivotal decision on whether to proceeds to full development with resource committed (Phillips, 2018a; Phillips, 2018b). The process is holistic with internal cross-collaboration, which requires people and resources from many functions such as technological/R&D, marketing, sales, manufacturing/operations and legal/IP (Cooper and Sommer, 2016; Phillips, 2018a; Phillips, 2018b; Phillips, 2018c; Slater et al, 2014). Externally, early and continuous customer feedback and iteration enable efficient planning to avoid requirements cramming in the end (Cooper and Sommer, 2016). Furthermore, the rigidity of the linear process allows accountability, while agility facilitates flexible execution of tasks (Cooper and Sommer, 2016).

For agile execution as an integrated system of innovation, nine elements – three artefacts, three tools and three roles – are considered (Cooper and Sommer, 2016). Refer to Table 2-10 in Section 2.1.5 for detailed explanation. Design sprint as one major artefact is further elaborated. Sprint sets up a five-day step-by-step process to answer crucial questions and test ideas with customers (Knapp et al, 2016). The process includes mapping out a problem and picking a focus to target, sketching competing solutions, deciding on the best solution, building realistic prototype as well as testing with target customer (Knapp et al, 2016). Sprint practically applies design thinking (Knapp et al, 2016). Design thinking allows visualization of concepts and the actual delivery of new products and services

(Cooper et al, 2009), which includes three spaces – inspiration, ideation and implementation – each with different but related activities for problem solving (Brown, 2008; Brown and Katz, 2011). To think us-with-them (designer with customer) allows discovery of unmet opportunity at the fuzzy front end as well as creation of new visions and alternative scenarios that address new problems in the organization (Cooper et al, 2009).

Figure 2-9: DIY guide for running sprint (Knapp et al, 2016, p. 17)



In addition to agility, acceleration for scalability is another critical topic. First, the stage-gate is context-based: Stage-Gate Full is used for major projects with high risk, Stage-Gate Lite is adopted when the project addresses significant change with moderate risk, and Stage-Gate XPress is applied for minor project with low risk (Cooper, 2014; Phillips, 2018b). These projects are still disciplined by gates, but the system of activities, deliverables, and go/kill criteria can be unique for different projects (Cooper, 2014). Apart from contextualization, the process can also be accelerated by overlapping stages, concurrent activities, dedicated team, proper resourcing and process automation (Cooper, 2014). Some intervention mechanisms are further considered: 1) clear scheduling with flexible decision-making, 2) synchronization of internal process and external intelligence gathering, and 3) drawing in new expertise for linear progression and capturing learning of past projects (Ellwood et al, 2017). Deliberate intervention are paired with generic mechanisms to allow for improvising for changes to plans, responding to internal

and external environment, as exploring new ideas and exploiting past learnings (Ellwood et al, 2017).

Implications from open innovation are separately emphasized. Open innovation presses the formal handling of external ideas, IP, technologies and products along the stage-gate product innovation process (Chesbrough, 2003; Cooper, 2008). Extensive interaction with external partners should be managed throughout (Trott, 2012). The application of open innovation criteria facilitates formal consideration of external choices, namely systematically reviewing external knowledge and deliberately pursuing external paths to market (Grönlund et al, 2010). Importance is attached to continuous assessment and evaluation rather than fit and alignment, in terms of business model and core competences (Grönlund et al, 2010). Besides, methods of open innovation may enable the accomplishment of specific tasks at certain stage, for example, to hold idea contest in the ideation stage (Cooper and Edgett, 2008). All mechanisms of open innovation with different directions of knowledge flow (Chesbrough and Bogers, 2014; Stanko et al, 2017) spanning across different levels (Bogers et al, 2017) can potentially be useful tools of collaborative innovation. Each mode of open innovation collaboration may require a unique process to govern. For instance, 'Want, Find, Get, Manage Model' is applied to capture good practices in collaborating with innovation alliance (Slowinski and Sagal, 2010). Table 2-24 shows dynamic capabilities on innovation process.

Table 2-24: Dynamic capabilities on innovation process

Sub-categories	Key micro-foundations
General characteristics	• Bring together technology-push and market-pull models of innovation (Trott, 2012; Rothwell and Zegveld, 1985) • Include upstream R&D with cross-boundary knowledge exchange (Gassmann and Enkel, 2004; Enkel et al, 2009; Chesbrough and Bogers, 2014) • And downstream commercialization to serve diversified markets

	(Chesbrough, 2006a; West and Bogers, 2014; Chesbrough and Bogers, 2014) • Integrate all activities for value creation and capture (Chesbrough, 2006a; West and Bogers, 2014; Chesbrough and Bogers, 2014)
Stage-Gate NPD	• Manage innovation in sequential stages and gates - Stages: quality execute project tasks - Gates: Assess past deliverables, current business rationale and future plan (Cooper, 2008; Cooper, 2014; Cooper and Sommer, 2016; Cooper, 2016; Phillips, 2018b) • Cross-collaborate with different functions and integrate voice of customer (Cooper and Sommer, 2016; Anand et al, 2009; Slater et al, 2014; Chen, 2017) • Combine rigidity for accountability and agility for flexible execution (Cooper and Sommer, 2016; O'Connor, 2008; Anand et al, 2009; Chen, 2017)
Elements of agile execution	• Three artefacts: sprint, daily scrum and retrospect meeting; • Three tools: product backlog, sprint board and burn-down charts; • Three roles: member, process manager and product owner (Cooper and Sommer, 2016) • Apply design sprint, based on design thinking (Knapp et al, 2016; Brown, 2008; Cooper et al, 2009; Brown and Katz, 2011)
Scalability	• Three versions in different context: Stage-Gate (Full), Stage-Gate XPress and Stage-Gate Lite (Cooper, 2014; Phillips, 2018b; Slater et al, 2014) • Combine deliberate interventions and generic improvising (Ellwood et al, 2017)
Implications from open innovation	• Open criteria for external knowledge sourcing (Grönlund et al, 2010) • As methods to achieve specific tasks (Cooper and Edgett, 2008) • As separate process to govern specific collaboration – Use 'Want, Find, Get, Manage Model' to manage innovation alliances (Slowinski and Sagal, 2010)

Structure and governance

Organizations ought to design the structure for innovation. Organizational structure or form can impact knowledge sharing and capabilities development (Felin et al, 2012). "The more permeable and organic the structure, the greater

potential for innovative ideas to spring" (Lawson and Samson, 2001, p. 393). Organic structure encourages horizontal and vertical communication and rapid response to environment (Slater et al, 2014). Strengthened internal and external connection allows firm to innovate in diverse business ecologies (Day and Schoemaker, 2016). Multi-divisional form is advocated to enable structural separation of certain business units to explore new initiative for diversification purpose (Teece, 2007; O'Connor, 2008; Day and Schoemaker, 2016). Structurally separated business units have their own consistency of resources, networks, operating systems and policies to pursue innovative options, which are loosely coupled to exploitative mainstream organization (O'Connor, 2008; Slater et al, 2014; Day and Schoemaker, 2016). In this way, dual structures – mechanistic mainstream and organic units – are enabled (Chen, 2017). Decentralization – autonomy in decision-making of specific units – spurs flexibility and responsiveness (Teece, 2007; Birkinshaw et al, 2016). Instead of absolute enclose, the units still remain connected for tasks that requires cross-functional or cross-divisional collaboration (Verona and Ravasi, 2003; Teece, 2007; Kelley, 2009). Moreover, clear roles and responsibilities and clear reporting systems are set up to support structural separation (O'Connor, 2008; Slater et al, 2014).

Apart from designing the right organizational structure, companies renegotiate their environment with extensive reliance on external networks (O'Connor, 2008; Slater et al, 2014; Day and Schoemaker, 2016). Systems need to be built to manage external knowledge exchange and enrich external networks (O'Connor, 2008). IT enhances efficiencies of innovation process as well as radically alters internal and external knowledge management (Lawson and Samson, 2001). IT facilitates connectedness, communication and coordination among innovation partners (Joshi et al, 2010; Hosseini et al, 2017), which thus enables cross-functional and cross-company knowledge sharing (Day, 2011). Specific mechanisms include environmental scanning, advanced data mining, alive organizational memory systems, as well as internal and external

commercialization of knowledge (Hosseini et al, 2017). Besides, innovation intermediaries, with different focus and primary function, provide guidance for faster application of external ideas and explore markets for internal ideas (Chesbrough, 2006a; Billington and Davidson, 2013). Leveraging innovation intermediaries includes linear processes of problem identification, team assembly, problem aggregation, locating solvers, local context integration, pilot, as well as with on-going documentation and performance tracking (Billington and Davidson, 2013). Decision-making to remain internal or go external as well as creating governance structure to processes are gaps for future exploration (Billington and Davidson, 2013).

Governance oversees the execution of innovation against goals and allows adjustment for better operational effectiveness through double-loop learning (O'Connor, 2008; Anand et al, 2009). Portfolio management develops more rigor in project selection at gates (Phillips, 2018a), and a diversified portfolio helps keep options open and hedge against risks (O'Connor, 2008). Specific action is to apply scorecard to form go/kill criteria for portfolio review at gates, which contains factors of strategic alignment and importance, product superiority against competition, leveraging core competencies, market attractiveness, likelihood of technological success, as well as return versus risks (Phillips, 2018a; Phillips, 2018c; Phillips, 2018c). A unique governance board with different expertise (technological or marketing) should be set up to oversee project-level issues (O'Connor, 2008). Besides, appropriate performance metrics should be established, with both activity- and performance- based measures considering infrequent commercial success of innovation (O'Connor, 2008). Examples could be number of ideas in the pipeline, revenue growth from new products/services (Slater et al, 2014), accumulated new market connections, new technical capabilities and new partnerships or moved the firm into a new strategic domain (O'Connor, 2008). Moreover, constant reflection and reconfiguration of innovation processes are required to benchmark internal and external excellence,

evolve new tools, add new skills as well as diagnose innovation system (O'Connor, 2008).

Governance applied to a certain aspect of innovation is next considered. Companies should adopt an open system to manage IP along the innovation process: 1) generate ideas from multiple external sources in ideation stage, 2) source IP for problem solving or sell unused IP to external in development stage, and 3) buy or sell products with content of IP for immediate growth in commercialization stage (Cooper, 2008). Organizations make decision on when to use open forms and closed forms of innovation and then apply appropriate governance models accordingly for project selection and management (Hosseini et al, 2017). "Thus, organizations require appropriate partner selection processes to ensure that the right partners are selected while accounting for diversity within the portfolio of innovation partners" (Hosseini et al, 2017). The 'Want, Find, Get, Manage Model' sets a good example to manage innovation alliances (Slowinski and Sagal, 2010). Furthermore, different supply chains are applied to allow for dynamic ambidexterity: efficient supply chains for exploitative projects with predictable demands and responsive supply chains for explorative projects with changing features and unpredictable demands (Chen, 2017).

Concrete infrastructure is then explained, in addition to more tacit elements of structure, system and governance. Artefacts are important enablers of information revealing and behaviour reinforcing (Felin et al, 2012). The creation of a separate facility for innovation (research centre) promotes autonomous exploration and participation of both individual and institution throughout the world (Verona and Ravasi, 2003). Besides, physical barriers needs to be removed to encourage transparency and collaboration, instead open encountering spaces with engaging visuals and audios should be set up, such as open offices, abundant meeting rooms and bustling cafeteria (Verona and Ravasi, 2003; Anthony et al, 2017). Visual signs, for example the Latin motto cogitate incognita, are put up

everywhere to remind people to 'think the unthinkable' (Verona and Ravasi, 2003). Whiteboards of sprint provides visibility that enables creative synthesis (Knapp et al, 2016). Moreover, electronic archives are maintained to allow access, retrieve and distribution of corporate knowledge, such as market reports, quality assurance results, technical documentation and so on (Verona and Ravasi, 2003). Table 2-25 shows a summary of dynamic capabilities on structure and governance.

Table 2-25: Dynamic capabilities on structure and governance

Sub-categories	Key micro-foundations
Organizational structure	• Have permeable structure to allow (open) innovation (Lawson and Samson, 2001; Slater et al, 2014; Day and Schoemaker, 2016) • Structural separation – apply multidivisional form and dual structure (Teece, 2007; O'Connor, 2008; Day and Schoemaker, 2016; Chen, 2017) • Manage consistency of elements in structurally separate business units (O'Connor, 2008; Slater et al, 2014; Day and Schoemaker, 2016) • Set up clear roles and reporting systems to support structural separation (O'Connor, 2008; Slater et al, 2014) • Maintain connection through cross-functional or cross-divisional collaboration (Verona and Ravasi, 2003; Teece, 2007; Kelley, 2009)
Systems and intermediaries	• Establish system to manage extensive external networks (O'Connor, 2008) • Use mechanisms of IT to enhance innovation process and knowledge sharing (Lawson and Samson, 2001; Joshi et al, 2010; Day, 2011; Hosseini et al, 2017) • Leverage innovation intermediaries to extend knowledge search (Chesbrough, 2006a; Billington and Davidson, 2013; Hosseini et al, 2017)
Governance	• Oversee execution as well as allow for adjustment (O'Connor, 2008; Anand et al, 2009) • Manage a diversified portfolio of projects by applying scorecard at gate reviews (O'Connor, 2008; Phillips, 2018a; Phillips, 2018c; Phillips, 2018c) • Set up governance board to surveillance project issues (O'Connor, 2008) • Apply both activity- and performance- based performance metrics (O'Connor, 2008; Slater et al, 2014)

	• Constant reconfigure innovation processes to incorporate new learnings (O'Connor, 2008) • Manage IP, partnership and supply chain (Cooper, 2008; Slowinski and Sagal, 2010; Chen, 2017; Hosseini et al, 2017)
Infrastructure	• Create a separate facility for innovation (Verona and Ravasi, 2003) • Design open spaces with engaging visuals to encourage innovation (Verona and Ravasi, 2003; Knapp et al, 2016) • Maintain electronic archives to assist knowledge management (Verona and Ravasi, 2003)

Although no consensus has arrived on categorization of dynamic capabilities, developing a holistic framework can aid analysis (Lawson and Samson, 2001). Confusion still exists about grouping micro-foundations into categories of dynamic capabilities, which might result from debating categories and insufficient empirical evidence in previous literature. However, the transferable nature of some micro-foundations breeds opportunity of flexible adoption. Considering close interaction between categories (Slater et al, 2014; Kelley, 2009), the four emerging categories are regarded as complementary rather than fragmented. Continuous feedback (experiential learning) that allows change and adaptation is more important than to try to set everything right in the beginning. Besides, the categorization of dynamic capabilities with supportive micro-foundations is powerful to resolve several theoretical gaps of all three concepts.

First, dynamic capabilities offer insights into systems, structures and processes of firm-level adoption of open innovation (Vanhaverbeke and Cloodt, 2014).Three gaps of open innovation are addressed, namely the opportunity of organizational-level adoption (Bogers et al, 2017), professional management (Gassman et al, 2010; Huizingh, 2011) and investigation of practical mechanisms (Stanko et al, 2017). Second, the categorization of dynamic capabilities provides a useful alternative to organize open innovation processes, combining directions of knowledge flow (West and Bogers, 2014) and multiple levels of analysis

(Chesbrough and Bogers, 2014; Bogers et al, 2017; Gupta et al, 2007). Similarly, categories of dynamic capabilities serve as a viable alternative to integrate modes of organizational ambidexterity (Birkinshaw et al, 2016; Chen, 2017), facilitating the investigation of managerial mechanisms (O'Reilly and Tushman, 2011). Third, two gaps of the concept of dynamic capabilities itself are settled, such as culture implication and bottom-up micro-foundations (Teece, 2007; Hosseini et al, 2017). On the basis of theoretical elaboration, the next section shows the relevance of theoretical background to research aim and questions.

2.4.4 Research aim and questions

Figure 2-10 proposes a more integrated theoretical framework, which combines the theoretical framework in Section 2.4.2 as well as accommodates the four emergent categories of dynamic capabilities in Section 2.4.3. The whole of the theoretical framework echoes general **aim of the research**: *'How to adopt open innovation from strategy to practice?'* Emphasis is put on *how* the logic flows from strategy to practice: from high-level strategy of organizational ambidexterity to lower-level practices of open innovation through a medium abstraction level of dynamic capabilities. Following the logic from strategy to practice, three research questions are designed to explore certain specifics of nested interactions among the three concepts. The three **research questions** are listed as follows. Table 2-26 summarizes key references in literature, relating to each of the three research questions.

1. *What is the relationship between ambidextrous strategy and open innovation?*
2. *What are open innovation related processes under categories of dynamic capabilities?*
3. *How does ambidextrous strategy facilitate structured open innovation adoption through dynamic capabilities?*

Figure 2-10: The integrated theoretical framework

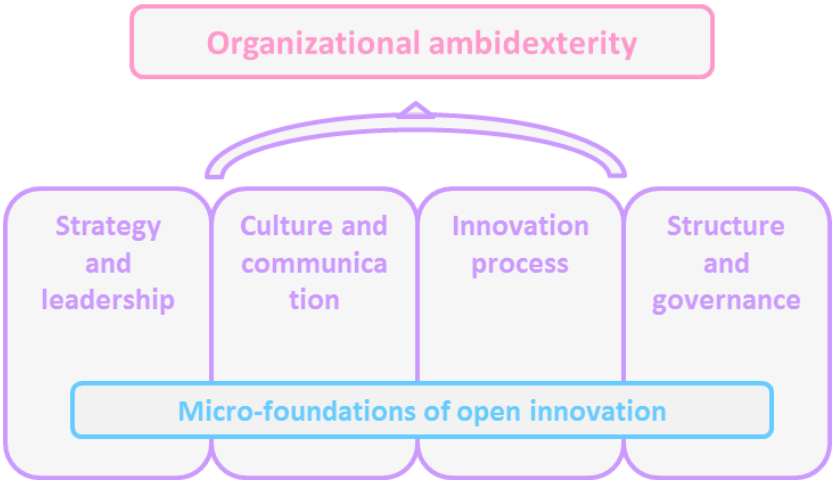


Table 2-26: Linking research questions to literature

Aim of research: *How to adopt open innovation from strategy to practice?* Strategic adoption of open innovation (Vanhaverbeke and Cloodt, 2014) To grasp opportunities of organization-level adoption of open innovation (Bogers et al, 2017)	
Current linkages to rationale Section 2.4.2	***Theoretical gaps to explore*** Section 2.4.2 & Section 2.4.3
RQ1: *What is the relationship between ambidextrous strategy and open innovation?* • Realization of organizational ambidexterity within and across organizational boundaries (Lavie and Rosenkopf, 2006; Lavie et al, 2010; Raisch et al, 2009)	***Open innovation*** • Organization-level adoption (Bogers et al, 2017) • Strategic adoption (Vanhaverbeke and Cloodt, 2014) • To address the strategic paradox of ***organizational ambidexterity*** in context of open innovation (Gupta et al, 2006; Bogers et al, 2017)
RQ2: *What are open innovation related processes under categories of dynamic capabilities?* • Open innovation as micro-foundations under categories of dynamic capabilities, mainly in an	***Open innovation*** • Organization-level adoption (Bogers et al, 2017) • Strategic adoption (Vanhaverbeke and Cloodt, 2014) • Proper guidance to manage open innovation (Gassman et al, 2010; Huizingh, 2011) • Investigation of practical mechanisms (Stanko et al, 2017)

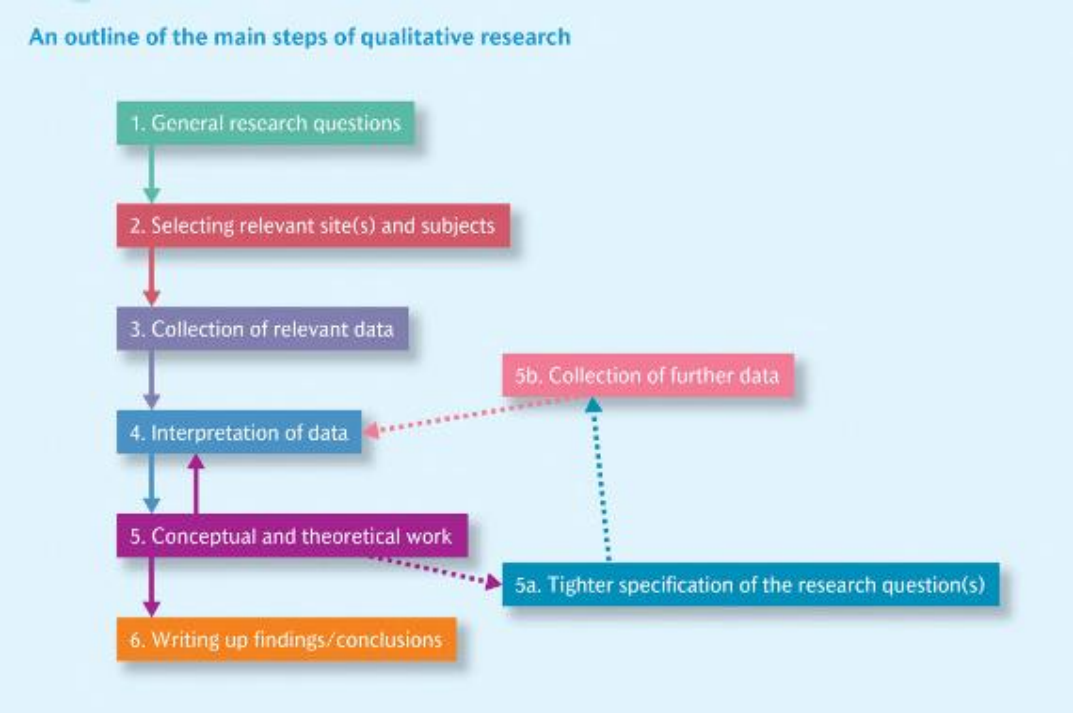
implicit way (Teece, 2007; Day and Schoemaker, 2016)	***Dynamic capabilities*** • Oversight of culture and bottom-up micro-foundations (Teece, 2007; Hosseini et al, 2017) *To **merge micro-foundations** of all three concepts:* • Open innovation as distributed innovation processes (Chesbrough and Bogers, 2014) • Dynamic capabilities with subsets of micro-foundations (Teece, 2007; Day and Schoemaker, 2016) • Explorative and exploitative activities of ***organizational ambidexterity*** (Benner and Tushman, 2003; Trott, 2012) ***Dynamic capabilities** as **a useful alternative** to* • Combine directions of knowledge flow (West and Bogers, 2014) and multiple levels of analysis in open innovation (Chesbrough and Bogers, 2014; Bogers et al, 2017; Gupta et al, 2007) • Integrate explorative and exploitative activities under modes of ambidexterity (Birkinshaw et al, 2016; Chen, 2017)
RQ3: *How does ambidextrous strategy facilitate structured open innovation adoption through dynamic capabilities?* • Dynamic capabilities are rooted in exploitative and explorative activities (Benner and Tushman, 2003) • Organizational ambidexterity relies on dynamic capabilities to utilize business opportunities (Teece, 2007; O'Reilly and Tushman, 2013) • Refer to the two cells above on relationship between open innovation and the other two concepts	***The potential to link up the three concepts** in bibliographic reviews of all three concepts* • Frequent utilization of organizational ambidexterity and dynamic capabilities with most-cited articles of open innovation (Randhawa et al, 2016) • Dynamic capabilities as a central cluster and open innovation as context for future study in organizational ambidexterity (Wilden et al, 2018) • Organizational ambidexterity as a fruitful linkage and open innovation as a context to study dynamic capabilities (Teece, 2007; Wilden et al, 2016)

Chapter 3 Methodology

3.0 Chapter overview

This chapter discusses methods adoption. To show systematic adoption, this research will be structured according to steps of qualitative research in Figure 3-1 (Bryman and Bell, 2015). Idiosyncrasy of adoption is expected, considering the practicalities of this research. Section 3.1 explains philosophical underpinnings and qualitative strategy in relation to research aim and questions, conforming to Step 1. Answering to the research questions, Section 3.2 illustrates relevant context and clarifies researcher-context relationship, paralleling to Step 2. Section 3.3 informs facets of practicalities in data collection such as relevance of primary and secondary data sources, corresponding Step 3. Following data collection, Section 3.4 deals with systematic data analysis and reporting (Step 4 Interpretation of data and Step 6 Writing up findings/conclusions). Iterations of research process in accordance with theory (Step 5, Step 5a and Step 5b) are addressed at the most relevant points. Finally, Section 3.5 gives a summary of methods as well as checks adoption in accordance with evaluative criteria of qualitative research.

Figure 3-1: An outline of the main steps of qualitative research (Bryman and Bell, 2015, p. 395)



3.1 Research aim and research design

This section shows general considerations of research design. The research aim and questions are revisited, before embarking on explaining research philosophy to shape the way of understanding and research strategy to allow coherent adoption of methods.

3.1.1 Research aim and questions revisited

The **aim of research** is to explore: *"How to adopt open innovation from strategy to practice?"* The aim of research is arrived from one pertinent problem faced by the context of research: how to structurally adopt open innovation practices in organizations. The practical problem aligns with two theoretical gaps in the field of open innovation, strategic adoption (Vanhaverbeke and Cloodt, 2014) and

organization-level adoption (Bogers et al, 2017). Theoretical elaboration in Chapter 2 has shown the usefulness of concepts of organizational ambidexterity and dynamic capabilities to assist structured adoption of open innovation in the organizational context. The logic of open innovation adoption from strategy to practice is reiterated: organizational ambidexterity as guiding strategy and dynamic capabilities as medium-level structure that integrate distributed open innovation practices. The three research questions are formulated to explore different aspects to facilitate the flow of the logic.

RQ1: *What is the relationship between ambidextrous strategy and open innovation?*

This question explores concrete empirical evidences regarding how open innovation can be linked to dual strategic orientations of organizational ambidexterity, to support symbolic argument on addressing the paradox of organizational ambidexterity in context of open innovation (Gupta et al, 2006; Bogers et al, 2017).

RQ2: *"What are open innovation related processes under categories of dynamic capabilities?"*

This question explores empirical evidences on open innovation practices embedded in wider organizational activities, under categories of dynamic capabilities to support strategic implementation. The viability of dynamic capabilities as the structure to organize open innovation activities is proven (Gassman et al, 2010; Huizingh, 2011).

RQ3: *"How does ambidextrous strategy facilitate structured open innovation adoption through dynamic capabilities?"*

Open innovation practices are linked to organizational ambidexterity on level of strategy in RQ1 and dynamic capabilities on level of capability in RQ2. On the basis of which, RQ3 constitutes researcher interpretation to make the logic flow from strategy to practice as a practical solution of structured open innovation adoption.

The three concepts are brought together as a system to inform structured open innovation adoption, which goes beyond symbolic linkages made between concepts (Randhawa et al, 2016; Wilden et al, 2016; Wilden et al, 2018).

To explore the research aim and questions, the next two sections elaborate on two critical aspects of research design respectively: philosophical considerations and general research strategy. Section 3.1.2 explains why and how the shift of organizational metaphor from brain to organism impact philosophical considerations that derives interesting insights on topic of research. Supressed organizational reality as 'process' within a system under the metaphor of organism is put forward, which sends to background the dominant view of organizational reality as 'information' (knowledge learning) shared by all three concepts. Comparatively, Section 3.1.3 details why and in general how qualitative research is conducted to develop a complex solution to structured open innovation adoption.

3.1.2 Research philosophy

*"The term **research philosophy** refers to a system of beliefs and assumptions about the development of knowledge… it is precisely what you are doing when embarking on research: developing knowledge in a particular field."* (Saunders et al, 2016, p. 124) All theories of organization and management are based on metaphors (implicit images) to conceive organizational reality (Morgan, 2006). In total, there are six main metaphors to explore topics of social science: transcendental, language game, culture, cybernetic (brain), organism and machine (Morgan and Smircich, 1980; Cunliffe, 2011). Because this research's focus is on organizational problem-solving rather than individual consciousness, this research deliberately leaves out two metaphors with excessive attention on dialogic interplay between individuals (transcendental and language game). Details of the other four more relevant metaphors – culture, brain, organism and machine – to

explore organizational reality are provided, with respective philosophical considerations of ontology, human nature and epistemology compared in Table 3-1 (Morgan and Smircich, 1980; Morgan, 2006; Cunliffe, 2011). Viewing organizations as metaphors boasts powerful insights (seeing) that may meanwhile become distortion (not seeing) (Morgan, 2006).

Table 3-1: Philosophical assumptions and metaphors of organizations (Morgan and Smircich, 1980; Morgan, 2006; Cunliffe, 2011)

Metaphor with brief description	**Culture** *Values, ideas, beliefs, norms, rituals and shared meaning*	**Brain** *Information processing, learning and intelligence*	**Organism** *Open system and on-going processes in relation to environment*	**Machine** *Managed parts with defined role in the functioning of the whole in stable environment*
Ontological assumption *(Nature of social reality)*	Reality as a realm of symbolic discourse.	Reality as a contextual field of information.	Reality as a concrete process.	Reality as a concrete structure.
Human nature *(Human's role in reality)*	Man as an actor, the symbol user.	Man as information processor.	Man as an adaptor.	Man as a responder.
Epistemological stance *(Appropriate knowledge)*	To understand the pattern of symbolic discourse.	To map contexts.	To study systems, process, change.	To construct a positivist science.

The relevance of the four metaphors of organization to explore the three concepts – open innovation, organizational ambidexterity, and dynamic capabilities – are discussed. Table 3-2 shows how arguments of each concept fit with the metaphors. Mainstream understanding is highlighted and key words implying metaphor adoption underlined. For insight, this research investigates the organization as organism, which conceives the organization as an open system with processes responding to environment (Morgan, 2006). The metaphor is interesting, because it is neither obvious (confirming the assumptions) nor absurd

(denying all the assumptions) (Alvesson and Sandberg, 2011). Regarding open innovation and dynamic capabilities, it departs from mainstream metaphor of brain focusing on knowledge exchange thus gives voice to marginalized metaphor of organism emphasizing processes in relation to environment. Considering organizational ambidexterity, the metaphor of organism confirms the exploration side while challenges the exploitation side, and it is a shift away organizational learning as brain as origin of the concept. Besides, the open system of organism is able to accommodate interacting subsystems (Morgan, 2006). The ignored metaphor of culture and mentioned metaphors of brain and machine can potentially be integrated into the metaphor of organism as subsystems.

Table 3-2: Metaphor adoption of the three concepts

	Open innovation	Organizational ambidexterity	Dynamic capabilities
Machine		• Exploitation – "to compete in *mature technologies and markets* where efficiency, control, and incremental improvements are prized" (O'Reilly III and Tushman, 2013, p. 324)	
Organism	• "all open innovation activities of a company and its partners take place in an *open innovation ecosystem*" (Rohrbeck et al, 2009, p. 425). • "Only firms that have the *right structures and processes in place* can work effectively with external partners" (Vanhaverbeke and Cloodt, 2014, p. 275).	• Exploration – "to compete *in new technologies and markets* where flexibility, autonomy, and experimentation are needed" (O'Reilly III and Tushman, 2013, p. 324) • "*adaptation* at the organizational level is a function of the *variation-selection-retention process* occurring across business units – and the ability of senior management to regulate this process in way that maintains *ecological fitness* of organization with its environment" (O'Reilly III et al, 2009, p. 84).	• "*Evolutionary fitness* depends on the external "selection" environment: evolutionarily fit dynamic capabilities enable a firm to survive and perhaps grow, and to prosper in the marketplace" (Helfat et al, 2007, p. 7)

Brain	• "distributed innovation processes based on purposely managed *knowledge flows* across organizational boundaries" (Chesbrough and Bogers, 2014, p. 17)	• "the relation between the exploration of new possibilities and the exploitation of old certainties in *organizational learning*" (March, 1991, p. 71).	• "the firm's ability to *integrate, build, and reconfigure internal and external competences* to address rapidly changing environments" (Teece et al, 1997, p. 516)

Under the favoured metaphor of organism, the coherence of philosophical considerations of ontology, human nature and epistemology is explained. Ontology is concerned with the nature of social reality (Bryman and Bell, 2015; Saunders et al, 2016). Ontological assumption under the metaphor of organization is *"Reality as a concrete process"* (Morgan and Smircich, 1980, p. 492; Cunliffe, 2011, p. 650). Human's role within this reality is an adapter, passively adapting as well as proactively managing (Morgan and Smircich, 1980; Cunliffe, 2011). Epistemology refers to the path to gain acceptable knowledge (Bryman and Bell, 2015; Saunders et al, 2016). *"To study systems, process, change"* constitutes the appropriate knowledge to explore the reality as process (Morgan and Smircich, 1980, p. 492; Cunliffe, 2011, p. 650). Aligning with ontology and epistemology, systems and processes theories are recognized as one profitable theoretical perspective to explore (Cunliffe, 2011). All three concepts – organizational ambidexterity, dynamic capabilities and open innovation – convergence on their potential to be deconstructed into processes. The process perspective sets the boundary of literature review: inclusion and exclusion of a certain piece of literature depends on its relevance to process. Based on research philosophy, research strategy in a general sense is discussed next.

3.1.3 Research strategy

This section formulates the research strategy to address the research aim and questions. This sections first reviews the general situation of methods adoption within the field of open innovation. The concept of open innovation is first illustrated by adopting cases of several world-leading companies, such as IBM,

Intel, Lucent and P&G (Chesbrough, 2003; Chesbrough, 2006a). An overview of method adoption is shown by analysing most-cited focal articles of the field, according to most recent bibliographic review (Randhawa et al, 2016). A mixture of methods are observed: theory presentation with case illustrations (Chesbrough, 2003; Chesbrough and Appleyard, 2007), quantitative survey (Lausen and Salter, 2006), quantitative bibliographic analysis (Dahlander and Gann, 2010), exploratory multiple case study (Sawhney et al, 2005), exemplar single case study (Huston and Sakkab, 2006), as well as qualitative interviews (Chesbrough and Crowther, 2006). No preference of method adoption has been observed, thus there is the opportunity to choose methods to suit the specific needs of a certain investigation.

The aim of research is to explore: *"How to adopt open innovation from strategy to practice?"* And the three specific research questions are designed to capture details to make the logic flow from strategy to practice. Because the research intends to figure out *"what is happening; to seek new insights; to ask questions and assess phenomena in new light"*, the nature of research is exploratory (Robson, 2002, p. 59; Saunders et al, 2009). It is advantageous to clarify understanding of a problem in a flexible way (Saunders et al, 2009; Miles et al, 2014). Emphasizing meaning derived from words rather than numbers, qualitative research instead of quantitative research is proposed as the general strategy of research (Saunders et al, 2009; Bryman, 2008; Bryman and Bell, 2015). Qualitative research provides a wealth of information in depth and detail (Patton, 2002). The richness of data can potentially reveal complexity that is nested in real-world context (Miles et al, 2014; Bryman, 2008; Bryman and Bell, 2015).

Methods adoption of the strategy qualitative research is then considered. Table 3-3 presents a framework that shows differences between qualitative and quantitative methods of research regarding the coherence of data collection, analysis and interpretation (Creswell, 2014). Qualitative methods are characterized by emergent design to learn about the research problem, open-

ended questions to probe insight, multiple sources of qualitative data and utilization of themes to organize data, which results in the development of a complex solution to the research problem (Creswell, 2014). Detailed methods adoption of data collection and analysis are explained in Section 3.3 Data collection and Section 3.4 Data analysis and reporting to avoid repetition. Following the steps of qualitative research shown in Figure 3.1, next section illustrates the relevance of research context to explore strategic adoption of open innovation. An appropriate context should be selected and targeted, before formally embarking on data collection and analysis.

Table 3-3: Quantitative and qualitative methods (Excerpt from Creswell, 2014, p. 17)

Quantitative Methods	Qualitative Methods
Pre-determined	Emerging methods
Instrument based questions	Open-ended questions
Performance data, attitude data, observational data, and census data	Interview data, observation data, document data, and audiovisual data
Statistical analysis	Text and image analysis
Statistical interpretation	Themes, patterns interpretation

3.2 Research context

This section explains the selection of relevant research context to address the research aim and questions. Literature has pointed out the relevance of large companies regarding open innovation adoption. Chesbrough and Brunswicker (2014) show that open innovation adoption is not a passing fad in large organizations, based on a survey conducted in 125 large companies in Europe and the United States. Open innovation is widely practiced and the intensity of adoption is on the rise among large organizations (Chesbrough and Brunswicker, 2014). Considering the tradition and upward trend of open innovation adoption in large organizations, large organizations should provide rich practices of open innovation. The context of this research is generally described as large

organizations in Scotland, which take initiative in open innovation adoption. The research context is detailed as follows.

Realizing world-leading companies such as GE, P&G, GM and NASA who have already been conducting activities of scanning the horizon, creating external partnerships and working together seeking solutions to generate product and service innovation for future growth, Scotland starts to building the momentum to embrace such collaboration known as open innovation (Wagner and Fain, 2018). This PhD research is conducted in parallel with 'Open Innovation Programme: Monitoring and Evaluation Framework' (abbreviated as SE project to differentiate from the PhD research), which is a two-year consulting project lead by the PhD researcher's first supervisor to promote knowledge exchange among industry, government agency and academia regarding open innovation adoption. The 'triple helix' approach of the SE project is described as: 1) 13 large companies in both private and public sector are at the forefront of experimenting bespoke open innovation practices; 2) Scottish Enterprise as the government agency provides dedicated leadership and financial investment; and 3) University of Strathclyde representing the academia captures and disseminates shared learning on best practices of open innovation adoption (Wagner and Fain, 2018).

Further information is given on the 13 large companies on the SE project that set the scene of this research. The 13 companies come from public and/or private sector without direct market competition, which cover a wide variety of industries including governmental service, healthcare, ferry, food manufacturing, software and hardware technology, power, energy, engineering, defence and banking. Besides, the SE project has witnessed company withdrawal and weak contact, as failure is commonplace in conducting innovation (Day, 2011; Day and Schoemaker, 2016). There are 9 highly engaged companies among the whole of 13, and only 5 companies agree to be involved in the PhD project (Company A-E in Table 3-8 in Section 3.3.2). The reason to describe the companies as a whole is

that they would become visible, if their industry category is together noted with the SE project. For data protection, this research only refers to companies' nature of industry, that is, public and/or private.

The SE project encourages these large organizations to develop open innovation capabilities as well as fosters innovation in small and medium-sized enterprises (SMEs) by providing opportunities to work these large organizations, which supports the increase of global competitiveness of Scottish companies (Wagner and Fain, 2018). Outside-in open innovation, especially the mechanism of open innovation challenge, is promoted among the 13 large companies to tap into knowledge and technologies from networks of Scottish SMEs (Wagner, 2016). The SE project hosts quarterly cohort meetings to harness and promote different aspects and emerging practices of open innovation adoption (Wagner and Fain, 2018). Year 1 of the SE project intends to understand meaning, actions, commonalities and challenges and the degree of openness of organizations, and Year 2 moves forward the journey of the 13 cohort companies by drawing on best practices from world-class companies, universities and consultancies (Wagner, 2016; Wagner and Fain, 2018). Table 3-4 provides more details on planning the cohort meetings as well as the milestone actions of the PhD researcher.

Table 3-4: Cohort meeting planning of the SE project (Annual review, 2016)

Meeting timeline	Theme	The PhD researcher
09/2015 (Launch)	Definition and actions of open innovation	
02/2016	Elements of open innovation adoption	Start to follow some company interviews
06/2016	Commonalities and challenges	
08/2016	Measurement of open innovation maturity	Follow almost all company interviews
12/2016	Open innovation matrix and collaboration	
02/2017	Engaging suppliers	
06/2017	Best practices of innovative company	Start to attend cohort meetings
11/2017	Best practices of company and university	
04/2018	Product development process	

As is shown in Table 3-4, the PhD researcher starts to follow company interviews from February, 2016 (5 months after joining the university as a PhD). The role of the PhD researcher is note-taking during the company interviews and reflective summary-writing on key points with supporting evidences. As skills of research accumulate, the PhD researcher starts to follow almost all company interviews from August, 2016. The PhD researcher follows over 50 company interviews in total from 2016 to 2018, and she also attends the last three cohort meetings from 2017 to 2018. All these experiences facilitate an in-depth understanding of these large Scottish companies as the context of research and acculturation about best practices of open innovation around the globe. To avoid cannibalizing research outputs of the SE project and the PhD project, it is a joint decision by the supervisors and the PhD researcher to make the two project relatively independent especially theoretical framing at the beginning of the PhD journey. Therefore, the materials of the SE project is referenced as secondary data of the PhD research.

Additionally, the SE project reveals that it can be challenging to embed open innovation principles into these well-established large organizations (Wagner and Fain, 2018). As a collective understanding of the cohort companies, open innovation occurs along a sequential steps of idea, challenge, collaboration and development (Wagner and Fain, 2018). First, ideas are generated, screened and filtered by considering current and future technological requirement and business environment; second, innovation challenges are utilized as a problem-solving tool to attract external solutions; third, collaboration between the solution-seeking organization and external partners is negotiated accompanying effective communication and knowledge-sharing; fourth, intense activities with collaborative partners take place to fully develop solutions to the open innovation projects (Wagner and Fain, 2018). Despite following similar steps of open innovation, idiosyncratic adoption of different companies is explained by discrepancies in requirements of the companies (Wagner and Fain, 2018).

Organizational transformation is required to successfully adopt the steps of open innovation (Wagner and Fain, 2018). Critical enablers of transformation comprise: 1) people: persuade managerial buy-in and appoint open innovation roles, 2) process: manage process to direct activates and develop supportive structure, and 3) culture: empower employees and show tolerance of failure (Wagner and Fain, 2018).

The SE project concentrates on the open innovation processes per se, without sufficiently elaborating on these critical factors of organizational transformation. For alternative insights to the SE project, the PhD project explores the integration of open innovation into wider organizational processes as well as reveals more comprehensive organizational arrangements to drive the transformation to open innovation. In other words, this research will exhaustively search for processes and activities of open innovation in relation but not limited to factors of people, process and culture. The micro-foundations of open innovation are integrated under categories of dynamic capabilities to support ambidextrous orientation of organizational strategy. To summarize, this research shares the context with the SE project: large organizations in both private and public sector in Scotland, who take initiative in open innovation adoption. The unique context of research provides the PhD researcher preferential access to gatekeepers of these cohort companies, but meanwhile it poses challenge because the non-disclosure agreement attached to the SE project denies the opportunity to sample outside the cohort companies. Next section explains methods and practicalities of data collection within this research context.

3.3 Data collection

This section has three subsections to explore data collection. Section 3.3.1 presents different methods of data collection in qualitative research, on the basis of which the adoption of methods in this research is explained. Section 3.3.2 and

Section 3.3.3 provide details on semi-structured interviews and documents respectively as chosen methods of data collection. Additionally, sampling and ethics are briefed within Section 3.3.2.

3.3.1 Methods of data collection

A research method is a technique to collect data (Bryman and Bell, 2015). There are four basic methods to collect data in qualitative research (Creswell, 2014). Different methods of data collection are briefly introduced, with their advantages and disadvantages compared in Table 3-5.

- *Observation/Ethnography* is the "process of joining a group, watching what is going on, making some notes, and writing it all up" (Bryman and Bell, 2015, p. 443).
- *Interviews* are when researcher conducts interviews with participants (Creswell, 2014). It is probably the most widely adopted method in qualitative research (Bryman and Bell, 2015) and relatively economical (Silverman, 2006; Creswell, 2014).
- *Documents* are collected during process of research, either public or private (Creswell, 2014). Documents are objects 'out there' with heterogeneous sources, which awaits to be analysed and interpreted for meaning (Bryman and Bell, 2015).
- *Audio-Visual materials* are data with forms of sound or visual (Creswell, 2014). Mass media outputs, visual documents and virtual documents may be considered as part of documents in other reference (Bryman and Bell, 2015).

Table 3-5: Qualitative data collection types, options, advantages and limitations

(Creswell, 2014, p. 191-192)

Data collection types	Options within types	Advantages of the type	Limitations of the type
Observations	• Complete participant – researcher conceals role • Observer as participant – role of researcher is known • Participant as observer – observation role secondary to participant role • Complete observer – researcher observes without participating	• Researcher has a firsthand experience with participant. • Researcher can record information as it occurs. • Unusual aspects can be noticed during observation. • Useful in exploring topics that may be uncomfortable for participants to discuss.	• Researcher may be seen as intrusive. • Private information may be observed that researcher cannot report. • Researcher may not have good attending and observing skills. • Certain participants (e.g., children) may present special problems in gaining rapport.
Interviews	• Face-to-face – one-to-one, in person interview • Telephone – research interviews by phone • Focus group – research interviews parcipants in a group • E-mail Internet interview	• Useful when participants cannot be directly observed. • Participants can provide historical information. • Allows researcher control over the line of questioning.	• Provides indirect information filtered through the views of interviewees. • Provides information in a designated place rather than the natural field setting. • Researcher's presence may bias responses. • Not all people are equally articulate and perceptive.
Documents	• Public documents – minutes of meetings or newspapers • Private documents – journals, diaries, or letters	• Enables a researcher to obtain the language and words of participants. • Can be accessed at a time convenient to researcher – an unobtrusive source of information. • Represents data to which participants have given attention. • As written evidence, it saves a researcher the time and expense of transcribing.	• Not all people are equally articulate and perceptive. • May be protected information unavailable to public or private access. • Requires the researcher to search out the information in hard-to-find places. • Requires transcribing or optically scanning for computer entry. • Materials may be incomplete. • The documents may not be authentic or accurate.

Audio-Visual Materials	• Photographs • Videotapes • Art objects • Computer messages • Sounds • Film	• May be an unobtrusive method of collecting data. • Provides an opportunity for participants to directly share their reality. • It is creative in that it captures attention visually.	• May be difficult to interpret. • May not be accessible publicly or privately. • The presence of an observer (e.g., photographer) may be disruptive and affect responses.

NOTE: This table includes material adapted from Bogdan & Biklen (1992), Creswell (2013), and Merriam (1998).

Referring to Table 3-5, specific reasons are provided regarding why interviews and documents are adopted as methods of data collection in this research:

- The opportunity of observation has been declined by the gatekeepers of the companies, because the companies are reluctant or even resistant to allow the researcher to follow too closely through their innovation which usually associates with sensitive information (strategic and technical details). When the issue under investigation is unamenable to observation, interviewing offers a viable means to reveal reality (Bryman and Bell, 2015; Creswell, 2014).

- *Qualitative interviews* are applied due to accessibility and manageability. Qualitative interviews enjoy advantages of (Creswell, 2014; Bryman and Bell, 2015):
  - Reconstruction of events in relation to current reality by interviewees;
  - Avoidance of interviewer's disturbance the context of research;
  - Less intrusion in people's work lives in organizational settings;
  - Greater coverage of people, incidents and localities; and
  - Allowing the researcher's control over the line of questioning.

  Focus group as a special form of interview is not used, because of the difficulty to gather multiple interviewees in one place at the same time. And also the research is not too interested in dynamism between interviewees as a group,

which is one main characteristic of focus group (Bryman and Bell, 2015). Therefore, only one-to-one face-to-face interviews are conducted.

- The method of ***documents*** as unobtrusive source of information (Creswell, 2014) is combined with interviews to get details of open innovation adoption.
- Options of audio-visual materials are not included due to inaccessibility (Creswell, 2014), except for interviewees' drawing during interview when they cannot articulate themselves verbally.

3.3.2 Semi-structured interview with interview guide

Types of interview is first discussed. Their similarities and differences as well as strengths and weaknesses are compared. Reasons of semi-structured interview adoption are then given, followed by illustrations of practicalities such as design of interview guide, sampling and ethical issues.

Types of interview (formality and structure)

According to level of formality and structure, there are three types of interviews: structured interview, semi-structured interviews and unstructured interview (Saunders et al, 2009; Bryman, 2008; Bryman and Bell, 2015). A brief description is included below.

- A *structured interview* "entails the administration of an interview scheduled by an interviewer. The aim is for all interviewees to be given exactly the same content of questioning" (Bryman and Bell, 2015, p. 211; Bryman, 2008, p. 193; Saunders et al, 2009). Therefore, it contains very specific questions and a fixed range of answers (Saunders et al, 2009; Bryman, 2008; Bryman and Bell, 2015). Interviewees' replies to identical cues are aggregated to guarantee reliability (Bryman, 2008; Bryman and Bell, 2015).

- A *semi-structured interview* is used when "The researcher has a list of questions on fairly specific topics to be covered, often referred to as an *interview guide*, but the interviewee has a great deal of leeway in how to reply" (Bryman and Bell, 2015, p. 481; Bryman, 2008, p. 438; Saunders et al, 2009). All questions in the interview guide will be asked but may not follow the sequence outlined in the schedule, and the interviewer is able to probe interesting issues raised by interviewees (Bryman, 2008; Bryman and Bell, 2015; Saunders et al, 2009).

- An *unstructured interview* is informal (Saunders et al, 2009), in which "the researcher uses at most an *aide-mémoire* as a brief set of prompts to him or herself to deal with a certain range of topics" (Bryman and Bell, 2015, p.481; Bryman, 2008, p. 438; Saunders et al, 2009). It is conversational, precipitated by events, behaviours and beliefs of interviewees around the topic area (Saunders et al, 2009; Bryman, 2008; Bryman and Bell, 2015).

To compare, structured interviews are used to collect quantifiable data in quantitative research, while semi-structured interviews and unstructured interview are two forms of qualitative interviewing (Saunders et al, 2009; Bryman, 2008; Bryman and Bell, 2015). Qualitative interviewing differs from quantitative interviewing in several ways, namely less structured, greater interest in interviewee's perspective, more probing for relevant insights, more tolerance of departure from interview guide, more flexible with emergent issues, as well as richer and more detailed answers (Bryman and Bell, 2015; Bryman, 2008). Qualitative interviewing thus emphasizes flexible process of research to allow interviewee to frame issues from their perspective (Bryman and Bell, 2015; Bryman, 2008; Patton, 2002). Below shows another way to describe types of interview (variations in instrumentation) with clearly outlined strengths and weaknesses.

Types of interview (variations in instrumentation)

Four types of interview are described with characteristics, strengths and weaknesses demonstrated (Patton, 2002). See Table 3-6. As Patton (2002) argues, the four types are not pure types, characteristics of which can be combined. Below is a brief introduction of the four types (Patton, 2002):

- The *informal conversational interview (unstructured interview)* is the most open-ended approach with maximum flexibility to probe emergent issues in talking.
- The *interview guide approach* lists topic areas and questions to be explored during the interview to ensure same line of enquiry, but meanwhile allows spontaneity in probing.
- The *standardized open-ended interview* involves wording of each question in a careful and full manner before the interview to guarantee sameness and consistency in asking.
- The *closed, fix-response interview* is closed questionnaire utilized in quantitative studies.

Table 3-6: Variations in interview instrumentation (Patton, 2002, p. 349)

Type of interview	Characteristics	Strengths	weaknesses
Informal conversational interview	Questions emerge from the immediate context and are asked in the natural course of things; there are no predetermination of question topics or wording.	Increases the salience and relevance of questions; interviews are built on and emerge from observations; the interview can be matched to individuals and circumstances.	Different information collected from different people with different questions. Less systematic and comprehensive if certain questions do not arise naturally. Data organization and analysis can be quite difficult.

Interview guide approach	Topics and issues to be covered are specified in advance, in outline form; interviewer decides sequence and wording of questions in the course of the interview.	The outline increases the comprehensiveness of the data and makes data collection somewhat systematic for each respondent. Logical gaps in data can be anticipated and closed. Interviews remain fairly conversational and situational.	Important and salient topics may be inadvertently omitted. Interviewer flexibly in sequencing and wording questions can result in substantially different responses from different perspectives, thus reducing the comparability of responses.
Standardized open-ended interview	The exact wording and sequence of questions are determined in advance. All interviewees are asked the same basic questions in the same order. Questions are worded in a completely open-ended format.	Respondents answer the same questions, thus increasing comparability of responses; data are complete for each person on the topics addressed in the interview. Reduces interviewer effects and bias when several interviewers are used. Permits evaluation users to see and review and instrumentation used in the evaluation. Facilitates organization and analysis of the data.	Little flexibility in relating the interview to particular individuals and circumstances; standardized wording of questions may constrain and limit naturalness and relevance of questions and answers.
Closed, fix-response interview	Questions and response categories are determined in advance. Responses are fixed; respondent chooses from among these fixed responses.	Data analysis is simple; responses can be directly compared and easily aggregated; many questions can be asked in a short time.	Respondents must fit their experiences and feelings into the researcher's categories; may be perceived as impersonal, irrelevant, and mechanistic. Can distort what respondents really mean or experienced by so completely limiting their response choices.

Semi-structured interview with interview guide

Considering the exploratory nature of this research, the format of interview in this research is semi-structured interview (Saunders et al, 2009; Bryman, 2008; Bryman and Bell, 2015) with interview guide as the instrument (Patton, 2002). Neither applying too fixed structured interview nor too informal unstructured, semi-structured interview is adopted with an interview protocol not only to focus attention on specific topics and questions but also to allow leeway of interviewer's probing as well as interviewee's framing (Saunders et al, 2009; Bryman, 2008; Bryman and Bell, 2015). And the format of interview cannot be completely unstructured, because a clear theoretical framework has been constructed before going to the field to collect data. The semi-structure format is beneficial regarding fairly clear focus of investigation (Bryman, 2008; Bryman and Bell, 2015).

According to instrumentation, the interview guide approach is used for benefits of comprehensiveness, systematicness and also some degree of conversational and situational (Patton, 2002). This approach also facilitates economic and effective use of interviewing time (Patton, 2002). To avoid weakness of inadvertent omission and too different responses, the interviewer attempts to cover same basic questions to allow comparison between responses of different interviewees, which is a borrowed characteristics from the approach of standardized open-ended interview (Patton, 2002). Such approach allows idiosyncratic application to better fit of research context. Following this, in this research, responses of interviewees are tied back to the theoretical framework by applying the interview guide and asking the same basic questions. Emergent perceptions and insights of interviewee on key issues are captured as well.

To prepare an interview guide, several basic elements require consideration, namely order of topics and flow of questions, relevance to answer research

questions, comprehensible of language, exclusion of leading questions in quantitative interview, and inclusion of basic interviewee information for purpose of contextualization (Bryman, 2008; Bryman and Bell, 2015). Two aspects are particularly highlighted, when formulating interview questions for this research: one is to link interview questions with theory and research questions, the other is to iterate before finalizing the interview guide (Bryman, 2008; Bryman and Bell, 2015). The two aspects are then dealt with one by one.

Theory-based interview guide

First presented is a table (Table 3-7) to demonstrate the linkage between interview guide and literature. Interview topics and questions (the first column) are linked to gaps of preliminary literature review (the second column). Considering unavoidable discrepancies between preliminary literature review and final literature review due to explorative nature of research, relevance to final literature review is shown in another column (the third column).

Table 3-7: Theory-based interview guide

Interview topics and questions	Rational to preliminary literature	Relevance to sections in final literature
1. Strategy and open innovation 1) How do you understand (open) innovation? *- Could you briefly summarize open innovation activities?* *- Who are your (external) collaborators?*	To explore 1) Open innovation (concept and activities)	**Section 2.1 Open innovation** - Section 2.1.1 The concept of open innovation - Section 2.1.2 Directions of knowledge flow - Section 2.1.3 Levels of analysis - Section 2.1.4 Open innovation, strategy and business model - Section 2.1.5 (Open) innovation process
2) What's your understanding of corporate strategy? In terms of innovation vs efficiency *- Describe innovation strategy, if there is one in place.* 3) Currently, how does your organization resolve this paradox? *- How do you see the relationship between structure and culture?*	2) & 3) Organizational ambidexterity (concept and activities)	**Section 2.3 Organizational ambidexterity** - Section 2.3.1 The concept of organizational ambidexterity - Section 2.3.2 Modes of balancing
4) What is the role of (open) innovation in resolving the paradox, fit or shift?	4) Relationship between open innovation and organizational ambidexterity	**Section 2.4 Theoretical integration** - Section 2.4.2 Theoretical framework
2. Dynamic capabilities and open innovation activities *General considerations is sought instead of too subtle details.* *Examples or stories are more than welcomed.* 1) Capturing ideas • Where do you capture ideas (e.g. technology, wider expertise, or existing solution) within/outside your organization? • How would you filter/select ideas & who is involved? • Is it an existing process or something new to learn? • How would you support idea generation, either formal or informal? ○ Timing and considerations to move the idea forward? 2) Moving idea forward in business • How to move idea forward within your current business model & processes? • Any considerations & interactions among business model dimensions?	To explore relevance of open innovation practices under categories of dynamic capabilities, namely 1) Sensing (micro-foundations) ○ *Time & trigger between sensing and seizing* 2) Seizing (micro-foundations)	***Literature below is relevant to this whole interview section.*** **Section 2.1 Open innovation** - Section 2.1.2 Directions of knowledge flow - Section 2.1.3 Levels of analysis - Section 2.1.4 Open innovation, strategy and business model - Section 2.1.5 (Open) innovation process **Section 2.2 Dynamic capabilities** - Section 2.2.1 The concept of dynamic capabilities - Section 2.2.2 Dynamic capabilities as higher-order capabilities - Section 2.2.3 Current categories of dynamic capabilities **Section 2.3 Organizational ambidexterity** - Section 2.3.3 Alternative ways to deconstruct ambidexterity - Section 2.3.4 Additonal practices of ambidexterity

Vision, structure, system, process, incentive, culture/communication & infrastructure • What are the resources/know-how/skills needed? Do you have or potentially know where to get them within & outside? • How would you encourage people to engage in open mind-set or new practices? ○ Timing and considerations to change the pool of ideas/product/service offerings? 3) Future plan or vision • How would you describe your organization's long-term vision to balance? • Would (open) innovation play a key role & in what ways?	○ *Time & trigger between seizing and transforming* 3) Transforming (micro-foundations)	**Section 2.4 Theoretical integration** - Section 2.4.2 Theoretical framework - Section 2.4.3 Integration of dynamic capabilities and supportive micro-foundations
3. Adapting to organizational environment How would these activities tentatively help to win competition & better serving stakeholders (including customers) both in short term & long term, according to logic of the nature?	To explore evolutionary fitness of open innovation activities.	**Section 2.2 Dynamic capabilities** - Section 2.2.4 Architecture of dynamic capabilities **Section 2.3 Organizational ambidexterity** - Section 2.3.5 Logic of organizational ambidexterity
4. From your perspective • How do you see your role in resolving the strategic paradox? • How might open innovation help? Enablers and barriers? ○ What secondary data might be relevant & available? ○ Who would you recommend to interview next? (Specific to OI champion)	To explore personal stance which may influence perception. To ask for secondary data and do snowball interviewee.	**Section 3.3 Data collection** 3.3.2 Semi-structured interview with interview guide

Preliminary literature review is briefly discussed to show the logic of open innovation adoption from strategy to practice. Organizations strive to be ambidextrous by balancing exploration and exploitation on the strategic level. The strategic orientation is then implemented through dynamic capabilities supported by open innovation practices. Categories of dynamic capabilities tentatively link to ambidextrous orientation and time horizon. Sensing is associated more with exploration of business opportunities, while seizing with exploitation through managing business model and resource allocation (O'Reilly III and Tushman,

2008). By comparison, transforming balances exploration for flexibility and exploitation for efficiency in the long run (O'Reilly III and Tushman, 2008). Despite open innovation is only explicitly claimed as a micro-foundation within transforming (Teece, 2007), sensing, seizing and transforming may all potentially be open. In addition, organizational evolution (variation-selection-adaptation) (O'Reilly III et al, 2009) and evolutionary fitness (Helfat et al, 2007) are considered.

According to theoretical linkage in preliminary literature review, the first section of the interview guide "1. Strategy and open innovation" targets the first research question *"1. What is the relationship between ambidextrous strategy and open innovation?*" The section first explores concept and activities of open innovation and organizational ambidexterity respectively as well as later tentatively asks about their relation. The second section of the interview guide "2. Dynamic capabilities and open innovation activities" intends to answer the second research question *"2. What are open innovation related processes under categories of dynamic capabilities?"* Micro-foundations of open innovation is explored under organizational dynamic capabilities of sensing, seizing and transforming. The third section "3. Adapting to organizational environment" attempts to explore the relation between open innovation and organizational evolution, which is the impact of conducting open innovation activities. The fourth section "4. From your perspective" collects interviewee information as well as serves the purpose of further sampling. The third research question *"3. How does ambidextrous strategy facilitate structured open innovation adoption through dynamic capabilities?"* is not formally included in the guide. Because strategy and practices of organization are observable to interviewees, whereas the medium abstraction level of dynamic capabilities is more implied. Therefore, the third research question consists more of academic elaboration to make managerial implications. After explaining high-level coherence with literature, attention is paid to craft details of research questions.

Crafting the interview guide

There have been iterations before arriving at the final version of interview guide. An informal conversation takes place as the pilot interview, with major learnings captured. The first learning is to use layman language when talking to industrial people. For example, the phrase 'commercializing these opportunities' is re-worded as 'moving ideas forward in business'. The second learning is that the interviewee could not answer the big categories of sensing, seizing and transforming. The interviewer needs to be more specific about what may be the activities under these big categories. Inspirations to deconstruct the activities comes from a checklist to design organizations for dynamic capabilities (Felin and Powell, 2016). For instance, the question in the final protocol "Where do you capture ideas (e.g. technology, wider expertise, or existing solution) within/outside your organization?" is modified from "Where does knowledge about new technologies and market opportunities reside in the organization?" (Felin and Powell, 2016, p. 91) Contextualization is sought by formally considering sources (within/outside) and types (e.g. technology, wider expertise, or existing solution) of knowledge.

Some further add-ons on top of the frozen final version of interview guide are shown in *italicized format* for more comprehensive probing. For example, two follow-up question are added, following the first question "1) How do you understand (open) innovation?" Because only by asking this question, interviewee will only touch upon the concept of open innovation without mentioning either specific activities or scale of collaboration. Therefore, the interviewer should explicitly ask *"Could you brief summarize open innovation activities?"* and *"Who are your (external) collaborators?"* Another example is to ask the *"How do you see the relationship between structure and culture?"* after the third question "3) Currently, how does your organization resolve this paradox?" This follow-up question intends to explore complementarity between structural and contextual

ambidexterity. Because different modes of ambidexterity may potentially be combined (Kauppila, 2010; O'Reilly III and Tushman, 2013). Besides, hints are given for type of information required in section 2: "*Examples or stories are more than welcomed."* Additionally, *"Thanks very much for your cooperation!"* is added as a courteous ending. Next considered are practicalities of conducting interview, starting with sampling.

Sampling

When it is impracticable to collection data from the entire population within time and budget, a sample needs to be selected (Saunders et al, 2009). Compared with probability sampling characterized by random selection in quantitative research, qualitative research is inclined to revolve around purposive sampling with direct reference to research questions (Bryman, 2008; Bryman and Bell, 2015). Informed by research questions, selection criteria of interviewees are established and fixed at the outset of research (Bryman and Bell, 2015; Saunders et al, 2009). Within the research context of large Scottish companies (private and public) that takes initiative in open innovation adoption, the selection criterion of interviewees is the relevance of job role (not necessarily job title) to open innovation. Table 3-8 documents basic information of 12 interviewees in 5 cohort companies and schedule of data collection.

Table 3-8: Profile of interviewees and schedule of interviews

Interviewee	Date	Duration	Sector	Job title
A1	11/04/2017	1h 45m	Private	Open Innovation Coordinator
A2	19/05/2017	1h 59m	Private	Group Director of R&D
A3	02/08/2017	0h 58m	Private	Global Research Scientist
A4	02/08/2017	1h 02m	Private	Global Marketing Manager
B1	19/06/2017	1h 53m	Public	Senior Commercial Development Officer
B2	16/05/2018	0h 48m	Public	Open Innovation Development Officer
C1	17/04/2017	1h 17m	Public	Development Officer
C2	26/06/2017	1h 14m	Public	Group Manager, Business Growth

C3	31/07/2017	1h 24m	Public	Economic Development Manager
D1	08/06/2017	1h 32m	Private	Open Innovation Lead
E1	24/07/2017	1h 45m	Half-regulated	Project Engineer
E2	09/08/2017	2h 04m	Half-regulated	Senior Innovation Analyst

Note: Company E is referred to as a half-regulated business by Interviewee E2, with complicated history relating to privatization of the UK. Considering the regulation is out of inquiry of this research, Company E is regarded as a private sector business in finding and discussion.

Because the approaches of sampling are not mutually exclusive, there is the potential to flexibly combine different techniques to meet multiple research interests and needs (Patton, 2002; Bryman and Bell, 2015). Snowball sampling is employed to establish contact from the initial cases to further locate information-rich participants (Patton, 2002; Bryman and Bell, 2015). It helps when there is difficulty in identifying cases (Saunders et al, 2009). Snowball sampling happens, when interviewees are asked the last question in the interview guide: "Who would you recommend to interview next? (Specific to OI champion)" The gatekeepers of open innovation are the ones that knows best who may be relevant or hold a complementary view on open innovation adoption within their organization. Take Company A as an example. The open innovation coordinator proposes other interviewees in the company, who conduct innovation as part of their job across different functions such as research, marketing and product development.

Sample size is next discussed. There is no universal rule regarding sample size in qualitative research (Patton, 2002). Sample size depends on purpose of inquiry, usefulness of data, as well as availability of time and resource (Patton, 2002). Although the parallel SE project allows rapport building between the PhD researcher and gatekeepers of open innovation in these cohort companies, negotiating access is still challenging or difficult. As is claimed in one e-mail rejection, *"Unfortunately, providing the requested information would breach our intellectual property protection procedures. Consequently, we cannot participate in that aspect of your studies."* This explains the necessity of one sentence in the

interview guide, which writes *"General considerations is sought instead of too subtle details."* Due to the presence of non-disclosure agreement of the SE project, sampling can only take place within the scope of the cohort companies. The PhD researcher has exhausted the possibility within the cohort, by asking almost every gatekeeper (except for some are completely out of the radar) in these cohort companies for permission to be interviewed.

Besides, regarding the process of interviewing, the gatekeepers are first approached informally to obtain verbal consent at company interviews and cohort meetings along the progression of the SE project. The time and place of interviews are later confirmed by phone or e-mail. The actual interviews takes place either at the university or on company site. After interviewing the gatekeepers, the possibility to snowball more interviewees is fully exploited. The sample size of 12 is already the most that the PhD researcher can make out of the cohort companies. All interviews are properly reordered during the interview and fully transcribed afterwards. Next, ethical issues are discussed mainly around interviews but may also touch upon more general issues on qualitative data collection.

Ethical issues

Ethical issues directly relates to the integrity of research, so it is important of researcher to be aware basic principles of ethics in business research (Bryman and Bell, 2015). There are four main ethical principles in relation to researcher-participant relations: harm to participants, lack of informed consent, invasion of privacy and deception (Diener and Crandall, 1978; Bryman, 2008; Bryman and Bell, 2015). First and foremost, do no harm (Miles et al, 2014). Harm to participants is addressed by maintaining confidentiality of records and anonymity of accounts, regarding both individuals and organizations (Bryman and Bell, 2015). Concerning disclosure of commercially sensitive information on innovation, one

interviewee phoned the researcher to confirm confidentiality and anonymity before agreeing to be interviewed. Therefore, the researcher makes great effort to guarantee confidentiality and anonymity. Documents as secondary are also managed with caution. For instance, rather than giving away 'Company D – Copy of collective challenge OI templates' in its original format, information are extracted and summarized from the original template to show details in a more abstract way.

Second, informed consent of participants is sought prior to study, by transparently communicating information about content and process of research (Bryman and Bell, 2015; Creswell, 2014). An electronic copy of participant information sheet (PIS) approved by the department in Appendix 1 are sent to participants as part of early e-mail correspondence. PIS briefs purpose of research, requirements and rights of participation as well as data collection and report (Saunders et al, 2009; Bryman and Bell, 2015). A copy of interview questions is sent as well to make interviewees aware of what questions will be asked in the course of interviewing. Hard copies of the two files are provided again on the day of interviewing, and participants are then asked to sign the consent form. Verbal permission to record is requested beyond the consent form, before the recorder is turned on. Third, invasion of privacy is minimized by sensitively responding to participants and giving the opportunity to withdraw (Bryman and Bell, 2015). Fourth, deception is avoided by authentically reporting data (Bryman and Bell, 2015; Creswell, 2014). The classic advice is followed: "When in doubt, tell the truth." (Miles et al, 2014, p. 62)

Besides, ethical issues are anticipated and should be carefully managed throughout the whole research process (Saunders et al, 2009; Creswell, 2014). Prior to study, a research problem needs to be formulated that benefits the participants (Creswell, 2014; Miles et al, 2014). This study offers a structured understanding of open innovation adoption, thus may help participants to

persuade management buy-in. Participants are not pressured to sign the consent form, with their privacy respected throughout (Creswell, 2014; Miles et al, 2014). During data collection, the researcher minimizes disturbance, by arranging time and location of interview at participant's convenience (Creswell, 2014). Over-zealous questions and pressing for response are avoided (Saunders et al, 2009; Miles et al, 2014). Later in data analysis and reporting, anonymity of organizations and participants is guaranteed, by using pseudonyms or code names (Creswell, 2014; Saunders et al, 2009). Multiple perspectives and contrary findings are authentically reported (Creswell, 2014). In addition, data will be properly stored for a reasonable period of time, and copy of report will be shared with participants on completion of study (Creswell, 2014). Therefore, ethical issues requires early anticipating and regularly checking (Miles et al, 2014). After discussing issues of primary data collection, documents as a way to collect secondary data is explained.

3.3.3 Documents

"Most research questions are answered using some combination of secondary and primary data." (Saunders et al, 2009, p. 258) Secondary data thus offers a useful source to answer, or at least partially to answer research questions (Saunders et al, 2009). Secondary data comes from a variety of sources: documentary data, surveys, as well as multiple area-based or time-based sources (Saunders et al, 2009). Sources of data are evaluated according to criteria of: 1) overall suitability of data to research questions, 2) benefits and costs of application, and 3) accessibility of data (Saunders et al, 2009). Certain advantages and disadvantages are attached, when using secondary data. Advantages include saved time and money, unobtrusive source of data, allowing longitudinal studies, providing comparative and contextual data, leading to serendipitous discovery and permanence of data (Saunders et al, 2009). Disadvantages may be collected and presented for a different purpose, difficult or costly access, unsuitable

aggregations and definitions and no real control over quality of data (Saunders et al, 2009).

Documents as one source of secondary data is a form of material with characteristics of: 1) readable, 2) not collected specifically for this research, 3) preserved to ensure availability for analysis, and 4) relevant to concerns of the research (Bryman, 2008; Bryman and Bell, 2015). Sources of documents could be personal documents, public documents, organizational documents (database, communication and website), mass media outputs, visual documents, virtual documents, journals, newspapers, magazines, interview transcripts, video-recording, and even the world as text (Bryman and Bell, 2015; Saunders et al, 2009; Bryman, 2008). Criteria of quality evaluation includes authenticity of origin, credibility (free from error and distortion), representativeness of evidence, as well as with clear and comprehensible meaning (Scott, 1990; Bryman, 2008; Bryman and Bell, 2015).

Table 3-9 presents a list of documents that have been used in this research, with further information on source and format of document, content of documents and relevance to answer research question. The documents come from a variety of sources, such as company documents referred to by interviewees, project files of the open innovation programme, as well as public available documents online. All these documents are mainly used as evidences in finding and discussion, and some may also be used as part of literature and to help understand context of research. To overcome the difficulty to access organizational documents not available in public domain (Bryman and Bell, 2015), the interviewees are explicitly asked, although not pressed, to provide relevant organizational documents. The question “What secondary data might be relevant & available?” is included in the fourth section of the interview guide. Private company documents are likely to be authentic and meaningful (Bryman, 2008; Bryman and Bell, 2015). After explaining data collection, the next section informs how data has been analysed.

Table 3-9: List of documents in this research

Document	Source of document	Description of document	Relation to research question
Company D – Meeting material of open innovation programme	Company document in PPT format	Introduce the open innovation programme: • Concept • Benefits • Success story • Process • Partner ecosystem • Challenge toolkit • Scalability	• Clarify the nature and activities of open innovation.
Company D – Copy of collective challenge OI templates	Company document in Excel format	Give the template following Want, Find, Get, Manage Model of open innovation • Want • Find, (get and manage) internal and external partners	• Detail application of Want, Find, Get, Manage process.
Company D – Quarter 1 report, 2017	Open innovation programme document in hard copy	Company progress update: • Scaling open innovation • Internal ideation • External ideation • Challenge and network development • Culture and communication • Future of open innovation	• Clarify open innovation activities and processes.
Launch meeting: Open Innovation initiative groups for first activity, 2015	Open innovation programme cohort meeting 1 in word format	Address topics of: • Definition of open innovation • Best practices of open innovation regarding people, process, strategy and tool	• Clarify expectations about open innovation (activities).
Annual review, 2016	Open innovation programme annual review in PPT format	Gives an overview of: • Springboard from year 1 • Programme for year 2 • Case study development	• Clarity the line of cohort meetings planning.

Company reporting of open innovation programme cohort meeting 7	Open innovation programme cohort meeting 7 in PPT format	Show company updates since last cohort meeting: • Innovation challenge • Success story • Process	• Clarify open innovation activities and processes.
Company reporting of open innovation programme cohort meeting 9	Open innovation programme cohort meeting 9 in PPT format	Show company updates since last cohort meeting: • Innovation challenge • Success story • Process • Change of organizational arrangements	• Clarify open innovation activities and processes.
Company C – OI presentation	Company document in PDF format	Introduce civic innovation: • Space of innovation • Civic innovation (Open innovation programme) • Civic innovation Process, esp. design sprint	• Clarify open innovation activities and processes.
Glasgow Economic Strategy 2016-2023	Public available document online	Describe current city-level economic strategy: • Background • Objective • Strategy • Leadership • Ambitions	• To demonstrate where innovation fits within city-level economic strategy.
Stage-Gate® – The world's most popular product development process	Open innovation programme cohort meeting 9 in hard copy PPT format	Introduce Stage-Gate product development process: • Success factors • Stages and gates • Governance and go/kill decision-making at gates	• Provide an in-depth understanding of Stage-Gate product development process.
Mastering Open Innovation	Open innovation programme project brochure in hard copy	Provides information on the Scottish Enterprise open innovation programme: • Steps of open innovation implementation • Culture • Key insights • Industry insights	• Clarify research context.

Company E – Divisional innovation strategy, 2018	Public available document online	Outlines information on innovation strategy: • Current industry climate • Future of innovation • Customer benefits delivery through clearly defined innovation process	• Clarify the company's innovation strategy with detailed innovation process.
InnoCentive@ Work	Public available document online	Describe the collaborative innovation management system: • What is it? • InnoCentive@Work: Process	• Describe process of innovation challenge management.
InnoCentive: Adding Value to Stage-Gate Through the Use of Challenges	Public available document online	Describe integration of open challenges to existing processes: • *Overview of InnoCentive and* Stage-Gate process • Challenge scenarios in the context of Stage-Gate • A challenge-driven approach to product development	• Describe integration of open innovation challenge into Stage-Gate product development process.

3.4 Data analysis and display

"Thick, rich description provides the foundation for qualitative analysis and reporting." (Patton, 2002). The attractiveness of the richness of data poses great challenge to identify analytic paths (Bryman and Bell, 2015; Bryman, 2008; Patton, 2002). This section outlines the general line of reasoning, before detailing the specific method of data analysis. There are three basic forms of reasoning: induction, deduction and abduction (Mantere and Ketokivi, 2013; Bryman and Bell, 2015; Saunders et al, 2016). To practices reasoning in organizational research, the interaction among rule, explanation and observation is considered (Mantere and Ketokivi, 2013). Deduction takes the rule and the explanation as premise to derive the observation (general to particular); induction use the observation and the explanation to infer the rule (particular to general); and

abduction seeks the explanation that is inferred from the rule and the observation (Mantere and Ketokivi, 2013). Table 3-10 further compares the three forms of reasoning (Saunders et al, 2016).

Table 3-10: Deduction, induction and abduction: from reason to research
(Saunders et al, 2016, p. 145)

	Deduction	Induction	Abduction
Logic	In a deductive inference, when the premises are true, the conclusion must also be true	In an inductive reference, known premises are used to generate untested conclusions	In an abductive inference, known premises are used to generate testable conclusions
Generalizability	Generalising from the general to the specific	Generalising from the specific to the general	Generalising from the interactions between the specific and the general
Use of data	Data collection is used to evaluate propositions or hypotheses related to an existing theory	Data collection is used to explore a phenomenon, identifying themes and patterns and create a conceptual framework	Data collection is used to explore a phenomenon, identify themes and patterns, locate these in a conceptual framework and test this through subsequent data collection and so forth
Theory	Theory falsification or verification	Theory generation and building	Theory generation or modification; incorporating existing theory where appropriate, to build new theory or modify existing theory

Abductive reasoning has been followed, because this research provides a conjectural framework as the explanation of organizational reality with presence of rule and observation (Mantere and Ketokivi, 2013). *"Abduction involves the researcher selecting the 'best' explanation from competing explanations or interpretations of data."* (Bryman and Bell, 2015, p. 27; Mantere and Ketokivi, 2013) This research applies the organism as the metaphor of organization, which provides a fruitful way to explain strategic adoption of open innovation with organizational ambidexterity and dynamic capabilities serving as the structure. The dynamism between the general and the specific is captured (Saunders et al, 2016), regarding organizational ambidexterity and dynamic capabilities as general

rules of strategic management and open innovation as specific activities in context. Further confirming description of theory and data of abduction (Saunders et al, 2016), existing concepts of organizational ambidexterity and dynamic capabilities are incorporated into the context of open innovation adoption and data is collected to evidence themes as well as generate insights to develop the conceptual framework. After discussing general lines of reasoning, Table 3-11 provides a summary of specific approaches of qualitative data analysis (Patton, 2002; Bryman, 2008; Bryman and Bell, 2015).

Table 3-11: Approaches of qualitative data analysis

Analytic approach	Description
Phenomenological analysis	"Phenomenological analysis seeks to grasp and elucidate the meaning, structure, and essence of the lived experience of a phenomenon for a person or a group of people" (Patton, 2002, p. 482). The intention is to live with the data in an in-depth way (Patton, 2002). Five phases of analysis are "immersion, incubation, illumination, explication, explication, and creative synthesis." (Patton, 2002, p. 486; Moustakas, 1990).
Qualitative comparative analysis	Qualitative comparative analysis focus on making systematic comparisons across a number of case to generate explanations (Ragin, 1987; Ragin, 2000; Patton, 2002). "this configurational approach to cross-case pattern analysis was to retain holism embedded in context-rich individuals cases while making comparisons of relatively large numbers of cases" (Patton, 2002, p. 492). Boolean algebra is used to facilitate comparisons (Patton, 2002).
Qualitative content analysis	"It comprises a searching-out of underlying themes in the materials" (Bryman, 2008, p. 529; Bryman and Bell, 2015, p. 569). Ethnographic content analysis, as a typical kind of qualitative content analysis, differs from quantitative content analysis in terms of allowing for constantly revising themes or categories from examination of data (Bryman, 2008; Bryman and Bell, 2015).
Thematic analysis	It is one of the most common approaches to analyse qualitative data, but without either an identifiable heritage or a distinctive cluster of techniques (Bryman, 2008; Bryman and Bell, 2015). It is regarded as one kind of qualitative content analysis (Bryman, 2008). "As its name implies, this approach is meant to provide a framework for thematic analysis of qualitative data and provides one way of thinking about how to manage themes and data." (Bryman, 2008, p. 555; Bryman and Bell, 2015, p. 599)
Semiotic analysis	"Semiotic analysis focuses on the way that messages are communicated as systems of cultural meaning. It is based on semiotic theory, which suggests that the symbolic order of a culture is constructed and interpreted through a system of signs" (Bryman and Bell, 2015, p. 570). It is to uncover hiding meanings which resides in texts (Bryman, 2008).
Hermeneutic approach	"A hermeneutic approach, because of its emphasis on the location of interpretation within specific social and historical context, would seem to represent an invitation to ensure that the analyst of texts is fully

	conversant with that context." (Bryman, 2008, p. 533) The central idea is to bring out the meanings of a text from lens of the author (Bryman, 2008).
Conversation analysis	"Conversation analysis (CA) is the fine-grained analysis of talk as it occurs in the interaction in naturally occurring situations… These analyses are concerned with uncovering the underlying structures to talk in interaction and as such with the achievement of order through interaction." (Bryman and Bell, 2015, p. 531; Bryman, 2008, p. 494)
Discourse analysis	Discourse analysis is "an approach to language that can be applied to forms of communication other than talk" (Bryman and Bell, 2015, p. 535; Bryman, 2008, p. 499). The approach "emphasizes the way versions of the world, of society, events and inner psychological worlds are produced in discourse" (Potter, 1997, p. 146; Bryman, 2008; Bryman and Bell, 2015)
Narrative analysis	"Narrative analysis is an approach to the elicitation and analysis of language that is sensitive to the sense of temporal sequence that people, as tellers of stories about their lives or events around them, detect in their lives and surrounding episodes and inject into their accounts." (Bryman and Bell, 2015, p. 541)

Referring to Table 3-11, some approaches are completely irrelevant to this research, because they have different emphases when analysing qualitative data. Phenomenological analysis focus on capturing in-depth lived experience (Patton, 2002), qualitative comparative analysis on comparison across large number of cases (Ragin, 1987; Ragin, 2000; Patton, 2002), semiotic analysis on cultural meaning (Bryman, 2008; Bryman and Bell, 2015) and hermeneutic approach on lens of researcher (Bryman, 2008). Besides, conversation analysis, discourse analysis and narrative analysis are approaches to analyse language per se as data, which are not suitable for this research (Bryman and Bell, 2015). The approach of qualitative content analysis generally contrasts quantitative content analysis, in terms of permitting emerging themes or categories in addition to predefined ones (Bryman, 2008; Bryman and Bell, 2015). More specifically, thematic analysis as one kind of qualitative content analysis is applied to allow the utilization of framework to manage themes and data (Bryman, 2008; Bryman and Bell, 2015). The presence of the framework in thematic analysis coincides and assists the practising of abductive reasoning.

To elaborate, thematic analysis provides a process to systematically encode qualitative information (Boyatzis, 1998). *"Thematic analysis is a method for*

identifying, analysing and reporting patterns (themes) within data." (Braun and Clarke, 2006, p. 79) This research follows a linear but recursive six-phase process in thematic analysis: 1) familiarizing yourself with your data, 2) generating initial codes, 3) searching for themes, 4) reviewing themes, 5) defining and naming themes and 6) producing the report (Braun and Clarke, 2006). Due to the analytic logic of abduction, a hybrid approach of code development is taken: the theory-driven approach uses theory as a guide the articulation of meaningful themes, and the data-driven approach extracts differentiated themes emergent from subsamples of data (Boyatzis, 1998). Regarding data display, it is necessary to create frameworks to capture the interactions among different levels of abstraction, from data (the most specific) all the way to theory (the most general) (Saldaña, 2016). Table 3-12 gives an illustrative example of the thematic framework around the concept of 'organizational ambidexterity'.

Table 3-12: Thematic framework around the concept of 'organizational ambidexterity'

Theme	Subtheme	Code	***Code* embedded in data**
The strategic paradox	Exploitation	Saving money	*"The business is about making money. It's about **saving money**."(A1)* *"(the organization) is madly dashing **towards savings**" (B2)*
		Efficiency and optimization	*"a large public sector organization is more stood **towards efficiencies** and **optimizing services**…" (C3)*
		Success trap	*"It's quite easy to **rest on your laurels**…" (A1)*
	Exploration	If not explore	*"if we **don't innovate**, then other organizations will and we will be **left behind**…" (D1)*
		Bold vision	*"we need to take a **bold vision** of what markets we want to operate..." (D1)*
	Both/and approach	Both efficiency and innovation	*"(My organization) embraces **both** the **need for efficiency** and also the **need for innovation**..." (A2)* *"All corporations will have **innovation and efficiency** at the heart of their strategy." (A2)*

	Barriers to balance	Barriers of people and time	*"depending on our **staffing availability** and resourcing availability" (D1)* *"**People are being squeezed**." (E2)* *"we are involved in **many things out with** that kind of stream…" (A4)* *"trying to **resource with people's time is a challenge**" (D1)* *"I think we have **a key focus through (the open innovation coordinator's work** and her boss) with their partnership…" (A4)*
		Barrier of scarce money	*"**small pockets of innovation budget** across different departments…" (A1)* *"**find financial budget in a period of austerity**..." (D1)* *"Obviously public sector, we are **in the hands of local government funding**." (C1)*
		Go external as a way out	*"If you need a result quickly… **doing it internally is not the way** to do it…" (A1)* *"where we are trying to be a little bit more disruptive, a little bit more innovative, obviously **running open innovation programme is a start**..." (D1)*
Modes of balancing	Structural ambidexterity	Structural separated programme or team	*"(The name of open innovation programme) is **a programme**… to further enhance the focus on technology enablement." (Company D – Meeting material of open innovation programme)* *"we've got **a team** that drive open innovation…" (E2)* *"a **separate entity**" (A4)*
		Connection (integration)	*"we can basically **go and meet anyone in the company**… and trying to get engagement with them." (E1)* *"(What) we are doing is kind of **integrating** that." (D1)*
	Contextual ambidexterity	Fit with organizational environment	*"Open Innovation pursuits inside my organisation needs ~~to~~ **fit well with the current organisational environment** (culture, business situation, project needs, strategic direction and needs)." (A2)*
	Sequential ambidexterity	Flexibility along time	*"We **probably shift around** a little bit. And it's kind of a **cyclical** thing… " (A2)* *"we can go out to the world and we can collaborate with other types of people. We maybe only need their assistance **for a week or a couple of months**" (D1)*
	Combination of modes	A mixed-bag approach	*"have the correct structure in place in order to change the cultural issues… you must take the approach of **a mixed bag**." (C1)*

Beyond clear data display, some more tactics regarding the write-up of qualitative research are considered: 1) the methods section should include basic elements to inform reader with how the research is approached; 2) data needs to be presented in a smart fashion in both body and tables to demonstrate successful

theorizing; 3) figures with sufficient explanation can be used to organize and clarify thinking as well as help visual presentation of findings; 4) a narrative should be told with each theme as a character contributes to the coherent whole of the story; 5) learning from qualitative research regarding style of writing is also recommended (Pratt, 2009). For specific adoption, this research addresses all basic elements of methods, displays data visually in table and figures, as well as develops interesting and balanced narratives around concepts.

3.5 Summary and evaluation

This chapter outlines methods adoption, following steps of qualitative research. Alternative approaches are shown, before decisions are made and explained. This chapter starts with revisiting research aim and questions, on the basis of which philosophical considerations are clarified under the organizational metaphor of organism and the general adoption of qualitative research strategy is briefed. To collect relevant data, the context of large Scottish companies, more specifically cohort companies of the SE project, is targeted. Specific methods to collect data are then detailed. Semi-structured interviews are employed as the primary method of data collection. Purposive sampling and ethical issues are addressed as well. Documents are demonstrated as another method of data collection, with explanation on the relevance of sources of documents to resolve the research aim and questions. To analyse collected qualitative data, abduction is adopted as the general line of reasoning and thematic analysis as the specific analytic process. Some tactics on writing up qualitative research are further included. Table 3-13 summarizes key decisions that are made in each step of research:

Table 3-13: Key decisions within each step of research

Step of research	Method adoption	Description
General research question	Research philosophy	• Metaphor of organization: organism. • Ontology: reality as process. • Human nature: man as adapter. • Epistemology: to study systems, process and change.
	Research strategy	• The nature of research is exploratory to seek insights. • The qualitative approach is applied, which boasts flexible inquiry and richness of data.
Research context	Large Scottish companies	• Large companies provide relevant context to explore. • The parallel SE project is presented as an enabler as well as a constraint, with explanation on role of the PhD researcher. • The complementarity between the SE project and the PhD project is further demonstrated.
Data collection	Semi-structured interview with interview guide	• The adoption of semi-structured interview guarantees clear focus of investigation as well as allows flexibility to probe. • The interview guide is used to facilitate the linkage between theory and data collected.
	- Sampling	• Purposive sampling serves as the main sampling technique. • Snowball sampling is used to further locate participants. • The small sample sized is explained by practical limitations.
	- Ethics	• Confidentiality and anonymity. • Informed consent of participants. • Careful management of ethics through the whole process of research.
	Documents	Data sources includes: • Company documents referred to by interviewees. • Project files of the open innovation programme. • Public available documents online.
Data analysis and display	Abduction	• Abduction facilitates selecting favourable explanation. • The theoretical framework assists the interaction between theory (the general) and data (the specific).
	Thematic analysis	• The process of thematic analysis is presented, with an illustrative example evidenced by data.
Writing up findings/ conclusion	Tactics to deliver quality writing	• Some tactics are covered, such as utilizing tables to assist data display and developing narratives to construct a coherent story.

Details of methods adoption are then checked according to evaluative criteria of qualitative research. Validity points to the integrity of conclusions (Bryman, 2008; Bryman and Bell, 2015). “Qualitative validity means that the researcher checks for accuracy of the findings by employing certain procedures” (Creswell, 2014, p. 201). This research combines data sources of interviews and documents. Triangulation of data sources facilitates coherent justification of social reality (Bryman, 2008; Bryman and Bell, 2015; Creswell, 2014). Moreover, thick description is provided to convey findings, which provides a database for others to decide on transferability between contexts (Bryman, 2008; Bryman and Bell, 2015; Creswell, 2014). By comparison, reliability points to repeatability and consistency of research (Bryman, 2008; Bryman and Bell, 2015). Qualitative reliability emphasizes on consistency of research approach across different researchers and different projects (Creswell, 2014). Although it is not applicable regarding multiple researchers and projects, reliability (dependability) is addressed in terms of careful auditing all phases of research process in an accessible manner (Bryman, 2008; Bryman and Bell, 2015). Transparency of research process and decision making enhances quality of research (Flick, 2007). Boasting validity and reliability, this research is not designed without limitation. Philosophically, powerful insights generated from applying a certain metaphor of organization may become distortions of not seeing from alternative metaphors (Morgan, 2006). Practically, the SE project sets the boundary of sampling thus forgoes the opportunity to explore the wider context of Scotland.

Chapter 4 Finding and Discussion

4.0 Chapter overview

This chapter details finding and discussion in accordance with the research aim and questions. The three big sections (Section 4.1, Section 4.2 and Section 4.3) are arranged in accordance with the three research questions. Section 4.1 describes the relationship between open innovation and ambidexterity, targeting at the strategy gap of open innovation. Section 4.2 outlines how specific open innovation activities take effect as part of organizational dynamic capabilities in support of strategy implementation. Section 4.3 completes the logic from strategy to practice, explaining how ambidextrous strategy facilitate structured open innovation through dynamic capabilities. In addition, Section 4.4 presents the relevance of organization evolution and (biological metaphor). Each sub-section stands as a meaningful unit that resonates certain parts of literature review. Table 4-1 provides an index to help retrieve the complicated connections.

Table 4-1: Index of findings in relation to research questions and literature

Aim of research: How to adopt open innovation from strategy to practice?		
Section 4.1 Open innovation and organizational ambidexterity **– RQ1:** What is the relationship between ambidextrous strategy and open innovation?		
4.1.1 Open innovation	4.1.1.1 The scene and perception of open innovation 4.1.1.2 Open innovation activities	2.1.1 The concept of open innovation 2.1.4 Open innovation, strategy and business model 2.1.2 Directions of knowledge flow 2.1.3 Levels of analysis
4.1.2 Organizational ambidexterity	4.1.2.1 The ambidextrous paradox 4.1.2.2 Current balancing actions	2.3.1 The concept of organizational ambidexterity 2.3.2 Modes of balancing

4.1.3 Role of open innovation in organizational ambidexterity		**2.4.2** Theoretical framework
Section 4.2 Dynamic capabilities and open innovation activities **– RQ2:** What are open innovation related processes under categories of dynamic capabilities?		
4.2.1 Strategy and leadership **4.2.2** Culture and communication **4.2.3** Innovation process **4.2.4** Structure and governance	4.2.1.1 Vision and strategy 4.2.1.2 Senior management 4.2.2.1 General culture for innovation 4.2.2.2 Entrepreneurial risk-taking 4.2.2.3 Organizational intelligence 4.2.2.4 Communication 4.2.2.5 Capabilities of people 4.2.3.1 General innovation process 4.2.3.2 Open innovation process 4.2.3.3 Process integration of open innovation 4.2.4.1 Organizational structure 4.2.4.2 Systems and intermediaries 4.2.4.3 Governance 4.2.4.4 Infrastructure	*Major section:* **2.4.3** Integration of dynamic capabilities and supportive micro-foundations *Details also from sections:* 2.1.2 Directions of knowledge flow 2.1.3 Levels of analysis 2.1.5 (Open) innovation process 2.2.3 Current categories of dynamic capabilities 2.3.2 Modes of balancing 2.3.3 Alternative ways to deconstruct ambidexterity 2.3.4 Additional practices of ambidexterity
Section 4.3 Orchestrate the logic of open innovation adoption **– RQ3:** How does ambidextrous strategy facilitate structured open innovation adoption through dynamic capabilities?		
(No sub-sections)		**2.4.2** Theoretical framework **2.4.3** Integration of dynamic capabilities and supportive micro-foundations
Section 4.4 Organizational evolution and (biological metaphor)		
(No sub-sections)		2.2.4 Architecture of dynamic capabilities 2.3.5 Logic of organizational ambidexterity

4.1 Open innovation and organizational ambidexterity

This section answers to **the first research question**: *"What is the relationship between ambidextrous strategy and open innovation?"* Open innovation and organizational ambidexterity are separately explored, before the linkages in between are revealed. The section is structured as follows. Section 4.1.1 Open innovation is divided into two sub-sections. Section 4.1.1.1 explains background and reveals current understanding of open innovation. Acknowledging the nature of open innovation as distributed micro-foundations of innovation, Section 4.1.1.2 audits open innovation activities with knowledge exchange spanning across multiple levels of analysis. Section 4.1.2 Organizational ambidexterity also comprises two sections. Section 4.1.2.1 clarifies how organizational ambidexterity is currently framed and points out difficulties to be overcome. Section 4.1.2.2 outlines current available micro-foundations according to modes of organizational ambidexterity. More importantly, Section 4.1.3 explores the role of open innovation to help realize dual orientations (exploration and exploitation) of organizational ambidexterity.

4.1.1 Open innovation

The section of open innovation consists of two sub-sections. Section 4.1.1.1 lays out the scene of open innovation and clarifies the concept of open innovation within context. The environment of unknown unknowns challenges the traditional conceived boundary of the firm. Facets of open innovation such as process, system and collaboration are elaborated, followed by a re-definition for contextualization purpose. Based on collective understanding of open innovation in the study context, Section 4.1.1.2 deconstruct micro-foundations of open innovation processes along directions of knowledge flow. Open innovation challenge is highlighted as a ubiquitous tool of outside-in open innovation. Internal cross-collaboration parallel to cross-boundary knowledge exchange is also

considered. Multi-level adoption involving networks of stakeholders is shown in the end.

4.1.1.1 The scene and perception of open innovation

Environmental uncertainty sets the scene of open innovation. *"Open innovation is... the easiest way to describe is to think about the unknown unknowns." (C1)* Uncertainty (unknown unknowns) is a ubiquitous circumstance in today's economic and business environment (Teece and Leih, 2016). "With uncertainty, we not only don't know what is going to happen, but also don't know what the possible distribution of outcomes (futures) looks like, in part because we do not even know the range of possible outcomes." (Teece and Leih, 2016, p. 7). Unknown unknowns thus have a two-fold meaning. On the one hand, organizations expect an unpredictable future with ever-changing technology, market or more general business. *"we are dealing with challenges, in terms of the technology is changing, the business environment is changing, the demographics of the people who are doing their work…." (E2)* On the other hand, the scale and scope of their organizational problem as well as availability of solution are unknown as well. *"With open innovation, for us, you don't quite know the scale and scope of the problem. You don't know who is going to be around to provide the solution if one exists. Otherwise you ask to create one." (C3)*

As is seen in the above quotes, the companies are referring to more general uncertainties rather than too specific uncertainties of knowledge as is documented in open innovation literature. According to the original conceptualization of open innovation (Chesbrough, 2003), uncertainties are narrowly summarized as accessibility of widespread talents with useful knowledge, rising venture capital and start-ups, diversified routes to commercialize shelved ideas as well as influential supplier in R&D and commercialization. Open innovation needs to be put in the wider context of

organization and external environment to take effect. This rationales the shift of organizational metaphor from brain to organism. The metaphor of organism emphasizes open system with on-going process in relation to external environment, with the metaphor of brain (knowledge and learning) as one subsystem (Morgan, 2006). General environmental uncertainty poses a major challenge to managers, which calls for different managerial responses, coping mechanism and entrepreneurial proclivities (Teece and Leih, 2016). Active decision-making is further required, based on insights from experts and leaders or even wisdom from crowds (Teece and Leih, 2016). The consideration of external inputs challenges the traditional conceived boundary of the firm.

Open innovation argues for permeable boundaries of the firm to enable free flow of knowledge as firms look to innovate (Chesbrough, 2003; Chesbrough, 2006a; Chesbrough, 2006b). *"Open innovation for me is when a company has or an organization has exhausted the possibilities of resolving a problem internally." (C3) "it is about rather than trying to solve problems and challenges internally, it's broadening to the wider marketplace…. how do you deliver, how do you use a whole range of external stakeholders trying to solve the challenges and problems that you have within your own organization." (C2)* If firms are not able to hold all knowledge internally to support innovation, they will alternatively look out to search for solution in wider marketplace. In this way, companies make greater use of external ideas and technologies in their own businesses (Chesbrough, 2003; Chesbrough, 2006a; Chesbrough, 2006b). This confirms the argument on outside-in open innovation, which advocates the opening up of innovation process to enable the integration of external inputs (Gassmann and Enkel, 2004; Enkel et al, 2009; Chesbrough and Bogers, 2014).

Recognizing the assumption of porous firm boundaries, the nature of open innovation is revealed as distributed innovation processes. *"we are finding one of the biggest parts of the problem in the potential solution is the process behind*

how that service is delivered, not necessarily the service itself." (B1) The process behind is equally important to observable delivery of outputs. Hence, it is imperative to create frameworks and processes so as to facilitate structured adoption of open innovation. *"It's about both creating ~~both~~[1] an acceptance of (what) companies can or organizations can resolve its own problems internally ~~but~~ (and) creating the framework and the processes (that) allows it to bring in other companies which may potentially be smaller operations alongside… There needs to be a support (of) process around it, because the nature of engagement has to be managed and mediated…" (C3)* These quotes confirm the renewed definition of open innovation Chesbrough and Bogers (2014) as distributed innovation processes with cross-boundary knowledge exchange, which are utilized with pecuniary and non-pecuniary mechanisms in accordance with business model.

Literature argues for the formulation of businesses models as architectures and systems to regulate distributed processes of open innovation (Chesbrough, 2006a; Chesbrough, 2006b). Very limited evidence is provided on business model, except for one interviewee implying the transition from 'business as unusual' to 'business as usual' (Huizingh, 2011). As E1 describes the journey, *"I think initially when you are just implementing it, I think then it's a strategy at that point. So it would be a strategy that implement, perhaps open innovation team who would say we are going to take these actions in order to make sure that we get external inputs and these external activities put into our business-as-usual. But as you go on in the process, as you get more advanced at it, then it starts to become a business model… The end day of any good innovation programme should ~~be~~ not need an innovation team. It should be something that's as your business model. So it should be something in the end that go through anyone in your business. Everyone in your business knows how to access open innovation tools or ~~know~~ how to work*

[1] The interviewees are not perfect in their language usage, therefore "~~word delete~~" and "(word add)" are used to correct minor mistakes to facilitate language flow. This is consistent with the adoption of thematic analysis, which emphasizes themes of data rather than language per se. Details have been given in Section 3.4 Data analysis and display.

the process and should know how to carry out any of the open innovation processes. In that side, it goes from being a strategy near the start to ending up as a business model." Therefore, open innovation starts as 'business as unusual' assisted by a dedicated innovation team, and evolves to become tools and processes embedded within 'business as usual'.

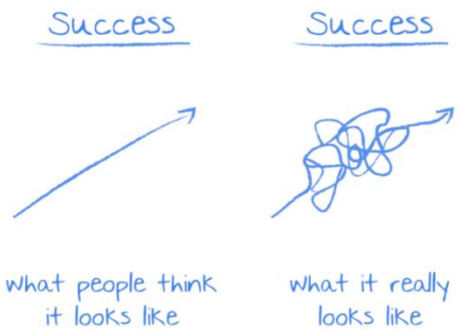
Limited evidence on strategy and business model shows open innovation is far from being strategically managed, which justifies the query of this research to resolve the strategy gap of open innovation (Vanhaverbeke and Cloodt, 2014). In the narrower sense of innovation, open strategy and open business model are separately formulated to guide the strategic utilization of innovation communities, ecosystems and networks for value creation and capture (Chesbrough and Appleyard, 2007; Appleyard and Chesbrough, 2017). In the broader context of organization, open innovation should be linked to strategy of corporate growth, which balances exploitation and exploration for future competition (Vanhaverbeke and Cloodt, 2014; Vanhaverbeke and Peeters, 2005). Business model facilitates the integration of open innovation efforts into wider organizational system for value creation and capture (Chesbrough, 2003; Chesbrough, 2006a; Zott et al, 2011; Smith et al, 2010; Bogers et al, 2017). Dimensions of open innovation (as design elements of business model) require systematically managing (Chiaroni et al, 2010; Chiaroni et al, 2011; Enkel et al, 2011; Saebi and Foss, 2015). The dimensions may potentially be integrated into some categories of dynamic capabilities.

Apart from systematically managed processes of open innovation, 'collaboration' appears another key word when conversing with interviewees. This corroborates the observation that all definitions of open innovation converge on 'collaboration' (Tynnhammar, 2017). *"My kind of feeling on open innovation is really a way of enabling collaboration through innovation." (D1)* Another interviewee holds a similar view, *"In simple terms I understand open innovation to be collaboration*

with people and companies who are external to the organisation. It facilitates new knowledge, skills and competencies to be brought into the organisation to help it develop new products and services." (A2) Thus, new knowledge, skills and competencies comprise the content of collaboration. Moreover, the size of collaboration can be huge: companies build up an impressive partner ecosystem with tens of millions problem solvers to deliver flexible solutions of innovation challenges. *"We have a partner ecosystem of about 43 million solvers that we can collaborate with. We have arrangements in place with a variety of open innovation intermediaries, ranging from 9 Sigma, Yet 2, right through to Topcoder… and we have several others that are under development." (D1)*

Some scattered findings on the concept of open innovation are further presented. Open innovation is not strictly separated from current happening of innovation, which denies the criticism of open innovation as a mutually exclusive alternative to closed innovation (Trott and Hartmann, 2009). *"Open innovation is a mix of everything just now… it is a wide ranging thing just now within (our company), but it is not strictly all open innovation." (A1) "The "open" aspect of Open Innovation stems from collaborating with external partners to create innovative solutions. Not all innovation is open." (Company D – Meeting material of open innovation programme)* Additionally, the journey to open innovation is not as straightforward as people think. *Companies "Fail fast and take the leap". (Company D – Meeting material of open innovation programme)* See Figure 4-1. The approach to innovation is described as *think big, start small and scale fast (Company E – Divisional innovation strategy, 2018).* Accumulation and scale of small quick-wins set out the path to the future of open innovation.

Figure 4-1: Fail fast and take the leap (Company D – Meeting material of open innovation programme, p. 9)



To summarize, faced with uncertain environment, companies become active decision makers and adopt permeable boundaries to allow mechanisms of innovation accompanied by knowledge exchange. Key words of open innovation consist of process, system (business model) and collaboration. Based on Chesbrough and Bogers' definition (2014, p. 17) as well as emphasizing strategic utilization of open innovation, **open innovation** in the context of research is re-defined as "distributed and collaborative innovation processes that fit with wider organizational system in support of strategy implementation". Moreover, open innovation is a choice rather than a must, contingent on context of innovation. The journey to open innovation is tortuous and companies learn along the way. Small quick-wins illuminate the way ahead. Based on the collective understanding of open innovation, the next audits open innovation activities currently happening in the context of research.

4.1.1.2 Open innovation activities

According to the theoretical framing of this research (Section 2.4.2), micro-foundations of open innovation serve as building blocks of organizational dynamic capabilities to support strategy implementation. This section provides an audit of open innovation activities in the context of research, according to directions of

knowledge flow as one major way to deconstruct open innovation activities. Three archetypes have been mentioned in literature, namely outside-in, inside-out and coupled (Gassmann and Enkel, 2004; Enkel et al, 2009; Chesbrough and Bogers, 2014). Only outside-in processes of open innovation is observed in the context of research at the moment of study. Companies do source inputs from external collaborators to stretch the company's knowledge base (Gassmann and Enkel, 2004; Enkel et al, 2009; Chesbrough and Bogers, 2014). By comparison, neither inside-out nor coupled processes of open innovation have been identified. This confirms the dominance of outside-in processes in existing research (Enkel et al, 2009; Gassmann et al, 2010; Chesbrough and Brunswicker, 2013; Chesbrough and Bogers, 2014; West and Bogers, 2014). This rationales the importance that has been attached to absorptive capacity, which describes capabilities along the processes of knowledge learning (Cohen and Levinthal, 1990; Zollo and Winter, 2002; Lichtenthaler and Lichtenthaler, 2009; Lichtenthaler, 2011).

Mechanisms of internal collaboration are considered as part of open innovation within context of research, because there exist transferable learnings between the outside-in open innovation and internal collaboration. *"I suppose one of the most important aspects of open innovation is making sure that you are engaged with people inside your company and then you are also engaged with as wider group as possible outside your company." (E1)* Learnings between outside-in open innovation and internal collaboration take place in both directions. On the one hand, a strong internal approach supports the external finding of answers: *"I think if we have a strong internal approach, then we know exactly when we should go outside and look at the external world to find answers. That scales things in a slightly different way." (D1)* On the other hand, the external piece can inform internal ways of doing: *"I think what we are doing in open innovation, which is to become more collaborative outside of (our company) will start to impact the behaviours of the people inside (our company)… If you can work on the external stuff and get good at that, you are at the same time simply impact the internal*

cooperation as well right down to those traditional parts of our business that didn't see themselves having a purpose of innovating." (A2)

Recent literature acknowledges that the experience of dealing open innovation intermediaries gives hints on ways to breaking down internal boundaries of innovation within an organization (Lee and Shin, 2017). Mimicking ways of working of innovation intermediaries (NineSigma, Innocentive and YourEncore), formal tools of internal collaboration have been set up (i-One PAD, i-Challenge and i-Expert) (Lee and Shin, 2017). Table 4-2 shows the comparison between tools of innovation intermediaries and internal collaboration. "i-OnePAd and i-Challenge broke boundaries across teams; i-Expert broke boundaries between individual researchers. Taken together, the three tools broke down organizational silos and increased cross-divisional collaboration at both the team and individual levels. The tools also created a pathway into the open innovation system: researchers first used internal tools to find solutions. When a solution could not be found internally, they could then explore open innovation intermediaries" (Lee and Shin, 2017, p. 30). These evidences in literature accredit the existence of transferable learnings between the outside-in open innovation and internal collaboration.

Table 4-2: Parallel tools of innovation intermediary and internal collaboration

(Summarized from Lee and Shin, 2017, p. 28-30)

Innovation intermediary	Formal mechanisms of internal collaboration
• NineSigma: Searches and connects with organizations capable of solving a posted problem	• i-One PAD: Connects solution-seeking team with potential solvers team with expectation of breakthrough technologies and products
• InnoCentive: Provides a web-based platform through which individual solution providers may connect with challenges	• i-Challenge: Provides an internal completion platform that connects anonymous seekers and solvers and awards winning solvers

• YourEncore: Finds the best experts in its network and invites them to aid in problem solving	• i-Expert: Serves as an individual seeker/solver matchmaking tool to find solution for small technical issues

Another recent research confirms the usefulness of internally applied open innovation practices in the context of multi-business firms with a diverse knowledge base (Moellers et al, 2018). Several integration mechanisms are mentioned: 1) supportive IT-platform for information sharing, idea submission, feedback coordination and network sustaining, 2) HR practices consisting recruiting collaborative people, job rotation and designated employee for coaching or project-related technology transfer, 3) innovation event (idea context), 4) regular physical events such as workshop and information sessions, 5) cross-divisional meetings, and 6) proactive promotion by innovation facilitator unit (Moellers et al, 2018). Considering the complementarity between cross-boundary open innovation and internal collaboration corroborated by theoretical and empirical evidences, all answers of interviewees relating to both are captured and merged in Table 4-3.

Table 4-3: Open innovation activities in the research context

Outside-in open innovation	Internal collaboration
• Open innovation challenge • Want, Find, Get, Manage Model • Technological search/landscaping • Collaboration with customer • Innovation centres • Corporate website • University research • Conference, meeting and workshop • Event • Partner ecosystem/solver community • Community Planning Partnership • Design sprint	• Idea generation • Design sprint • (Stage-Gate) innovation process • Cross-collaboration • Innovation in value proposition • Ideation time and budget • Innovation forum • Solverboard

According to Table 4-3, open innovation challenge is a ubiquitous tool of outside-in open innovation, idea generation is an approach frequently applied in internal

collaboration, and design sprint is a shared method of both outside-in open innovation and internal collaboration. Open innovation challenge is generally explained as the starting point of application and one critical point of learning in the context here. The process excellence of open innovation challenge, ideation generation and design sprint are detailed under the dynamic capability of innovation process (Section 4.2.3). Open innovation challenge is referred to as the most favourable method to try out open innovation by the supporting government agency (Scottish Enterprise). *"SE has adopted one form of Outside-In OI (challenges) as the basic form of OI. That makes a lot of sense because it can be seen to be one of the OI tools with lower entry costs and its potential results may be seen sooner or rather than later." (Launch meeting: Open Innovation initiative groups for first activity, 2015, p. 7)* Therefore, open innovation challenge is the explicitly requested and promoted basic form of outside-in open innovation.

Answering to the promotion, all these companies have been engaged in posting public-facing challenges to proactively seek external collaboration. As one open innovation leads puts it, *"Most of the work that we've done has been on public facing challenges, where they have been branded and people understand that they are collaborating with (our company). But we will do some more work in the field of technology landscaping and anonymous request for a proposal, where there might be something more commercially sensitive over the coming months." (D1)* The companies acknowledge open innovation challenge as one major tool to adopt open innovation, without denying the potential of different methods such as technology landscaping under other circumstances. As B2 puts it, *"innovation challenge is just a small part of open innovation. And there is so much more that we can do and so many different tools that we can implement."* Besides, companies have been learning along the way on how to make the best of open innovation challenge. *"The challenge brief must be written with precision, so that potential solvers see how their solutions might address the problem, and at the same time broad enough to attract solutions from other industrial sectors."*

(Wagner and Fain, 2018) As one interviewee confirms, "*you need to make sure that you really frame your challenge right for them, and make sure that it is really vague enough… you really need to try to generalize as much as possible so make it into something that sounds like a lot more things rather than just specific terms…" (E1)*

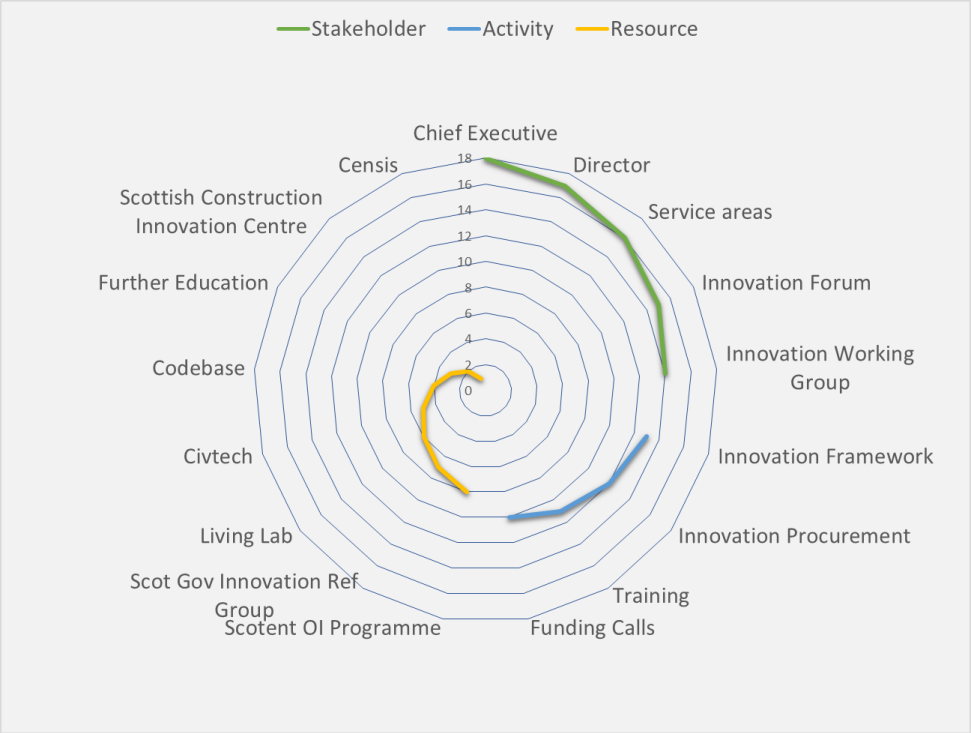
Alternative to directions of knowledge flow, levels of open innovation is next considered. As has been detailed in Section 2.1.3 in literature review, the five levels of analysis comprise intra-organizational, organizational, inter-organizational, extra-organizational, as well as industry, regional innovation systems, and society (Bogers et al, 2017). Referring to Table 4-3, the left column (outside-in) covers open innovation activities more external to the organization, which is loosely coupled with levels of inter-organizational, extra-organizational, as well as industry, regional innovation systems, and society. The right column (internal collaboration) consists of innovation activities relative internal to the organization, which connotes levels of intra-organizational and organizational. This research intends to address the gap of how open innovation helps to shape opportunities at organizational level and looks to connect mechanisms spanning across different levels (Bogers et al, 2017). Levels of analysis in this research is applied to encourage multi-level adoption of open innovation, more specifically, to identify 'who' are the collaborators of open innovation and 'where' do they locate. Findings relating to levels of analysis are then presented and discussed.

It is the perception that *"Everybody understands that ideas can come from anywhere, from any part of the organization. It doesn't need to be the R&D team. It could be from outside the organization, customers, suppliers, or whoever." (A2) E1 refers to some more categories of collaborators, who are industry centres, academia, SMEs (through Scottish Enterprise) as well as innovation intermediaries*. These evidences confirm the necessity to involve different external partners of open innovation, namely customers, suppliers, research institutions, competitors

and foreign organizations (Greco et al, 2015). At the same time, companies should consider internal engagement of people at multiple levels of organization. *"It needs to come from a variety of levels, in my opinion. It think we need support from the very top right through from our executive management team, from our CEO, chief operating officer, right through to director, middle management, and of course anywhere employees at any other level. " (D1)* Therefore, companies should be open about the sources of ideas from within and outside.

Adding to evidences of private sector organizations as described above, public sector organizations have a tradition to engage diverse partners to conduct civic innovation. *"Co-production which to me mirrors completely good open innovation. We would be engaging with the service area that holds the budget in delivering goods or services." (B1)* Figure 4-2 shows a visual of their stakeholders of open innovation (Company reporting of open innovation programme cohort meeting 9, 2018). The visual shows systematic integration of internal stakeholders, structure, activities with external stakeholders holding complementary resources. Internal stakeholders from top-down include chief executive, director and service areas. External collaborators with different potential of collaboration consist of Censis, Scottish Construction Innovation Centre, Further Education, codebase, Civtech, Living Lab, Scot Gov Innovation Ref Group and Scotent OI Programme. Although the visual puts the structures of innovation in parallel, the researcher would interpret their roles in a slightly different way on the basis of original description: Innovation Forum as the overseeing body, Innovation Working Group as the team of supporting, and Innovation Framework as the model of adoption (Company reporting of open innovation programme cohort meeting 9, 2018).

Figure 4-2: Visual of stakeholders (Company reporting of open innovation programme cohort meeting 9, 2018, p. 10)



Similarly, the open innovation programme of the other public sector organization also involves diverse partners. Figure 4-3 offers an overview of collaborative partners. *Categories of collaborative partners involve centre for civic innovation, academic partnerships, community planning partnerships and enabling platforms. (Summarized from Company C – OI presentation)* C3 claims that the centre for civic innovation is the physical presence that hosts societal wide innovation challenges, where all partners are pooled together and centrally coordinated for open innovation. As C3 explains, *"the idea is that a problem is brought in to here and then these are the resources. So essentially what happens is that each of those had their relationship previously, some are strong and some are weak relationships, sometimes part of the organization is completely circumvented, or sometimes it's brought in at the wrong time. The idea is that all these players are here just now. All we want to do is to calibrate them and then around the centre for civic innovation." (C3)*

Figure 4-3: Innovation partnerships (Company C – OI presentation, p. 12)

To summarize, the companies conduct open innovation activities with outside-in knowledge flow. Comparing Table 2-3 of literature and Table 4-3 of empirical finding in this section, it is conspicuous that there is huge potential for companies to take on more diverse mechanisms of outside-in open innovation and try out mechanisms of inside-out and coupled open innovation. Internal collaboration is presented as meaningful parallels and transferable learnings of outside-in open innovation, which is confirmative to recent literature (Lee and Shin, 2017). Alternatively, following the logic of levels of analysis, multi-level adoption of open innovation connecting to networks of stakeholders is presented. Open innovation activities conducted with various stakeholders nested at multiple levels inside and outside the organization requires systematic integration and management.

4.1.2 Organizational ambidexterity

This section of organizational ambidexterity is divided into two subsections. Section 4.1.2.1 clarifies basic understanding of the concept of organizational ambidexterity. Evidences relating to both sides (exploration and exploitation) of

organizational ambidexterity is first demonstrated. Concrete internal barriers to balance are enumerated, consisting of people, time and money. Then open innovation is posed as a potential solution to help address the barriers. Section 4.1.2.2 covers scattered actions conforming to current framing of solutions to organizational ambidexterity. Evidences of all three modes of ambidexterity (structural, contextual and sequential) are provided. Insufficiency of one single mode and complementarity of different modes show prospects of re-combination for a more holistic solution.

4.1.2.1 The paradox of organizational ambidexterity

The strategic paradox of organizational ambidexterity is revisited. Exploitation and exploration represent dual strategic orientations of an organization (Chen, 2017). The balance of exploration and exploitation is crucial in determining the fate of an organization (March, 1991). Organizational ambidexterity assumes that an organizational should be capable of both exploitation and exploration, more specifically, to compete by efficiency, control, and incremental improvements in mature technologies and markets as well as to compete by flexibility, autonomy, and experimentation in new mature technologies and markets (O'Reilly III and Tushman, 2013). The interviewees' perception on strategic orientations between exploitation and exploration are captured below.

On one side of the paradox, exploitation (striving for efficiency) is a commonality shared by both private and public sector organizations within the research context. In the private sector, *"The business is about making money. It's about saving money. Unfortunately, a business like (our organization) has been in the situation where you don't innovate until you really have to… It's about Six Sigma. It's about resource poor… It's quite easy to rest on your laurels…" (A1)* Chasing efficiency for its own sake make the company blind to external competition, which forgoes the opportunity of strategic differentiation (Porter, 1996). Excessive exploitation for short-term efficiency without considering exploration for future

throws the firm into the 'success trap' (Levinthal and March, 1993). The ability to tune for changing environment is forgone (Junni et al, 2013). Similarly in the public sector, *"(the organization) is madly dashing towards savings." (B2) "there is an understanding of a large public sector organization is more stood towards efficiencies and optimizing services but not suited to disrupting or creating new business models or services." (C3)*

On the other side of the paradox, exploration (to innovate) is recognized as the key to unlock future opportunities. *"We recognize that if we don't innovate, then other organizations will and we will be left behind in a place where we can't compete or we will cease to exist." (D1) "In the short term, it's about exploiting project opportunities with our clients. Not in the long run it isn't, we still want to do that. In the long term, we need to take a bold vision of what markets we want to operate, where we want to develop particularly capabilities." (D1)* Exploitation for efficiency will continue to exist in the future, but it is also necessary for companies to develop new capabilities to serve new markets. More conclusive comment is made by another interviewee. *"Innovation and efficiency is not really an "either/or" situation but instead a balance of both is required... My organization does not recognise this as a paradox. It embraces both the need for efficiency and also the need for innovation to generate good profitability for shareholders, and create new products and services for customers" (A2).* These arguments confirms the 'both/and' approach' as a more preferable solution to organizational ambidexterity (Smith et al, 2010). Balanced efficiency and innovation contribute to the profitability of the organization.

Despite recognizing the importance of being ambidextrous, organizations struggle to pursue exploration and exploitation simultaneously. *"in terms of being ambidextrous, we have the ability to scale and we can move on different things, but that is limited by our ability to progress solutions and depending on our staffing availability and resourcing availability… We are on the early journey on*

that path. We are not on a level where we have too really distinct strategies, where we say this one is for absolutely delivery and this one is for making us agile and be able to really understand the market and scale up and down to deliver more emergent things." (D1) The companies are in the rudimentary stage on the journey toward ambidexterity. There is neither clear strategy intent nor resource commitment for organizational ambidexterity. The difficulty to trade-off between exploration and exploitation is abstractly expressed in terms of resource allocation in previous literature, from the perspective of learning (March, 1991). This research releases the learning perspective, which thus provides more concrete description on difficulties to practically manage organizational ambidexterity. Major barriers referred to by the interviewees consist of people, time and money.

The barriers of people and time come hand in hand. People are not available for innovation. *"The blocks are the people, because there's not enough people. People are being squeezed." (E2)* Squeezed people are not able to take time off for innovation. Besides, it is hard for innovation to get on top of people's working agenda, because people's job objectives might not associated with an innovation focus. *"How we balance is with difficulty and we just have to prioritize, but the difficulty in that is for marketing, we are involved in many things out with that kind of stream… I have to prioritize to hit my own milestones and the objectives that my bosses set me are achieved." (A4)* Similarly noted by another interviewee, *"trying to resource with people's time is a challenge, because they are currently working on lots of client projects and trying to free up their time to focus on something that's an idea that might not be delivered until that year, you know, may or may not be seen as a priority for them." (D1)* Furthermore, the only people resource noted is the open innovation coordinator/lead themselves. People in other departments rely heavily on them to conduct open innovation. As a marketing manager points out, *"I think we have a key focus through (the open innovation coordinator's work and her boss) with their partnership with local education, local*

authorities, and local government. That's where the innovation work really happens." (A4) The open innovation coordinator/lead is believed to be the contact point for external connection.

Apart from constraints of people and time, scarce money is another barrier of open innovation adoption. A budget dedicated to (open) innovation adoption is missing in context of research. *"There ~~is~~ (are) small pockets of innovation budget across different departments, but it is for overall innovation not belonging to any department." (A1)* Austere industry climate further poses challenge to persuade investment on open innovation. *"The other challenge around that is how do you find financial budget in a period of austerity towards taking some of these ideas forward." (D1) "(The) majority of the oil and gas industry, and particularly (our area of business) is geared more towards efficiency at the moment, because of the global downturn in oil and gas over the last few years. That's what most businesses have adapted to." (D1)* Budget constraint is something shared by both private and public organizations. *"Budget is another one that is very similar across both (sectors). Obviously public sector, we are in the hands of local government funding. While as the private sector, they are with the economic climate at the moment. They are very resistant to spend a large amount of cash actually without knowing what the benefit is going to be." (C1)*

Internal constraints of people, time and budget press organizations to consider the external alternative of open innovation. Open innovation may provide a viable solution, where there is difficulty to move things forward internally. *"Generally, if an idea came in or something which becomes a big project. You need to find more people. Possibly you would need someone like Sottish Enterprise or something to facilitate that with… whether it's through funding or finding people or partners to work with… my opinion is very much that you can do it, it doesn't mean you should. If you need a result quickly, then possibly doing it internally is not the way to do it, particularly because people don't have the time to go and explore these*

things." (A1) Internal innovation is not a must but just being one choice. This confirms the argument that organizational ambidexterity can be realized within and across the boundary of the organization (Lavie and Rosenkopf, 2006; Lavie et al, 2010; Raisch et al, 2009). In era of open innovation, extravert knowledge sourcing does not necessarily contradicts introvert balancing exploration and exploitation (Kauppila, 2010). Open innovation allows preferential access to others' resources and capabilities (Lavie et al, 2010), which thus may provide a means to achieve organizational ambidexterity.

Generally, organizational ambidexterity is recognized as a strategic paradox critical to the survival of all organizations in the context of research. As A2 notes, *"All corporations will have innovation and efficiency at the heart of their strategy."* Companies are committed to both exploration and exploitation. This confirms to the 'both/and' approach to realize organizational ambidexterity (Smith et al, 2010). Rather than abstractly claiming resource constraints from the learning perspective (March, 1991), this research provides concrete evidences about practical barriers of organizational ambidexterity, namely people, time and money. With the presence of these internal barriers, open innovation arguing for the external piece of innovation is posed as an enabler of organizational ambidexterity. As D1 claims, *"We are trying to move into a place, where we are trying to be a little bit more disruptive, a little bit more innovative, obviously running open innovation programme is a start towards that journey."* Open innovation presses the exploration side, which thus disrupts the original balancing between exploration and exploitation. Finish discussing the ambidextrous paradox itself, evidences on modes of balancing are presented next.

4.1.2.2 Current balancing actions

Three different modes of balancing are documented in previous literature as viable solutions to address the paradox of organizational ambidexterity, which are structural ambidexterity, cultural ambidexterity as well as sequential

ambidexterity (O'Reilly III and Tushman, 2013). This section looks at how open innovation fits with current framing of the solutions to organizational ambidexterity. The balancing actions are conducted more in an intuitive/emergent way than in a structured/deliberate manner. Although not much has been done to strike the balance between exploration and exploitation within the context of research, some evidences do exist supporting all three modes of balancing. The three modes of balancing are then elaborated one by one.

Structural ambidexterity argues for the enclosure of certain units for either exploration or exploitation (Kauppila, 2010). Normally, open innovation is set up either as a separate programme or a separate team away from the main organizational functions to explore opportunities. For example, *"(The name of open innovation programme) is a programme within (the geographic division of the) business to further enhance the focus on technology enablement." (Company D – Meeting material of open innovation programme)* Alternatively in another company, *"we've got a team that drive open innovation, we are the process providers, but we are also developing the owners* who *lie out in the business. That's the key for our innovation. It doesn't stop. With us, we are a team of 12 people. We fight. We do our best." (E2)* Although the open innovation programme or team stands a separate entity, necessary connection with mainstream needs to be maintained for adoption. *"we can basically go and meet anyone in the company and meet anyone working on anything in the projects, talking to them and trying to get engagement with them." (E1)*

Contextual ambidexterity refers to the building of supportive context to induce individual perceptions and behaviours in the short run (Gibson and Birkinshaw, 2004; O'Reilly III and Tushman, 2013). Open innovation needs to fit with current holistic organizational environment for adoption, and the presence of tools and incentive may help raise awareness and persuade engagement in open

innovation. *"Open Innovation pursuits inside my organisation needs to fit well with the current organisational environment (culture, business situation, project needs, strategic direction and needs). Much of these pursuits are about educating and making others aware of OI and its potential as well as directly encouraging and showing employees how to engage in OI; including providing tools. In time, it's expected that many employees inside (our company) will have the confidence and incentive to collaborate more with external companies and institutions." (A2)* Comparatively, no evidence is given on the shift of organizational identity in the long run (O'Reilly III and Tushman, 2013). This may result from the sample of interviewees mostly consist of dedicated staff to open innovation, who are lower down the organization hierarchy thus are not really involved in planning for organization-wide cultural change.

The balance between efficiency and innovation is not static along organizational evolution as time passes. This rationales sequential ambidexterity as another mode of balancing, acknowledging there can be rhythmic oscillation between exploration and exploitation to allow for prioritization at a certain time (Brown and Eisenhardt, 1997; O'Reilly III and Tushman, 2013). The balance between exploration and exploitation may shift from time to time, but organizations should be mindful of both all the time. Pursuing one at the cost of the other does not makes a wise decision. *"we probably some times, some periods of time, would be towards the innovation side, in other times maybe less involved in innovation more down into the cost-efficiency, labour-efficiency, and so on and so forth. Neither situation if you were to run one exclusively at the cost of the other makes any sense. You've got to be mindful of both. I think a fit organization is mindful of both. It has got one eye on innovation and one eye on efficiency. I think they are connected. I don't think they exist as two separate things. We probably shift around a little bit. And it's kind of a cyclical thing in some regards for some businesses." (A2)*

Open innovation may constitute an enabler of sequential ambidexterity. Open innovation creates the agility to work with external talents around the globe at different time for different purpose. Sometimes a certain type of people is taken on board to deliver projects for efficiency, at other times a different type of people are involved to address more emergent problems. *"If you look from that perspective, an ambidextrous perspective, that means we don't have to employ everybody, we can go out to the world and we can collaborate with other types of people. We maybe only need their assistance for a week or a couple of months. That's enough. We don't need to have them work for us all the time. And that allows us to collaborate with people, and to be agile, and be able to have a strategy that allows us to deal with steady-state business for a client project, and be able to deal with things that are a bit more emergent or a bit more sort of future focused." (D1)* Temporary collaboration with different talents allows the flexibility to shift between exploration and exploitation over time.

Evidences above verifies the viability of all three modes of ambidexterity (O'Reilly III and Tushman, 2013). Below are some further comments on modes of balancing. The perception of the innovation programme/team as a structurally separated entity corroborates structural ambidexterity as a favourable mode of balancing (Benner and Tushman, 2015). However, the open innovation programme/team is not strictly separated from the mainstream operation. *"I think it (open innovation) has been a sort of separate message and a separate entity. But I think as this team moves forward, it will be more and more embedded and it will become more and more part of everything that goes on." (A4) "(What) we are doing is kind of integrating that. We basically see open innovation as an approach for us to solve problems and to overcome different challenges. In the same way, there are several other things that we can do in terms of making process more efficient and effective. But for us, we see it as a key part of our technology strategy and now will become focus on how we take this forward."*

(D1) Integration and embeddedness characterizes the journey forward, but the trend will take time to roll out.

Additionally, the interviewees do recognize that structure and culture are not perfectly independent solutions. Companies may have to adopt a mixture of both. As C1 puts it, *"you have to have the correct structure in place in order to change the cultural issues that we have… I think you must take the approach of a mixed bag. You can basically put a structure in place and then force open innovation to members of staff, who are actually doing the job. You have to bring them along the journey with you."* The quote implies the complementarity between aspects of structure and culture, which reveals the prospects to recombine different modes of balancing aiming at excellence in both exploration and exploitation (Kauppila, 2010; O'Reilly III and Tushman, 2013; Chen, 2017). After separate enquiry on open innovation and organizational ambidexterity, the next section aims at integrating and formally clarifying their relationship.

4.1.3 Role of open innovation in organizational ambidexterity

Open innovation and organizational ambidexterity have recognized each other as close fields of research (Randhawa et al, 2016; Wilden et al, 2018). There is the conspicuous gap of strategy in the field of open innovation (Vanhaverbeke and Cloodt, 2014), the strategic paradox of organizational ambidexterity is referred to as a relevant topic to pursue (Gupta et al, 2006; Bogers et al, 2017). The other way round, within emerging externality (Nosella et al, 2012), organizational ambidexterity can only be achieved by combined efforts of both within and across (Lavie and Rosenkopf, 2006; Lavie et al, 2010; Raisch et al, 2009). Despite mentioning the importance of each other at face value, empirical evidence on how open innovation help realize organizational ambidexterity is completely missing in previous literature. This section attempts to make direct linkages between open innovation and organizational ambidexterity in different ways, backed up by abundant supporting evidences. Generally, it is the belief that open

innovation potentially contributes to both sides of the strategic paradox of ambidexterity. *"Open innovation provides more opportunities to help improve efficiency and generate new and differentiated products and services, both faster and cheaper than before." (A2)* Open innovation facilitates the maximization of exploitation as well as the shift of the balance more toward exploration.

Regarding exploitation, (open) innovation is regarded as a means to improve efficiency. *"One of the ways we are creating efficiency is through innovation." (E1) "(It's) about how you could be more innovative to be more efficient." (C1)* Similarly, *"I think efficiency is all about that day-to-day operational/tactical stuff that our business does. Innovation for me is challenging what is done. Of course good innovation can lead to improved efficiency. Good innovation can lead to improved profitability." (A2)* More specially on the impact of open innovation, *"working with people outside your business and brining in new technologies, ideas, services, processes… can ultimately help to drive efficiency through decreasing manufacturing costs..."* *(A1)* Regarding long-term implication, *"those efficiencies will evidence delivery of the long-term vision." (B1)* Therefore, the logic is (open) innovation creates efficiency, and the delivery of efficiency help realise the organization's long-term vision.

More importantly, open innovation shifts the balance of ambidexterity more toward the exploration side in three ways. First, deliberate conducting open innovation encourages exploration, which gives an opportunity for innovative ideas to thrive. This avoids the 'failure trap': sacrificing long-term innovative capacity by cancelling under-developed innovative ideas with limited short-term impact (Levinthal and March, 1993; Junni et al, 2013). Putting out open innovation challenge to the public domain signals the organization's commitment to external collaboration, which is seen as a brave step to explore opportunities through innovation. As A2 puts it, *"the very fact (that) we have gone out and put challenges to the open public domain for the first time is a little bit of a step*

forward... which is serious a brave step to make for an organization that's probably a bit too insular, or a bit too internally focused, too sensitive about what it shares. And I think we've probably made those initial steps to at least overcome the anxiety that the people in the business might have about advertising a need and just putting it out there and trying to get input from I guess anybody in the world. That has been an interesting step forward."

Second, open innovation leads company to embark on adventurous expedition to blue ocean areas. Red ocean strategy aims beat the competition in existing marketplace (exploiting existing demand), while blue ocean strategy targets at make current competition irrelevant by create uncontested market space (explore new demand) (Kim and Mauborgne, 2004). Open innovation opens up prospects to reap value from blue oceans where there is less or even no competition, without necessarily sacrificing optimizing for red oceans with fierce competition. Being open about results of open innovation challenges increases the chance of finding solutions with different strategic orientation. Organizational ambidexterity is achieved through simultaneous exploration in blue oceans and exploitation in red oceans. *"(There) are a variety of different challenges that we can look at. We really need to be open minded in the sense of where we are going and what we find. Some of the technology intelligence we gather will resolve some of these running challenges that will enable us go into a new marketplace or compete in sort of the ~~a~~ strategy terminology ~~in terms~~ of blue ocean, really look at areas that other people will not look at. ~~There~~ (It) is obviously we can continuous compete in our current market and optimize that in terms of red ocean sort of strategy. For me, we have the capacity to do both through our open innovation programme." (D1)* Blue oceans breed opportunities to forward open innovation adoption, without forgoing returns from the red oceans.

Third, open innovation facilitates the exploration of radical unknowns. Diversity and experimentation characterize actions of exploration (Lavie et al, 2010). Open

innovation is more 'revolutionary' than 'evolutionary'. *"I think the stuff we are doing in our open innovation programme is more radical. It is not as evolutionary in most senses as revolutionary… that starts to get quite exciting." (D1)* Open innovation tackles challenges with little known about 'how to resolve' in the beginning. *"For our open innovation program, (name of the open innovation programme), we've basically used that to identify areas that we have no idea of or we have limited idea of how to solve that challenge in the first place." (D1)* The radicalness is also expressed in the amount of budget allocated to co-production. *"Where open innovation fits in is co-production that mentioned where you are involving all your stakeholders. That's here. So 50, k and over, it's a full tender… Anything less than 50k, essentially we wouldn't really bother trying to co-produce that." (B1)* Thus, open innovation facilitates revolutionary solutions to innovation challenges with radical unknowns.

Considering open innovation as an approach to explore radical unknowns, open innovation works in complementary to other approaches to suffice the ambidextrous orientation of organization. Projects with different orientations are allocated to different teams to take forward. *"We had a business improvement initiative called ESSA, which is eliminate, standardize, simplify, and automate. And that was really focused on driving things about incremental percentages… we are focusing on the things which the magnitude are 10X improvements." (D1)* Similarly in another organization, *"(our) transformational program within the organization is… looking at lean and process development, which is incremental improvements on existing activity. We are trying to bring in something more radical. So we've had some discussions with our internal transformational team to say, fine, you stick to your process redesign etc. etc. We are doing the civic innovation. And we can discuss to make sure we are following the same line. We are kind of clear which challenge goes which way." (C2)* The key is to recognize the synergy as well as develop effective interaction between different but complementary streams of innovation.

Generally, open innovation facilitates the realization of both exploration and exploitation sides of organizational ambidexterity. On the one hand, open innovation is a means to improve efficiency, which further delivers organization's long-term vision. On the other hand, open innovation shifts the paradox more toward exploration in multiple ways: 1) deliberate open innovation facilitates the exploration of innovative ideas; 2) open innovation opens up opportunities to explore blue oceans untapped by current competitors; and 3) open innovation explores challenges with radical unknowns complementary to incremental transformation. Open innovation is capable of changing dynamisms between exploration and exploitation, which sheds light on resolving the strategic paradox of organizational ambidexterity.

4.1.4 Summary

This section explores the relationship between open innovation and organizational ambidexterity. Section 4.1.1 elaborates the concept of open innovation as well as audit current open innovation activities. Details are given in Table 4-4. Subsection 4.1.1.1 clarifies the scene and nature of concept, based on which arrived the contextual definition of open innovation. Convergent with literature, open innovation is an active choice of organization to have permeable boundaries under uncertain circumstance. Key facets of open innovation include process, system (business model) and collaboration, which forms the building blocks of the contextualized re-definition. Moreover, missing evidence on strategy rationalises this research's pursuit of strategic adoption of open innovation in wider organizational context. Subsection 4.1.1.2 deconstructs micro-foundations of open innovation according to directions of knowledge flow and levels of analysis in previous literature. Mechanisms of outside-in open innovation and internal collaboration (internal parallel) are captured. Systematic management of networks of stakeholders at multiple levels inside and outside the organization are emphasized.

Table 4-4: Key findings and relevant literature of Section 4.1.1

	Key findings	Relevant literature
4.1.1.1 The scene and perception of open innovation	*"unknown unknowns" (C1)* *"the technology is changing, the business environment is changing" (E2)* *"you don't quite know the scale and scope of the problem" (C3)*	Uncertain environment (Teece and Leih, 2016)
	"exhausted the possibilities of resolving a problem internally" (C3) *"it's broadening to the wider marketplace" (C2)*	Permeable firm boundaries (Chesbrough, 2003; Chesbrough, 2006a; Chesbrough, 2006b)
	"the potential solution is the process behind" (B1) *"creating the framework and the processes" (C3)*	Distributed innovation processes (Chesbrough and Bogers, 2014)
	"it goes from being a strategy near the start to ending up as a business model" (E1)	Business models (Chesbrough, 2006a; Chesbrough, 2006b) Strategy gap (Vanhaverbeke and Cloodt, 2014)
	"enabling collaboration through innovation" (D1) *"collaboration with people and companies who are external" (A2)*	Collaboration (Tynnhammar, 2017)
4.1.1.2 Open innovation activities	Table 4-3: Open innovation activities in the research context *(All interviewees)* *"Outside-In OI (challenges) as the basic form of OI" (Launch meeting: Open Innovation initiative groups for first activity, 2015, p. 7)*	Outside-in open innovation (Gassmann and Enkel, 2004; Enkel et al, 2009; Chesbrough and Bogers, 2014) Internal collaboration (Lee and Shin, 2017; Moellers et al, 2018)
	"ideas can come from anywhere" (A2) *"It needs to come from a variety of levels" (D1)*	Levels of open innovation (Bogers et al, 2017)
	Figure 4-2: visual of stakeholders *(Company reporting of open innovation programme cohort meeting 9, 2018)* Figure 4-3: Innovation partnerships *(Company C – OI presentation)*	External partners (Greco et al, 2015)

Section 4.1.2 discusses findings regarding the paradox of organizational ambidexterity. Table 4-5 outlines key findings paired with relevant literature. Subsection 4.1.2.1 shows that interviewees mention more about the exploitation

side of the strategic paradox, without denying the necessity of the other side of exploration. An organization needs to conduct both exploration and exploitation to be ambidextrous, confirmative to literature. Beyond abstractly claimed as resource constraint, concrete barriers of people, time and money are pointed out. Open innovation is proposed as a way to release the barriers. Subsection 4.1.2.2 provides supportive evidences of actions conforming to modes of ambidexterity (structural, contextual and sequential), which confirms current framing of viable solutions to organizational ambidexterity. Moreover, the complementary between different modes regarding open innovation adoption paves the way for holistic integration (re-combination).

Table 4-5: Key findings and relevant literature of Section 4.1.2

	Key findings	Relevant literature
4.1.2.1 The paradox of organizational ambidexterity	<u>Exploitation</u> *"madly dashing towards savings" (B2)* *"efficiencies and optimizing" (C3)* *"The business is about making money. It's about saving money… It's quite easy to rest on your laurels…" (A1)* <u>Exploration</u> *"take a bold vision of what markets we want to operate" (D1)* <u>Balance</u> *"both the need for efficiency and also the need for innovation" (A2)*	Exploration and exploitation (March, 1991; O'Reilly III and Tushman, 2013) The 'success trap' (Levinthal and March, 1993) The 'both/and' approach' to organizational ambidexterity (Smith et al, 2010)
	Barriers of people and time: *"People are being squeezed" (E2)* *"involved in many things out with that kind of stream" (A4)* *"may or may not be seen as a priority" (D1)* Barrier of money: *"small pockets of innovation budget across different departments" (A1)* *"find financial budget in a period of austerity" (D1)* *"we are in the hands of local government funding" (C1)*	Difficulty of resource allocation (March, 1991)
	"If you need a result quickly, then possibly doing it internally is not the	Preferential access to others' resources and capabilities

	way to do it, particularly because people don't have the time to go and explore these things" (A1)	(Lavie et al, 2010)
4.1.2.2 Current balancing actions	*"a programme… to further enhance the focus on technology enablement" (Company D – Meeting material of open innovation programme)* *"we've got a team that drive open innovation" (E2)* *"a separate entity" (A4)*	Structural ambidexterity (Kauppila, 2010; O'Reilly III and Tushman, 2013)
	"needs to fit well with the current organisational environment… have the confidence and incentive to collaborate" (A2)	Contextual ambidexterity (Gibson and Birkinshaw, 2004; O'Reilly III and Tushman, 2013)
	"We probably shift around a little bit. And it's kind of a cyclical thing in some regards for some businesses." (A2) *"we can go out to the world and we can collaborate with other types of people. We maybe only need their assistance for a week or a couple of months" (D1)*	Sequential ambidexterity (Brown and Eisenhardt, 1997; O'Reilly III and Tushman, 2013)
	"have the correct structure in place in order to change the cultural issues… you must take the approach of a mixed bag" (C1)	Prospects to re-combine different modes of balancing (Kauppila, 2010; O'Reilly III and Tushman, 2013; Chen, 2017)

Section 4.1.3 provides substantive evidences to demonstrate the relationship between open innovation and organizational ambidexterity. Open innovation is shown to contribute to the realization of both sides of the strategic paradox of organizational ambidexterity. On the exploitation side, open innovation is regarded as an approach to increase efficiency. On the exploration side, open innovation promotes exploration in more diverse ways: deliberate exploration of innovative ideas, exploration in blue oceans, as well as explore solutions to radical unknowns complementary to incremental transformation. Therefore, open innovation advances exploitation through improved efficiency and encourages exploration through more radical experimentation. Special importance is attached to the potential of open innovation to shift the balance away from obsessive exploitation to more of exploration. More details are given in Table 4-6.

Table 4-6: Key findings and relevant literature of Section 4.1.3

	Key findings	Relevant literature
4.1.3 Role of open innovation in organizational ambidexterity	Exploitation *"we are creating efficiency is through innovation" (E1)* *"be more innovative to be more efficient" (C1)* *"good innovation can lead to improved efficiency" (A2)* *"help to drive efficiency through decreasing manufacturing costs" (A1)*	Close relationship between open innovation and organizational ambidexterity (Randhawa et al, 2016; Wilden et al, 2018) But missing empirical evidence
	Exploration *"put challenges to the open public domain for the first time is a little bit of a step forward… we've probably made those initial steps to at least overcome the anxiety" (A2)* *"enable us go into a new marketplace or compete in… blue ocean, really look at areas that other people will not look at" (D1)* *"open innovation programme is more radical" (D1)* *"50, k and over, it's a full tender" (B1)* *"we are focusing on the things which the magnitude are 10X improvements" (D1)*	The 'failure trap' (Levinthal and March, 1993; Junni et al, 2013) Blue ocean strategy (Kim and Mauborgne, 2004) Diversity and experimentation (Lavie et al, 2010)

General discussion in relation to RQ1

Based on finding of the whole Section 4.1, general discussion in relation to RQ1 *"What is the relationship between ambidextrous strategy and open innovation?"* is provided. Section 4.1 covers 1) the background of open innovation, 2) the strategic paradox of organizational ambidexterity with implied linkage on level of practice, and 3) relatively explicit linkage on level of strategy. Regarding open innovation, empirical evidences in Section 4.1.1.1 corroborates key words in accordance with literature, such as permeable organizational boundaries (Chesbrough, 2003; Chesbrough, 2006a; Chesbrough, 2006b), distributed innovation processes (Chesbrough and Bogers, 2014) and collaboration

(Tynnhammar, 2017). Based on mainstream definition by Chesbrough and Bogers (2014) as well as to emphasis strategic utilization according to research need, open innovation is contextually redefined as “distributed and collaborative innovation processes that fit with wider organizational system in support of strategy implementation”.

Referring to contextualized understanding of open innovation, Section 4.1.1.2 deconstructs micro-foundations of open innovation accompanying knowledge exchange, which provides potential substances of strategy implementation. The fact that there are only outside-in processes of open innovation, with missing inside-out and coupled processes of open innovation, confirms the dominance of outside-in processes of open innovation (Gassmann and Enkel, 2004; Enkel et al, 2009; Chesbrough and Bogers, 2014). Besides, the presence of processes of internal collaboration in context supports recent publications on internal collaboration as a useful part of open innovation (Lee and Shin, 2017; Moellers et al, 2018). Alternative to directions of knowledge flow, contextual open innovation is considered to be a multi-level phenomenon (Bogers et al, 2017) engaging diverse external partners (Greco et al, 2015).

Regarding organizational ambidexterity, Section 4.1.2.1 acknowledges the existence of the strategic paradox to balance exploration and exploitation in the context of research (March, 1991; O'Reilly III and Tushman, 2013). The companies preferably should take the ‘both/and’ approach to manage both sides of organizational ambidexterity (Smith et al, 2010). Practical barriers of people, time and money are pointed out, implying the abstract difficulty of resource allocation (March, 1991). With the advantage of preferential access to external resources and capabilities (Lavie et al, 2010), open innovation is proposed as a prospective solution to release the barriers to achieve organizational ambidexterity.

More directly, Section 4.1.2.2 connects open innovation and organization ambidexterity on level of practice. Supporting existing literature, open innovation activities are shown to be able to achieve all three modes of ambidexterity: setting up separate team/programme of open innovation for structural ambidexterity (Kauppila, 2010; O'Reilly III and Tushman, 2013), considering organizational climate for contextual ambidexterity (Gibson and Birkinshaw, 2004; O'Reilly III and Tushman, 2013), as well as engaging collaborators at the point of need for sequential ambidexterity (Brown and Eisenhardt, 1997; O'Reilly III and Tushman, 2013). The potential to recombine different modes is further pointed out (Kauppila, 2010; O'Reilly III and Tushman, 2013; Chen, 2017). These evidences justifies the rationale to integrating activities open innovation and organizational ambidexterity, on level of practice.

More importantly, Section 4.1.3 makes a straightforward linkage between open innovation and organizational ambidexterity on level of strategy, which addresses gaps of strategic adoption of open innovation (Vanhaverbeke and Cloodt, 2014) and organization-level adoption of open innovation (Bogers et al, 2017). Emergent evidences show that open innovation is capable of facilitating both exploration and exploitation. Open innovation is an approach to facilitate exploitation. Open innovation shifts to the paradox more toward the exploration side in three ways: deliberate capture of innovation ideas, expedition in blue oceans and experimentation with radical unknowns. This rationalises the positioning of organizational ambidexterity as the strategic organization paradox to address in context of open innovation (Gupta et al, 2006; Bogers et al, 2017). Concrete evidences are given to support the the previous symbolic claim that organizational ambidexterity is realized within and across organizational boundaries (Lavie and Rosenkopf, 2006; Lavie et al, 2010; Raisch et al, 2009).

Framing organizational ambidexterity as the strategic paradox, this section has made the linkage between levels of strategy and practice regarding open

innovation adoption. Comparatively, the next section explores the connection between levels of capability and practice to support strategic implementation, drawing on the concept of dynamic capabilities.

4.2 Dynamic capabilities and open innovation activities

The section intends to answer **the second research question**: *"What are open innovation related processes under categories of dynamic capabilities?"* This question explores categories of dynamic capabilities, merging micro-foundations of all three concepts. Open innovation processes together with wider organizational activities, comprise micro-foundations under themed categories of dynamic capabilities to support strategic implementation. In accordance with theoretical elaboration in literature review (Section 2.4.3), each sub-section elaborates one category of dynamic capability: Section 4.2.1 Strategy and leadership, Section 4.2.2 Culture and communication, Section 4.2.3 Innovation process and Section 4.2.4 Structure and governance. Themed categories of dynamic capabilities are deconstructed into sub-themes with micro-foundations. Vivid stories of micro-foundations are told, referring to either empirical evidence or extended literature review. In this way, current excellence of open innovation adoption in research context is captured, meanwhile gaps of adoption are tentatively addressed by more exhaustively scoping best practices documented in literature.

4.2.1 Strategy and leadership

This section is deconstructed into two sub-sections, representing two main ways to support strategic alignment for open innovation. Section 4.2.1.1 makes explicit linkages between open innovation and levels of strategy of organization, including immediate alignment as well as future planning. To guarantee strategic alignment,

Section 4.2.1.2 addresses the role of supportive (senior) management, either formal mandate or informal encouragement.

4.2.1.1 Vision and strategy

This section presents and discusses empirical findings on topics of immediate alignment with vision and strategy at present and potential integration into strategic planning for the future. (Open) innovation is either written into innovation strategy or embedded into common vision and levels of strategy of the organization. Defined from the perspective of technological innovation management, an innovation strategy sets objectives for innovation to deliver value and build competitive advantage (Dodgson et al, 2008). An innovation strategy contains four interrelated supportive elements: 1) the enacted strategy itself: defines the overall fit of innovation efforts under technological and market context; 2) resources for innovation: includes resources of different nature within and beyond organizational boundary, namely financial, human, technological, marketing, organizational and networking; 3) innovation capabilities: dynamic capabilities along processes of knowledge learning; and 4) innovation process: facilitates doing the right things in the right manner (Dodgson et al, 2008).

Trew (2018) similarly frames an innovation strategy by applying different wordings. An innovation strategy includes elements of 1) goals of innovation and the role of innovation to achieve overall business objectives, 2) strategic focus of innovation under conditions of markets, product types and technologies, 3) investment strategy and strategy types, and 4) resource commitment and strategic portfolio decisions (Trew, 2018). Besides, Fisher and Kinnemeyer (2018) clarify the process to translate higher level business goals into innovation projects: 1) business goals describe general appetite for market growth; 2) lower down, business strategy sets more concrete market goals; 3) to fulfil the market target, innovation strategy defines clear targets of conducting innovation; and 4) specific

innovation projects with different nature are formulated, with new product innovation project to address issues of product design and cost innovation projects to increase productivity of existing operation.

Literature shows having an innovation strategy helps attract attention to innovation (Lawson and Samson, 2001). However, only one company in the research context has explicitly defined innovation strategy. Company E have a divisional innovation strategy. *"This document outlines the changing (industry) landscape we are faced with and what our future (businesses) will look like. It describes how we plan to innovate to meet the challenges and deliver benefits to customers, and details the processes we intend to follow to ensure that we spend customers' money in the most efficient and effective manner." (Company E – Divisional innovation strategy, 2018, p. 4)* Despite the document lays out subtle details of innovation, the innovations strategy is not well understood. *"Our innovation strategy for (our company) will be for us to look at supporting the new technologies that are coming in, see how those technologies can fit into our (business), so that we can support that development. It's about understanding the requirements we hear from the people in the field or the process owners and we will then roll that out with agreement from our other partners as well."* (E2) The interviewee covers only 'how' to deliver innovation through process, without mentioning 'why' and 'what' also as parts of the coherent whole of the innovation strategy. Thus, proper interpretation is as important as the existence of the innovation strategy.

Except for having a separate strategy for innovation, wider efforts of innovation can be embedded in common vision and corporate strategy. For example, one organization's strategic priorities are developed to be ambidextrous (O'Reilly and Tushman, 2008; Birkinshaw et al, 2016). The strategic priorities embrace orientations of both exploration (innovation for differentiation) and exploitation (efficiency). *"We have three main pillars, which are about product differentiation,*

manufacturing efficiency, and revenue growth." (A1) Interestingly, the three pillars altogether resemble the classical theory of the growth of the firm: cost control and differentiation routes are believed to be routes to pursue for firm growth (Penrose, 1959). The strategic pillars guide the reiteration of open innovation activities over time. *"Anything that we do in terms of projects or even sessions we are holding. We are trying to link those back to particular pillars of the strategy. We can try to reiterate the link between what we were doing and ultimately where we are trying to get to." (A1)*

Moreover, to establish the centre for innovation is formally written in the strategy in one public organization. *"36. We will support growing businesses in our new high-growth innovation hub at the Tontine Building at Glasgow Cross, supporting 153 companies over the next 5 years." (Glasgow Economic Strategy 2016-2023, p. 9)* There is also the fit of open innovation with strategic vision in one private organization. *"Our corporate vision is very much open to interpretation at the moment. We have core values. We have a strategy. We have a vision which looks at, as I said, over a particular time horizon. And open innovation will be an approach that fits in with what we are doing in terms of our technology and innovation focus. I think at the moment open innovation is something different from we've done in the past. It's a bit disruptive. I would say that we would become more integrated as we start to scale our programme in our business in the next couple of years." (D1)* All these evidences support the necessity to embed (open) innovation within strategy (Lawson and Samson, 2001; Andriopoulos and Lewis, 2009; Slater et al, 2014; Hosseini et al, 2017).

Besides, no evidence is found on adaptiveness and flexibility of the strategy itself (Brown and Eisenhardt, 1997; Kelly, 2009; O'Reilly III and Tushman, 2013; Birkinshaw et al, 2016; Appleyard and Chesbrough, 2017; Hosseini et al, 2017). This may result from the focus of this research is on the investigation of organizational reality within current dynamic environment without engaging a

historical perspective to trace the development of strategy. Considering the incompatibility of research approach, this point is deliberately omitted for more relevant others to explore in the future. Despite not discussing the dynamism of strategy itself, environmental contingencies over time are accounted for in these organizations' long-term strategic planning. Next, long-term strategic planning is elaborated, compared with immediate strategic alignment discussed in several paragraphs above.

There are different expectations about short-term and long-term. The nature of problems may be different: short-term problems tend to be technical while long-term strategic. *"short-term problems tend to be more technological or about new technologies, and longer-term problems are generally more strategy-based or how we organize our processes in the future." (E1)* The urgency of a particular solution required may also exerts influence: emergent quick-fix versus long-term planned strategic exploration. *"If that is something quite emergent, that has to be fixed in a very quick horizon. If it's something typical in our technology roadmaps, there is a bit more time towards working that journey." (D1)* Therefore, literature argues for the creation of a balanced portfolio (options of projects) to address various conditions of technology and market in different time horizons (Baghai et al, 1999; Kelley, 2009; Day and Schoemaker, 2016).

Although the interviewees are not capable of systematically articulating the coherence regarding aspects of portfolio thinking (Baghai et al, 1999), they do realize the necessity to consider contingencies of both technology and market in strategic planning of projects. Regarding technology, technological road-mapping is employed to guide strategic exploration of technology (Chesbrough, 2003). Technological road-mapping provides a reference for technological scouting within and across industry. *"What we have in the business is a series of technology roadmaps, which define where we want to go over a particular range of time. There will be business critical clients that needs to be delivered within that time to*

satisfy a particular need. What we sort of do is to link our open innovation programme to those… The other thing that we need to consider is how we are taking these ideas and working with the right people at the right time. Because we might need to take an idea to find a particular piece of technology, which might not exist within our industry but might exist in another industry." (D1)

Apart from considering technology on the supply side, market-product planning on the market side is then described. Similar to the portfolio of three horizons noted in literature (Baghai et al, 1999; Kelley, 2009), one company category manage their projects according to Ansoff's product-market matrix. *"I'm trying to have a portfolio of projects, some of which are big steps, some of which are small steps, some of which are selling new things to our current customers, some of which are selling current things to new customers… from classic Ansoff's Matrix, we are trying to take a look at the various dimensions of various projects in terms of the strategic fit, size of the prize, the amount of effort, the amount of time we are trying to do." (A2) "Category management decide(s) whether it is a tier 1, tier 2, or tier 3 process or product. A Tier 3 requires minimal change… of an existing product. In Tier 2, there is about a bit product development involved… a new formulation or something like that… and Tier 1 is the next big idea..." (A1)*

4.2.1.2 Senior management

This section discusses the role of (senior) management to facilitate strategic alignment. Literature has systematically deconstructed dynamic managerial capabilities into managerial cognition, social capital and human capital (Helfat and Martin, 2015). Instead of conceptualizing and auditing managerial capabilities as capitals that managers objectively hold, this research focus on 'how' managers act as part of the organizational system to facilitate strategic implementation.

Managerial buy-in is difficult but must be in place, before resources can be committed and actions conducted. *"It's a power struggle. That would be true of anything, but the important part is management buy-in, senior management buy-in… We have to keep fighting for that buy-in. But ultimately we know if the company doesn't want to sign up for it, we can only push so far." (E2) "we've done briefings to our chief executive and got her to buy in the concept of it. We've got that senior officer buy-in. Our chief executive understands it as much as we do, so she is now committed both resource and her support to it. So it's now about how we translate that into actual activity." (C2)* Evidences on resource commitment are only mentioned in general, without mentioning too specific actions on resource development, as is documented in literature (Baghai et al, 1999; Lawson and Samson, 2001; Teece, 2007; Vanhaverbeke and Cloodt, 2014; Anthony et al, 2017).

Except for buy-in and resource commitment, managers lead by nurturing a climate for innovation, carrying out clear communication and facilitating top-down engagement (Day and Schoemaker, 2016; Hosseini et al, 2017; Chen, 2017). As D1 explains, *"they will approve budget. They will approve content being released to media. They will approve several other areas. But to me, it's really almost I guess as an ambassador for our programme. And that will champion it on an internal and external level but also someone that kind of offer insight and advice into their opinions and where they see we could potentially take it." (D1)* Beyond budget provider economically, more importantly, the managers afford roles of ambassadors and consultants culturally. This implies the importance of managers in facilitating coherent adoption (Berkhout et al, 2010; Trott, 2012) and integration of innovation to the wider organization (Kelley, 2009).

Additionally, general human resource management (instead of too specific cultural roles) is discussed as another critical consideration of managers. This is an absolute blind spot in context of research, and only high-level skills such as

employee selection, development and retention are covered in auditing practices of the three concepts (O'Connor, 2008; Anand et al, 2009; Slater et al, 2014; Birkinshaw et al, 2016; Chen, 2017). Such insufficient description requires more systematic and formal investigation of practices of human resource management in the open innovation context. Recently in the field of human resource management, Hong et al (2018) provide a conceptual review on collaborative-based human resource management, with explicit linkages made to knowledge management in open innovation. Table 4-7 is included to demonstrate these collaborative human resource management practices and describe their associations with open innovation.

Table 4-7: Collaborative-based HRM practices and open innovation (Excerpt from Hong et al, 2018, p. 16)

Domains of HRM	Specific practices	Relationship with knowledge management issues in the context of open innovation	Contributions to knowledge management processes in the context of open innovation
Recruitment	Seeking appointees with potential to develop collaboration skills	Potentially resolving conflicts associated with knowledge diversity	Potentially facilitating the integration of knowledge inflow
Training	Developing collaboration and networking skills knowledge outflow	Building capability to engage in relationship building and to overcome challenges associated with knowledge diversity and selective disclosure	Cultivated employees would support knowledge inflow and outflow
Appraisal and compensation	Reinforcing collaborative and trust-based relationships	Building relationships to overcome challenges associated with IP management, knowledge diversity, and selective disclosure	Trust-based relationships would support knowledge inflow and knowledge outflow
Job design	Enhancing understanding of	Potentially overcoming challenges in knowledge diversity	Better understanding of different jobs would

	and communication with external sources	facilitate knowledge inflow

4.2.2 Culture and communication

Culture and communication are crucial for innovation. As one interviewee puts it, *"one of questions kept being asked is how we can create the conditions that drives more innovation within business… it's all about changing mind-set." (A2)* This section discusses empirical evidences on micro-foundations under the themed dynamic capability of culture and communication. Five subthemes are addressed in five subsections. To begin with, Section 4.2.2.1 describes general expectations of what an innovative culture should be. Section 2.2.2.2 elaborates entrepreneurial risk-taking as one critical idiosyncratic capability for innovation. Allowing for the cultural characteristics to thrive, literature on marketing is drawn upon. Section 2.2.2.3 and Section 2.2.2.4 address topics of intelligence gathering and integrated communication respectively. Additionally, Section 4.2.2.5 discusses the indispensable capabilities of people, focusing on the role of open innovation managers in organizing efforts of innovation.

4.2.2.1 General culture for innovation

Although all the interviewees mention the importance of building a culture for innovation, none of them is fully aware that a culture for innovation needs to be managed as a holistic system. One company selects seven cultural principles for corporate communication: *easy and fast, flexible, measured, open-minded, iterate and learn, collaborative and scaled, as well as outcome-based (Company reporting of open innovation programme cohort meeting 9, 2018).* Figure 4-4 shows the slide in the original file. These cultural principles are newly put forward by the company in 2018, without being tested with micro-foundations in practical context. Considering empirical understanding of culture for innovation is neither

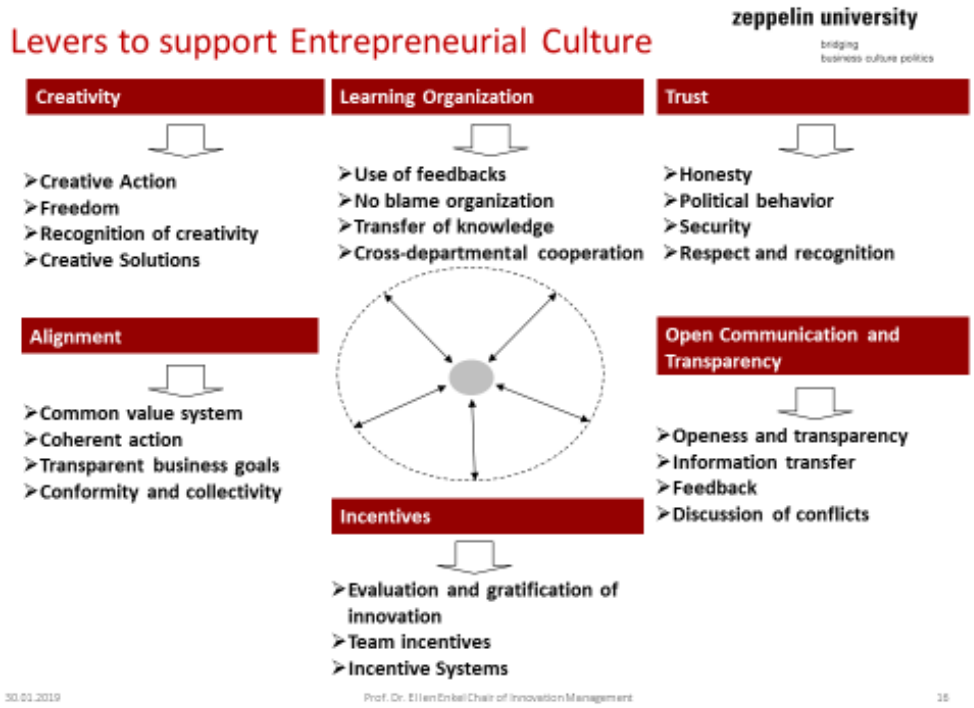
systematic nor comprehensive in the research context, more inspirations are drawn from additional literature review.

Figure 4-4: Building the vision: select the principles (Company reporting of open innovation programme cohort meeting 9, 2018, p. 11)

Literature argues for the establishment of an adhocracy culture, with core values of entrepreneurship, innovation, adaptability, propensity for risk and external orientation core values (Slater et al, 2014). The adhocracy culture accommodates several ambidextrous requests, such as responsive and proactive customer orientation, entrepreneurial and control orientations, as well as up-stream R&D and down-stream commercialization focuses (Slater et al, 2014; Birkinshaw et al, 2016). Similarly but more comprehensively expressed, the facets of culture for innovation is categorized into four orientations: 1) market-orientation: practising market-pull through responsively satisfying expressed customer needs and proactively addressing latent ones; 2) technology orientation: practising technology-push by commitment to R&D, especially acquisition of new technological knowledge to serve extant and latent customer needs; 3) entrepreneurial orientation: innovation for both exploitative and explorative business purposes; and 4) learning orientation: development of new technologies and appreciation of new ideas (Enkel, 2018a).

General characteristics on culture for innovation relies on norms (levers) for actual adoption. Figure 4-5 presents six levers – creativity, learning organization, trust, open communication and transparency, incentives and alignment, each of which further associates with supportive actions of adoption (Enkel, 2018a). Alternatively expressed, Ahmed (1998) puts forward culture norms for innovation, namely challenge and belief in action, freedom and risk-taking, dynamism and future orientation, external orientation, trust and openness, debates, cross-functional interaction and freedom, myths and stories, leadership commitment and involvement, awards and rewards, innovation time and training, corporate identification and unity as well as organizational structure (autonomy and flexibility). These norms (levers) cover not only on the topic of culture but wider organizational elements, which implicitly shows the necessity to manage categories of dynamic capabilities as a coherent system.

Figure 4-5: Levers to support entrepreneurial culture (Enkel, 2018a, p. 16)



Some scattered characteristics are additionally discussed, which are covered in typologies of dynamic capabilities in the literature review chapter thus may overlap with the newly added references on general characteristics of innovation culture. First, divergent thinking is needed for organizations to consider unrealized, unproven or untested opportunities (Lawson and Samson, 2001). Second, vigilant learning is required to capture deep consumer insights in an era of ambiguity and complexity (Day, 2011). Micro-foundations of vigilant learning includes 1) fostering a robust market orientation, 2) giving voice to people within the organization and in extended networks, 3) supressing biases to allow for open-minded interpretation of information, and 4) triangulating perspectives on complex issues (Day, 2011; Day and Schoemaker, 2016). Third, collective learning for scalability purpose is achieved from encouraging open sharing and open interaction within and outside organizational boundaries (Lawson and Samson, 2001; Verona and Ravasi, 2003; Day, 2011; Birkinshaw et al, 2016; Day and Schoemaker, 2016). After clarifying what a general culture for innovation is like, next section elaborates entrepreneurial risk-taking as one critical and unique characteristic of innovation culture.

4.2.2.2 Entrepreneurial risk-taking

An entrepreneurial organizational culture should value creativity and tolerate creative people, believing that innovation is an appropriate path for organization to survive in environmental uncertainty (Enkel, 2018a). However, in reality, low tolerance of failure is still a commonplace barrier that blocks creativity and innovation. People are fearful of failure. *"Failure is never encouraged within public sector." (C3)* In private sector, *"sometimes some project doesn't work. People say oh, you waste money or something like that." (A3)* The solutions may come from two routes: ease people's apprehension about failures of innovation on the one hand and encourage practices of entrepreneurial risk-taking on the other hand.

Story-telling of quick-wins and transparency of communication are key to ease the apprehension of entrepreneurial risk-taking. Story-telling is a useful way to educate (Hosseini et al, 2017). Quick-wins are evidences demonstrating approaches of how open innovation do works. *"I think the only way to engage is by proving what you are trying to do works. That's the quick wins." (A1)* Similarly claimed, *"that might need a couple of successful outcomes first to be able to be back to demonstrate this process works." (C2)* Quick-wins also provide the rationale to scale up. *"we start out small. We are growing. If it's successful, we will grow bigger." (E2)* Instead of biased telling stories of fanciful successes, it is important for the organization to truthfully admit and communicate the failures along the path to innovation. *"(Failure is) valuable because it shows that we are as an organization, at least being actively trying to resolve things rather than being passive." (C3)* Companies may err and learn the lesson afterwards (Lawson and Samson, 2001; Day, 2011; Day and Schoemaker, 2016). People not only need to understand 'what works' but also 'what doesn't work'. *"Story telling what you've done and how it worked, what was successful, but also not always just what was great but what didn't work well, what you've learned for the future…" (A1)* Telling stories, whether success or failure, makes transparent communication. In this way, tolerance of failure is shown (Lawson and Samson, 2001).

To further promote exploration without apprehension, creative slack with funding and facility is offered (Lawson and Samson, 2001; Day, 2011). Companies do grant ideation time and allocate budget for R&D personnel beside regular working projects. Positive reinforcement is attached, if the project proves to be a success. Negative punishment is not exercised, even if the project tends out to be a failure. *"For me, I have a 10% idea time. That's beside project. I can do 90% for the project but 10% is my free time. I can even visit university or go to library to do some literature search, beside my main project. Or even I got a new idea, I can try in the lab, do myself… not for the project, just for 10% I can use. And money, because there is funding support 10% for my idea. I have a 10% idea time and the funding.*

They encourage… for example, you use your 10% time and money… give you £ 1000 this year. You got new idea. And if this project is put in production next year, you got £ 2000. They doubled your 10% money. If next year, success, then the year after, you got £ 3000. They doubled the money and time. That means they encourage you do your own stuff… If it's not successful, next year you still keep to £ 1000. You still have the money to try other stuff." (A3)

The budget for ideation directs the discussion to more general consideration of incentives (rewards) to encourage innovation. Literature shows the potential to apply diverse incentives, either monetary or non-monetary (Lawson and Samson, 2001; Day, 2011; Birkinshaw et al, 2016; Day and Schoemaker, 2016; Hosseini et al, 2017). The interviewees claim that monetary incentive should be the first to consider, but none of the organizations provide monetary incentive to reward efforts of open innovation. Monetary incentive is not allowed in public organizations. *"Incentives, we can't give any. It's just not allowed." (B1)* Some private company does have reward and recognition programme with monetary bonus, but open innovation has not been effectively linked to those programmes. To make the linkage illuminates the path forward. *"We have our reward and recognition programme process internally. We reward people with cash prizes for particular ideas. We haven't really use that, as yet for our open innovation programme, because the idea we had are mostly historical. That's something we are looking at moving forward. We also need to look at other ways of incentivising people and motivating them to, because some people prefer other things to money." (D1)*

As is mentioned in the above quote, people may value other incentives more than money. The interviewee further suggests it may be a good way to incentivise by allowing people to experience. People may simply be interested in getting involved. *"they might want to experience. They might want an opportunity to attend a particular workshop or be a part of a challenge." (D1)* The engagement

piece itself may be an incentive. People who contributes the idea may want to follow through idea implementation from start to finish. *"the person who submitted the idea becomes part of that project team and is involved to seeing it through from idea to implementation." (A1)* Moreover, it is always wise to look and see what incentive effectively works within other organizations. Benchmarking is an effective way to learn how to motivate people. *"We are also doing some benchmarking with other organizations on that to determine what is the most effective way to motivate people and to recognize their ideas." (D1)*

Incentives are considered from a different perspective, when companies are dealing with external innovation intermediaries. Whether to offer prize or not is an implicit custom, associated with certain intermediaries. Organizations may think the final award of contract to do the work is a lot more effective than offering a small prize. What incentive to offer in which intermediary is an area companies are trying to work out at the moment. *"Externally we haven't offered any prizes as yet for the challenge that we've issued. But that is largely being our approach so far as through Nine Sigma. It's not a custom to offer prizes with Nine Sigma. You can choose to. What we've done is we have basically been transparent and said that if we really like your idea and your proposal is a great fit for what we want to do. Then we will progress to award your contract to work, and that in itself is more effective than offering up a small prize. Other intermediaries do offer prizes, and that enables us to target slightly different audiences and also acquire solutions in slightly different ways. And that is something we are looking at." (D1)*

4.2.2.3 Organizational intelligence

Very minor detail is mentioned by the interviewees, regarding the impact of organization intelligence on (open) innovation. Only one interviewee with background of marketing (global marketing manager) points out the relevance of the function of marketing intelligence and the difficulty to get them on the same page of innovation. *"I'm very reliant on my colleague next door, (name of the*

person), who is the marketing intelligence expert. He is the one looking at all the trends and data, that kind of things. When we share that information. It is key that is understood by the product development people and the research people. They understand, because it would be great to be ahead of your customers in terms of we know what you need to do before you know what you need to… we know what product would be great for you. It solves a lot or a few problems. And some of that comes from marketing intelligence… I guess the paradox is that they have their own agenda, and they have their own view on things and how best can achieve innovation." (A4) Considering missing evidence in context, this section recaptures main points in literature review and adds some details on marketing intelligence.

Organizational intelligence comes from scoping three areas: learn from the past on blind spots of own industry and potential learning from other industry, know about the present by attending to emerging signals as well as envision the future by strategic scenario thinking of a broader context (Day and Schoemaker, 2016). The content of scoping can be development relating to technologies, products and markets (Lawson and Samson, 2001). The sources of scoping can be internal R&D and external research institutions, customers, suppliers, competitors (Verona and Ravasi, 2003; Teece, 2007; Anand et al, 2009). From an open innovation perspective, the focus is on capturing different learnings from external sources: research institutions with science and technology, customers with insightful market needs, suppliers with component innovation as well as competitors with information on diagnostic benchmarking and competitive differentiation (Lawson and Samson, 2001; Verona and Ravasi, 2003; Teece, 2007; Anand et al, 2009; Chen, 2017). Therefore, time span, content and purpose are three critical considerations, when conducting organizational intelligence.

Marketing intelligence is additionally discussed, to extend the topic of organizational intelligence emphasizing on systematic and strategic utilization of information. "Market intelligence is the systematic collection and analysis of

publicly available information about competitors and developments in the marketplace. The goal of marketing intelligence is to improve strategic decision making, assess and track competitor's actions, and provide early warning of opportunities and threats." (Armstrong et al, 2015, p. 119). Systematic collection and analysis of information avoids spreading efforts of blind exploration, and the purpose of intelligence gathering is directed at providing substance to inform strategic decision making. Similar to general to organizational intelligence, sources of marketing intelligence also be diverse, consisting of internal executives, engineers, scientists, purchasing agents and sales force, as well as external suppliers, re-sellers, key customers and competitors (Armstrong et al, 2015). Internet and social media are further mentioned as useful sources of information (Armstrong et al, 2015).

4.2.2.4 Communication

Dissemination naturally comes after intelligence gathering (Pavlou and El Sawy, 2011). Communication is a critical topic to create a culture for innovation. *"I think that the communication aspect of us running our open innovation programme is absolutely critical. And that helps us to seed an opener culture toward innovation." (D1)* Literature mainly addresses the topic of communication from an abstract knowledge management perspective. There are only high-level comments about principles of open knowledge exchange: multilateral knowledge flow, different forms of knowledge exchange (Lawson and Samson, 2001) as well as enabling information technology (Hosseini et al, 2017). Philosophically, this research conceives the organization as organism with processes, which departs from the image of brain focusing on information processing (Morgan, 2006). Coherent with this philosophical stance, open knowledge exchange are embedded in practices of organizational communication, and information technology integrated as channels of communication. This section will follow the logic of market (brand)

communication, which cultivates more organic practices without sacrificing systematic design of organizational communication.

Organizations should consider the design of a holistic experience of (open) innovation. A concise and compelling theme of innovation needs to be devised in the first place to guide experience design (Pine and Gilmore, 1998). Communication is implemented through various experience providers (Schmitt, 1999). “ExPros (experience providers) include communications, visual and verbal identity and signage, product presence, co-branding, spatial environments, electronic media, and people. To create an experience, ExPros must be managed in three ways: (1) coherently (i.e., in an integrated fashion); (2) consistently over time; and (3) by paying attention to detail and using each ExPro to its fullest potential for creating the experience.” (Schmitt, 1999, p. 63) This coincides the concept of integrated marketing communication, which argues for careful management of channels of communication (all encountering points) to deliver a clear, consistent and compelling message of the organization or brand (Armstrong et al, 2015). Evidences on creating a compelling theme of innovation and possible channels of communication are provided below.

To make a concise and compelling message (Pine and Gilmore, 1998; Armstrong et al, 2015), one public sector organization adopts a very clever way to proactively create such a message of open innovation. In their opinion, open innovation doesn’t need to be worded in exact terms of ‘open innovation’ to get implemented. Open innovation has been branded as ‘civic innovation’, under which all open innovation practices are covered. The organization has been dealing with citizens for very long time, the term ‘civic innovation’ can easily facilitate understanding and create a resonance among internal audience. *“Civic innovation is our open innovation project, when we bid Scottish Enterprise for funding. It was our civic innovation project. Our civic innovation project is an approach to open innovation. It might change and develop in the future. Our civic*

innovation process is what we think of as open innovation… I guess for an internal audience, they probably wouldn't know what open innovation is, so we talk to them the projects we deliver which is civic innovation." (C2) Civic innovation can a compelling theme that is easy to understand and create a resonance among internal audience of the organization.

To communication that compelling theme of open innovation, potential experience providers (channels of communication) in the research context are located, with their specific relevance to (open) innovation demonstrated. The direction of communication comprise either top-down implementation as well as bottom-up engagement.

- Message from the top shows high-level visibility:
  - *"I think the message needs to come from the top level, not just about (the open innovation coordinator) bleating on about open innovation." (A1)*
  - *"We've got the commitment from the chief executive. She is willing to commit additional resource to this. So in the first challenge of childcare, she came down and did the introduction to the session. She made it clear that she saw this is a really important process for the (organization) to go through." (C2)*

- Let the rumour thrive facilitates bottom-up engagement:
  - *"if you want to have a bit culture change, you need to start by going in at the top, getting really strong buy-in from them, but you also need to go in right to the bottom level as well." (E1)*
  - *"We talk anywhere, canteen, corridor, meeting… for production issue or new ideas… Here the company does a lot, not like other companies." (A3)*

- Intranet is helpful to lead the change and maintain awareness:

- *"I think the changes that cast making to the intranet will help. I think it's how we lead." (A4)*
- *"At the moment, we have released several news announcements about how we inform the business what we are doing… as the programme increases, we need to share more and more information with people, so they are aware of what we are doing in our vision and how that is going to benefit them." (D1)*

- External voice includes explicit message of innovation for clarification:
  - *"our external voice, is to make sure that it's there, it's included, it's something that we talk about. And we balance that somehow with what we do internally, in terms of how we integrate with both innovation and research and development." (A4)*

- Workshops and events are hosted to facilitate learning by doing:
  - *"This year we've probably run about 7 workshops. We were doing that gathering and sharing the learnings with people. We are maintaining that. We are growing that. And that's how we get changed, because you are building up core activity of knowledge." (E2)*
  - *"You might be holding an engagement event for those people, or holding learning lunches, or you are having a big meeting where you can talk to everyone about it, see what they think about it, and get them engaged." (E1)*

- Social media assists the integration of online and offline open innovation activities:
  - *"We've used LinkedIn and Twitter to advertise our challenges to provide a link to our Nine Sigma site to get people's attention. That was massively successful. We had an enormous upload of people to looking at our sites as to resolve that. We also use that during our event last year for Connect-Up. We've advertised our Connect-Up Event on LinkedIn and Twitter. I believe that we had a several hundred percent increase in people viewing the Connect-Up site as*

we advertise our challenge in our social media channels. They are very powerful, and we need to be careful about what we communicate on there, but as long as the communication is clear, then I think they are fantastic platforms to push things forward with." (D1)

Emphasis is further put on integration of channels of communication (experience providers) to ensure the coherency and consistency of communication (Schmitt, 1999; Armstrong et al, 2015). The momentum of open innovation is maintained by constantly and consistently keeping people in the loop over time. *"learnings have been about how you need to make sure that you are basically constant and consistent with your engagement. You can never light up or slow down your engagement with people. It's to keep up with a constant pace, so whether that be on the system for gathering challenges, whether you are trying to keep that up, keep them informed about the update of it, or if you are doing it through meetings, you need to make sure that if you get an idea for someone, you keep them in the loop all the way of where that project is going." (E1)*

Besides, the concept of value co-creation is drawn upon to accommodate open innovation activities extending beyond organizational boundaries, despite no empirical evidence is observed in context of research. This concept addresses the logic of why value can be created and captured externally to the organization. Market is becoming a forum for value co-creation, where communication takes place in transparent conversation and interaction between firms and informed, networked, empowered, and active consumers (Prahalad and Ramaswamy, 2004). "Different actors are no longer part of a chain but exist in a networked co-economy, where collaboration is enacted and the markets depend and thrive on it." (Jaakkola et al, 2015, p. 194) This coincides with the ecosystem view of open innovation, claiming that "all open innovation activities of a company and its partners take place in an open innovation ecosystem" (Rohrbeck et al, 2009, p. 425).

4.2.2.5 Capabilities of people

To avoid general description on personal traits from a static behavioural perspective, this section specifically addresses 'how' open innovation managers dynamically conduct multiple roles to support orchestration of open innovation activities. In the typology of open innovation capabilities, Hosseini et al (2017) point out three main capabilities of people: social brokerage, peer leadership and boundary spanning. Empirical evidences not only support the three capabilities of people but also expand the scope of meaning. The three capabilities of people are explored one by one as follows.

The first capability is social brokerage, which is about partner identification and connection (Hosseini et al, 2017). With the expectation of better interaction among collaborative partners, this role is to link and coordinate different partners from both within and outside in accordance with business needs of the organization. *"Open innovation coordinator should be about coordinating partnerships between people within (our company) and people outside of (our company) based on needs and wants that the company has or technologies or processes or whatever services that are found outside the business that we think could be useful to us. The coordinate part is about linking those two things together and facilitating that meeting, that relationship…" (A1)*

An open innovation manager identifies his/her role as a process expert in conducting social brokerage. Where there is always availability of abundant technical experts within and outside the boundary of organization, there is always an absence of a process expert to manage the flow of innovation. *"I want to be an expert on open innovation process, but I don't want to be an expert on technology, because we are just a team of 12 people. Why would we be the technology specialists, where there are other people that have the knowledge either from within the company or outside the company?" (E2)* The process expert is

responsible for broadening the linkage between strategic direction and operational delivery: top-down translating strategic vision as well as bottom-up feeding back operational challenges. *"What I'm trying to do is to translate in both ways: translate down the way in terms of strategic vision to the operational managers but also then take that operational challenge and delivery mechanism and feed that back into the strategic and corporate structure." (C2)*

Second, the open innovation managers provide peer leadership (informal persuasion) to suffice common goals of the organization (Hosseini et al, 2017). Open innovation managers lead by informal persuasion. *"persuading people that we have the knowledge and the support from other organizations to really make significant change and to support that significant change and turning innovation that happens at the moment in isolation into an enabler for much bigger and better things..." (B1)* Apart from informal motivation mentioned in literature, more structured peer leadership is believed to facilitate systematic adoption over time. *"My role at the moment is to lead our programme, and to be able to define what open innovation might be for our organization, and to be able to shape that and to influence people, and to be able to put in place effective processes, systems, and tools towards solving really interesting and complicated challenges. That's how I see my role. I guess ultimately my role is to produce a vision of what open innovation could be for our company, and to be able to lead people along that journey, and to be able to say this is the point where we started and here is where we see an end state could be." (D1)*

Third, the role of boundary spanning is about cognitively bring different worlds together in a harmonious way (Hosseini et al, 2017). The tacit nature of the cognition perspective may explains why the interviewees are unable to comment on this role. The following quote implies open innovation manager's role of cognitive integration. *"My role is to develop and improve the platform, infrastructure works, and that the people are engaged in it, and it can deliver on*

those boundaries… What we (are) doing is to bring together unique skill sets that we are able to see they can progress to our organization. We will make it quick to react the change that people are seeing. It opens up the pathways. It's our job to support that." (E2) The open innovation managers attempt to master relevant elements to support that cognitive integration. The integration of different streams to progress innovation solutions dismantles the clearly defined boundaries of 'problem solvers', thus making the way for professional identify shift to 'solution seekers' (Lifshitz-Assaf, 2016).

The three roles are interwoven rather than mutually exclusive. This is corroborated by the existence of alternative categorization regarding roles of open innovation managers. Similarly but not identically, the three roles of social brokerage, peer leadership and boundary spanning (Hosseini et al, 2017) are framed into facilitator role, tactician role and sensegiver role, which are more specifically defined for open innovation collaboration managers (Ollila and Yström, 2017). Comparatively, Ollila and Yström (2017) accredit more clear description and some additional details concerning each role, as is shown in Table 4-8.

Table 4-8: Management roles and underlying activities (Excerpt from Ollila and Yström, 2017, p. 246)

Identified managerial roles	Activities
Facilitator role - Role for knowledge transfer across people, organizations and sometimes even between industries	– Balance different perspectives and interests enabling dialoguing – To break old patterns – To bridge perceived gaps – Harness diversity

Tactician role - Role to expand the power base and resolve conflicts	– Play the organizational politics – Strategically and selectively listen to the different expectations and perspectives – Cleverly maneuver in a landscape of different institutional logics and multiple stakeholder views – Anchor decisions retrospectively
Sensegiver role - Role bringing meaning to and helping people make sense of the complexity and ambiguity	– Enable joint action – Articulate principles for the collaboration – Influence the organizational reality construction of others – Emphasized the valuable aspects of the collaboration and mitigated potential concerns and worries

4.2.3 Innovation process

Aligning with the process perspective to investigate organizational reality, Section 4.2.3 addresses topics in relation to innovation process, general as well as specific. Considering the research background is set to be 'open innovation', very minor details is observed on general innovation process and the majority of description targets at process more specific to open innovation. Allowing for this practicality, this section is divided into three subsections: general innovation process, open innovation process and their integration.

Section 4.2.3.1 combines the discussion on four subthemes on general innovation process in literature review, namely general characteristics, Stage-Gate NPD, elements of agile execution and scalability. Section 4.2.3.2 presents idiosyncratic open innovation processes of these organizations, in accordance with the convergent understanding about open innovation process along the SE project. Section 4.2.3.3 clusters different ways on potential integration of open innovation processes into more general innovation process.

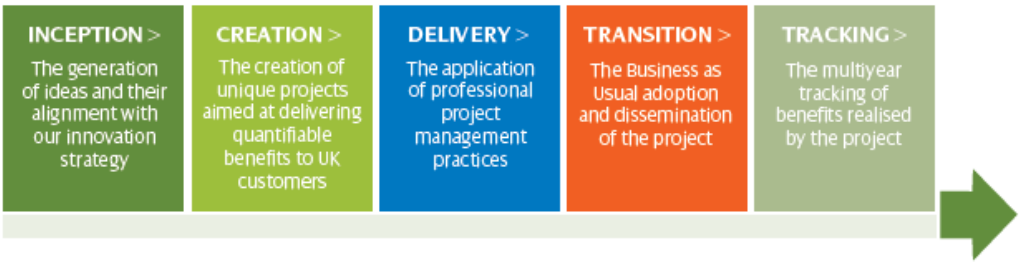
4.2.3.1 General innovation process

Very detailed description of good practices on general innovation process is offered in literature review, referring to Section 2.1.5 (Open) innovation process

and Section 2.4.3 Integration of dynamic capabilities and supportive micro-foundations. To avoid unnecessary repetition, this section only offers a brief recap of key points with combined references. The general innovation process accommodates both logics of technology-push and market-pull (Trott, 2012; Rothwell and Zegveld, 1985), which integrates activities of upstream R&D as well as downstream commercialization accompanying cross-boundary knowledge flow (Gassmann and Enkel, 2004; Chesbrough, 2006a; Enkel et al, 2009; West and Bogers, 2014; Chesbrough and Bogers, 2014). Besides, the innovation process should be designed in sequential stages and gates, in charge of quality execution and assessment respectively (Cooper, 2008; Cooper, 2014; Cooper and Sommer, 2016; Cooper, 2016; Phillips, 2018b). Some features around the innovation process are further considered: cross-collaboration, voice of customer, balanced rigidity and flexibility, agile execution and scalability (Cooper, 2014; Cooper and Sommer, 2016; Ellwood et al, 2017; Phillips, 2018b).

After literature recap, relevant empirical evidences are presented. Only one organization has a formal innovation strategy, where there is an explicitly defined innovation process with detailed description. The discussion of general innovation process mainly relies on this piece of secondary file on innovation strategy. Figure 4-6 provides a visual display of the innovation process. *The innovation process follows five sequential steps of inception, creation, delivery, transition and tracking. The process provides a robust methodology to deliver benefits for customers and stakeholders, which ensures that open innovation activities are conducted aligning with innovation priories responding to opportunities and challenges. Emphasis is further put on to transparency in delivering outputs: multi-level engagement (who), project justification (why), expected benefits (what) as well as project progress (how). (Summarized from Company E – Divisional innovation strategy, 2018)*

Figure 4-6: Company E's innovation process (Company E – Divisional innovation strategy, 2018, p. 26)



This organization's innovation process enjoys systematic designed stages and gates, referring to best practices of the stage-gate process of product development (Cooper, 2008; Cooper, 2014; Cooper and Sommer, 2016; Cooper, 2016; Phillips, 2018b). *Tasks within stages are clearly shown: 1) inception involves capturing ideas from internal and external innovation sources; 2) creation identifies customer benefits and collaborators as well as formulates a project plan with elements of ownership and success criteria for internal approval (strategy and technology); 3) delivery addresses tasks of project planning, resource allocating and budget managing; 4) transition deals with project dissemination to business-as-usual through reports (project report and annual report), website, conference and event; and 5) tracking involves quantifying and tracking benefits of projects and wider business-as-usual and industry. (Summarized from Company E – Divisional innovation strategy, 2018)*

Besides, different from separately designed stages and gates in Stage-Gate process of product development, gates are embedded as parts within stages regarding Company E's innovation process: 1) inception filters proposals based on dual measures of strategic alignment and value delivery to customers; 2) creation defines measures to leverage funding: technological readiness, scale of funding, scale of benefits, certainty of benefits delivery, as well as transferability of benefits to wider context; 3) delivery involves steering groups to ensure projects are on

track as well as provide guidance on aspects of project planning, allocating resources and managing budgets; 4) transition lays out essential elements for business-as-usual adoption, namely ownership, successful delivery, realization of benefits, financial approval, policy standards and specifications, as well as training and dissemination; and 5) tracking assesses benefits, in terms of measurable business performance and forecasted impact of project delivery over the course of solution. (Summarized from Company E – Divisional innovation strategy, 2018)

Except for well described stages and gates, the organization's innovation process does not directly but rather implies some of the design features. Features of cross-functional collaboration and voice of customer (Cooper and Sommer, 2016) are embedded as diverse *innovation sources in the stage of inception, which comprehensively covers academia, customers and stakeholders, manufacturers, other industries, our peers, our people, partners as well as other customers (Summarized from Company E – Divisional innovation strategy, 2018).* Other features such as balanced rigidity and flexibility, agile execution and scalability (Cooper, 2014; Cooper and Sommer, 2016; Ellwood et al, 2017; Phillips, 2018b) are completely missing in the research context. Considering the scarce empirical evidence of one organization, it is suggested to further explore micro-foundations relevant to all four subthemes relevant to the general innovation processes, namely general characteristics, Stage-Gate NPD, elements of agile execution and scalability.

4.2.3.2 Open innovation process

Following the logic from general to specific, this section outlines open innovation processes of these organizations within research context. The background of research is revisited to show how come these open innovation processes. At the beginning of the SE project, open innovation challenge as one approach of outside-in open innovation is deliberately promoted among the cohort companies

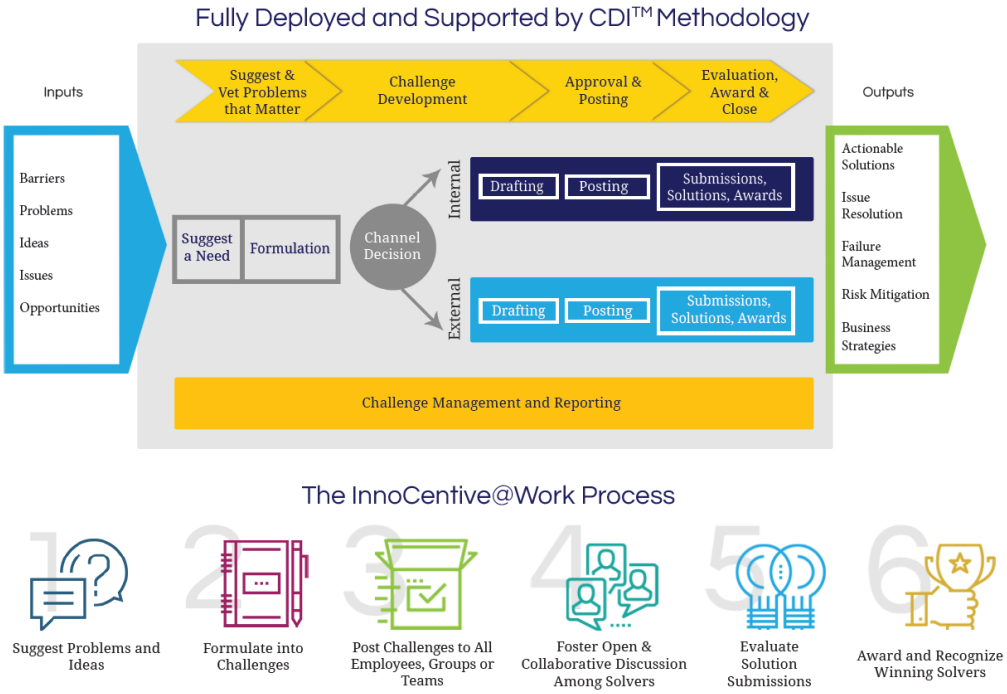
(Wagner, 2016). This results in the common understanding of open innovation process at the end of the project, consisting of four sequential steps of idea, challenge, collaboration and development (Wagner and Fain, 2018). Around this shared prototype, the organisations build their own idiosyncratic open innovation processes (to address open innovation challenges). Except for one organization's process is still under development, all the other four organization's open innovation processes are shown. Each of the process highlights different pieces to complete the whole puzzle of open innovation adoption.

The Want, Find, Get, Manage Model (Slowinski and Sagal, 2010) is employed by one organization as the internal ideation process to manage the open innovation challenges. *WANT captures ideas from multiple innovation sources. FIND analyses opportunities, scopes out capabilities and develops business case. GET/MANAGE makes the decision on insourcing and outsourcing of IP, validates concept or product and lastly puts the solution to market (Summarized from Company D – Quarter 1 report, 2017).* Besides, a want brief is created to document information on resources, processes, IP, metrics and criteria (Slowinski and Sagal, 2010). *WANT describes background information of challenge, strategic alignment and technical specifications. FIND lists out potential collaborators: universities, research institutes, individuals, companies and government agencies in direct contact and relatively indirect intermediaries with different network characteristics. Information on GET/MANAGE is absolutely missing. (Summarized from Company D – Copy of collective challenge OI templates)* The missing information may result from these companies' rudimentary adoption of open innovation, where there is still huge potential to explore process development.

Apart the internal ideation process, the organization borrows the methodology from InnoCentive, an innovation intermediary, in order to combine the external piece of ideation. As is shown in Figure 4-7, the flow of challenge process is deconstructed into six stages: 1) suggest problems and ideas, 2) formulate into

challenges, 3) post challenges to all employees, groups or teams, 4) foster open and collaborative discussion among solvers, 5) evaluate solution submissions, and 6) award and recognize winning solvers (InnoCentive@Work, 2018). The process is capable of accommodating dual ideation (internal and external) throughout the entire challenge lifecycle (InnoCentive@Work, 2018). In this way, open innovation becomes a formal alternative to in-house closed innovation. The fact that different processes exist to govern the same process points out the gap to further consider process integration. The process may also serve as the evidence to support the outside-in direction of open innovation, where learnings from external innovation intermediaries informs process management of internal ideation.

Figure 4-7: The InnoCentive@Work process (InnoCentive@Work, 2018, p. 2)



The processes of the other three companies are self-devised. One company creates a 'Hatch a challenge' process to manage the flow of open innovation challenges. ""Hatch a Challenge" includes nine stages: Challenge Request, Publish,

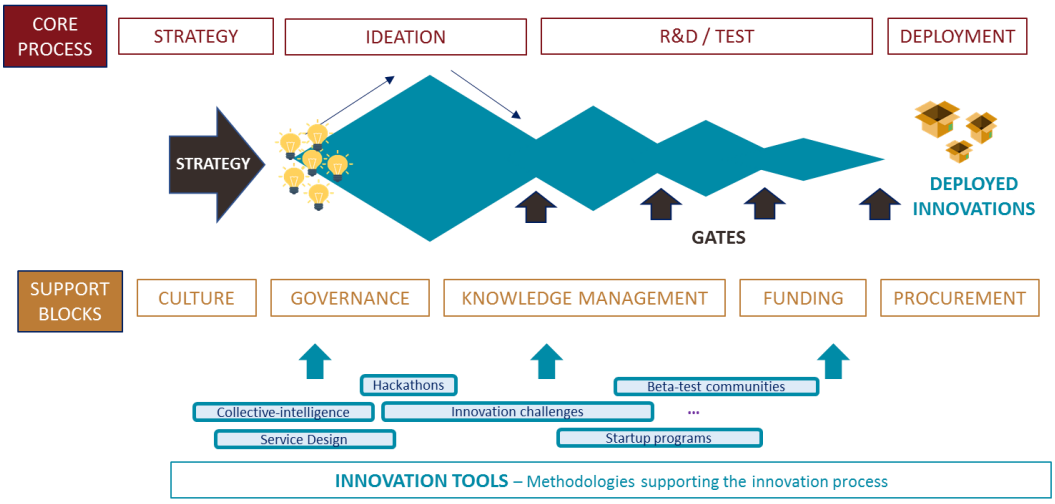
Gather, Innovation Tech Board, Top 3, Launch Outside, Review Responses, Trial and Business as usual." (Wagner and Fain, 2018, p. 21) Briefly described by an interviewee from the company, the process covers *"gathering, processing, taking out to external groups and then implementing". (E1)* The process keeps on running quarterly to manage collaborative innovation projects, which provides a possibility to expand this program to the wider business community (Wagner and Fain, 2018). The process boasts the ambition to finally integrate challenge solutions into day-to-day operation as part of regular business, through learning dissemination and digital communication (Wagner and Fain, 2018). Despite the satellite open innovation process, its integration into business-as-usual is formally considered. Having presented evidences of the private sector, the process adoption of public sector is next exhibited.

One public sector organization creates a unique challenge process, which includes three stages: stimulate demand/build capacity, review point/pipeline management, and challenge. The flow of process is described as follows. *The first stage 'stimulate demand/build capacity' addresses rationale and capacity: whether we should do this and we can do this. The second stage 'review point/pipeline management' conducts cost benefit analysis of practicalities and makes the decision: whether we can deliver and we should deliver. The third stage 'challenge' outlines the approach to proceed, following the sequence of 59 minute design challenge, 5 day sprint and 100 day challenge. (Summarized from Company C – OI presentation; Company reporting of open innovation programme cohort meeting 7, 2017).* Despite the shortened process, tasks are clearly defined within the stages and measures of control are exerted.

Figure 4-8 shows the innovation process of the other public sector organization. The process provides a structured way to manage the flow of open innovation activities from strategy-driven ideation all the way through to innovation deployment. Some building blocks are identified to facilitate the flow of the

process, which consists of culture, governance, knowledge management, funding and procurement. Moreover, some alternative innovation tools to innovation challenge as enabling methodologies of the process are taken into consideration, consisting of hackathons, collective intelligence, service design, beta-test communities, start-up programs and so on. As B2 explains, *"The whole point to develop an open innovation process is to have something way more structured. Someone who has an ideas doesn't need us to basically do it for them. They get all the tools and they get all the knowledge to be able to move that idea forward."* Although the process has been fancifully depicted, concrete adoption is still in a very nascent stage within the organization.

Figure 4-8: Building the how: Detailing the process and prioritizing innovation tools (Company reporting of open innovation programme cohort meeting 9, 2018, p. 15)



Key learnings from these idiosyncratic processes are reiterated: 1) inspiration of open innovation process design may come from well-established process, 2) the process should be able to accommodate both internal and external ideation, 3) the integration into business-as-usual needs to be formally considered, 4) the process doesn't need to be long to conduct the necessary functions of stages and gates, and 5) it would be helpful to comprehensively outline supportive blocks and

innovation tools. Quoting the collective learnings of the SE project, “Managed processes provide clarity and direction… Structured and managed processes enable repetition to ensure that open innovation becomes routine.” (Wagner and Fain, 2018, p. 13) The next section elaborates in what ways specific open innovation processes may fit into more general processes of innovation.

4.2.3.3 Process integration of open innovation

This section discusses ways of process integration of open innovation. First and foremost, the design sprint model is commonly adopted process methodology by the organizations as an actionable structure to arrange brainstorming workshops, which constitutes one artefact to facilitate agile execution of the general innovation process (Knapp et al, 2016; Cooper and Sommer, 2016). The 5-day sprint process fast-forwards into the future to see finished product and efficiently investigates customer reactions (Knapp et al, 2016). “On Monday, you’ll map out the problem and pick an important place to focus. On Tuesday, you’ll sketch competing solutions on paper. On Wednesday, you’ll make difficult decisions and turn your ideas into a testable hypothesis. On Thursday, you’ll hammer out a realistic prototype. And on Friday, you’ll test it with real live humans.” (Knapp et al, 2016, p. 16) Key success factors are further covered: 1) set the right challenge: ambitious but focused; 2) recruit the right team: a mixture of executors and experts consisting of decider, facilitator, finance expert, marketing expert, customer expert, tech/logistics expert and design expert; 3) time and place: full blockage of time for focus and continuity and arrangement of sprint room with enough visuals to enable shared spatial memory (Knapp et al, 2016).

Some supportive evidences on design sprint are presented. The sprint brings together multidisciplinary people to collaborate on quick solutions. *“We could use the Sprint model to create multi-disciplinary teams on the basis of that and start to solve some of these challenges… that art of collaborating and achieving a lot in a*

short period of time." (D1) In private sector, the sprint help create product-market opportunities. *"We have done something on what called a design Sprint, to get us to there, which is all about looking for new applications for existing products, to generation more demand, and ultimately I guess the more risky and less well-known to create new products for new marketplaces." (A2)* In public sector, the sprint enjoys triple opportunities: *1) service improvement opportunity: developing challenge and solution, learning different ways of doing and increasing awareness of local network; 2) development opportunity: encouraging divergent thinking; and 3) experience: better understanding of problem and improving confidence of staff and commercialization. (Summarized from Company C – OI presentation)* Beyond the benefits of the methodology itself, the sprint affords the opportunity for people bring the learnings back to make organization-wide change. *"It's not only bringing the skills or expertise to their organization, but also bringing the ability to then go back and change the organization to try to embed whatever the solution they create." (C2)*

The sprint process can further be tailored to suit specific needs of companies, in a similar sense to have three versions of Stage-Gate (Full, XPress and Lite) designed for contextualized adoption (Cooper, 2014; Phillips, 2018b). On the one hand, the process is shorten to a one-day session for ideation around a specific topic. *"We are doing a kind of design Sprint. But what we decided to do is rather than to do a traditional five-day… What we decided to do was to have a day of idea capture… there was about 20 people at the event… from all areas of the business…" (A1)* On the other hand, the process is prolonged to a 100-day programme to fully scope out the 5-day solution for business wide adoption. *"It's a linear process. We'll work with the challenge area… the 59-minute design challenge will get you to think a little bit differently and to expose them to different ways of working, (which) is part of the five-day Sprint. The five-day Sprint will then look at the actually problem and look at potential solutions… And then the 100-day program would potentially take some of those ideas forward and then try to work through*

to a proof concept, a pilot within a geographic area of the city. And once that proves to be successful, we then pass that back to the business. The business within develops a business model around that idea." (C1)

Besides, the commonplace integration point of open innovation process to the general innovation process referred to by the interviewees is Stage 2 and Gate 3. Corroborating literature's description on stage-gate process of product development, the transformation point of projects from fiction to fact takes place at Stage 2 Build business case where key tasks and deliverables are defined and Gate 3 Go to development where the pivotal decision on resource commitment is made (Phillips, 2018a; Phillips, 2018b). *"The business case is basically where we align the benefits and the reasoning why we want to head into that particular direction. We can seek our approval for that and then it's a question of go or no go. We can obviously make a decision on whether we are going to pursue that market or whether we are not." (D1)*

On the basis of intelligence gathering in the stage of business case development (Stage 2), the decision whether or not to proceed to development (Gate 3) is made by scrutinizing a set of business criteria. "*each idea is assessed against a set of criteria comprising: size of opportunity (volume and price); strategic fit (differentiated product, cost reduction, safety improvement, expands the market); resource expectation (people, money, time); probability of success; does the skills exist inside the company or not." (A2)* The last criterion checks the availability of skills within the boundary of company, which poses open innovation as a formal consideration. Beyond Gate 3 Go to development, open criteria should also be exercised at other gates throughout the whole stage-gate process, which encourages constant investigation of the usefulness of external options as well as re-evaluation of business model and core competencies of the organization (Grönlund et al, 2010).

Furthermore, open innovation integrates into the general innovation process as methods to facilitate task execution within different stages (Cooper and Edgett, 2008). Take open innovation challenges as an example. Currently within the research context, the challenges are developed internally before going externally to scope solutions. *"Once they come through to internal challenges, it's not really difficult for us to translate them externally and take them to market. We start to seek solutions. I'm working with different intermediaries to do that." (D1)* In fact, there can potentially be scenarios of challenges: 1) ideation challenges: help explore novel ideas to feed discovery pipeline at the fuzzy front-end; 2) (scoping) challenges: outsource problems to external problem solvers thus improve decision-making on whether to proceed to a formal business case; 3) internal (failure) challenges: may turn out to be viable with presence of external sources in stage of development (InnoCentive: Adding Value to Stage-Gate Through the Use of Challenges, 2018).

4.2.4 Structure and governance

Allowing for the other three tacit dynamic capabilities of strategy and leadership, culture and communication and innovation process to thrive, more concrete dynamic capability of structure and governance needs to be set up. To start with, Section 4.2.4.1 presents micro-foundations relevant to overall arrangement of organizational structure as an enabler of open innovation. Section 4.2.4.2 demonstrates supportive systems that enables knowledge flow, including virtual platforms to facilitate internal innovation as well as intermediaries to manage external networks. Section 4.2.4.3 elaborates the role of governance, namely measures and regulatory bodies to ensure the effectiveness of specific innovation process as well as wider organizational innovation adoption. Compared with relatively soft organizational structure, system and governance, Section 4.2.4.4 addresses the hard aspect of infrastructure for innovation.

4.2.4.1 Organizational structure

This section addresses the general arrangement of organizational structure to enable the adoption of open innovation. Generally, organizations should have permeable and organic structure to increase the likelihood of innovation activities to spring, in response to wider business ecologies (Lawson and Samson, 2001; Slater et al, 2014; Day and Schoemaker, 2016). The adoption of open innovation promotes a new environment, where neither rigid nor large structure is required to solve organizational challenges. *"Having our open innovation programme certainly helps us in the sense we have a new environment and we need to be able to deliver with that environment. Our open innovation approach means that we don't need to have a rigid structure. As a business, we don't need to have a large structure to be able to deliver on some really interesting challenges. We can reach out to a particular intermediary and go through our partner ecosystem and reach out to the appropriate person to solve that challenge." (D1)*

Apart from organic structure, structural separation with uniquely managed coherence of elements is shown to be useful (Teece, 2007; O'Connor, 2008; Slater et al, 2014; Day and Schoemaker, 2016; Chen, 2017). This confirms arguments on structural ambidexterity and contextual ambidexterity (O'Reilly III and Tushman, 2013), with evidences shown in Section 4.1.2.2 thus not repetitively described here. Besides, structural separation requires appointing clear roles and responsibilities (O'Connor, 2008; Slater et al, 2014), with detailed explanation on people capabilities covered in Section 4.2.2.5. Structural separation also requires the presence of clear reporting system (O'Connor, 2008; Slater et al, 2014). Open innovation needs including in the company's reporting system to get proper documentation. *"I (the open innovation collaborator) provide a monthly report on the open innovation activities that I carry out to (my boss). And (my boss) puts that into his monthly report which goes to (my boss's boss)." (A1)*

Except for reporting system, it is necessary to link open innovation to legal procedure. The legal side of things can be time-consuming, thus there is the gap to streamline and speed-up. "We have spent a lot of time on contracts, and that is something *that has proven to be a challenge… that's something I would like to it streamlined." (E2)* Building contractual model to manage intellectual property is shown to be an area of consideration. *"We also have another distinct process which is quite important. That is around how we work with people in the sense of contract models and creating the right types of contractual agreements. That is something we try to integrate at the moment. As I said we are at an early stage in doing that. We are starting to set up these contracts, and also link with our non-disclosure agreement, which is built to our contractual models." (D1)* Legal procedure is an area currently being seriously considered by these organizations. Early involvement of the legal department and flexible partnership arrangement are advocated as best practices within the stage of collaboration along shared process prototype of the SE project (Wagner and Fain, 2018).

Additionally, discussion is around the topic of cross-collaboration between different divisions and different functions (Verona and Ravasi, 2003; Teece, 2007; Kelley, 2009). Private companies are structured to facilitate interaction between different businesses. *"The restructure of the business is more about moving the original silos to being one (umbrella organization)… trying to get different cultures and different companies working together on projects and sharing information." (A1)* Different functional resources are joined up for flexible collaboration. *"instead of having business departments, we have what we call business functions, for example, supply chain, human resources, engineering, right through to project management, strategy, etc… (That) allows us to scale up and down depending on our business requirements and allows us to be slightly agile." (D1)* Similarly reality in public sector is expressed by different wordings: *"service areas in the (organization) are supporting the locality teams deliver services in the community. It's almost to put the right people into that community environment to make sure*

the right services are delivered." (B1) Moreover, cross-collaboration specific to innovation process has been demonstrated with empirical evidences on engaging diverse innovation sources in Section 4.2.3.1 and multidisciplinary teams in Section 4.2.3.3.

4.2.4.2 Systems and intermediaries

This section elaborates findings on systems and intermediaries to coherently manage internal and external networks of innovation. As is noted in literature, IT facilitates connectedness, communication and coordination among innovation partners (Lawson and Samson, 2001; Joshi et al, 2010; Day, 2011; Hosseini et al, 2017). Internally, the establishment of a virtual platform (innovation system) is an enabler of open innovation. On their early journey to open innovation, none of the organizations within the research context has a mature virtual platform ready for application. The interviewees are thus asked to brainstorm what characteristics of such virtual platform should have in their imagination. The characteristics are enumerated in the bullet points below.

- Interactive to allow for discussion:
  - *"I like the model that Steve (Depute Manager, Centre of Excellence for Collaborative Innovation at NASA) talked about. It was one that is more of an interactive platform and discussion board… It was much more interactive and people are willing to open up. That is where we need to get to. That is an opportunity to raise and discuss issues and to try to come up with solutions rather than just a very static process." (C2)*

- Gamification (social media feel) to promote engagement:
  - *"Solverboard is a tool, where people can submit ideas. It has got a very social media feel… It also allows people to like, comment, share… and allows the best ideas that people think are the best ideas to be ranked. Engagement is*

awarded through… There is a bit of gamification of things on there… so points, badges… those things can work to incentivise people…" (A1)

- Simple to try out:

  - *"One of the great things about Solverboard is it's incredible simple… The great thing about is it's a very early introduction tool, so you can start to bring people on board with it. Start small and get more and more people involved. You put challenges in there. You can put on the scorecards. It got some basic analytics. It basically captures information and it keeps it altogether. It's incredibly simple…" (A2)*

- One-click portal to avoid confusion:

  - *"what we are very conscious is that we don't want people to have to go to multiple places to click. We need to have a one click window. For example, user ID we were working with Solver Board, so end user doesn't have to remember what~~'s~~ their user ID is or what their password is. It's something that our IT system guys helped us with, to say we get that right at the beginning..." (E2)*

- Visibility of innovation process and activities:

  - *"We'll then start to get a sense of where is the innovation coming from? Who are the innovators? Who are the creative minds? We can start to get a sense of where is the creative thought going on? Who's behind that? It also channels people's minds and bringing them inside the tool to start to link things. And we could automate that whole process." (A2)*
  - *"We want to move away from manual process to automated process for visibility. People can log on and they can see they can make a difference. They can score themselves on ideas, they can see the movement. It's really driving and creating energy. That's where we want to be." (E2)*

- One all-encompassing system for coherent oversight:

  - *"We've got a variety of different approaches… engineering improvement system… technological improvement system… business improvement system…another area (an innovation system)… At the moment, we are heading towards a more coherent approach. We are looking to do is to have one system internally, where people can share their ideas and we can also collaborate with them on active challenges and gain their thoughts and their experience within that." (D1)*

After discussing characteristics of innovation system relatively internal to the organization, the necessity to establish system to manage external networks is elaborated (O'Connor, 2008). The engagement of innovation intermediaries facilitates systematic capture of external knowledge (Chesbrough, 2006a; Billington and Davidson, 2013; Hosseini et al, 2017). With understanding of different focuses and functions of innovation intermediaries (Chesbrough, 2006a; Billington and Davidson, 2013), the companies can select which intermediary to go to and manage that collaboration. *"we start to collaborate with open innovation intermediary by selecting them on the basis of what audience do we need to target this to, or are we looking target the challenge, for example, to Top Coder because it's around algorithm, or Kaggle because it's about software development challenge, or we are looking at something that's by materials or design, then we can go to Nine Sigma, or are we looking for a piece of technology that is really disruptive and we need to find that in which case we go to people like Yet2. So we have an idea of who to go to, and when, and the cost of these relationships and running the challenges and facilitating that." (D1)*

The internal and external systems are currently standing separate for different purposes, but integration is shown to be the trend of future. One company utilizes Yammer for internal communication, tries out several innovation intermediaries, as well as consider the introduction of Solverboard as the main platform of

integration. *"I see them as separate as they stands just now… Yammer is very good for giving broad details and sharing, and bringing in people in getting their interest. The Solverboard will be dedicated to the open innovation programme of how we release those challenges. The Nine Sigma, ~~InnoMotives~~ (Ennomotive), and the other platform provider, ones which are under stage review… We want to have a one platform, mainly Solver Board." (E2) "Solverboard for me is a potential tool to get a lot of collaborative (on) what's going on inside the organization, and potentially can then act as one of the tools for touching with people outside." (A2)*

Considering the convergent mentioning of Solverboard, additionally evidences are drawn from Solverboard's website to demonstrate its potential to integrate internal and external innovation. Solverboard is designed to engage everyone in innovation, discover your best thinkers, cut across business silos, measure the impact of ideas, start quickly and cost efficiently, as well as get everyone collaborating (Solverboard, 2019a). Aligning with the philosophical stance of this research to view the organization as an 'organism' – an open system with processes responding to environment (Morgan, 2006), the platform of Solverboard is positioned as an 'ecosystem' of innovation that enables people to act on world-wide sourced knowledge (Solverboard, 2019b). Figure 4-9 exhibits a visual of the ecosystem. "Our ecosystem allows you to access the human intelligence of your people, your network, and the world. The Solverboard Work platform engages employees and your wider network of suppliers and partners together with our open innovation site Solverboard World." (Solverboard, 2019b)

Figure 4-9: Our product ecosystem (Solverboard, 2018b)

4.2.4.3 Governance

Governance structures serve as necessary reflection points to surveillance the on-going processes and activities of innovation. Due to these companies are still early on the journey of open innovation, governance is an area waiting to be developed in the future. Supportive evidence is only found on the topic of establishing a governance body to surveillance project issues (O'Connor, 2008). One private sector company sets up an innovation forum to manage idea generation. Built as part of the ideation process, the innovation forum is where the decision to go or kill is formally made. *"The innovation forum will be on a monthly basis to determine what do we do, do we kill it, do we move it forward, where do we move it forward, get it into the formal process… It needs to progress, if it's a good idea. It will be killed, if it's not." (A2)*

In another private company, two innovation boards are set up to manage projects of different scales. The strategy board makes decision on long-term larger projects, while the technical board deals with short-term smaller ones. *"The two boards are the innovation strategy board and the innovation technical board. The innovation strategy board… are involved in setting the strategy and making sure*

that's implemented, but they also look at larger projects. They approve larger projects or make changes to projects, when they are being proposed. For smaller projects, so probably projects are going up to maybe two years or two and a half year's length, the problem maybe leave to a second group, the technical group. Again that's a group of people from across the business, who have various technical backgrounds who've got a wide range of knowledge of the industry. So when it becomes a proposal, they will be able to say well this hasn't been thought about before, how this is going to be different, or this is good but you can maybe add a section looking at X, Y, or Z, or they can just say that we don't think this is a good idea to do because of whatever reasons." (E1)

Comparatively, one public sector organization is looking at the role of Community Planning Partnership to serve *"a gateway function" (C3).* Information trickles up first, before decision is implemented top-down. *"The ideas probably come from the outside, go to the top, and then washes their way down to go to their appropriate area. And that idea would then be going forward using their specific approach." (C1)* The Community Planning Partnership facilitates joint decision-making of different collaborators and guarantees resource commitment. *"Community Planning Partnership is represented by our chief executive, within is NHS, police, fire, housing associations, third sector… These organizations will all bring them (the city-wide innovation challenges) to the table… Those organizations will agree ~~actually, okay…~~ those top three~~, that's~~ are the ones we want to address first. So then that will come back down to us in terms of civic and open innovation process. We will then try to tackle or address them. But each of the organizations might need to commit resources down here." (C2)*

Despite rich evidence found on governance board to surveillance, all other scattered points under the general topic of governance are missing in the research context. More structured alternative understanding on gate governance and innovation KPIs is reviewed. Along the stage-gate process of product

development, gates are governance structures to check deliverables of past stage and make decisions on go/kill/hold/recycle of projects (Trew, 2018). The tool of gate scorecard is introduced to assist the effectiveness of quality control of innovation projects (Trew, 2018). The scorecard consists of six assessment criteria: 1) strategic importance and strategic alignment, 2) the fitness of project to core competences, 3) attractiveness of value proposition to customers, 4) growth potential of market and intensity of competition, 5) technical feasibility to develop and manufacture, and 6) trade-off of prospects expressed in risk versus return (Trew, 2018).

More general innovation KPIs are next covered. There are three types of innovation KPIs: process, project and business (Trew, 2018). First, process metrics checks adherence to process, comprising both subjective measures (rating quality of gate meetings, degree of deviation from system's rules and assessment by process manager) and objective measures (on-time and on-budget performance of projects, time-to-market from Gate 3 to launch, number of ideas submitted) (Trew, 2018). Second, project metrics gauge the probability of successful projects, which include measures such as cost versus revenue, customer satisfaction and market share (Trew, 2018). Third, business metrics assess the contribution of projects to business in total, considerations of which involve business revenue, sales growth, profitability, return on investment, number and success rate of product launch (Trew, 2018).

These general KPIs can be tailored to govern a certain process of open innovation. Enkel (2018b) develops specific KPIs to assess effectiveness of open innovation efforts within stages of want, find, get and manage. The performance indicators (KPIs) are elaborated: 1) KPIs of 'want' shows ability to attract: number of ideas especially from suppliers, number of open innovation ideas, percentages of ideas that pass on time and number of ideas with positive evolution; 2) KPIs of 'find' describe the ability to identify: number of new needs identified, number of needs

suitable for communication with collaborators, number of needs to go to procurement and number of needs with timely response from collaborators; 3) KPIs of 'get' constitute the ability to contract: number of open innovation contracts signed and percentage of contracts following guidelines; and 4) KPIs of 'manage' addresses capacities of quality execution and budgeting: percentage of projects reviewed by open innovation champion, quality of (key) open innovation projects subjectively measured by open innovation champion, partner evaluation, learnings, alignment with R&D strategic programme, number of total innovation projects and number of open innovation projects within, open innovation spend in kind and out of pocket within total R&D budget, percentage of spend with strategic innovation partners, sum of open innovation spend within total innovation projects (Enkel, 2018b).

4.2.4.4 Infrastructure

This section elaborates the deployment of infrastructure for innovation. From a general 'why' perspective, innovation requires the presence of infrastructure to effectively engage people. *"we created the centre of civic innovation, which is that home." (C3)* This supports literature's arguing for the necessary to create a separate physical space for innovation (Verona and Ravasi, 2003). *"It's not virtual. It's not an idea. It's a physical space that you can touch and move around, and host events, and actually the main thing is you bring your operations in here and you work from here. And it's a different working environment that you would do this in your day-to-day job." (C3) "It's key that staff get out of their comfort zone some time away from their work." (C1)* In addition to the off-site choice, the infrastructure can also be set up on-site. *"Sometimes it's about getting outside of (company site), but it would useful if there is a space in (company site) that was just a bit different from our general meeting room." (A1)*

Similarly to the scarcity of empirical evidences, literature on dynamic capabilities merely recommends some scattered good practices, such as open space office, meeting points, coffee encounters, mobile workstations, accessible e-archives and visual signs (Verona and Ravasi, 2003). Therefore, additional practices are drawn upon. Oksanen and Ståhle (2013) put forward five characteristics of physical space for innovation: 1) communicativeness: encourages immediate workplace interaction; 2) modifiability: supports versatility of activities and enables flexible ways of doing; 3) smartness: allows ubiquitous interaction through technology application such as wireless communication, visual and audio sensing systems, user interaction methods and augmented reality; 4) attractiveness: targets interesting and creative people with a combination of elements including location, architecture, service and enabling idea to flow; and 5) value reflection: comes from the embeddedness of inspiring values of openness, sustainability, collaboration, creativity and playfulness within the design of team project room, open studio, prototyping workshop and communal area.

4.2.5 Summary

This section explores the linkages between open innovation and dynamic capabilities. Micro-foundations of all three concepts – open innovation, dynamic capabilities and organizational ambidexterity, are merged and integrated into themed categories of dynamic capabilities. Four categories of dynamic capabilities are presented with sub-themes with respective micro-foundations demonstrated by evidences of different kinds. One kind is supportive empirical evidences identified in research context. Where there is missing empirical evidences on certain micro-foundations, more detailed explanation is drawn from existing literature. There are also newly added literary references (marked in colour purple in summary tables), either to accommodate emergent insights or address gaps of existing literature. Finding and discussion in relation to each category of dynamic capabilities are shown as follows.

Section 4.2.1 discusses findings on open innovation related organizational practices regarding the dynamic capability of strategy and leadership. Subsection 4.2.1.1 shows supportive empirical evidences on embeddedness of innovation within strategy and portfolio perspective of strategic planning. The necessity of having an explicit innovation strategy is particularly emphasized by drawing on new references and empirical evidences, and the reason why there is missing evidence on dynamism of strategy is additionally explained. Subsection 4.2.1.2 presents findings on supportive roles of senior management to facilitate strategic alignment. There have been supportive evidences on themes of resource commitment, managerial leadership and coherent integration. Resource commitment is only captured in general terms as an aftermath of managerial buy-in within research context. Moreover, a new reference is added to enrich best practices on human resource management in context of open innovation. Table 4-9 shows in detail the connections between key findings and relevant literature.

Table 4-9: Key findings, additional insights and relevant literature in Section 4.2.1

	Key findings and additional insights	Relevant literature
4.2.1.1 Vision and strategy	Company E's innovation strategy *(Company E – Divisional innovation strategy, 2018, p. 4)* *"Our innovation strategy for (our company) will be for us to look at supporting the new technologies" (E2)*	Innovation strategy (Dodgson et al, 2008; Trew, 2018; Fisher and Kinnemeyer, 2018)
	"three main pillars… product differentiation, manufacturing efficiency, and revenue growth." (A1)	Ambidextrous strategic vision (O'Reilly and Tushman, 2008; Birkinshaw et al, 2016) Theory on firm growth (Penrose, 1959)
	"support growing businesses in our new high-growth innovation hub" (Glasgow Economic Strategy 2016-2023, p. 9) *"open innovation… fits in with… our technology and innovation focus" (D1)*	Embed (open) innovation within strategy (Lawson and Samson, 2001; Andriopoulos and Lewis, 2009; Slater et al, 2014; Hosseini et al, 2017)
	"have a portfolio of projects" (A2)	Think the future as portfolios

	"Category management decide(s) whether it is a tier 1, tier 2, or tier 3 process or product." (A1)	(Baghai et al, 1999; Kelley, 2009)
	"What we have in the business is a series of technology roadmaps" (D1)	Technological road-mapping (Chesbrough, 2003)
4.2.1.2 Senior management	Resource commitment in general *"We've got that senior officer buy-in. Our chief executive… is now committed both resource and her support to it" (C2)*	Resource commitment in detail (Baghai et al, 1999; Lawson and Samson, 2001; Teece, 2007; Vanhaverbeke and Cloodt, 2014; Anthony et al, 2017)
	"they will approve budget. They will approve content being released to media. They will approve several other areas… as an ambassador for our programme. And that will champion it on an internal and external level but also someone that kind of offer insight and advice…" (D1)	Empower, support, encourage (Day and Schoemaker, 2016; Hosseini et al, 2017; Chen, 2017) Facilitate coherent adoption and integration of innovation (Berkhout et al, 2010; Trott, 2012; Kelley, 2009)
	Human resource management: recruitment, training, appraisal and compensation, as well as job design	Collaborative-based HRM practices and open innovation (Hong et al, 2018)

Section 4.2.2 presents finding on the very important theme of culture and communication of dynamic capabilities. Many relevant details are laid out in Table 4-10. Subsection 4.2.2.1 generally describes expectations on characteristics of a culture for innovation. Topics include descriptive words, ambidextrous orientations, supportive norms and creative mentalities. Coherent management of culture norms within the wider organizational system is particularly emphasized. Subsection 4.2.2.2 elaborates on one critical characteristic of entrepreneurial risk-taking. Supportive evidences are shown on story-telling of success and lessons from failure. Regarding incentives, monetary ones are either banned or yet to be developed, and non-monetary ones are limited to allowing for experience and awarding contract.

To allow the innovation culture to thrive, the next two-subsection focus more on the critical aspect of communication. With nearly no evidence on organizational intelligence, Subsection 4.2.2.3 elaborates the topic by drawing on more details from existing lists of dynamic capabilities as well as learning from systematic

market intelligence. After intelligence gathering, Subsection 4.2.2.4 addresses the dissemination of intelligence. Borrowing the logic of experience marketing and integrated marketing communication, an original solution with demonstrative empirical evidences is proposed to design a holistic experience of open innovation. Aligning with the marketing perspective, the possibility of value co-creation among various stakeholders is further shown. Furthermore, to guarantee the smooth running of open innovation, 4.2.2.5 particularly emphasizes three roles of open innovation managers with different natures. All three roles are corroborated by quotes of the interviewees.

Table 4-10: Key findings, additional insights and relevant literature in Section 4.2.2

	Key findings and additional insights	Relevant literature
4.2.2.1 General culture for innovation	*Seven cultural principles: easy and fast, flexible, measured, open-minded, iterate and learn, collaborative and scaled, as well as outcome-based (Company reporting of open innovation programme cohort meeting 9, 2018)*	Adhocracy culture (Slater et al, 2014; Birkinshaw et al, 2016)
	Four orientations: market orientation, technology orientation, entrepreneurial orientation and learning orientation	Facets of innovation culture (Enkel, 2018a)
	Six levers: creativity, learning organization, trust, open communication and transparency, incentives and alignment	Levers to support entrepreneurial culture (Enkel, 2018a)
	Culture norms: challenge and belief in action, freedom and risk-taking, dynamism and future orientation, external orientation…	Culture norms for innovation Ahmed (1998)
	Further elaboration on divergent thinking, vigilant learning and collective learning	Combined references: Lawson and Samson, 2001; Verona and Ravasi, 2003; Day, 2011; Birkinshaw et al, 2016; Day and Schoemaker, 2016
4.2.2.2 Entrepreneurial risk-taking	*"proving what you are trying to do works. That's the quick wins." (A1)*	Story-telling (of success) (Hosseini et al, 2017)

	"that might need a couple of successful outcomes… to demonstrate this process works." (C2) *"If it's successful, we will grow bigger." (E2)*	
	"(Failure is) valuable…" (C3) *"not always just what was great but what didn't work well, what you've learned for the future…" (A1)*	Learn from failure (Lawson and Samson, 2001; Day, 2011; Day and Schoemaker, 2016)
	"I have a 10% idea time and the funding." (A3) Lacking in monetary incentive: *"Incentives, we can't give any." (B1)* *"We have our reward and recognition programme process internally… We haven't really use that, as yet for our open innovation programme…" (D1)* Non-monetary incentives: *"they might want to experience." (D1)* *For innovation challenges in intermediaries, "we will progress to award your contract to work…" (D1)*	Allow experimentation by granting time, money and other incentives (Lawson and Samson, 2001; Day, 2011; Birkinshaw et al, 2016; Day and Schoemaker, 2016; Hosseini et al, 2017)
4.2.2.3 Organizational intelligence	Elaboration on time span, content and purpose of scoping organizational intelligence	Combined references: Lawson and Samson, 2001; Verona and Ravasi, 2003; Teece, 2007; Anand et al, 2009; Day and Schoemaker, 2016; Chen, 2017
	Systematic and strategic deployment of market intelligence	Market intelligence (Armstrong et al, 2015)
4.2.2.4 Communication	Deliberate departure from the knowledge perspective	Combined references: Lawson and Samson, 2001; Hosseini et al, 2017
	A compelling theme: *"for an internal audience, they probably wouldn't know what open innovation is, so we talk to them the projects we deliver which is civic innovation" (C2)* Channels of communication: - Message from the top *(A1; C2)* - Bottom-up rumours *(E1; A3)* - Intranet *(A4; D1)* - External voice *(A4)* - Workshops and events *(E2; E1)* - Social media *(D1)* Coherency and consistency: *"make sure that you are basically constant and consistent with your engagement (E1)*	Design of a holistic innovation experience by devising a compelling theme and managing channels of communication (Pine and Gilmore, 1998; Schmitt, 1999) Integrated marketing communication (Armstrong et al, 2015)

	Market as a forum for value co-creation, involving multiple actors in a networked ecosystem	Value co-creation (Prahalad and Ramaswamy, 2004; Jaakkola et al, 2015) Open innovation ecosystem (Rohrbeck et al, 2009)
4.2.2.5 Capabilities of people	*"coordinating partnerships between people" (A1)* *"I want to be an expert on open innovation process" (E2)* *"translate down… and feed that back" (C2)* *"persuading people" (B1)* *"to lead our programme" (D1)* *"What we (are) doing is to bring together unique skill sets that we are able to see they can progress to our organization." (E2)*	Social brokerage, Peer leadership, and Boundary spanning (Hosseini et al, 2017)
	Alternative typology of management roles: facilitator, tactician and sensegiver	Roles of open innovation collaboration managers (Ollila and Yström, 2017)

Section 4.2.3 explains finding on themed dynamic capability of innovation process, both general and specific. Section 4.2.3.1 presents findings on general innovation process, merging four subthemes in literature review, namely general characteristics, Stage-Gate NPD, elements of agile execution and scalability. Considering only one organization has a well-articulated innovation process, there is limited description on stages and gates with some implied design features. Therefore, general innovation process is a huge gap of practical adoption within the research context. Section 4.2.3.2 targets at more specific open innovation processes. Thriving around convergent process of the SE project, the companies either adopt existing processes or devise their unique processes from scratch, each of which enjoys special advantages. Section 4.2.3.3 emphasizes ways of process integration of open innovation. Design sprint is captured as commonly adopted methodology of the organizations to facilitate cross-collaboration and agile execution. Open innovation can potentially be embedded as open criteria at gates as well as methods for task execution within stages along the whole innovation process. Table 4-11 offers a detailed recap of key findings, additional insights and relevant literature.

Table 4-11: Key findings, additional insights and relevant literature in Section 4.2.3

	Key findings and additional insights	Relevant literature
4.2.3.1 General innovation process	Company E's innovation process: inception, creation, delivery, transition and tracking *(Company E – Divisional innovation strategy, 2018)* Innovation sources in inception *(Company E – Divisional innovation strategy, 2018)*	Description on stages and gates (Cooper, 2008; Cooper, 2014; Cooper and Sommer, 2016; Cooper, 2016; Phillips, 2018b) Cross-collaboration and voice of customer (Cooper and Sommer, 2016)
	With limited evidence of one organization, micro-foundations of all four subthemes requires further exploration: - General characteristics - Stage-Gate NPD - Elements of agile execution - Scalability	Combined references: Rothwell and Zegveld, 1985; Gassmann and Enkel, 2004; Chesbrough, 2006a; Cooper, 2008; Enkel et al, 2009; Trott, 2012; West and Bogers, 2014; Chesbrough and Bogers, 2014; Cooper, 2014; Cooper and Sommer, 2016; Cooper, 2016; Ellwood et al, 2017; Phillips, 2018b
4.2.3.2 Open innovation process	The company's ideation process *(Summarized from Company D – Quarter 1 report, 2017)* Want brief *(Summarized from Company D – Copy of collective challenge OI templates)* Six-step process to manage innovation challenge at innovation intermediary	Want, Find, Get, Manage Model (Slowinski and Sagal, 2010) InnoCentive@Work process (InnoCentive@Work, 2018)
	Self-devised processes in context: - 'Hatch a challenge' process *(Wagner and Fain, 2018)* - The innovation process of two public sector organizations *(Company C – OI presentation; Company reporting of open innovation programme cohort meeting 7, 2017; Company reporting of open innovation programme cohort meeting 9, 2018)*	Shared process prototype of the SE project: idea, challenge, collaboration and development (Wagner and Fain, 2018)
4.2.3.3 Process integration of open innovation	*"create multi-disciplinary teams" (D1)* *"looking for new applications for existing products… and to create new products for new marketplaces" (A2)*	Design sprint and design thinking (Knapp et al, 2016; Brown, 2008; Cooper et al, 2009; Brown and Katz, 2011)

	Opportunities of service improvement, development and experience *(Company C – OI presentation)* Contextualized implementation: *"to have a day of idea capture" (A1)* *"the 100-day program would potentially take some of those ideas forward" (C1)*	
	Integration at Stage 2 and Gate 3: *"The business case is basically where we align the benefits and the reasoning why we want to head into that particular direction. We can seek our approval for that and then it's a question of go or no go." (D1)* *"a set of criteria comprising… ; does the skills exist inside the company or not" (A2)*	Stage 2 and Gate 3 (Phillips, 2018a; Phillips, 2018a) Open criteria (Grönlund et al, 2010)
	Diversified usage of open innovation challenges within different stages	Open innovation as methods to facilitate task execution within stages (Cooper and Edgett, 2008) Scenario of challenges (InnoCentive: Adding Value to Stage-Gate Through the Use of Challenges, 2018)

Section 4.2.4 elaborates findings on micro-foundations around the dynamic capability category of structure and governance. Section 4.2.4.1 shows supportive evidences on several topics on organizational structure, which consists of permeable and organic structure, structural separation, clear roles and responsibilities, clear reporting system, legal procedure as well as cross-collaboration of different kinds. Section 4.2.4.2 demonstrates expectation on characteristics of internal system of innovation and points out the necessity to engage innovation intermediaries as external systems of innovation. Despite current disparate internal and external systems of innovation, the future lies in their potential integration into one digital platform such as Solverboard. Section 4.2.4.3 reveals mechanisms of governance to surveillance on-going innovation processes. There is only empirical evidence to support the establishment of a governance body, where there is an absence of details on all other scattered subthemes. Extended literature review enlightens possible

alternatives to more systematically capture KPIs of innovation, general and specific. Section 4.2.4.4 presents supportive evidences on the rationale to establish a separate physical space for innovation. Relevant literature is further drawn upon to comprehensively reveal general characteristics that constitutes the physical space for innovation. Table 4-12 displays these key findings, together with additional insights and relevant literature.

Table 4-12: Key findings, additional insights and relevant literature in Section 4.2.4

	Key findings and additional insights	Relevant literature
4.2.4.1 Organizational structure	*"we don't need to have a rigid structure… We can reach out to a particular intermediary and go through our partner ecosystem…" (D1)*	Permeable and organic structure (Lawson and Samson, 2001; Slater et al, 2014; Day and Schoemaker, 2016)
	Refer to evidences on structural ambidexterity and contextual ambidexterity in Section 4.1.2.2	Structural separation with managed coherence of elements (Teece, 2007; O'Connor, 2008; Slater et al, 2014; Day and Schoemaker, 2016; Chen, 2017)
	"I (the open innovation collaborator) provide a monthly report on the open innovation activities that I carry out to (my boss)…" (A1)	Clear roles and reporting systems (O'Connor, 2008; Slater et al, 2014)
	"We are starting to set up these contracts, and also link with our non-disclosure agreement, which is built to our contractual models." (D1) Early involvement of the legal department and flexible partnership arrangement as best practices	The stage of collaboration in shared process prototype of the SE project (Wagner and Fain, 2018)
	"trying to get different cultures and different companies working together on projects" (A1) *"(Having business functions) allows us to scale up and down… and… agile." (D1)* *"service areas in the (organization) are supporting the locality teams deliver services in the community" (B1)*	Cross-collaboration between functions and divisions (Verona and Ravasi, 2003; Teece, 2007; Kelley, 2009)

	Refer to evidences on innovation process in Section 4.2.3.1 and Section 4.2.3.3	
4.2.4.2 Systems and intermediaries	Expectation on virtual platform (internal innovation system): - Interactive *(C2)* - Gamification *(A1)* - Simple *(A2)* - One-click portal *(E2)* - Visibility *(A2; E2)* - All-encompassing *(D1)*	Mechanisms of IT to enhance innovation process and knowledge sharing (Lawson and Samson, 2001; Joshi et al, 2010; Day, 2011; Hosseini et al, 2017)
	"collaborate with open innovation intermediary by selecting them on the basis of what audience do we need to target… to Top Coder because it's around algorithm, or Kaggle because it's about software development challenge…" (D1)	System to manage external networks (O'Connor, 2008) Leverage of innovation intermediaries (Chesbrough, 2006a; Billington and Davidson, 2013; Hosseini et al, 2017)
	Platform integration: *"We want to have a one platform, mainly Solver Board." (E2)* *"Solver Board… is a potential tool to get a lot of collaborative (on) what's going on inside the organization, and… touching with people outside." (A2)*	Solver Board as the ecosystem of innovation, integrating levels of internal, network and open (Solverboard, 2018a; Solverboard, 2018b)
4.2.4.3 Governance	*"innovation forum" (A4; A2)* *"innovation strategy board and innovation technical board" (E1)* *"Community Planning Partnership" (C3; C1; C2)*	Governance board for surveillance (O'Connor, 2008)
	Missing evidences on topics of: - Surveillance and flexible adjustment - Application of scorecard at gate reviews - Activity- and performance- based performance metrics - Manage specific aspects of innovation	Combined references: Chesbrough, 2006a; Cooper, 2008; O'Connor, 2008; Anand et al, 2009; Slater et al, 2014; Slowinski and Sagal, 2010; Chen, 2017; Hosseini et al, 2017; Phillips, 2018a; Phillips, 2018c; Phillips, 2018c
	Gate scorecard	Gates as decision points (Trew, 2018)
	Levels of innovation KPIs: process, project and business	Innovation KPIs (Trew, 2018)
	KPIs along the Want, Find, Get, Management Model	Measurement in open innovation (Enkel, 2018b)
4.2.4.4 Infrastructure	*"the centre of civic innovation" (C3)* *"a different working environment" (C3)*	Separate infrastructure for innovation (Verona and Ravasi, 2003)

	"staff get out of their comfort zone some time away from their work" (C1)	
	Five characteristics of innovative space: Communicativeness, modifiability, smartness, attractiveness and value reflection	Attributes of physical environment as a source of innovation (Oksanen and Ståhle, 2013)

General discussion in relation to RQ2

To explore RQ2 *"What are open innovation related processes under categories of dynamic capabilities?"*, this section shows themed categories of dynamic capabilities that provide a viable framework to organize open innovation related micro-foundations of the organization. This supports that dynamic capabilities is a useful guidance to professionally manage open innovation (Gassman et al, 2010; Huizingh, 2011). Practical mechanisms of open innovation are systematically investigated (Stanko et al, 2017), more explicitly considered as micro-foundations within categories of dynamic capabilities (Teece, 2007; Day and Schoemaker, 2016). To categorize dynamic capabilities according to theme of relevance brings new learning to all three concepts, by proposing an alternative departing from dominant logic to categorize micro-foundations: 1) directions of knowledge flow (West and Bogers, 2014) and levels of analysis of open innovation (Bogers et al, 2017); 2) sensing, seizing and transforming as organization-level dynamic capabilities (Teece, 2007); and 3) structural, contextual and sequential ambidexterity modes to realize organizational ambidexterity (O'Reilly III and Tushman, 2013).

After demonstrating general contributions, the four subsections accommodates more specific details of the four themed categories of dynamic capabilities emerging from literature review: 1) strategy and leadership, 2) culture and communication, 3) innovation process, and 4) structure and governance. Finding and discussion within these subsections reveal supportive evidences of current subthemes, gap-fill missing evidences as well as capture emergent insights.

Bottom-up micro-foundations in addition to top-down ones are formally taken into consideration (Teece, 2007). Rather than repetitively iterating supportive evidences of subthemes that have been clearly exhibited in the summary tables (Table 4-9, Table 4-10, Table 4-11 and Table 4-12), emphasis is put on gap-filling missing evidences and capturing emergent insights.

Section 4.2.1 elaborates the dynamic capability of strategy and leadership. Subsection 4.2.1.1 includes detailed discussion of one companies' innovation strategy and extended literature review to show rationale and content of an explicit innovation strategy (Dodgson et al, 2008; Trew, 2018; Fisher and Kinnemeyer, 2018), complementary to current advocacy of implicit embeddedness of open innovation within other strategies (Baghai et al, 1999; Lawson and Samson, 2001; Andriopoulos and Lewis, 2009; Kelley, 2009; Slater et al, 2014; Hosseini et al, 2017). Subsection 4.2.1.2 admits the adoption gap of having detailed resource commitment plans for innovation (Baghai et al, 1999; Lawson and Samson, 2001; Teece, 2007; Vanhaverbeke and Cloodt, 2014; Anthony et al, 2017). Beyond scattered practices of human resource management (Kelley, 2009; Berkhout et al, 2010; Trott, 2012; Day and Schoemaker, 2016; Hosseini et al, 2017; Chen, 2017), a new reference is drawn upon to comprehensively cover collaborative-based HRM practices (Hong et al, 2018).

Section 4.2.2 discusses the dynamic capability of culture and communication, which resolves the gap of deliberate oversight of culture (Teece, 2007; Hosseini et al, 2017). Subsection 4.2.2.1 shows the context's negligence in describing what a culture for innovation should be like, therefore new references are added to explain characteristics and norms of innovation culture (Enkel, 2018a; Ahmed 1998). Subsection 4.2.2.2 presents supportive evidences on all aspects of entrepreneurial risk-taking. Subsection 4.2.2.3 shows very minor details on organizational intelligence, thus literature on market intelligence is borrowed to guide systematic deployment of intelligence (Armstrong et al, 2015). Departing

from the knowledge perspective, Subsection 4.2.2.4 demonstrates how to deliver integrated marketing communication for innovation (Pine and Gilmore, 1998; Schmitt, 1999; Armstrong et al, 2015) with supportive empirical evidences. Further opportunities of value co-creation in wider ecosystem is advocated (Prahalad and Ramaswamy, 2004; Rohrbeck et al, 2009; Jaakkola et al, 2015). Subsection 4.2.2.5 exhibits supportive evidences and an alternative typology to describe critical roles of open innovation (Hosseini et al, 2017; Ollila and Yström, 2017).

Section 4.2.3 demonstrates the dynamic capability of innovation process. The subsection structure is arranged differently from the subthemes in the literature review chapter, to allow for the natural flow of finding and discussion. Regarding general innovation process, Subsection 4.2.3.1 shows only supportive evidence on basic functions of stages and gates, with the absence of all other subthemes (general characteristics, agility and scalability). Detailed micro-foundations explained in literature review thus become good practices to consider. Subsection 4.2.3.2 illustrates some open innovation processes supportive to literature (Slowinski and Sagal, 2010; InnoCentive@Work, 2018; Wagner and Fain, 2018). Subsection 4.2.3.3 outlines points of integration of open innovation into general innovation process. Apart from supportive evidences on critical stage and gate (Phillips, 2018a; Phillips, 2018a) and open criteria (Grönlund et al, 2010), new inspirations are drawn from emerging topics of design sprint (Knapp et al, 2016) and scenario of challenges (InnoCentive: Adding Value to Stage-Gate Through the Use of Challenges, 2018).

Section 4.2.4 presents the dynamic capability of structure and governance. Subsection 4.2.4.1 captures supportive evidences to almost all subthemes to literature, except for some emergent legal practices (Wagner and Fain, 2018). Overlapping evidences with other categories of dynamic capabilities are noticed, pointing out the possibility of flexible categorization and between-category

interaction. Subsection 4.2.4.2 not only shows supportive evidences on both internal and external system of innovation, but also elaborates on the potential of platform integration (Solverboard, 2018a; Solverboard, 2018b). Subsection 4.2.4.3 only covers finding on governance board for surveillance (O'Connor, 2008), with all other missing literary subthemes become gaps of adoption. To facilitate systematic application of governance mechanisms, tools of gate scorecard, innovation KPIs (Trew, 2018) and measurement in open innovation (Enkel, 2018b) are introduced as good practices. Subsection 4.2.4.4 captures supportive evidences on establishing a separate space for innovation (Verona and Ravasi, 2003) as well as draws on a new reference to explain how attributes of physical environment can become a source of innovation (Oksanen and Ståhle, 2013).

The whole Section 4.2 presents finding and discussion on how micro-foundations of open innovation within wider organizational activities constitute categories of dynamic capabilities, which affords abundant opportunities for strategic implementation. Together combining finding and discussion of on tentatively linkages between open innovation and strategic ambidexterity in Section 4.1, the next section arrives at an integrated managerial solution to open innovation adoption, which orchestrates the flow of logic from strategy to practice.

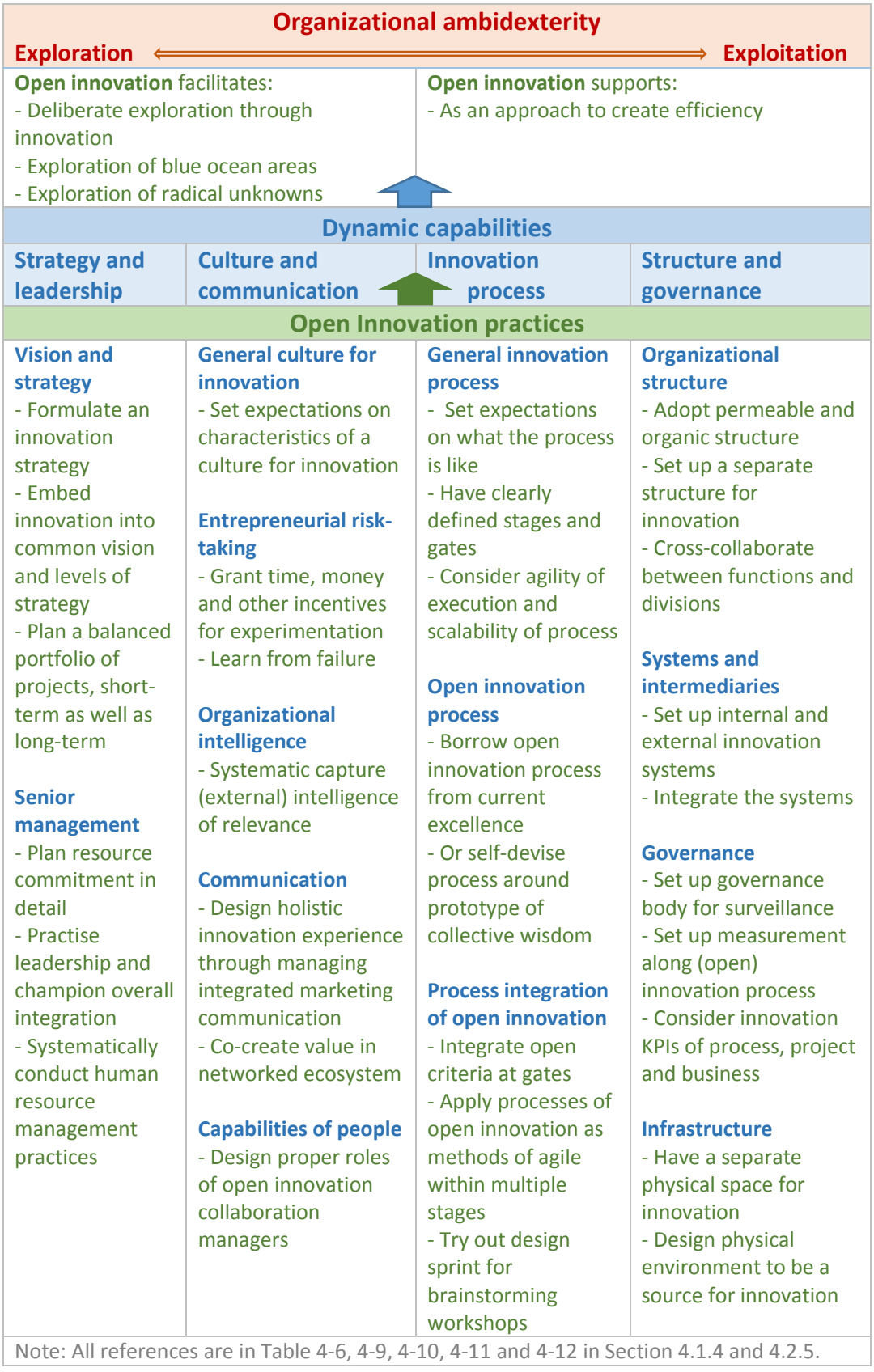
4.3 Orchestrate the logic of open innovation adoption

Integrating finding and discussing on implications of organizational ambidexterity and dynamic capabilities on open innovation adoption in Section 4.1 and Section 4.2, this section intends to orchestrate the logic flow from strategy to practice. The orchestration of the logic answers to **the third research question**: *"How does ambidextrous strategy facilitate structured open innovation adoption through dynamic capabilities?"* Aligning with the logic of theoretical elaboration in literature review, open innovation can be structurally adopted from strategy to practice: from high-level organizational ambidexterity as organizational strategy,

to medium-level dynamic capabilities as systematic framework, and further down to low-level supportive open innovation micro-foundations. Built on the prototype of theoretical framework (Figure 2-10 in Section 2.4.4), Figure 4-10 provides key details on open innovation adoption from strategy to practice by drawing on either empirical evidences or extended literature review in Section 4.1 and Section 4.2.

Referring to Figure 4-10, a demonstrative narrative is created to make clear how to apply the logic of open innovation adoption from strategy to practice. In the first place, organizations need to make conscious decisions on the strategic balance of exploration and exploitation. The targets of open innovation should fit to either the exploration or the exploitation side within of the strategic paradox. After determining 'why' and 'what' of open innovation, 'how' to conduct open innovation as micro-foundations under categories of dynamic capabilities is planned to support strategy implementation. One illustrative example is given in each category of dynamic capability: 1) on strategy and leadership, organizations may choose whether to have an innovation strategy or embed open innovation into other strategies; 2) on culture and communication, organizations should consider designing integrated marketing communication campaigns for specific open innovation projects; 3) on innovation process, organizations borrow or create process of (open) innovation; 4) on structure and governance, supportive structure and levels of KPIs are of serious considerations to the organizations.

Figure 4-10: Open innovation adoption from strategy to practice



Note: All references are in Table 4-6, 4-9, 4-10, 4-11 and 4-12 in Section 4.1.4 and 4.2.5.

Figure 4-10 demonstrates open innovation practices in a language that is ready for managerial action. Each line of the practices affords an opportunity to conduct open innovation at present or in the future. Practically, the figure offers a diagnostic tool for organization to meditate on their capabilities to adopt open innovation as well as serves as a prototype for reference regarding contextualized adoption and continuous improvement. Theoretically, the integration of the three concepts (open innovation, dynamic capabilities and organizational ambidexterity) contributes to literature by acknowledging close linkages between each two of the concepts, as is captured in recent bibliographic reviews of all three concepts (Randhawa et al, 2016; Wilden et al, 2016; Wilden et al, 2018). This originality lies in combining all three concepts as well as re-engineer the logic for strategic adoption of open innovation along levels of strategy, capability and practice: organizational ambidexterity as organizational strategy, dynamic capabilities as a medium-level framework and open innovation as practices.

The intention of proposing a framework for strategic and systematic open innovation adoption is not to advocate for a universal best solution for all but to open up alternative insights. It is to put scattered innovation capabilities into categories to assist analysis (Lawson and Samson, 2001). There is never the denial of the existence of alternative figure regarding strategic adoption of open innovation, for example, strategy archetypes of innovation management (Bader and Enkel, 2014). Based on Miles and Snow's (1978) typology of organizational adaptation strategies, Bader and Enkel (2014) put forward three proactive strategy archetypes of innovation management: market segment securing defenders, dual-oriented analysers and opportunity seeking prospectors. In Figure 4-11, each strategy archetype associates with its own logic to organize internal structures and processes, product-market choices, radicalness of innovations, corresponding a certain set of open innovation behaviours (Bader and Enkel, 2014). Dual-oriented analysers are potentially ambidextrous (Gibson and Birkinshaw, 2004; Raisch and Birkinshaw, 2008; Bader and Enkel, 2014).

Figure 4-11: Characteristics of proactive strategy archetypes of innovation management (Bader and Enkel, 2014, p. 175)

	Market segment securing defenders	Dual-oriented analysers	Opportunity-seeking prospectors
Internal structures and processes	- Formalised (innovation) processes and legitimised management principles - Controlled actions and operations	- Degree of centralisation and formalisation might be high or low with tendency toward either prospector or defender profile	- Informal structures and flexible (innovation) processes - Low adherence to predefined practices and operations so as to quickly adapt to external dynamics
Market and innovation orientation	- Tight product-market domain - Limited opportunity search beyond own sector due to efficiency reasons - Internal process optimisation and cost-efficient core technologies - Attitude toward risk aversion - Market segment leadership - Cost leadership or niche market strategy - Tendency toward incremental innovations	- Superior target strategy with dual technological core (hybrid strategy) - Differentiation or cost leadership strategy depending on product category - Simultaneously strive for two goals: Increase in efficiency and increase in innovation novelty - Creation of both incremental and radical innovations	- Broad product-market domain - Continuous opportunity search beyond own sector - Trigger for change and novelty in dynamic environment - Risk-taking attitude - Technology leadership - Differentiation strategy - Tendency toward radical innovations
Open innovation behaviour	- Low degree of openness (considering both open innovation breadth and depth)	- Moderate degree of openness with tendency toward either prospector or defender profile	- High degree of openness (considering both open innovation breadth and depth)
	- Preference of intense customer relationships with current customers in familiar markets	- Preference of cross-industry and cross-field innovation activities	- Application of a variety of open innovation activities without evident preference for one specific activity
	- ***Secure and focus:*** Emphasis on internal R&D and application of very few open innovation activities due to efficiency reasons	- ***Select and intensify:*** Concentration on narrow number of information sources and collaboration partners within and across industry boundaries	- ***Open and spread:*** Systematisation of open innovation and anchoring within corporate strategy formulation

4.4 Organizational evolution and (biological metaphor)

The relationship between the three concepts and organizational evolution are discussed, before embarking on presenting finding of this research. Open innovation emphasizes knowledge exchange for value creation at a point in time, thus under-estimating value capture for organizational evolution in the long run. Open innovation research mainly focuses on collaborative inventing, that is, resource provision to exchange partners who values the resource for the potential of value creation (Chesbrough et al, 2018; West and Bogers, 2014). As a direct result of knowledge exploitation from an absorptive capacity perspective, the outcome of open innovation is associated with competitive advantage in product

innovation (Zobel, 2017). Similarly claimed, with the open aspect of cross-boundary knowledge flow, open innovation facilitates the development and commercialization new or improved products, services processes or processes (Chesbrough and Bogers, 2014). Removing the adjectives to reveal the truth, open innovation is conducted to advance innovation. The absurdity to innovate for innovation points out the necessity to shift the organization metaphor away from brain to organism for alternative insight.

The philosophical origin of this research is revisited. To overcome the problem of self-referencing (knowledge learning as both means and ends) associated with the metaphor of brain, this research investigates the organization as an organism (an open system with interacting processes) (Morgan, 2006). Under the metaphor of organism, the management of system and processes to satisfy organizational needs and coordinate environmental relations contributes to organizational survival and evolution (Morgan, 2006). The metaphor adoption explains the deliberate oversight of innovation as an outcome in itself and the shared evolutionary outcome of organizational ambidexterity and dynamic capabilities in context of this research. Mimicking the logic of variation-selection-retention to explain the survival of organisms in nature, organizational ambidexterity proposes that an organization is capable of proactively regulate processes to adapt for survival and evolution: sourcing ideas from various sources for variation, monitoring internal and external selection as well as moving explorative business into regular business for retention (O'Reilly III et al, 2009). Comparatively, the consequence of dynamic capabilities is described in terms of evolutionary fitness, that is, the effectiveness of resource manipulation in organizational context (Helfat et al, 2007). High evolutionary fitness further leads to organizational survive and growth (Wilden et al, 2016).

The relationship between open innovation and organizational evolution is far less straightforward than organizational ambidexterity and dynamic capabilities

witnessing more observable linkages. Recent publications of open innovation acknowledge open innovation capabilities as dynamic capabilities that alters resource base of the firm, either explicit or implicit (Chesbrough et al, 2018; Hosseini et al, 2017). Mapping, specifying, operationalizing and measuring open innovation processes are considered challenging research opportunities to explore open innovation capabilities as dynamic capabilities (Chesbrough et al, 2018). This rationalises the integration of open innovation processes as micro-foundations under categories of dynamic capabilities. Following this logic of investigation, outcomes of open innovation are indirectly linked to evolutionary outcomes of dynamic capabilities. The tacit linkage between open innovation and organizational evolution may comprise the major reason of why the interviewees are not able to relate the two in an effective way. Despite the linkages are very weak and not-too-rational, the application of (biological) metaphor by interviewees provides interesting insights on antecedent, process and outcome of open innovation. Evidences relating to antecedents are first presented.

Excessive strategic exploitation disables ambidextrous evolution of the organization. "*Sailing along, sailing along, sailing along… as an organization, we are probably a little bit too reactive rather than planning for doing things incrementally." (A1)* Without a clear vision and continuous trial-and-learn, the organization can only end up with averageness in competition. *"Our organization ~~just now in terms of an entity~~ is somewhat handicapped ~~I would say~~. Its vision is quite poor… I don't think an organization is learning fast enough. I don't think it's succeeding fast enough. I don't think it's failing fast enough… I think right now we need to bring in some new gene pool. We need to bring in some new thinking into (our company)… We are somewhere absolutely stuck in pool of averageness." (A2)* Open innovation with an external focus brings conscious reflection of competition within environment. *"Open innovation, by working with people outside our business, by being open to what is going on ~~also~~ allows us to (be) aware (of) what our competitors are also doing. Not just focus on ourselves, but being more*

sensitive to our surroundings and being about more able to translate I suppose what others are doing and let that feed into what we look to do or not to do for whichever reasons." (A1)

Some processes of adoption are shown next. The open innovation journey starts with open innovation coordinator infecting the organization as a role model. *"From the very start… it was about infecting the organization… once you infect some individuals, what are you then looking for them to do? It's to do the same. You are looking to energize people, you are looking to try to get them involved and you are then looking to excite them about what is going on, and then for them to be the new version of you at their place." (A1) Interviewee (A2) compares the role of open innovation coordinator to the stabilizing wheel that helps company learn to ride the bike of open innovation.* The role model approach through open innovation coordinator is spoken by another interviewee as a train trainer approach. *"Maybe take some train trainer approach. Once we are comfortable with the approach methodology, we can then bring some people in and we can train them up, and then that can filter through all..." (C1)* Open innovation permeates through the organization in a generic way, slowly.

Orchestrating processes of open innovation consequently influences ways of working in the organization. Like a squashy ball of gel, the organization keeps evolving through open innovation to manage ambidextrous requests of lean and agile in the long run. *"That would be about the organization maintaining to be lean and agile. And that lean drives to be functioning in a very lean environment doesn't become a blocker to creativity. I think that if we followed the principles of innovation and open innovation that… in a mature organization living like that, it would mean that you were constantly looking your outside world and adapting to what is actually needed, and what is available, and what you can do with that. So short-term is tricky but I think long-term yes. I think the whole activity around co-production and innovation would definitely just keep us constantly changing. I just*

have a vision in my head now. It's like a big squashy ball of gel that doesn't necessarily get any bigger but just keeps changing shape." (B1)

Except for implications on ambidextrous evolution, open innovation facilitates the reconsideration of multiple dimensions of the organization such as strategy, culture and capabilities. *"I think if it is adopted then, to me, it will influence a lot of things. I will influence our capabilities to work with industry, and to work with all sorts of solution providers. It will influence our view of innovation culture and strategy, in my opinion. It will obviously influence our ability to share ideas and to collaborate with people on all sorts of different levels, whether that's internally or externally. I think it would influence our organizational environment. Perhaps some of the places we want to locate. And also it could influence our future sourcing strategy. I think it's a very very powerful programme… We have massive opportunities ahead." (D1)* The interaction between open innovation and organizational environment (internal and external), breeds massive opportunities.

In addition, open innovation further enables a global vision, which is explained by the metaphor of fishing. The cultivation of partner ecosystem is compared to the selection of ponds to fish. *"It's an enabling approach, which allows us to move forward and to be able gain insights in technology intelligence that would have been very limited in scope to do before. There is a good saying that basically says if you fish in the same pond and you continue to catch the same fish. You really need casting your nets global wide and developing a partner ecosystem that allows you to do that. That allows you to view what is going on in many different places across many different industries. That obviously allows us to solve really complicated challenges." (D1)* Open innovation is considered as an enabling approach to help resolve complicated challenges by developing partner ecosystem on a global scale.

To summarize, considering the linkage between open innovation and organizational evolution is not straight forward, implications on (biological) metaphor used by interviewees mainly rely on researcher's interpretation. Findings are presented following sequence of antecedent, process and outcome of open innovation. Ambidextrous evolution of organization presses conscious reflection of competitive environment, which aligns with the external focus of open innovation. The adoption of open innovation starts with open innovation coordinator infecting the organization as a role model and slowly permeates the organization in a genetic way. Regarding consequences, open innovation helps address ambidextrous requests of lean and agile, facilitates the reconsideration of multiple dimensions to grasp future opportunities as well as enables a global vision on development of partner ecosystem.

Chapter 5 Conclusion

5.0 Chapter overview

This chapter concludes the thesis by reflecting the whole logic to approach the **research aim:** *"How to adopt open innovation from strategy to practice?"* Importance is further attached to emphasize research contributions in answering the **three research questions**:

RQ1: *What is the relationship between ambidextrous strategy and open innovation?*

RQ2: *What are open innovation related processes under categories of dynamic capabilities?*

RQ3: *How does ambidextrous strategy facilitate structured open innovation adoption through dynamic capabilities?*

Miniatures of all chapters within the thesis are portrayed as follows. Section 5.1 revisits the theoretical elaboration to justify the research aim and questions. Section 5.2 demonstrates coherent adoption of qualitative research methods to investigate the research aim and questions. Based on empirical evidences derived from systematic adoption of the research methods, Section 5.3 gives formal answers to the three research questions and discusses contributions. Rather than advertising a perfect piece of research, Section 5.4 truthfully admits limitations and discusses prospects for future research. Section 5.5 provides a very brief summary as the ending of the chapter.

5.1 Reflection on theoretical elaboration

To address the research aim, this research originally provides a useful logic regarding strategic adoption of open innovation, which flexibly accommodates and systematically integrates the concepts of open innovation, dynamic capabilities and organizational ambidexterity. On the basis separate investigation

of the concepts followed by theoretical integration in Chapter 2, this section recaptures theoretical elaboration closely following the logic of open innovation adoption from strategy to practice. The three concepts are demonstrated in accordance with their relevance to different levels of abstraction to complete the logic: 1) strategies, 2) capabilities, 3) practices/processes/activities/micro-foundations, as well as 4) outcomes.

On level of strategy, strategic deployment of open innovation practices remains an under-researched gap (Vanhaverbeke and Cloodt, 2014), which further affords the opportunity to explore organization-level adoption of open innovation (Bogers et al, 2017). To investigate organization-level strategic adoption of open innovation, the relevance of organizational ambidexterity has been pointed out (Vanhaverbeke and Peeters, 2005; Gupta et al, 2006; Randhawa et al, 2016; Bogers et al, 2017). Organizational ambidexterity represents dual strategic orientations of an organization: both to exploit in stable environments and to explore in dynamic environments (March, 1991; O'Reilly III and Tushman, 2008; Trott, 2012; Smith et al, 2010; Lavie et al, 2010; O'Reilly III and Tushman, 2013; Chen, 2017). Open innovation as an external choice helps the realization of organizational ambidexterity (Nosella et al, 2012; Riccaboni and Moliterni, 2009; Simsek, 2009; Kauppila, 2010; Lavie and Rosenkopf, 2006; Lavie et al, 2010; Raisch et al, 2009). Dynamic capabilities also plays a supportive role in organizational strategy, because dynamic capabilities are formulated to effectuate organizational strategy (Teece, 2012).

On level of practices/processes/activities/micro-foundations, all three concepts have been deconstructed. Mainstream logic of deconstruction in each field is shown below. Open innovation constitutes distributed innovation processes accompanying directions of knowledge flow as well as spanning across multiple levels within and outside the organization (Gassmann and Enkel, 2004; Enkel et al, 2009; Chesbrough and Bogers, 2014; Bogers et al, 2017). Dynamic capabilities are

deconstructed into subsets of social and behavioural micro-foundations along sensing, seizing and transforming (Teece, 2007; Day and Schoemaker, 2016). Moreover, organizational ambidexterity embraces explorative and exploitative activities under three viable modes of balancing: sequential, structural and contextual (O'Reilly III and Tushman, 2013). Despite the existence of dominant logic of deconstruction, all three concepts are open to alternative logic of reintegration.

In the field of open innovation, there exist opportunities to combine different archetypes on directions of knowledge flow (West and Bogers, 2014) and to adopt a cross-level approach to account for both top-down and bottom-up processes (Chesbrough and Bogers, 2014; Bogers et al, 2017; Gupta et al, 2007). Regarding organizational ambidexterity, the complementarity of different modes of balancing breeds the opportunity to seek cross-mode reintegration (Kauppila, 2010; O'Reilly III and Tushman, 2013; Chen, 2017). In terms of dynamic capabilities, alternative logic of deconstruction is pursued in order to allow for insightful understanding of the transferability of micro-foundations under dynamic capabilities of sensing, seizing and transforming (Teece, 2007). The alternative logic would be preferable, if it is able to overcome oversight of culture and accommodate bottom-up micro-foundations at the same time (Teece, 2007; Hosseini et al, 2017).

On level of capabilities, the framework of dynamic capabilities may provide a useful alternative logic of reintegration. More specifically, categories of dynamic capabilities offers a systematic framework to support implementation of high-level strategies by integrating low-level practices/processes/activities/micro-foundations. Selected existing lists on categories of dynamic capabilities with respective micro-foundations in relation to all three concepts have been audited and merged: dynamic capabilities (Verona and Ravasi, 2003; Teece, 2007; Anand et al, 2009; Pavlou and El Sawy, 2011; Day and Schoemaker, 2016), dynamic

capabilities for (open) innovation (Lawson and Samson, 2001; O'Connor, 2008; Slater et al, 2014; Hosseini et al, 2017) and dynamic capabilities for organizational ambidexterity (Birkinshaw et al, 2016; Chen, 2017). Covering key micro-foundations of all the lists above, four emergent categories of dynamic capabilities are put forward in Table 2-20 and elaborated in Table 2-22, 2-23, 2-24 and 2-25.

Based on the three levels of abstraction, open innovation adoption is expressed following the logic from strategy to practice: organizational ambidexterity as higher-level strategy, open innovation as lower-level practice, as well as dynamic capabilities as a medium-level framework to facilitate the linkage in between. The three research questions are formulated to explore specific details of the logic:

RQ1: *What is the relationship between ambidextrous strategy and open innovation?*
RQ2: *What are open innovation related processes under categories of dynamic capabilities?*
RQ3: *How does ambidextrous strategy facilitate structured open innovation adoption through dynamic capabilities?*

Open innovation is linked to organizational ambidexterity in RQ1 and dynamic capabilities in RQ2 respectively, before the three are integrated into a meaningful system in RQ3 which completes the whole logic of adoption from strategy to practice.

Additionally, conducting practices of the three concepts bring about outcomes. Open innovation leads to outcomes of new or improved products, services or processes (innovations) (Chesbrough and Bogers, 2014). There is the self-referencing problem: open innovation is conducted for innovation. A less straightforward alternative is that open innovation capabilities make organizational impact as dynamic capabilities (Chesbrough et al, 2018; Hosseini et

al, 2017). Regarding dynamic capabilities, miscellaneous direct and indirect outcomes from different perspectives are observed (Baretto, 2010; Wilden et al, 2016; Schilke et al, 2018). Comparatively, no straightforward linkage is effectively made between conducts of ambidexterity and organizational performance (Lavie et al, 2010). Despite the difference, dynamic capabilities and organizational ambidexterity converge on the evolutionary perspective to express outcomes: evolutionary fitness of dynamic capabilities (Helfat et al, 2007) and the fittest survive by being ambidextrous (O'Reilly III et al, 2009). The relevance of organizational evolution is coherent with research philosophy adoption (organization as an organism), which is explained in the next section.

5.2 Reflection on research approach

The aim of research is inspired by one pertinent issue in practicality: how to structurally adopt open innovation. As is reflected in theoretical elaboration, one potential logic from strategy to practice is proposed: organizational ambidexterity as strategy, open innovation as practice, and dynamic capabilities as the bridge in between. Generally, research methods in Chapter 3 are coherently designed to effectively explore empirical evidences following the logic of open innovation adoption. One highlight of this research lies on the most abstract level of research philosophy. Philosophically, this research adopts the metaphor of organism to investigate the organization, which regards organizational reality as process (Morgan and Smircich, 1980; Morgan, 2006; Cunliffe, 2011).

The metaphor of organism emphasizes 1) organizational responses to environment, 2) interrelated subsystems supported by processes as parts constituting the holistic organizational system, as well as 3) the alignment between different systems within and beyond organizational boundaries (Morgan, 2006). The metaphor of organism confirms the exploration side of organizational ambidexterity while departs from the knowledge learning perspective (metaphor

of brain) comprising mainstream researches in open innovation and dynamic capabilities as well as the origin of organizational ambidexterity. Neither obvious (confirming the assumptions) nor absurd (denying all the assumptions), the metaphor is interesting to investigate the organizational reality (Alvesson and Sandberg, 2011). Unique insights are derived from conceiving the organization as organism.

To explore organizational processes of open innovation adoption under the metaphor of organism, qualitative research methods boasting richness of data revealing the real-world context is appropriate (Miles et al, 2014; Bryman, 2008; Bryman and Bell, 2015). Referring to the main steps of qualitative research (Bryman and Bell, 2015), this research has adapted the steps to suit idiosyncratic needs. Steps of this research consist of research aim and research design, selection of relevant context, data collection, as well as data analysis and display. Validity and reliability are checked as evaluative criteria of qualitative research. Validity – integrity of conclusions, is achieved through triangulation of data sources and structured display of thick description (Bryman, 2008; Bryman and Bell, 2015; Creswell, 2014). Reliability – repeatability and consistency, results from careful presenting steps of research process (Bryman, 2008; Bryman and Bell, 2015). Big or small, every decision on methods adoption along the steps has been documented and explained. Such transparency further enhances quality of research (Flick, 2007).

Additionally mentioned is the PhD researcher's closeness to the research context. From the beginning, the PhD researcher is recruited as an assistant to work on a parallel consulting project leaded by her supervisor 'Open Innovation Programme: Monitoring and Evaluation Framework' (the SE project). The parallel project allows preferential access to gatekeepers of large Scottish companies (cohort companies) as the research context. Following company interviews and attending cohort meetings, the immersion of the PhD researcher in the context enables in-

depth understanding. Because descriptive details of context may help make sense of what and why certain actions take place (Bryman and Bell, 2015). It is challenging for the PhD researcher to work on two parallel projects with shared context but different emphases: the SE project on open innovation process, while the thesis on integration of open innovation into wider organizational arrangements. The SE project is considered an enabler in general, except for the attachment of non-disclosure agreement forbids sampling beyond the cohort companies.

5.3 Answers and contributions

Based on solid theoretical elaboration and systematically conducted qualitative research, this section provides high-level answers to the three research questions with theoretical contributions and managerial implications demonstrated. This section constitutes a miniature of Chapter 4 Finding and discussion. The answers to the three questions as a whole make the logic of open innovation adoption flow from strategy to practice, thereof the over-arching **aim of research** *"How to adopt open innovation from strategy and practice?"* is addressed. The aim of research in general addresses the gap of strategic adoption of open innovation (Vanhaverbeke and Cloodt, 2014) and grasps the opportunity to study organization-level adoption of open innovation (Bogers et al, 2017). The structure of this section is arranged as follows: Subsection 5.3.1, 5.3.2 and 5.3.3 answer to RQ1, RQ2 and RQ3 respectively.

5.3.1 Open innovation and organizational ambidexterity

RQ1: *"What is the relationship between ambidextrous strategy and open innovation?"*

Understandings of open innovation and organizational ambidexterity are separately shown, before being linked up. This research provides a contextualized redefinition of open innovation: “distributed and collaborative innovation processes that fit with wider organizational system in support of strategy implementation”, based on mainstream definition by Chesbrough and Bogers (2014, p. 17) to emphasize strategic utilization and key words of context. The audit of open innovation activities taking place within research context supports the dominance of outside-in processes of open innovation (Gassmann and Enkel, 2004; Enkel et al, 2009; Chesbrough and Bogers, 2014) as well as formally acknowledges internal collaboration as a useful part of open innovation (Lee and Shin, 2017; Moellers et al, 2018). Moreover, open innovation is shown to be a multi-level phenomenon (Bogers et al, 2017) engaging diverse external partners (Greco et al, 2015).

The strategic paradox of organizational ambidexterity to balance exploration and exploitation has been recognized in the research context (March, 1991; O'Reilly III and Tushman, 2013). The ‘both/and’ approach is confirmed to be favourable to manage organizational ambidexterity (Smith et al, 2010). The difficulty of resource allocation (March, 1991) is practically expressed as barriers people, time and money. Enjoying preferential access to external resources and capabilities (Lavie et al, 2010), open innovation may be an option to release the practical barriers. Evidences on open innovation activities are shown to support all three viable modes of ambidexterity: structural, contextual and sequential (O’Reilly III and Tushman, 2013) as well as the potential to recombine different modes (Kauppila, 2010; O'Reilly III and Tushman, 2013; Chen, 2017). These evidences pave the way to for integrating micro-foundations of open innovation and organizational ambidexterity on level of practice.

More importantly, the two concepts are explicitly linked on level of strategy, which aligns with the research aim to explore strategic adoption of open

innovation (Vanhaverbeke and Cloodt, 2014) and organization-level adoption of open innovation (Bogers et al, 2017). Open innovation contributes to both sides of the strategic paradox of organizational ambidexterity. On the exploitation side, open innovation is a means to improve efficiency. On the exploration side, open innovation shifts the paradox through deliberate exploration of innovative ideas, blue oceans and radical solutions. These emerging linkages support the possibility to address the paradox of organizational ambidexterity in context of open innovation (Gupta et al, 2006; Bogers et al, 2017) and serve as evidences on the realization of organizational ambidexterity within and across organizational boundaries (Lavie and Rosenkopf, 2006; Lavie et al, 2010; Raisch et al, 2009).

5.3.2 Open innovation and dynamic capabilities

RQ2: *"What are open innovation related processes under categories of dynamic capabilities?"*

This section answers this research question by demonstrating the relevance of levels of capability and practice of the organization, to support strategic adoption of open innovation (Vanhaverbeke and Cloodt, 2014) and organization-level adoption of open innovation (Bogers et al, 2017). This research puts forward four emergent themed categories of dynamic capabilities to organize micro-foundations of open innovation with wider organizational activities. In this way, open innovation practices are more explicitly considered micro-foundations under categories of dynamic capabilities (Teece, 2007; Day and Schoemaker, 2016). To create a holistic framework to aid analysis without imposing universal consensus (Lawson and Samson, 2001), the categorization of dynamic capabilities according to theme of relevance exerts influence on all three concepts.

In terms of open innovation, themed categories of dynamic capabilities provide a useful framework to manage structured adoption (Gassman et al, 2010; Huizingh,

2011) and alights a path to systematically investigate practical mechanisms (Stanko et al, 2017). Regarding dynamic capabilities, the categorization overcomes major weakness of current categorization, namely oversight of culture and bottom-up micro-foundations (Teece, 2007; Hosseini et al, 2017). In terms of organizational ambidexterity, each themed category of dynamic capability is capable of accommodating managerial practices with dual strategic orientations of exploration and exploitation (Chen, 2017).

Besides, to categorize dynamic capabilities according to theme of relevance exhibits a clear shift-away from the dominate logic to deconstruct micro-foundations in all three fields. The framework of themed categories of dynamic capabilities provides a useful alternative: 1) to combine different directions of knowledge flow (West and Bogers, 2014) and multiple levels of analysis in open innovation (Chesbrough and Bogers, 2014; Bogers et al, 2017; Gupta et al, 2007), 2) to integrate explorative and exploitative activities under modes of organizational ambidexterity (Birkinshaw et al, 2016; Chen, 2017), as well as 3) to reorganize micro-foundations under dynamic capabilities of sensing, seizing and transforming (Teece, 2007).

After clarifying contributions on the capability level, the practice level is considered. Practices of the three concepts have been merged, because all concepts can be deconstructed on level of practice: open innovation as distributed innovation processes (Chesbrough and Bogers, 2014), dynamic capabilities with subsets of micro-foundations (Teece, 2007; Day and Schoemaker, 2016), and explorative and exploitative activities of organizational ambidexterity (Benner and Tushman, 2003; Trott, 2012). Current typologies of all three concept are separately audited before re-integration: Table 2-12 on categories of dynamic capabilities, Table 2-13 on dynamic capabilities of open innovation, and Table 2-16 and 2-17 on dynamic capabilities of organizational ambidexterity. Table 2-20 shows the ability of the four emergent categories to cover micro-foundations

within current typologies. The four themed categories of dynamic capabilities consist of 1) strategy and leadership, 2) culture and communication, 3) innovation process, and 4) structure and governance.

Following abduction as the line of reasoning in data analysis, subthemes under each category of dynamic capability are either deliberately or emergent. Categories of 1) strategy and leadership, 2) culture and communication and 4) structure and governance are deliberately defined by literature. Sections and subsections of Section 4.2.1, 4.2.2 and 4.2.4, are arranged in exact parallel with themes and subthemes of dynamic capabilities in Table 2-22, 2-23, 2-25 respectively. Comparatively, the subsections in Section 4.2.3 are structured differently from subthemes in Table 2-24, to suit the inherent logic of data occurrence. In addition, supportive micro-foundations of subthemes come from three sources: 1) empirical evidences within research context, 2) more detailed explanation drawn from existing typologies, and 3) additional references on a certain micro-foundation, as is shown in Table 4-9, 4-10, 4-11 and 4-12.

5.3.3 Logic orchestration from strategy to practice

RQ3: *"How does ambidextrous strategy facilitate structured open innovation adoption through dynamic capabilities?"*

RQ3 frames the over-arching aim of research *"How to adopt open innovation from strategy and practice?"* in more specific terms, bringing together all three concepts of open innovation, organizational ambidexterity and dynamic capabilities. This directly fulfils the two gaps targeted by the aim of research, namely strategic adoption of open innovation (Vanhaverbeke and Cloodt, 2014) and organization-level adoption of open innovation (Bogers et al, 2017). Beyond symbolically acknowledging close linkages between each two of the concepts in bibliographic reviews of all three concepts (Randhawa et al, 2016; Wilden et al,

2016; Wilden et al, 2018), the answering of RQ3 originally integrates the three concepts along levels of strategy, capability and practice to form the logic of open innovation adoption from strategy to practice.

The answering of RQ3 is based on RQ1 and RQ2. RQ1 provides the relevance of organizational ambidexterity to open innovation, on levels of strategy and practice. RQ2 demonstrates the usefulness of dynamic capabilities as a framework to manage open innovation practices, on level of capability and practice. Besides, the linkage between strategy and capability has already made in literature: the strategic paradox of organizational ambidexterity relies on dynamic capabilities to utilize business opportunities (Teece, 2007; O'Reilly and Tushman, 2013). Hitherto, linkages among all three levels of strategy, capability and practice have been made. Open innovation adoption follows the logic from strategy to practice: organizational ambidexterity as strategy, dynamic capabilities as medium-level framework, and open innovation as supportive micro-foundations.

The answer of RQ3 is not a simple reiteration of RQ1 and RQ2, but rather a higher-level integration on the logic of open innovation adoption expressed in a language that is understandable to managers. Built on prototype of theoretical framework in Figure 2-10 as well as drawing on both theoretical and empirical evidences (Section 2.4.3, Section 4.1 and Section 4.2), the framework in Figure 4-10 fully explains the logic of open innovation adoption from strategy to practices with concrete evidences. The framework clearly exhibits the three levels of strategy, capability and practice in relation to open innovation adoption, which contains two major managerial implications.

First, the framework reveals the logic of managerial actions regarding open innovation adoption from strategy to practice: 1) formulate a specific purpose of open innovation that supports either exploration or exploration on level of strategy, 2) select relevant category or categories of dynamic capabilities to

support strategic implementation on level of capability, and 3) make decisions on which micro-foundation(s) of open innovation to work with and how to practically apply on level of practice. Second, the framework provides a reference point for organizations to diagnose and benchmark coherent adoption of open innovation over time. The framework assists identifying gaps of the past, determining actions of the present as well as renewing to allow for change in the future.

5.3.4 Relevance of organizational evolution

Regarding outcomes of open innovation adoption, the relevance of organizational evolution is discussed as an interesting finding of this research. Philosophically, this research investigates the organization as an organism (an open system with interacting processes) (Morgan, 2006). Organizations should evolve in a similar way as organisms (O'Reilly III et al, 2009). Although, there have been differences in demonstrating outcomes of three concepts (Chesbrough and Bogers, 2014; Baretto, 2010; Wilden et al, 2016; Schilke et al, 2018; Lavie et al, 2010), the three concepts converge on the evolutionary perspective of organization: the fittest survive through organizational ambidexterity (O'Reilly III et al, 2009), evolutionary fitness of dynamic capabilities (Helfat et al, 2007), as well as open innovation capabilities impacting as dynamic capabilities (Chesbrough et al, 2018; Hosseini et al, 2017). Considering the relatively indirect linkage between open innovation and organizational evolution, it has been hard for interviewees to clearly articulate. Therefore, this contribution is more theoretical than managerial.

5.4 Limitation and future research

Limitations are not necessarily bad things, because every limitation affords the opportunity of future investigation. Limitations and opportunities are presented theoretically, methodologically and linguistically.

Theoretically, this research positions itself as one useful logic to organize strategic adoption of open innovation, without claiming to be a perfect solution for all. This research has acknowledged the existence of other alternatives, such as proactive strategy archetypes of innovation management (Bader and Enkel, 2014). Besides, from strategy to practice, each level of strategy, capability and micro-foundations is open for future research: 1) whether the framework of dynamic capabilities with supportive open innovation practice can help address other strategic paradoxes than organizational ambidexterity, 2) whether there are alternatives to dynamic capabilities that can serve as the medium-level framework between strategy and practice, and 3) whether there are missing or emerging open innovation practices that support dynamic capabilities.

Another theoretical limitation is that no descriptor has been attached to the categories of dynamic capabilities, because this research holds that the categories of dynamic capabilities are collectively defined by underlying subthemes and micro-foundations. The intention to have a framework of dynamic capabilities is to put scattered innovation-related capabilities into categories to aid analysis rather than impose universal understanding (Lawson and Samson, 2001). Moreover, the processes are not in isolation but interacting as an open system under the organizational metaphor of organism (Morgan, 2006), therefore a certain process is only more relevant instead of strictly attached to a certain theme or subtheme of dynamic capabilities. Rather than arguing for a fixed universal best framework of dynamic capabilities to organize open innovation practices, the categories are left open and flexible for other researchers to interpret thus inspiring conversation for the future.

Methodologically, “The use of metaphor implies *a way of thinking* and *a way of seeing* that pervade how we understand our world generally” (Morgan, 2006, p. 4). The criterion of decision-making on metaphor application is whether the metaphor can provide fresh ways of understanding and shaping organizational

situations that we want to organize and manage (Morgan, 2006). This research brings the metaphor of organism forward to effectively probe organizational reality, with alternative metaphors of machine, brain, and culture descending to supportive subsystems in the background. However, "Metaphor is inherently paradoxical. It can create powerful insights that also becomes distortions, as the way of seeing created through a metaphor becomes a way of *not* seeing" (Morgan, 2006, p. 5). Each metaphor is associated with several strengths and weaknesses, as is demonstrated in Table 5-1. Therefore, it is encouraged to consider other metaphors, when investigating alternative organizational reality to suit particular needs of research.

Table 5-1: Metaphors of organization (Summarized from Morgan, 2006)

Metaphor	Description	Strengths	Weaknesses
Machine	When managers think of organizations as machines they tend to manage and design them as machines made up of interlocking parts that each play a clearly defined role in the functioning of the whole.	Mechanistic approaches works well under conditions where machine works well: when there is • Straightforward task, • Stable environment, • Same product time and again, • Precision at premium, and • Compliant human.	• (Organizational forms) difficult to adapt to changing circumstances. • Mindless bureaucracy. • Unanticipated consequence from individual interest. • Dehumanizing effects among lower-level employees.
Organism	This popular metaphor focuses attention on understanding and managing organizational "needs" and environmental relations.	• Emphasis on open system and on-going processes. • Systematic attention to satisfy needs to survive. • Interacting processes internally and in relation to the environment. • Different species of organization as options. • Virtue of organic forms in the process of innovation. • Contribute to theory of organizational evolution. • Focus on ecology and inter-organizational relations.	• Organizations are socially constructed, compared to objective nature. • Assumption of functional unity where everyone is pulling together. • The danger of metaphor becoming normative guideline for organizing practices.

Brain	The metaphor draws attention to the importance of information processing, learning, and intelligence.	• Identify requirements of learning organizations. • Imply how information technology supports the development of learning organization. • Rethink key management principles in the new information age.	• No coherent image of brain – problem of self-reference. • Overlook important conflicts of power and control during learning and self-organizing. • Strong normative bias – continuous learning as an end in itself
Culture	(Organization as cultures focus) on the values, ideas, beliefs, norms, rituals, and other patterns of shared meaning that guide organizational life.	• Direct attention to symbolic significance of aspects of organization. • Organization rests in shared systems of meaning. • Recognize socially constructed nature of organization's relation to environment. • Help to understand organization change (images and value).	• Ideological manipulation may accompanied by resistance, resentment and mistrust. • Culture is not measurable on a scale due to its nature as lived experience.
Flux and transformation	We are invited to understand organization as flux and transformation by focusing on the logics of change shaping social life.	• Seek to fathom the logic of change. • Organization survives with the environment in gestalt patterns. • Reframing paradoxes may create new path of development. • Change is emergent, but insights can help to determine how and where to intervene.	• Change is never in control. It is a powerless power. • Order of change is only apparent hindsight.

The shift of organizational metaphor opens up abundant avenues for future research. The metaphor of culture is shown as an example. There exists research on cultural norms to support (open) innovation adoption captured in Section 4.2.2.1 (Enkel, 2018a; Ahmed, 1998). More interesting, dimensions of strategy, structure, mechanisms, behaviours and communication have been considered as determinants of organizational culture that influence creativity and innovation (Martins and Terblanche, 2003). Therefore, culture may potentially serve as an alternative integrator of micro-foundations alternative to dynamic capabilities, constituting a cultural solution to open innovation. Furthermore, Table 5-1 covers an additional metaphor of interest: 'flux and transformation' with emphasis on

revealing the logic of change (Morgan, 2006). For example, Anthony et al (2017) provides the formula 'A + B + C = Δ' to guide organizational transformation to utilize opportunities of disruption. To introduce the change Δ: Transformation A repositions today's business to maximize resilience, Transformation B creates separate new growth, and C represents capability connections between Transformation A and B (Anthony et al, 2017). Alternative logics to study organizational change for (open) innovation awaits revealing.

Some additional methodological limitations are covered below. Contextually, this research emphasizes the potential of transferable learnings between the public and private sector (Choi and Chandler, 2015). However, the management of public sector differs from private sector in terms of more bureaucracy in structure, less materialistic managerial value and weaker linkage between performance and reward (Boyne, 2002). The influence of these differences on open innovation adoption is left for others to explore. Moreover, the public sector has some unique topics to investigate, such as finding solutions to wicked problems (Bogers et al, 2017), open innovation platforms (Mergel and Desouza, 2013) and city-level collaborative business models (Cohen et al, 2016). Another contextual gap is to investigate the usefulness of the logic of open innovation adoption from strategy to practices in other contexts.

Regarding methods of data collection, observation as an alternative to interviews and documents is suggested, which has been a declined opportunity by the gatekeepers within the research context. Besides, a longitudinal perspective of investigation is worthy of consideration. As organizations are transforming to survive environmental uncertainties, the phenomenon of open innovation keeps evolving in real-world context. The cohort companies on the SE project keep on learning new topics relevant to open innovation such as how to design value proposition to commercialize innovation. This research merely offers a snapshot of open innovation adoption of cohort companies along the SE project at this

point in time. Think wider, there is going to be experimentation of diverse open innovation practices in different contexts, which require continuous investigation and appropriate documentation.

Additionally, another limitation lies in the utilization of language. On level of practice, this research does not differentiate words of practice, process, activity, action and micro-foundation. There is no indication to distinguish these words of all three concepts. Besides, books on research methods do not differentiate these words to describe the nature of reality (ontology). For example, "processes, experiences and practices" are not seen as different things in *Research Methods for Business Students* (Saunders et al, 2016, p. 136-137). Additionally, dictionary meaning of these words used as noun is landscaped with relevant excerpts captured in Table 5-2. It is not hard to notice that the words of practice, process, activity and action reference each other to clarify respective meaning. There is no such word as micro-foundation in the dictionary, which is very likely an invented word specifically referring to underlying groundwork of dynamic capabilities (Teece, 2007). More discreet application of words and general mindfulness of language are suggested in future research.

Table 5-2: Dictionary meaning of words to describe practice level of understanding (Oxford English Dictionary, 2019)

	Dictionary meanings
Practice	1a. The actual application or use of an idea, belief, or method, as opposed to the theory or principles of it; performance, execution, achievement; working, operation. 1b. An action, a deed; an undertaking, a proceeding. 1c. The action of doing something; method of action or working. 2. Repeated exercise in or performance of an activity so as to acquire, improve, or maintain proficiency in it.
Process	I. Going on, continuous action, proceeding. 1. That which goes on or is carried on; a continuous action, or series of actions or events; a proceeding; (occasionally) a course or mode of action, a procedure. 2. Succession of things in order; sequence; progression. 3. A continuous and regular action or succession of actions occurring or performed in a definite manner, and having a particular result or outcome; a sustained operation or series of operations. (Now the most common use.)

Activity	1. The state of being active; the quality or condition of being an agent or of performing an action or operation; the exertion of energy, force, or influence. 2. Something which a person, animal, or group chooses to do; an occupation, a pursuit.
Action	I. Something that is done. 1. Something done or performed, a deed, an act; (in plural) habitual or ordinary deeds, conduct. II. The process or action of doing. 1a. With reference to a person or other entity regarded as capable of acting in an intentional manner: the performance of some activity or deed, typically to achieve an objective; acting, activity (as opposed to passivity or contemplation). 2b. With reference to a narrative work, period of time, etc.: the occurrence of events and activity, (now esp.) of a dynamic, exciting, or energetic nature; happenings, incidents; eventfulness.
Micro-foundation	No dictionary entries found for 'micro-foundation'.
Foundation	1. The action of founding or building upon a firm substructure. 2. *Figurative.* The action of establishing, instituting, or constituting on a permanent basis. 3. *Figurative.* a. A basis or groundwork on which something (immaterial) is raised or by which it is supported or confirmed; an underlying ground or principle; the basis on which a story, fiction, or the like is founded. b. *Plural.* The underlying principles or logical basis (of a subject), esp. as a separate matter for study.

5.5 Summary

This chapter captures the storyline answering to the **aim of research**: *"How to adoption open innovation from strategy to practice?"* All chapters are reflected to press for a higher-order synthesis within and between chapters, which guarantees the coherency of storyline on the journey of open innovation adoption. The reflection is arranged in the following sequence:

1) Literature review – theoretical background and research aim/questions;

2) Methodology – philosophical considerations and research process;

3) Finding and discussion – answers discussed with literary and empirical evidences as well as research contributions.

Section 5.1 reviews literature on concepts of organizational ambidexterity and dynamic capabilities together with open innovation, in order to inform structured

adoption of open innovation. After demonstrating the relevance of the three concepts on levels of strategy, capability and practice, this research proposes a unique logic of open innovation from strategy to practice: organizational ambidexterity as high-level strategy, dynamic capabilities as medium-level framework and open innovation as low-level practice. Based on theoretical elaboration, three research questions are designed to explore part of how the logic open innovation adoption flows from strategy to practice (aim of research):

RQ1 explores organizational ambidexterity as the strategic anchor to facilitate strategic alignment;
RQ2 investigates dynamic capabilities as the structure to organize open innovation practices to support strategic implementation;
RQ3 constitutes researcher interpretation to make the logic flow from strategy to practice with emphasis on managerial action.

Section 5.2 highlights some critical decisions on research methods adoption to address the research aim and questions. Philosophically, this research conceives the image of organization as an organism and investigates organizational reality as process, which represents a departure from mainstream understanding of all three concepts that views the organization as brain. Practically on methods adoption, qualitative business research have been systematically designed and followed in order to reveal the complexity of the phenomenon and locate rich empirical evidences regarding structured open innovation adoption. The quality of research is evaluated by checking two major criteria of qualitative research: validity and reliability. Additionally discussed is the unique researcher-context relationship, both an enabler and a barrier.

Section 5.3 presents finding and discussion by providing high-level answers to all three research questions, based on systematically conducted qualitative methods. **RQ1** is answered by recognizing open innovation contributes to both sides of the

strategic paradox of ambidexterity: improving efficiency (exploitation) as well as deliberate pursuing innovative ideas, blue oceans and radical solutions (exploration), on level of strategy. **RQ2** is answered by exhaustively finding and integrating evidences on open innovation practices to support themed categories of dynamic capabilities, on levels of capability and practice. Based on findings of RQ1 and RQ2, **RQ3** orchestrates the logic of open innovation adoption from strategy to practice, by putting forward a framework covering key decisions on all levels of strategy, capability and practice. The framework is presented in a user-friendly format ready for managerial action, either benchmarking or adjustment.

Three contributions have been brought about by answering to the research questions:

1) Theoretically, two major gaps of open innovation – organization-level adoption (Bogers et al, 2017) and strategic adoption (Vanhaverbeke and Cloodt, 2014), are addressed by drawing on concepts of organizational ambidexterity and dynamic capabilities. To categorize dynamic capabilities according to theme of relevance provides a useful alternative to mainstream logics to deconstruct micro-foundations regarding all three concepts, which combines different directions of knowledge flow (West and Bogers, 2014) and multi-level adoption of open innovation (Chesbrough and Bogers, 2014; Bogers et al, 2017), reintegrates activities under modes of ambidexterity (Birkinshaw et al, 2016; Chen, 2017), as well as reorganizes micro-foundations under dynamic capabilities of sensing, seizing and transforming (Teece, 2007). Besides, to integrate the three concepts as a system in open innovation adoption provides concrete evidences to support symbolic cross-concept linakges made in bibliographic reviews of all three concepts (Randhawa et al, 2016; Wilden et al, 2016; Wilden et al, 2018).

2) Methodologically, the interesting metaphor of organism is adopted to investigate the organization, which emphasizes holistic organizational system with

interrelated subsystems supported by processes responding to environment (Morgan, 2006). Under the metaphor of organism, the organizational reality is considered as process (Morgan and Smircich, 1980; Cunliffe, 2011), which affords the opportunity to merge micro-foundations of all three concepts: open innovation as distributed innovation processes (Chesbrough and Bogers, 2014), dynamic capabilities with subsets of micro-foundations (Teece, 2007; Day and Schoemaker, 2016) and explorative and exploitative activities of organizational ambidexterity (Benner and Tushman, 2003; Trott, 2012).

3) Practically, the logic from strategy to practice provides an actionable framework for managers to organize structured adoption of open innovation practices, with organizational ambidexterity as strategy and dynamic capabitlies as structure. The framework serves as a reference point for organizations to diagnose and benchmark coherent adoption of open innovation over time. Details of the framework can further fill in some scattered gaps within the three concepts, such as to addresss the paradox of organizational ambidexterity in context of open innovation (Gupta et al, 2006; Bogers et al, 2017), profession guidance to manage open innovation (Gassman et al, 2010; Huizingh, 2011), investigation of open innovation practices (Stanko et al, 2017), as well as oversight of culture and bottom-up micro-foundations under dynamic capabilities (Teece, 2007; Hosseini et al, 2017).

Additionally, Section 5.4 discusses limitations and opportunities of future research, theoretically, methodologically and linguistically. Theoretically, this research advocates itself as one useful solution to inform structured adoption of open innovation, without denying the existence of alternatives. Moreover, all three levels of strategy, capabilities and practice are potentially open for future research. Methodologically, alternative metaphors such as ‘culture’ and ‘flux and transformation’ are suggested to address other organizational problems of open innovation adoption. Besides, observation and longitudinal study are proposed as

research methods worthy of exploring in the future. Linguistically, discreet application of words and general mindfulness of language are suggested. As openness is advocated by open innovation, this research looks out to the future by welcoming open interpretation, discussion and collaboration.

References

Afuah, A. and Tucci, C. L. (2012) 'Crowdsourcing as a solution to distant search'. *Academy of Management Review*, 37(3), pp. 355-375.

Ahmed, P. K. (1998) 'Culture and climate for innovation'. *European Journal of Innovation Management*, 1(1), pp. 30-43.

Alvesson, M. and Sandberg, J. (2011) 'Generating research questions through problematization'. *The Academy of Management Review*, 36(2), pp. 247-271.

Amit, R. and Zott, C. (2012) 'Creating value through business model innovation'. *MIT Sloan Management Review*, 53(3), pp. 41-49.

Andriopoulos, C. and Lewis, M. W. (2009) 'Exploitation-exploration tensions and organizational ambidexterity: managing paradoxes of innovation'. *Organization Science*, 20(4), pp. 696-717.

Anthony, S. D., Gilbert, C. G. and Johnson, M. W. (2017) *Dual Transformation: How to Reposition Today's Business While Creating the future*. Boston, Massachusetts: Harvard Business Review Press.

Antons, D., Kleer, R. and Salge, T. O. (2016) 'Mapping the topic landscape of JPIM, 1984–2013: In search of hidden structures and development trajectories'. *Journal of Product Innovation Management*, 33(6), pp. 726-749.

Antons, D. and Piller, F. T. (2015) 'Opening the black box of "Not Invented Here": Attitudes, decision biases, and behavioral consequences'. *The Academy of Management Perspectives*, 29(2), pp. 193-217.

Appleyard, M. M. and Chesbrough, H. W. (2017) 'The dynamics of open strategy: from adoption to reversion'. *Long Range Planning*, 50(3), pp. 310-321.

Armstrong, G., Kotler, P., Harker, M. and Brennan, R. (2015) *Marketing: An Introduction*. 3rd edn. Harlow: Pearson Education Limited.

Augier, M. and Teece, D. J. (2007) 'Dynamic capabilities and multinational enterprise: Penrosean insights and omissions'. *Management International Review*, 47(2), pp. 175-192.

Augier, M. and Teece, D. J. (2008) 'Strategy as evolution with design: The foundations of dynamic capabilities and the role of managers in the economic system'. *Organization Studies*, 29(8-9), pp. 1187-1208.

Augier, M. and Teece, D. J. (2009) 'Dynamic capabilities and the role of managers in business strategy and economic performance'. *Organization Science*, 20(2), pp. 410-421.

Bader, K. and Enkel, E. (2014) 'Understanding a firm's choice for openness: Strategy as determinant'. *International Journal of Technology Management*, 66(2/3), pp. 156-182.

Baghai, M., Coley, S., and White, D. (1999) *The Alchemy of Growth*. Reading, MA: Perseus Books.

Barney, J. (1991) 'Firm resources and sustained competitive advantage'. *Journal of Management*, 17(1), pp. 99-120.

Barreto, I. (2010) 'Dynamic capabilities: a review of past research and an agenda for the future'. *Journal of Management*, 36(1), pp. 256-280.

Benner, M. J. and Tushman, M. L. (2003) 'Exploitation, exploration, and process management: the productivity dilemma revisited'. *The Academy of Management Review*, 28(2), pp. 238-256.

Benner, M. J. and Tushman, M. L. (2015) 'Reflections on the 2013 decade award—"exploitation, exploration, and process management: the productivity dilemma revisited" ten years later'. *Academy of Management Review*, *40*(4), pp. 497-514.

Berkhout, G., Hartmann, D. and Trott, P. (2010) 'Connecting technological capabilities with market needs using a cyclic innovation model'. *R&D Management*, 40(5), pp. 474-490.

Billington, C. and Davidson, R. (2013) 'Leveraging open innovation using intermediary networks'. *Production and Operations Management*, 22(6), pp. 1464-1477.

Birkinshaw, J. and Gupta, K. (2013) 'Clarifying the distinctive contribution of ambidexterity to the field of organization studies'. *Academy of Management Perspectives*, 27(4), pp. 287-298.

Birkinshaw, J., Zimmermann, A. and Raisch, S. (2016) 'How Do Firms Adapt to Discontinuous Change? Bridging the Dynamic Capabilities and Ambidexterity Perspectives'. *California Management Review*, 58(3), pp. 36-58.

Bogdan, R. C. and Biklen, S. K. (1992) *Qualitative Research for Education: An Introduction to Theory and Methods*. Boston: Allyn & Bacon.

Bogers, M., Afuah, A. and Bastian, B. (2010) 'Users as innovators: a review, critique, and future research directions'. *Journal of management*, 36(4), pp. 857-875.

Bogers, M., Chesbrough, H. and Moedas, C. (2018) 'Open innovation: research, practices, and policies'. *California Management Review*, 60(2), pp. 5-16.

Bogers, M. and Lhuillery, S. (2011) 'A functional perspective on learning and innovation: Investigating the organization of absorptive capacity'. *Industry and Innovation*, 18(6), pp. 581-610.

Bogers, M., Zobel, A.K., Afuah, A., Almirall, E., Brunswicker, S., Dahlander, L., Frederiksen, L., Gawer, A., Gruber, M., Haefliger, S. and Hagedoorn, J., Hagedoorn, J., Hilgers, D., Laursen, K., Magnusson, G. M., Majchrzak, A., McCarthy, I. P., Moeslein, K. M., Nambisan, S., Piller, F. T., Radziwon, A., Rossi-Lamastra, C., Sims, J. and ter Wal, A. L. J. (2017) 'The open innovation research landscape'. *Industry and Innovation*, 24(1), pp. 8-40.

Boyatzis, R. E. (1998) *Transforming Qualitative Information: Thematic Analysis and Code Development*. Thousand Oaks, California: Sage Publications, Inc.

Boyne, G. A. (2002) 'Public and private management: What's the difference?' *Journal of Management Studies*, 39(1), pp. 97-122.

Braun, V. and Clarke, V. (2006) 'Using thematic analysis in psychology'. *Qualitative Research in Psychology*, 3(2), pp. 77-101.

Brown, T. (2008) 'Design thinking'. *Harvard Business Review.* Digital article. Available at: https://fusesocial.ca/wp-

content/uploads/sites/2/2018/06/Design-Thinking.pdf (Accessed: 14 April 2019).

Brown, S. L. and Eisenhardt, K. M. (1997) 'The art of continuous change: Linking complexity theory and time-paced evolution in relentlessly shifting organizations'. *Administrative Science Quarterly*, 42, pp. 1-34.

Brown, T. and Katz, B. (2011) 'Change by design'. *Journal of Product Innovation Management*, 28(3), pp. 381-383.

Bryman, A. and Bell, E. (2015) *Business Research Methods*. 4th edn. Oxford: Oxford University Press.

Bryman, A. (2008) *Social Research Methods*. 3rd edn. Oxford: Oxford University Press.

Burns, T. and Stalker, G. M. (1961) *The Management of Innovation*. London: Tavistock.

Chen, Y. (2017) 'Dynamic ambidexterity: How innovators manage exploration and exploitation'. *Business Horizons*, 60(3), pp. 385-394.

Chesbrough, H. (2003) *Open innovation: The new imperative for creating and profiting from technology*. Boston: Harvard Business School Press.

Chesbrough, H. (2006a) *Open Business Models: How to Thrive in the New Innovation Landscape*. Boston: Harvard Business School Publishing.

Chesbrough, H. (2006b) 'Open innovation: A new paradigm for understanding industrial innovation', in Chesbrough, H., Vanhaverbeke, W. and West, J. (eds.) *Open Innovation: Researching a New Paradigm*. Oxford: Oxford University Press, pp. 1-12.

Chesbrough, H. (2012). 'Open innovation: Where we've been and where we're going'. *Research-Technology Management*, 55(4), pp. 20-27.

Chesbrough, H. W. and Appleyard, M. M. (2007) 'Open innovation and strategy'. *California Management Review*, 50(1), pp. 57-76.

Chesbrough, H. and Bogers, M. (2014) 'Explicating open innovation: clarifying an emerging new paradigm for understanding innovation', in Chesbrough, H.,

Vanhaverbeke, W. and West, J. (eds.) *New Frontiers in Open innovation*. Oxford: Oxford University Press, pp. 3-28.

Chesbrough, H. and Brunswicker, S. (2013) 'Managing open innovation in large firms'. *Stuttgart: Fraunhofer Institute for Industrial Engineering*. Digital article. Available at: http://ibbnetzwerk-gmbh.com/uploads/media/Fraunhofer_IAO_-_Open_Innovation.pdf (Accessed: 31 January 2018).

Chesbrough, H. and Brunswicker, S. (2014) 'A fad or a phenomenon? The adoption of open innovation practices in large firms'. *Research-Technology Management*, 57(2), pp. 16-25.

Chesbrough, H. and Crowther, A. K. (2006) 'Beyond high tech: early adopters of open innovation in other industries'. *R&D Management*, 36(3), pp. 229-236.

Chesbrough, H., Lettl, C. and Ritter, T. (2018) 'Value creation and value capture in open innovation'. *Journal of Product Innovation Management*, 35(6), pp. 930-938.

Chiaroni, D., Chiesa, V. and Frattini, F. (2010) 'Unravelling the process from Closed to Open Innovation: evidence from mature, asset-intensive industries'. *R&D Management*, 40(3), pp. 222-245.

Chiaroni, D., Chiesa, V. and Frattini, F. (2011) 'The Open Innovation Journey: How firms dynamically implement the emerging innovation management paradigm'. *Technovation*, 31(1), pp. 34-43.

Choi, T. and Chandler, S. M. (2015) 'Exploration, exploitation, and public sector innovation: An organizational learning perspective for the public sector'. *Human Service Organizations: Management, Leadership & Governance*, 39(2), pp. 139-151.

Cohen, B., Almirall, E. and Chesbrough, H. (2016) 'The city as a lab: Open innovation meets the collaborative economy'. *California Management Review*, 59(1), pp. 5-13.

Cohen, W. M. and Levinthal, D. A. (1990) 'Absorptive capacity: A new perspective on learning and innovation'. *Administrative Science Quarterly*, 35(1), pp. 128-152.

Cooper, R. G. (2008) 'Perspective: The stage-gates ® idea-to-launch process - Update, what's new, and NexGen systems'. *Journal of Product Innovation Management*, 25(3), pp. 213-232.

Cooper, R. G. (2014) 'What's Next?: After Stage-Gate'. *Research-Technology Management*, 57(1), pp. 20-31.

Cooper, R. G. (2016) 'Agile-stage-gate Hybrids: the next stage for product development'. *Research-Technology Management*, 59(1), pp. 21-29.

Cooper, R. G. and Edgett, S. J. (2008) 'Ideation for product innovation: What are the best methods?' *PDMA Visions Magazine.* Digital article. Available at: https://www.stage-gate.com/wp-content/uploads/2018/06/wp_29.pdf

Cooper, R., Junginger, S. and Lockwood, T. (2009) 'Design thinking and design management: A research and practice perspective'. *Design Management Review*, 20(2), pp. 46-55.

Cooper, R. G. and Sommer, A. F. (2016) 'Agile-Stage-Gate: New idea-to-launch method for manufactured new products is faster, more responsive'. *Industrial Marketing Management*, 59, pp. 167-180.

Creswell, J. W. (2013) *Qualitative Inquiry and Research Design: Choosing among Five Approaches*. 3rd edn. Thousand Oaks, California: Sage Publications, Inc.

Creswell, J. W. (2014) *Research Design: Qualitative, Quantitative, & Mixed Methods Approaches*. 4th edn. Thousand Oaks, California: Sage Publications, Inc.

Dahlander, L. and Gann, D. M. (2010) 'How open is innovation?' *Research Policy*, 39(6), pp. 699-709.

Day, G. S. (2011) 'Closing the marketing capabilities gap'. *Journal of marketing*, 75(4), pp. 183-195.

Day, G.S. and Schoemaker, P.J. (2016) 'Adapting to Fast-Changing Markets and Technologies'. *California Management Review*, 58(4), pp. 59-77.

Diener, E. and Crandall, R. (1978) *Ethics in Social and Behavioral Research*. Chicago: University of Chicago Press.

Di Stefano, G., Peteraf, M. and Verona, G. (2010) 'Dynamic capabilities deconstructed‡: a bibliographic investigation into the origins, development, and future directions of the research domain'. *Industrial and Corporate Change*, 19(4), pp. 1187-1204.

Di Stefano, G., Peteraf, M. and Verona, G. (2014) 'The organizational drivetrain: A road to integration of dynamic capabilities research'. *Academy of Management Perspectives*, 28(4), pp. 307-327.

Dodgson, M., Gann, D. M. and Salter, A. J. (2008) *The Management of Technological Innovation: Strategy and Practice*. Oxford: Oxford University Press.

Duncan, R. B. (1976) 'The ambidextrous organization: Designing dual structures for innovation', in Kilmann, R. H., Pondy, L. R. and Slevin, D. (eds.) *The Management of Organization* (1 vols). New York: North-Holland, pp. 167–188.

Dyer, J., Furr, N. and Lefrandt, C. (2014) 'The Industries Plagued by the Most Uncertainty'. *Harvard Business Review*. Digital article. Available at: https://hbr.org/2014/09/the-industries-plagued-by-the-mostuncertainty (Accessed: 26 January 2018).

Eisenhardt, K. M. and Martin, J. A. (2000) 'Dynamic capabilities: what are they?' *Strategic Management Journal*, 21(10-11), pp. 1105-1121.

Eisenhardt, K. M., Furr, N. R. and Bingham, C. B. (2010) 'Microfoundations of performance: balancing efficiency and flexibility in dynamic environments'. *Organization Science*, 21(6), pp. 1263-1273.

Ellwood, P., Grimshaw, P. and Pandza, K. (2017) 'Accelerating the innovation process: a systematic review and realist synthesis of the research literature'. *International Journal of Management Reviews*, 19(4), pp. 510-530.

Enkel, E. (2018a) ‘Entrepreneurial culture’. [PowerPoint presentation]. *Open Innovation Programme Cohort 2, Meeting 2.* Glasgow, Scotland, 30 November, 2018.

Enkel, E. (2018b) ‘Open innovation – strategic fit, maturity and measurement’. [PowerPoint presentation]. *Open Innovation Programme Cohort 2, Meeting 2.* Glasgow, Scotland, 30 November, 2018.

Enkel, E., Bell, J. and Hogenkamp, H. (2011) ‘Open innovation maturity framework’. *International Journal of Innovation Management*, 15(06), pp. 1161-1189.

Enkel, E., Gassmann, O. and Chesbrough, H. (2009) ‘Open R&D and open innovation: exploring the phenomenon’. *R&D Management*, 39(4), pp. 311-316.

Fainshmidt, S., Pezeshkan, A., Lance Frazier, M., Nair, A. and Markowski, E. (2016) ‘Dynamic capabilities and organizational performance: A meta-analytic evaluation and extension’. *Journal of Management Studies*, 53(8), pp. 1348-1380.

Felin, T., Foss, N. J., Heimeriks, K. H. and Madsen, T. L. (2012) ‘Microfoundations of routines and capabilities: Individuals, processes, and structure’. *Journal of Management Studies*, 49(8), pp. 1351-1374.

Felin, T. and Powell, T. C. (2016) ‘Designing organizations for dynamic capabilities’. *California Management Review*, 58(4), pp. 78-96.

Fiol, C. M. and Lyles, M. A. (1985) ‘Organizational learning’. *The Academy of Management Review*, 10(4), pp. 803-813.

Fisher, W. and Kinnemeyer, K. (2018) ‘Organizational design for innovation’. [PowerPoint presentation]. *Launch meeting: Open Innovation Cohort 2.* Glasgow, Scotland, 14 September, 2018.

Flick, U. (2007) *Managing Quality in Qualitative Research*. London: SAGE Publications Ltd.

Foss, N. J., Lyngsie, J. and Zahra, S. A. (2013) 'The role of external knowledge sources and organizational design in the process of opportunity exploitation'. *Strategic Management Journal*, 34(12), pp. 1453-1471.

Gassmann, O. (2006) 'Opening up the innovation process: towards an agenda'. *R&D Management*, 36(3), pp. 223-228.

Gassmann, O. and Enkel, E. (2004) 'Towards a theory of open innovation: three core process archetypes'. *R&D Management Conference*. Lisbon, Portugal, 6 - 9 July 2004.

Gassmann, O., Enkel, E. and Chesbrough, H. (2010) 'The future of open innovation'. *R&D Management*, 40(3), pp. 213-221.

Gianiodis, P. T., Ellis, S. C. and Secchi, E. (2010) 'Advancing a typology of open innovation'. *International Journal of Innovation Management*, 14(04), pp. 531-572.

Gibson, C. B. and Birkinshaw, J. (2004) 'The antecedents, consequences, and mediating role of organizational ambidexterity'. *The Academy of Management Journal*, 47(2), pp. 209-226.

Gioia, D. A., Patvardhan, S. D., Hamilton, A. L. and Corley, K. G. (2013) 'Organizational identity formation and change'. *Academy of Management Annals*, 7(1), pp. 123-193.

Grant, R. M. (1996) 'Toward a knowledge-based theory of the firm'. *Strategic Management Journal*, 17(Winter Special Issue), pp. 109-122.

Greco, M., Grimaldi, M. and Cricelli, L. (2015) 'Open innovation actions and innovation performance: a literature review of European empirical evidence'. *European Journal of Innovation Management*, 18(2), pp. 150-171.

Grönlund, J., Sjödin, D. R. and Frishammar, J. (2010) 'Open innovation and the stage-gate process: a revised model for new product development'. *California Management Review*, 52(3), pp. 106-131.

Gupta, A. K., Smith, K. G. and Shalley, C. E. (2006) 'The interplay between exploration and exploitation'. *The Academy of Management Journal*, 49(4), pp. 693-706.

Gupta, A. K., Tesluk, P. E. and Taylor, M. S. (2007) 'Innovation at and across multiple levels of analysis'. *Organization Science*, 18(6), pp. 885–897.

Helfat, C. E., Finkelstein, S., Mitchell, W. Peteraf, M. A., Singh, H., Teece, D. J. and Weinter, S. G. (2007) *Dynamic capabilities: Understanding Strategic Change in Organizations.* Malden, MA: Blackwell Publishing.

Helfat, C. E. and Martin, J. A. (2015) 'Dynamic managerial capabilities: Review and assessment of managerial impact on strategic change'. *Journal of Management*, *41*(5), pp.1281-1312.

Helfat, C. E. and Peteraf, M. A. (2015) 'Managerial cognitive capabilities and the microfoundations of dynamic capabilities'. *Strategic Management Journal*, *36*(6), pp. 831-850.

Helfat, C. E. and Winter, S. G. (2011) 'Untangling dynamic and operational capabilities strategy for the (n)ever-changing world'. *Strategic Management Journal*, 32(11), pp. 1243-1250.

Hong, J. F. L., Zhao, X. and & Snell R. S. (2018) 'Collaborative-based HRM practices and open innovation: a conceptual review'. *The International Journal of Human Resource Management*. Available at: https://www.tandfonline.com/doi/full/10.1080/09585192.2018.1511616 (Accessed: 26 January 2019).

Hosseini, S., Kees, A., Manderscheid, J., Röglinger, M., and Rosemann, M. (2017) 'What does it take to implement open innovation? Towards an integrated capability framework'. *Business Process Management Journal*, 23(1), pp. 87-107.

Huizingh, E. K. (2011) 'Open innovation: State of the art and future perspectives'. *Technovation*, 31(1), pp. 2-9.

Huston, L. and Sakkab, N. (2006) 'Connect and develop'. *Harvard Business Review*, 84(3), pp. 58-66.

InnoCentive@Work (2018) Available at: http://www.innocentive.com/wp-content/uploads/2016/05/InnoCentiveAtWork.pdf (Accessed: 06 April 2018).

InnoCentive: Adding Value to Stage-Gate Through the Use of Challenges (2018) Available at: https://info.innocentive.com/hubfs/White%20Papers/Adding_Value_to_Stage_Gate_1.3.pdf?hsCtaTracking=9ff92980-2684-4faf-8d95-17845e992fec%7Cd9b3f343-6376-4859-832d-e6fc23b26cb0 (Accessed: 06 April 2018).

Jaakkola, E., Helkkula, A. and Aarikka-Stenroos, L. (2015) 'Service experience co-creation: conceptualization, implications, and future research directions'. *Journal of Service Management*, 26(2), pp. 182-205.

Joshi, K. D., Chi, L., Datta, A. and Han, S. (2010) 'Changing the competitive landscape: Continuous innovation through IT-enabled knowledge capabilities'. *Information Systems Research*, 21(3), pp. 472-495.

Junni, P., Sarala, R. M., Taras, V. and Tarba, S. Y. (2013) 'Organizational ambidexterity and performance: a meta-analysis'*. Academy of Management Perspectives*, 27(4), pp. 299-312.

Kauppila, O. (2010) 'Creating ambidexterity by integrating and balancing structurally separate interorganizational partnerships'. *Strategic Organization*, 8(4), pp. 283-312.

Kelley, D. (2009) 'Adaptation and organizational connectedness in corporate radical innovation programs'. *Journal of Product Innovation Management*, 26(5), pp. 487-501.

Kervin, J. B. (1999) *Methods for Business Research*. 2nd edn. New York: HarperCollins.

Kim, W. C. and Mauborgne, R. (2004) 'Blue ocean strategy'. *Harvard Business Review*, 82(10), pp. 69-80.

Knapp, J., Zeratsky, J. and Kowitz, B. (2016) *Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days*. London: Transworld Publishers.

Kuhn, T. (1962) *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.

Laursen, K. and Salter, A. (2006) 'Open for innovation: the role of openness in explaining innovation performance among UK manufacturing firms'. *Strategic Management Journal*, 27(2), pp. 131-150.

Lavie, D. (2006a) 'The competitive advantage of interconnected firms: an extension of the resource-based view'. *Academy of Management Review*, 31(3), pp. 638-658.

Lavie, D. and Rosenkopf, L. (2006) 'Balancing exploration and exploitation in alliance formation'. *The Academy of Management Journal*, 49(4), pp. 797-818.

Lavie, D., Stettner, U. and Tushman, M. (2010) 'Exploration and exploitation within and across organizations'. *The Academy of Management Annals*, 4(1), pp. 109-155.

Lawson, B. and Samson, D. (2001) 'Developing innovation capability in organisations: a dynamic capabilities approach'. *International journal of innovation management*, 5(03), pp. 377-400.

Lazzarotti, V. and Manzini, R. (2009) 'Different modes of open innovation: a theoretical framework and an empirical study'. *International Journal of Innovation Management*, 13(4), pp. 615-636.

Lee, S. M., Hwang, T. and Choi, D. (2012) 'Open innovation in the public sector of leading countries'. *Management Decision*, 50(1), pp. 147-162.

Lee, S. M. and Shin, J. (2017) 'A path to collaborative innovation through internal boundary breaking: Open innovation tools applied within the organization helped LG Chem Research Park build a culture that nurtures collaborative innovation'. *Research-Technology Management*, 60(4), pp. 26-32.

Levinthal, D. A. and March, J. G. (1993) 'The myopia of learning'. *Strategic Management Journal*, 14(S2), pp. 95-112.

Lichtenthaler, U. (2008) 'Open innovation in practice: an analysis of strategic approaches to technology transactions'. *IEEE transactions on engineering management*, 55(1), pp. 148-157.

Lichtenthaler, U. (2011) 'Open innovation: Past research, current debates, and future directions'. *The Academy of Management Perspectives*, 25(1), pp. 75-93.

Lichtenthaler, U. and Lichtenthaler, E. (2009) 'A capability-based framework for open innovation: Complementing absorptive capacity'. *Journal of Management Studies*, 46(8), pp. 1315-1338.

Lifshitz-Assaf, H. (2016) *Dismantling Knowledge Boundaries at NASA: From Problem Solvers to Solution Seekers*. Available at SSRN: http://dx.doi.org/10.2139/ssrn.2431717 (Accessed: 26 January 2018).

Mantere, S. and Ketokivi, M. (2013) 'Reasoning in organization science'. *Academy of Management Review*, 38(1), pp. 70-89.

March, J. G. (1991) 'Exploration and exploitation in organizational learning'. *Organization Science*, 2(1), pp. 71-87.

Marsh, S. J. and Stock, G. N. (2003) 'Building dynamic capabilities in new product development through intertemporal integration'. *Journal of Product Innovation Management*, 20(2), pp. 136-148.

Martins, E. C. and Terblanche, F. (2003) 'Building organisational culture that stimulates creativity and innovation'. *European Journal of Innovation Management*, 6(1), pp. 64-74.

Mergel, I. and Desouza, K. C. (2013) 'Implementing open innovation in the public sector: The case of Challenge. Gov'. *Public Administration Review*, 73(6), pp. 882-890.

Merriam, S. B. (1998) *Qualitative Research and Case Study Applications in Education*. San Francisco, CA: Jossey-Bass Publishers.

Miles, M. B., Huberman, A. M. and Saldaña, J. (2014) *Qualitative Data Analysis: A Methods Sourcebook*. 3rd edn. Thousand Oaks, California: Sage Publications, Inc.

Miles, R. E., Snow, C.C., Meyer, A. D. and Coleman Jr, H. J. (1978) 'Organizational strategy, structure, and process'. *Academy of Management Review*, 3(3), pp. 546-562.

Moellers, T., Visini, C. and Haldimann, M. (2018) 'Complementing open innovation in multi-business firms: practices for promoting knowledge flows across internal units'. *R&D Management*. Digital article. Available at: https://onlinelibrary.wiley.com/doi/pdf/10.1111/radm.12343 (Accessed: 15 January 2019).

Morgan, G. (2006) *Images of Organization*. Updated edn. Thousand Oaks: SAGE Publications, Inc.

Moustakas, C. (1990) *Heuristic Research: Design, Methodology, and Applications.* Thousand Oaks, California: Sage Publications, Inc.

Nelson, R. R. and Winter, S. G. (1982) *An Evolutionary Theory of Economic Change*. Cambridge: Harvard University Press.

Nosella, A., Cantarello, S. and Filippini, R. (2012) 'The intellectual structure of organizational ambidexterity: A bibliographic investigation into the state of the art'. *Strategic Organization*, *10*(4), pp. 450-465.

Oksanen, K. and Ståhle, P. (2013) 'Physical environment as a source for innovation: Investigating the attributes of innovative space'. *Journal of Knowledge Management*, 17(6), pp. 815-827.

Ollila, S. and Yström, A. (2017) 'An investigation into the roles of open innovation collaboration managers'. *R&D Management*, 47(2), pp. 236-252.

O'Reilly III, C. A. and Tushman, M. L. (2008) 'Ambidexterity as a dynamic capability: resolving the innovator's dilemma'. *Research in Organizational Behavior*, 28, pp. 185-206.

O'Reilly III, C. A., Harreld, J. B. and Tushman, M. L. (2009) 'Organizational ambidexterity: IBM and emerging business opportunities'. *California Management Review*, 51(4), pp. 75-99.

O'Reilly III, C. A. and Tushman, M. L. (2011) 'Organizational ambidexterity in action: How managers explore and exploit'. *California Management Review*, 53(4), pp. 5-22.

O'Reilly III, C. A. and Tushman, M. L. (2013) 'Organizational ambidexterity: past, present, and future'. *Academy of Management Perspectives*, 27(4), pp. 324-338.

Oxford English Dictionary (2019) Available at: http://www.oed.com/ (Accessed: 09 April 2019).

Patton, M. Q. (2002) *Qualitative Research & Evaluation Methods*. 3rd edn. Thousand Oaks, California: Sage Publications, Inc.

Pavlou, P. A. and El Sawy, O. A. (2011) 'Understanding the elusive black box of dynamic capabilities'. *Decision Sciences*, 42(1), pp. 239-273.

Penrose, E. T. (1959) *The Growth of the Firm*. Oxford: Basil Blackwell Publisher.

Phillips, M. (2018a) 'Stage-Gate® – The world's most popular product development process' [PowerPoint presentation]. *Cohort Meeting 9: Open Innovation Programme*. Edinburgh, Scotland, 19-20 April, 2018.

Phillips, M. (2018b) 'Idea-to-Launch system to drive new products to market: Stage-Gate®' [PowerPoint presentation]. *Cohort Meeting 9: Open Innovation Programme*. Edinburgh, Scotland, 19-20 April, 2018.

Phillips, M. (2018c) 'Governance and gates – making the right investments: the critical go/kill decision points' [PowerPoint presentation]. *Cohort Meeting 9: Open Innovation Programme*. Edinburgh, Scotland, 19-20 April, 2018.

Piller, F. and West, J. (2014) 'Firms, users, and innovation: an interactive model of coupled open innovation', in Chesbrough, H., Vanhaverbeke, W., West, J. (eds.) *New Frontiers in Open Innovation.* Oxford: Oxford University Press, pp. 29-49.

Pine, B. J. and Gilmore, J. H. (1998) 'Welcome to the experience economy'. *Harvard Business Review*, 76(4), pp. 97-105.

Porter, M. (1996) 'What is strategy?' *Harvard Business Review*, 74(6), p. 61-78.

Potter, J. (1997) 'Discourse analysis as a way of analysing naturally occurring talk', in Silverman, D. (eds.) *Qualitative Research: Theory, Method and Practice*. London: SAGE Publications Ltd, pp. 200-222.

Prahalad, C. K. and Ramaswamy, V. (2004) 'Co-creation experiences: the next practice in value creation'. *Journal of Interactive Marketing*, 18(3), pp. 5-14.

Pratt, M. G. (2009) 'From the editors: For the lack of a boilerplate: Tips on writing up (and reviewing) qualitative research'. *Academy of management Journal*, 52(5), pp. 856-862.

Ragin, C. C. (1987) *The Comparative Method: Moving beyond Qualitative and Quantitative Methods*. Berkeley: University of California.

Ragin, C. C. (2000) *Fuzzy-set Social Science*. Chicago: University of Chicago Press.

Raisch, S. and Birkinshaw, J. (2008) 'Organizational ambidexterity: Antecedents, outcomes, and moderators'. *Journal of management*, 34(3), pp. 375-409.

Raisch, S., Birkinshaw, J., Probst, G. and Tushman, M. L. (2009) 'Organizational ambidexterity: balancing exploitation and exploration for sustained performance'. *Organization Science*, 20(4), pp. 685-695.

Randhawa, K., Wilden, R. and Hohberger, J. (2016) 'A bibliometric review of open innovation: Setting a research agenda'. *Journal of Product Innovation Management*, 33(6), pp. 750-772.

Riccaboni, M. and Moliterni, R. (2009) 'Managing technological transitions through R&D alliances'. *R&D Management*, 39(2), pp. 124-135.

Robson, C. (2002) *Real World Research*. 2nd edn. Oxford: Blackwell.

Rohrbeck, R., Hölzle, K. and Gemünden, H. G. (2009) 'Opening up for competitive advantage: How Deutsche Telekom creates an open innovation ecosystem'. *R&D Management*, 39(4), pp. 420-430.

Rothwell, R. and Zegveld, W. (1985) *Reindustrialization and Technology*. London: Longman Group Limited.

Saebi, T. and Foss, N. J. (2015) 'Business models for open innovation: Matching heterogeneous open innovation strategies with business model dimensions'. *European Management Journal*, 33(3), pp. 201-213.

Saldaña, J. (2016) *The Coding Manual for Qualitative Researchers*. 3rd edn. London: SAGE Publications Ltd.

Salter, A., Wal, A. L., Criscuolo, P. and Alexy, O. (2015) 'Open for ideation: Individual-level openness and idea generation in R&D'. *Journal of Product Innovation Management*, 32(4), pp. 488-504.

Saunders, M., Lewis, P. and Thornhill, A. (2009) *Research Methods for Business Students*. 5th edn. Harlow: Pearson Education Limited.

Saunders, M., Lewis, P. and Thornhill, A. (2016) *Research Methods for Business Students*. 7th edn. Harlow: Pearson Education Limited.

Sawhney, M., Verona, G. and Prandelli, E. (2005) 'Collaborating to create: The Internet as a platform for customer engagement in product innovation'. *Journal of Interactive Marketing*, 19(4), pp. 4–17.

Schilke, O., Hu, S. and Helfat, C. E. (2018) 'Quo vadis, dynamic capabilities? A content-analytic review of the current state of knowledge and recommendations for future research'. *Academy of Management Annals*, 12(1), pp. 390-439.

Schmitt, B. (1999) 'Experiential marketing'. *Journal of Marketing Management*, 15(1-3), pp. 53-67.

Schultz, M. and Hernes, T. (2013) 'A temporal perspective on organizational identity'. *Organization Science*, 24(1), pp. 1-21.

Scott, J. (1990) *A Matter of Record.* Cambridge: Polity Press.

Silverman, D. (2006) *Interpreting Qualitative Data*. 3rd edn. London: SAGE Publications Ltd.

Simsek, Z. (2009) 'Organizational ambidexterity: Towards a multilevel understanding'. *Journal of Management Studies*, 46(4), pp. 597-624.

Simsek, Z., Heavey, C., Veiga, J.F. and Souder, D. (2009) 'A typology for aligning organizational ambidexterity's conceptualizations, antecedents, and outcomes'. *Journal of Management Studies*, 46(5), pp. 864-894.

Slater, S. F., Mohr, J. J. and Sengupta, S. (2014) 'Radical product innovation capability: Literature review, synthesis, and illustrative research propositions'. *Journal of Product Innovation Management*, *31*(3), pp. 552-566.

Slowinski, G., & Sagal, M. W. (2010) 'Good practices in open innovation'. *Research-Technology Management*, 53(5), pp. 38-45.

Smith, W. K., Binns, A. and Tushman, M. L. (2010) 'Complex business models: Managing strategic paradoxes simultaneously'. *Long Range Planning*, 43(2-3), pp.448-461.

Solverboard (2019a) *Why use Solverboard?* Available at: https://www.solverboard.com/ (Accessed: 12 February 2019).

Solverboard (2019b) *What does the future of work look like?* Available at: https://www.solverboard.com/about/ (Accessed: 12 February 2019).

Stanko, M. A., Fisher, G. J. and Bogers, M. (2017) 'Under the wide umbrella of open innovation'. *Journal of Product Innovation Management*, 34(4), pp. 543-558.

Teece, D. (2007) 'Explicating dynamic capabilities: the nature and microfoudnations of (sustainable) enterprise performance'. *Strategic Management Journal*, 28(13), pp. 1319–1350.

Teece, D. J. (2010) 'Business models, business strategy and innovation'. *Long Range Planning*, 43(2-3), pp. 172-194.

Teece, D. J. (2012) 'Dynamic capabilities: routines versus entrepreneurial action'. *Journal of Management Studies*, 49(8), pp. 1395-1401.

Teece, D. J. (2014) 'The foundations of enterprise performance: dynamic and ordinary capabilities in an (economic) theory of firms'. *Academy of Management Perspectives*, 28(4), pp. 328-352.

Teece, D. J. (2016) 'Dynamic capabilities and entrepreneurial management in large organizations: Toward a theory of the (entrepreneurial) firm'. *European Economic Review*, 86, pp. 202-216.

Teece, D. and Leih, S. (2016) 'Uncertainty, innovation, and dynamic capabilities: An introduction'. *California Management Review*, 58(4), pp. 5-12.

Teece, D. and Pisano, G. (1994) 'The dynamic capabilities of firms: an introduction'. *Industrial and corporate change*, 3(3), pp. 537-556.

Teece, D. J., Pisano, G. and Shuen, A. (1997) 'Dynamic capabilities and strategic management'. *Strategic Management Journal*, 18(7), pp. 509-533.

Trew, S. (2018) 'Portfolio management and governance'. [PowerPoint presentation]. *Cohort Meeting 10: Open Innovation Programme.* Glasgow, Scotland, 2 November, 2018.

Trott, P. (2012) *Innovation Management and New Product Development*. 5th edn. Harlow: Pearson Education Limited.

Trott, P. and Hartmann, D. (2009) 'Why 'open innovation' is old wine in new bottles'. *International Journal of Innovation Management*, 13(4), pp.715-736.

Turner, N., Swart, J. and Maylor, H. (2013) 'Mechanisms for managing ambidexterity: A review and research agenda'. *International Journal of Management Reviews*, 15(3), pp. 317-332.

Tynnhammar, M. (2017) 'Open Innovation and its definitions'. *XXVIII ISPIM Innovation Conference – Composing the Innovation Symphony*. Vienna, Austria, 18-21 June 2017.

van der Borgh, M., Cloodt, M. and Romme, A. G. L. (2012) 'Value creation by knowledge-based ecosystems: evidence from a field study'. *R&D Management*, 42(2), pp. 150-169.

Vanhaverbeke, W. and Chesbrough, H. and West, J. (2014) 'Surfing the new wave of open innovation research', in Chesbrough, H., Vanhaverbeke, W. and West, J. (eds.) *New Frontiers in Open innovation*. Oxford: Oxford University Press, pp. 256-278.

Vanhaverbeke, W. and Cloodt, M. (2014) 'Theories of the firm and open innovation', in Chesbrough, H., Vanhaverbeke, W. and West, J. (eds.) *New Frontiers in Open innovation*. Oxford: Oxford University Press, pp. 256-278.

Vanhaverbeke, W. and Peeters, N. (2005) 'Embracing innovation as strategy: Corporate venturing, competence building and corporate strategy making'. *Creativity and Innovation Management*, 14(3), pp. 246-257.

Velu, C. (2015) 'Knowledge management capabilities of lead firms in innovation ecosystems'. *AMS Review*, 5(3-4), pp. 123-141.

Vergne, J. P. and Durand, R. (2011) 'The path of most persistence: An evolutionary perspective on path dependence and dynamic capabilities'. *Organization Studies*, 32(3), pp. 365-382.

Verona, G. and Ravasi, D. (2003) 'Unbundling dynamic capabilities: an exploratory study of continuous product innovation'. *Industrial and Corporate Change*, 12(3), pp. 577-606.

von Hippel, E. (2005) *Democratizing innovation*. Cambridge, MA: MIT Press.

Wagner, B. (2016) 'Scottish Enterprise open innovation initiative: Research perspective' [PowerPoint presentation]. *23rd Innovation and Product Development Management Conference*. Glasgow, Scotland, 12-14 June, 2016.

Wagner, B. and Fain, N. (2018) *Mastering Open Innovation.* Glasgow: Scottish Enterprise.

Wernerfelt, B. (1984) 'A resource-based view of the firm'. *Strategic Management Journal*, 5(2), pp. 171-180.

West, J. and Bogers, M. (2014) 'Leveraging external sources of innovation: A review of research on open innovation'. *Journal of Product Innovation Management*, 31(4), pp. 814-831.

West, J. and Bogers, M. (2017) 'Open innovation: current status and research opportunities'. *Innovation*, 19(1), pp. 43-50.

West, J., Salter, W., Vanhaverbeke, W. and Chesbrough, H. (2014) 'Open innovation: the next decade'. *Research Policy*, 43(5), pp. 805-811.

West, J., Vanhaverbeke, W. and Chesbrough, H. (2006) 'Open innovation: a research agenda', in Chesbrough, H., Vanhaverbeke, W., and West, J. (eds.) *Open Innovation: Researching a New Paradigm*. Oxford: Oxford University Press, pp. 285-307.

Wilden, R., Devinney, T. M. & Dowling, G. R. (2016) 'The architecture of dynamic capability research identifying the building blocks of a configurational approach'. *The Academy of Management Annals*, 10(1), pp. 997-1076.

Winter, S. G. (2003) 'Understanding dynamic capabilities'. *Strategic Management Journal*, 24(10), pp. 991-995.

Winter, S. G. (2006) 'Toward a neo-Schumpeterian theory of the firm'. *Industrial and Corporate Change*, 15(1), pp. 125-141.

Zahra, S. A., Sapienza, H. J. and Davidsson, P. (2006) 'Entrepreneurship and dynamic capabilities: a review, model and research agenda'. *Journal of Management Studies*, 43(4), pp. 917-955.

Zobel, A. K. (2017) 'Benefiting from open innovation: A multidimensional model of absorptive capacity'. *Journal of Product Innovation Management*, 34(3), pp. 269-288.

Zollo, M. and Winter, S. G. (2002) 'Deliberate learning and the evolution of dynamic capabilities'. *Organization Science*, 13(3), pp. 339-351.

Zott, C. and Amit, R. (2010) 'Business model design: an activity system perspective'. *Long Range Planning*, 43(2), pp. 216-226.

Zott, C., Amit, R. and Massa, L. (2011) 'The business model: recent developments and future research'. *Journal of management*, 37(4), pp. 1019-1042.

Appendices

Appendix 1: Participant information sheet

Participant Information Sheet

Name of department: Strathclyde University Business School, Marketing
Title of the study: Open innovation adoption from strategy to practice

Introduction
In order to boost the development of Scottish economy through open innovation adoption, this research aims at applying and developing open innovation theory to practice in the unique context of Scotland. The research is led by Lu Huang, a doctoral researcher in Department of Marketing of Strathclyde Business School, in University of Strathclyde. Lu has relevant experience in market consulting and consumer research. Working with Lu is Dr (Reader) Beverly Wagner and Dr Nusa fain, both of whom are faculty of Department of Marketing of Strathclyde Business School.

What is the purpose of this investigation?
In order to fill the strategy gap of open innovation, this research shows the theoretical linkages between open innovation, organizational ambidexterity and dynamic capabilities. It further presents empirical evidence on open innovation practices in the context of Scotland. The contribution is two-fold: 1) theory to practice: application of existing theories of organizational ambidexterity and dynamic capabilities within a Scottish open innovation context and 2) practice to theory: reflection on interesting field practices to facilitate theory building of strategic management and innovation management.

Do you have to take part?
Your participation in this study is voluntary and appreciated. However, you reserve the right to withdraw from the study or decline any questions at any time without detriment or explanation.

What will you do in the project?
This study requires you to engage in a semi-structured interview on a face-to-face basis at the university or at company sites. The interview questions are designed flexibly to accommodate the variation of practices across different case companies. You reserve the right to refuse any questions which you do not wish to answer. The expected duration of interview is one hour, and the interview time is discussed to best suit you. Additionally, it is necessary to note that none monetary incentive is given along the project.

Why have you been invited to take part?
You are invited to participant because 1) you company is a multi-national company actively engaging in open innovation and operating in Scotland, and 2) your role at the company (top management, middle management, or dedicated staff) is critical in open innovation adoption.

What are the potential risks to you in taking part?
This research might take you some time off your busy daily life. But you are not expected to violate any of your company policy or health and safety regulations in any way by inviting the research on to company premises. You have the right to withdraw at any stage of the study, if you feel at risk or compromised.

What happens to the information in the project?
With your consent, interviews are recorded before being transcribed and analysed by the researcher. All data collected is anonymised and you or your company will only be referred to by using code names. Only the researchers named in this document will be able to access raw data and none of your personal information will be disclosed to any third parties. Your personal details will be securely destroyed on completion of the study.

The University of Strathclyde is registered with the Information Commissioner's Office who implements the Data Protection Act 1998. All personal data on participants will be processed in accordance with the provisions of the Data Protection Act 1998.

Thank you for reading this information – please ask any questions if you are unsure about what is written here.

What happens next?
If you are happy with the information presented in this document and wish to proceed with the study, you could sign this consent form for confirmation before we start to the interview. Interviews are expected to take place in three companies from October 2016 to December 2017, followed by six months' data analysis. At the end of this process you will be provided with the developed theoretical framework and a general overview of the findings. You are more than welcomed to contact the researcher at any time should you have any enquiries about the study. There are some expectations for publication following completion of the study, and if any are to go ahead you will be notified via email. Again, all data is anonymised and your personal details will never be disclosed without your permission.

If you are not willing to participate in the study, thank you all the same for taking the time to read through this information.

Researcher contact details:
Lu Huang
PhD Researcher
Department of Marketing
Strathclyde Business School
University of Strathclyde
199 Cathedral Street
Glasgow
G4 0QU
Email: l.huang@strath.ac.uk

Chief Investigator details:
Dr Beverly Wagner
Department of Marketing
Strathclyde Business School
University of Strathclyde
199 Cathedral Street
Glasgow
G4 0QU
Email: beverly.wagner@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