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Controlling disruptive and radical innovations in large-scale services firms

Patrick Das

Controlling disruptive and radical innovations in large-scale services firms

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SUMMARY

How can large-scale services firms, such as banks, best undertake disruptive and radical innovations to enter new areas of growth, without interfering with current operations? Technical advancements in computing power and connectivity have further enabled economic globalisation and digitalisation, changing how people interact with each other, how businesses operate, and how services are offered. These changes bring challenges to the business models of established firms since they are continuously under threat of game-changing transformations and new firms that try to disrupt them. To be able to sustain a competitive advantage, disruptive and radical innovations are oftentimes described as the way forward, and firms increasingly form ecosystems to produce these innovations and compete in today's globalised economy.

Unfortunately, there are internal and external barriers to existing services firms that impede them to effectively produce and launch disruptive and radical innovations. First, regulations that ensure a level playing field and safeguard the position of multiple stakeholders in the market are typically not designed to support types of innovations that could destabilise the market. Second, there is a natural tension within firms between exploiting the 'known' existing business model, and exploring future 'unknown' growth. Hence, the tension between investments in the future and direct benefits emerges, resulting in a fundamental question: can we support organisations to survive in the face of change or is their disruption inevitable?

In contrast to products, services have intangible characteristics; therefore a service innovation cannot be researched, developed, prototyped, and tested in a similar way as physical products. Additionally, unlike traditional

product firms, many existing services firms lack experience and the relevant capabilities for organising for disruptive and radical innovations. Typically, this is due to the fact that these firms do not have a tradition in R&D activities. In spite of the abundance of studies on disruptive and radical innovation in product and R&D-intensive firms, there is only limited knowledge available on managing disruptive and radical innovations in services firms. Hence, applying theories that have not emerged from research in services firms is not deemed a suitable approach in itself to create ambidextrous service organisation in which innovations can thrive. It requires an understanding of the specific complexities and mechanisms underpinning the innovation process to design services that support firms to survive in the face of change.

The purpose of this thesis therefore is to research how large-scale services firms can enable more effective exploration of disruptive and radical innovations. The main objectives of this study are to explore mechanisms that underpin exploration of disruptive and radical innovations in large-scale services firms, and to improve the effectiveness of it. To meet these objectives I focus on the following research question: *How can large-scale services firms enable more effective exploration of disruptive and radical innovations?*

This question consists of multiple components that require investigation of innovation concepts, theories and empirical data gathering. This thesis starts with knowledge from description, by understanding current innovation theories; followed by knowledge by acquaintance, by observing how disruptive and radical innovations are managed within large-scale services firms and by intervening to increase effectiveness of the exploration system. Through qualitative empirical generalisations current theories are enriched: I explore how participants, on different

organisational levels (i.e. organisational, unit/division, and project level) experience the innovation system to create a holistic systems perspective.

How firms manage innovation has continuously evolved over time; and firms that consistently manage innovation outperform peers in terms of growth and financial performance. To accommodate the conflicting alignments in firms between exploration and exploitation firms need to shift structures to initiate and, in turn, execute innovation. A dual arrangement for innovation is required to manage trade-offs and the conflicting alignments for innovation and efficiency, coined 'organisational ambidexterity'. Creating an exploration unit separate from the exploitation unit (i.e. the core) is a prevailing view to support radical and disruptive innovations: it creates a safe incubation space separate from the core. In addition, nurturing a supportive relational context with the core organisation is of key importance whenever innovations need to be integrated with current assets. Nevertheless, a single firm is not likely to have all competences internally and therefore should utilise collective intelligence and participate in open innovation ecosystems consisting of providers, suppliers, and customers.

How should large-scale services firms control exploration of disruptive and radical innovations? Exploration of disruptive and radical innovations in firms cannot happen without controls that drive discipline and creativity. Nevertheless, control of innovation activities seems highly challenging due to inherence tensions between innovation and control. Not using management control systems, or using them inappropriate, may hamper innovation. Unfortunately, not much is known about the role of control within these types of firms in relation to disruptive and radical innovations. Literature suggests that these types of innovation require different control systems than traditional product innovation. I therefore created a scheme of management control systems based on best-practices in literature and

applied this scheme to examine what control systems are used for controlling disruptive and radical innovation activities in nine large-scale firms. The results show that although new innovation-agnostic controls are installed, traditional controls for exploitation purposes are misapplied within large-scale services firms for exploration of radical and disruptive innovations. Those controls typically do not fit with the nature of innovation activities, which results into several barriers and has several implications such as: cumbersome processes for innovation activities, misalignment of innovations with organisational goals, and misunderstanding by management of performance measurements for innovation activities. Furthermore, results show that contextual antecedents impact the controls used for innovation activities during the exploration stage, and they are an important category allowing scholars to explain why a certain mix of controls is used within a firm. Managers in turn should understand the contextual antecedents of their firm and design controls accordingly to increase effectiveness of innovation activities, to ultimately meet organisational goals.

What barriers are impeding firms to effectively explore radical and disruptive innovations? Many barriers, challenges, and obstacles for effective innovation within established firms have been documented in literature. However, the growing literature in the area of innovation barriers focuses strongly on obstacles related to product firms and R&D teams in manufacturing firms. In response to this, I explored internal barriers that influence the effectiveness of disruptive and radical innovations within large-scale financial services firms. A framework of internal barriers was developed and validated by means of an explorative case study. Data were collected at a financial services firm by exploring how innovation is organised and what barriers influence effectiveness of eight innovations. Results show that exploring disruptive and radical innovations by means of a separate exploration unit (A) partially supports exploration, but not

necessarily the exploitation of these types of innovations. If an innovation strategy (B), active management support (C), and a separate governance structure for innovation (D) is in place, innovations get stimulated in the exploration stages, as innovations do not experience a lack of appropriate resources or competition with other projects and programs. Yet, six items were identified as key barrier in this context: too much focus on risk-avoidance, an unsupportive organisational structure, no fundamental R&D, inertia caused by (local) systems architecture, lack of exploiting new ideas, and the Not-Invented-Here syndrome. As such, in the sample, these were more important than traditionally defined barriers such as sources of finance, and lacking exploration competences. Based on a small number of innovations within one firm, the results highlight the need for more in-depth research on the effects of barriers and how barriers can be overcome within this industry. Furthermore, the results show that there is a discrepancy between the societal demand for radical change within the financial industry and the ability of large financial services firms to innovate.

What controls support more effective exploration of disruptive and radical innovations? To solve this question I have investigated problems with the current firm system for innovation and identified multiple controls from both literature and practice to steer innovations. Based on this I showed what the effect of multiple control interventions is on overcoming firm challenges and barriers, and if it can enable more effective exploration. Controls were both introduced and removed in a three-year in-depth longitudinal study. Starting from the initial situation in which barriers to innovations on a project level were identified, interventions are proposed on a unit/department level to overcome barriers in two iterations. This has led to three main conclusions; first, eleven innovation controls show to have a positive effect on mitigating innovation barriers and increasing effectiveness of exploration activities. In addition to elements A, B, C, and

D addressed above, results show that also the presence of a senior board supporting innovations, strategic growth areas, coaches, a methodology, a stage-gate process, a single-market approach, dedicated innovation teams, and an innovation sponsor have a positive effect on the effectiveness of exploration activities. Second, contextual antecedents have a continuous impact on innovation systems; in response to a changing antecedent, innovation controls should be evaluated in light of the significance of the change and adjusted to meet the new situation. Third, I find that while the principle of an innovation control can have a positive effect on exploration activities; the operationalisation of innovation controls requires management attention to have the prescribed effect. Moreover, while the principle of a control might be conceptually clear, the implementation might require adjustments to evolve over time along with the maturity of the innovation system. In addition, the findings show that there is a need to acknowledge a contingent view of management control systems in large-scale services firms. Innovation theories mainly stem from product- and manufacturing-oriented research and large-scale services firms by default are not adequately designed for exploring disruptive and radical innovations. These firms typically require installation of many new innovation controls in comparison with product firms.

Concluding, this thesis shows that existing innovation theories offer a less adequate lens to enable more effective exploration of disruptive and radical innovations in large-scale services firms; it requires tailored innovation controls to overcome barriers and increase effectiveness of exploration activities. Comparable to a pendulum swing, a firm has to install innovation controls that provide enough room to spark creativity, but also has to ensure behaviour of management and employees is steered towards organisational goals. On the one hand, too much control imposed by the traditional exploit organisation hampers innovators; on the other hand, too little control will result into too much deviation from strategic

goals and ineffective resource utilisation. Moreover, it is a balancing act to provide room for disruptive and radical innovations to experiment, fail, learn, and succeed while utilising resources most effective.

Future research is suggested to focus on three main areas. First, scholars can advance the designed innovation control scheme, innovation barriers framework, and control intervention study. Although the developed tools have created a vehicle to assess effectiveness of exploring disruptive and radical innovations in firms, its improvement will further increase validity and reliability. Second, scholars can investigate the impact of the complexity of platform business model on the types of innovation controls. There is a growing interest in platform business models, but understanding of managing its complex character that is strengthened by digitalisation and economic globalisation is still underexposed. Organisations are under pressure by firms exploiting these business models and therefore increasingly start exploring these types of innovations without proper guidance on how to design and control this. Third, similar research is suggested to focus on the early stages of exploiting disruptive and radical innovations. Ultimately, at this stage a firm can start capturing value and innovating is as important and difficult in this stage as in the exploration stages.

1 INTRODUCTION TO THE RESEARCH

1.1 Motivation

How can services firms best undertake disruptive and radical innovations to enter new areas of growth, without interfering with current operations? How can a bank best use distributed ledger technologies to improve the international trade of local businesses? And how can large-scale services firms radically change their business models to become a platform for their customers and offer 24x7 services? These types of questions have arisen in the last decade because technological advancements in computing power and connectivity have further enabled economic globalisation and digitalisation, changing how people interact with each other, how businesses operate, and how services are offered to end-users. On the one hand, these changes bring opportunities, since even small firms with an Internet connection can serve customers all over the globe irrespective of their size, location, and time zone. On the other hand, these changes bring challenges, since established firms are continuously under threat of game-changing transformations and new firms that try to disrupt them (Christensen, 1997).

Achieving a sustainable competitive advantage is nearly impossible in many industries these days since the economy globalised (McGrath, 2013). To be able to remain competitive, disruptive innovations are oftentimes described as the way forward (Christensen & Overdorf, 2000; Weiblen & Chesbrough, 2015). Technical advancements in computing power and connectivity form the foundation of these innovations and firms

increasingly form ecosystems to launch these innovations. Often a technology platform is at the core of this ecosystem through which multiple stakeholders can combine their individual offerings into a coherent, customer-facing solution (Adner, 2006; Dattee, Alexy, & Autio, 2018).

Unfortunately, there are internal and external barriers to existing firms to effectively produce and launch disruptive and radical innovations. First, regulations that ensure a level playing field and safeguard the position of multiple stakeholders in the market are not typically designed to allow firms to produce radical and disruptive innovations that could destabilise existing markets. Second, there is a natural tension within firms, especially within firms with no R&D tradition, between exploiting on-going 'known' business and exploring future 'unknown' innovations (Lavie, Stettner, & Tushman, 2010). The former, exploitation, can be characterised by predictable results, direct benefits, and low risk; the latter, exploration, comes with high levels of unpredictability, high risks, and indirect benefits. Exploring future value requires specific firm structures that allow for experimentation, slack, and controlled failure to be able to shape a competitive advantage while still ensuring the firm can effectively operate its current business model. Hence, the tension between investments in the future and direct benefits emerges, resulting in a fundamental question: can we support organisations to survive in the face of change or is their disruption inevitable? This implies a need for existing firms to find suitable ways to develop innovations and stay ahead of their competition, while simultaneously exploiting the current business, to avoid obsolescence.

Overcoming the aforementioned challenges is fundamental to effectively exploring disruptive and radical innovations. By being able to seize emerging opportunities and integrate them with current assets, firms will also be able to achieve a competitive advantage. This ability, to be able to simultaneously explore new ideas and exploit the on-going business, is

coined ‘ambidextrous’ and can be achieved by separating exploration activities from the exploitation activities (i.e. structural ambidexterity), or allowing for simultaneous pursuit of exploration and exploitation in single units (contextual ambidexterity) (O’Reilly & Tushman, 2008; Raisch & Birkinshaw, 2008). In addition, firms should be capable of integrating external innovations to enhance their offerings (i.e. outside-in innovation) and outsource internal innovations to maximize value capture (i.e. inside-out innovation) (Chesbrough & Appleyard, 2007). Ultimately, firms have many design options to organise for innovation and to extract value from innovations – which model to take depends on a firm’s goals, the level of urgency and risk appetite.

Unlike traditional product-oriented firms, many services firms lack experience and the relevant R&D capabilities for organising innovation activities (den Hertog, van der Aa, & de Jong, 2010). Research shows that firms with internal R&D activities exploit their accumulated knowledge to develop new products, thereby enhancing economies of scale (Chesbrough & Crowther, 2006). Firms that do not have a tradition in R&D activities naturally search for external innovation, but require a level of ability to utilise these innovations (Rosenberg, 1994). The ambidextrous organisation should nurture this ability and support services firms to innovate; however, there is only limited knowledge in this emerging field of management of disruptive and radical service innovations since it differs from traditional product innovation (e.g. Aas, 2011; Aas, Breunig, Hydle, & Pedersen, 2015; den Hertog et al., 2010). Hence, applying theories that have not emerged from research in service-oriented firms is not deemed a suitable approach in itself to create ambidextrous service organisations in which disruptive and radical innovations can thrive. It requires an understanding of the complexities and mechanisms underpinning the innovation process to design services that support firms to sustain in the face of change.

1.2 Research Purpose

The purpose of this thesis is to research how services firms, and in particular large-scale services firms, can enable more effective exploration of disruptive and radical innovations. How can these firms do the right things in the best possible manner, with minimal time and effort spent to produce innovations that contribute to achieving a sustainable advantage? Moreover, throughout this thesis I will demonstrate how these firms can effectively coordinate, control, lead and organise their exploration activities. The focus is on the exploration stages of innovation since large-scale services firms are typically organised for exploitation, and thus well equipped to manage exploitation of the current business model. Yet, these firms are insufficiently organised for continuous exploration of disruptive and radical innovations because it requires other capabilities. Hence, this exploration stage represents a new capability that is added to the organisation and requires management attention to ensure this capability is controlled in the right manner, and outcomes meet expectations of management.

The main objectives of this study are to explore mechanisms that underpin, and to improve the effectiveness of, exploring disruptive and radical innovations in large-scale services firms. Altogether, I investigate whether empirical findings are repeatable and thus can serve as a starting point to enrich current innovation theories; and I aim to support practitioners in creating a better understanding of enabling more effective exploration of disruptive and radical innovations.

1.2.1 Research Questions

To meet the previously stated objectives this thesis is centred on the following research question:

- *How can large-scale services firms enable more effective exploration of disruptive and radical innovations?*

This question consists of multiple components that require investigation of concepts, theories, and empirical data. Therefore, this question is broken down into three sub-questions to ensure all components of the research question are addressed. Before the first sub-question is researched, available theories on ambidexterity, innovation types, and large-scale services firms are investigated in detail. This knowledge presents the theoretical backbone of the study that is used as input to research the three sub-questions. The following sub-questions will be researched:

1. *What key management control systems do large-scale services firms typically use to support exploration of disruptive and radical innovations?*

The first sub-question is about the environment; by investigating how multiple firms manage their innovation efforts I seek to understand organisational behaviour and build relevance (Hevner, March, Park, & Ram, 2004). By describing the applied management control systems (MCS) for innovation within large-scale services firms and the challenges of managing exploration activities, the problem space is further defined.

2. *What are the key barriers to the exploration of disruptive and radical innovations within large-scale services firms?*

Building on the descriptive research of MCS used in firms, a further investigation of the problem space is conducted. This sub-question deepens the understanding on the key barriers experienced by multiple innovators within this specific environment. Furthermore, it provides guidance to design systems that can support more effective exploration of disruptive and radical innovations.

3. *What management control systems support more effective exploration of disruptive and radical innovations in large-scale services firms?*

To provide an answer to the third sub-question and 'enable more effective exploration', a prescriptive intervention study is conducted. Based on the theoretical and empirical groundwork, innovation controls are designed and tested within a firm by means of three control interventions. The effect of these controls on mitigating innovation barriers, and on increasing the effectiveness of exploration activities is assessed and evaluated. Ultimately, the empirical findings are evaluated to assess their impact on the ability to enable effective exploration of disruptive and radical innovations. It is determined if observations can serve as a starting point to enrich current innovation theories, and if these observations can support practitioners.

1.3 Research Approach

How do we know what we know and what justifies the approach for this research? Russell (1912) distinguished 'knowledge by description' and 'knowledge by acquaintance'. This distinction, which is exemplified by the physics of knowing how to balance a bicycle versus the practical knowledge of how to ride a bicycle, is the foundation of research. One that builds on theory and is not directly acquainted with a theory will gather knowledge by description; one that directly interacts with its object will gather knowledge by acquaintance. Thus, to answer research questions, one can start with observations, which can lead to new theory through empirical generations; or one can start with a theory, test it through observations, and can either reject, refine or develop a new theory through empirical generalisations (Wallace, 1971). Irrespectively of the approach, to justify research one must be acquainted with the object and understand the relationship with research. This thesis starts from knowledge by description, by understanding current innovation theories, followed by knowledge by acquaintance, by observing how disruptive and radical innovations are managed within large-scale services firms and intervening to increase effectiveness.

1.3.1 Philosophical Stance

All research is grounded on a researchers' philosophical assumptions about the nature of reality, which influence the practice of research and subsequently the various strategies and instruments applied by a researcher. This reality enables and assists one to select, adapt and evaluate methodologies and methods to answer research questions (Easterby-Smith, Thorpe, & Jackson, 1991). The assumptions that a

researcher has during an inquiry are called knowledge claims and present how a researcher will learn and what the researcher will learn during the inquiry. Creswell (2003) presents four philosophical worldviews to understand knowledge claims that underlie research: post-positivism, social constructivism, participatory approach and pragmatism. Although these worldviews stand on their own, in practice they can be intertwined during an inquiry.

In this thesis I start with theory to solve a real-world situation. As in *pragmatism*, the problem is considered to be the most important and I will use applicable methods to understand the problem (Cherryholmes, 1992). Hence, pragmatism serves as a guiding principle for this research inquiry. Nevertheless, other types of knowledge claims are applied to learn during this research inquiry. When converging more into the problem situation, *social constructivism* has a prominent role; claims arise out of interpretation of beliefs that participants of the real-world situation have about the world. One looks at complexity of views rather than narrowing meanings and relies as much as possible on the participants' views of the situation under study. Moving forward, like *post positivists*, the objective is to use theory to better understand the world; however, the research goal is not to confirm or reject hypotheses, but rather to learn how theories work in a real-world situation to test, verify and refine theories and better understand the world (Phillips & Burbules, 2000). By interpretation of how real-world participants experience theoretical driven interventions I reflect on theories to support effective management of disruptive and radical innovations, and build new knowledge. Concluding, no single explicit worldview is predominantly present in this study. The intent is to start from theory to solve the research problem, and to make sense of the meaning others have about the environment to be able to enrich current theories.

1.3.2 Research Strategy

In problem solving, I adopt the *systems* (or holistic) *perspective*. The systems perspective is grounded on the idea that when researching a problem, anything less than the holistic view of science would fail to identify some of the essential features of science (Churchman & Ackoff, 1950). The selected worldviews and assumptions open the door for selecting applicable methods that support in answering the research questions. As described throughout this chapter, I start with available theories and use these to analyse the research problem. Through empirical generalisations, current theories are enriched. The empirical generalisations are of a qualitative nature and case studies are performed; I explore how multiple participants, on different organisational levels (i.e. management, unit/division, and project level), experience innovation to create a holistic view.

I use rational methods of investigation for this research problem, meaning that all scientific knowledge is considered the best-tested knowledge we currently have. A portion of the world (i.e. our problem, theory, and case) is selected to investigate and carry out disciplined observations in experiments. If the results are repeatable, they will count as part of the body of knowledge (Checkland & Holwell, 2007). After investigating theories and the organisational object, I actively participate in a change situation to solve the immediate problem of the absence of an effective system for exploring disruptive and radical innovations, while simultaneously conducting research. Moreover, I perform action research (see: Baskerville, 1999) and enter a real-world situation to both improve it and to acquire knowledge.

Complexity theories

The problem of designing a firm in which disruptive and radical innovations can thrive, is an example of a complex problem; there are many parts to the system (i.e. the firm) and all parts (e.g. business units, staff functions, and external stakeholders influencing exploration and exploitation of innovations) are related to each other in sometimes complicated ways (Sage & Armstrong, 2000). Like complex systems in nature, researchers have argued that organisations such as large-scale services firms are dynamic non-linear systems, and outcomes of their actions seem unpredictable but, like turbulence in gases and liquids, are governed by a set of simple order-generating rules (Burnes, 2005). In solving complex problems, complexity theories provide a useful lens to understanding and changing firms.

Large-scale firms steer behaviour by setting up system rules (i.e. corporate governance) for its agents (i.e. managers and employees) (Mitleton-Kelly, 2003). To adapt to constant change, this system is constantly modified by interaction with its agents. And even though disruptive and radical innovations seem to thrive well in chaotic environments, managing it with structured processes will increase effectiveness (e.g. Griffin, Price, Vojak, & Hoffman, 2014; McDermott & O'Connor, 2002). The majority of problems demonstrated have more to do with the management of its complex character, rather than with technological concerns that affect individual subsystems. The capacity to continuously innovate relies on intensive, real-time communication within a structure of a few, very specific rules (e.g. processes, deliverables, methodologies) (Brown & Eisenhardt, 1997). Hence, to enable effective exploration and exploitation of disruptive and radical innovations, current organisational sub-systems need to be modified and in particular the exploration sub-system. Moreover, in order to adapt to change, firms need to create a system with sub-systems that acknowledge the nature of

innovation, while also allowing running the current business most efficient. Subsequently, in the thesis a holistic view of a firm in society will be taken, subsystems will be identified required for exploring and exploiting disruptive and radical innovations, and the interactions between its agents and system rules will be analysed.

1.3.3 Research Instruments

To collect data and answer the research questions, I will develop research instruments that allow me to obtain high quality data. To select options for data collection one has to determine the granularity of data required to substantiate knowledge claims (e.g. open-ended versus closed-ended questions, the number of data sources, and the length of data collection). A qualitative approach allows one to make knowledge claims based on the interpretation of individual experiences in the selected cases. This involves collecting data from field observations and open-ended interviewing. In addition to this, field observations will be enriched with documented data to compare innovations and management designs. This involves amongst others, the governance models providing the organisational procedures for guiding innovation activities and data about single innovations, such as: throughput times, budgets and decisions. To answer all questions separate studies are conducted and specific research instruments are designed best equipped to provide evidence.

Before answering all research questions a literature review is conducted. Sub- questions one, two and three are answered based on data gathered by case studies. When building theory from case studies, one should use one or more cases to create theoretical either constructs, propositions and/or midrange theory from empirical evidence (Eisenhardt, 1989). All case studies in this thesis will serve as distinct experiments that stand on their own as an analytic unit. I conduct multiple case studies and treat

them like a series of discrete experiments that serve as replications or contrasts of current theory. Moreover, this theory-building approach is deeply embedded in rich empirical data and therefore is likely to produce theory that is accurate, interesting, and testable (Eisenhardt & Graebner, 2007).

In sub-question one I research what management control systems are applied for exploring innovations in multiple large-scale services firms. This is an explorative multi-case study to gather management-level data within multiple large-scale firms. Building on this knowledge, in sub-question two I answer what key barriers are; an explorative qualitative study within a single firm is conducted to gather project-level data on innovations. The resulting insights of these studies are then used as inputs to research sub-question three on how to increase success of exploration. Various control interventions are implemented, tested and validated in a single firm on a unit/division level, during a three-year in-depth longitudinal study.

1.4 Research Outline

The chapters of this thesis are based on multiple studies that I have conducted. The text is partially identical to published work, but the papers have been partially amended to avoid redundancy and increase readability of this thesis. The structure of the thesis is displayed in Figure 1.

Chapter 2 provides the theories for exploring disruptive and radical innovations within large-scale services firms. This chapter constructs the

theoretical components of the research problem and describes the environment in which the research takes place.

Chapter 3 introduces theory on management control systems and contains an empirical multi-firm case study that presents the use of control mechanisms for innovation. It answers the first sub-research questions and contributes to the understanding of how multiple large-scale firms organise for disruptive and radical service innovations. **Chapter 4** identifies barriers to disruptive and radical innovations and reflects on key barriers perceived in large-scale financial services firms. This chapter provides an answer to the second sub-research question by contrasting theoretical and practical barriers to innovations. Chapters 3 and 4 show a crucial discrepancy between the necessity for change within services firms and their ability to produce radical and disruptive innovations.

The knowledge that has been built in all previous chapters is the groundwork for **Chapter 5** of this thesis. This chapter answers sub-research three by assessing the impact of multiple interventions on the effectiveness of managing innovations within a large-scale services firm. By introducing and removing management controls for innovation, I show how innovation barriers can be overcome and how management controls can be applied as drivers for success. **Chapter 6** provides a discussion regarding the validity of the research, scientific contribution, and limitations. It answers all research questions and will finally recommend areas for future research.

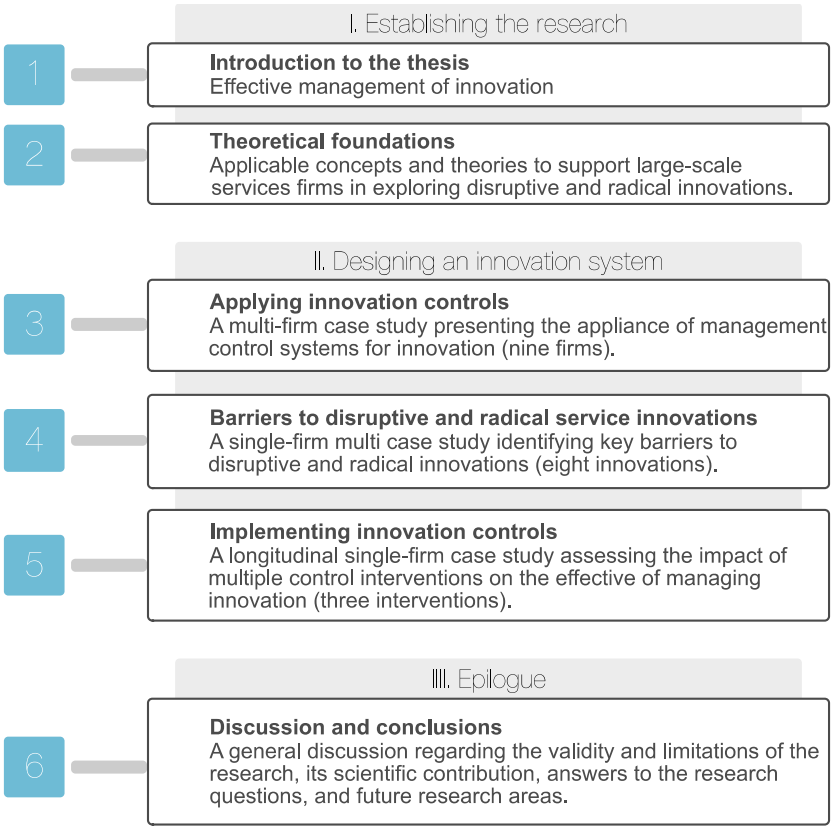

Figure 1: Thesis structure

2 TOWARDS AN UNDERSTANDING OF DISRUPTIVE AND RADICAL INNOVATION IN LARGE-SCALE SERVICES FIRMS

In the previous chapter the applied research problem and methodologies were introduced. To understand how firms can effectively organise for innovation, many researchers have conducted both empirical and theoretical studies. Nevertheless, the particular issue of effectively exploring radical and disruptive innovations in large-scale services firms is difficult to be described by a single theory. Therefore, more theoretical lenses are helpful to investigate the different components of this research problem. This chapter explores the following question: What theories can be used in supporting large-scale services firms to explore disruptive and radical innovations?

To address how firms can effectively explore radical and disruptive innovations, this chapter constitutes the theoretical backbone by selecting innovation theories that support solving the research problem. These theories will be explained in detail to provide understanding of the current state of literature, as a source for answering the main research question.

Section 2.2 defines innovation and explains the dichotomy between sustaining and disruptive innovation, versus incremental and radical innovation. In Section 2.3, ambidexterity theory is described while in Section 2.4 open innovation theory is described; both will be used as lenses throughout this thesis to understand how firms organise their innovation activities.
Finally, Section 2.5 introduces innovation in services firms and shows the main differences between managing product and service innovation.

2.1 Unravelling the innovation concept

How firms manage innovation has continuously evolved over time; and firms that consistently manage innovation outperform peers in terms of growth and financial performance (Tidd, 2006). Throughout the last decades, research in innovation has increased and managing of innovations has been embedded widely in organisational structures to sustain a competitive advantage. Nevertheless, there is a lot of debate around the concept of innovation.

Kinnunen (1996) defines innovation on the basis of the insights and observations of Gabriel Tarde (1843-1904). Tarde's theory was inspired by the question why out of one hundred innovations only ten would spread. His theory concerns the following three notions:

(1) Social change in societies or cultures requires penetration of inventions - innovations (i.e. successful inventions) change the course of social phenomena and help people to adapt to their changing environment.
(2) Inventions diffuse by process of imitation - people imitate beliefs and desires or motives that are transmitted from one individual to another.
(3) Innovations are often modified or re-invented in the course of the diffusion process and they need to fit the existing culture or environment.

In line with Tarde's diffusion theory, in the fields of sociology and economics, innovation has been further researched and applied (Kinnunen, 1996). In the sociological literature innovation is described as an activity and process. Innovation refers to the idea of novelty, yet the most commonly used definitions differ considerably: some focus on the

act itself, while others focus on the impact, and others focus on the subjective perception (Godin, 2008). In the field of economics, innovation was adopted in the late 1930's. Joseph Schumpeter, one of the most influential economists of the 20th century, distinguished invention and innovation, and linked this to economic change (Schumpeter, 1935):

(1) Invention is an act of intellectual creativity and 'is without importance to economic analysis'.
(2) Innovation is an economic decision: 'a firm applying an invention or adopting an invention'.

In this view capitalism is creative destruction (i.e. processes of industrial mutation that continuously revolutionise the economic structure from within) and innovations are responsible for this phenomenon (Schumpeter, 1965). Moreover, according to Schumpeter, technological innovation is the critical dimension of economic change as it is a source of business cycles.

In recent decades, the arrival of new players in existing markets that offer new, better, cheaper, or quicker services all over the world irrespective of their location, has been accelerated by digitalisation and globalisation of the economy. These offerings have increased societal welfare since products and services have become available for people that previously could not afford or receive these products or services. It has also led to a disruption of traditional products and services and it requires existing firms to innovate, rather than incrementally improve offerings, in order to remaining competitive. While existing firms excel at incrementally improving their offerings and sell more of these, new entrants tend to target 'overlooked' segments and rapidly scale up to established markets (Christensen & Raynor, 2014). Hence, the need for effective management

of disruptive and radical innovations has become necessary for firms to be able to increase their agility and quickly react upon market changes.

In order to facilitate innovation, many firms have incorporated processes, such as the stage-gate models coined by Cooper (1990). This is a blueprint for managing new product, or service, development and improves effectiveness and efficiency of the process. It divides the innovation process into a set of stages, subdivided by control checkpoints, or gates, with set deliverables (Cooper, 2008). Originally, this process had five stages and gates, but in practice scholars and practitioners choose to increase or decrease the number of stages based on their needs, or the type of innovation (e.g. Aas, 2011; Eling, Griffin, & Langerak, 2014; Osorio, 2011). The appliance of these models has become very popular and helps firms to reach innovation outcomes by driving new products and services from idea to market faster and with fewer mistakes. Moreover, research shows that effective innovators tightly manage the innovation process as they execute the four principle elements of innovation: ideation, project selection, development, and commercialisation.

2.2 Focusing on disruptive and radical innovations

Explicit and commonly agreed definitions of innovation are rare among academics and practitioners. That is why it is difficult to find conclusive terminology for different types of innovation. As a starting point I define innovation as 'the generation, acceptance and implementation of new ideas, processes, products or services' as described by Thomas (1965).

Both practitioners and scientists have continuously introduced new types of innovation or loosely used existing types throughout time (e.g. Christensen, Raynor, & McDonald, 2015). Yet, different types of innovation require different management approaches to be effective and successful. In this thesis, I distinguish four types of innovation based on two well-known dichotomies: the sustaining and disruptive innovation dichotomy by Christensen and Bower (1995), and the incremental and radical innovation dichotomy by Dewar and Dutton (1986), displayed in Figure 2. To sustain a competitive advantage and compete in today's globalised economy, existing firms should enable the exploration and exploitation of disruptive and radical innovations. However, managing these types of innovations has the potential to destabilise the firm, because the innovation processes necessary to enable this typically require significant changes to current operations.

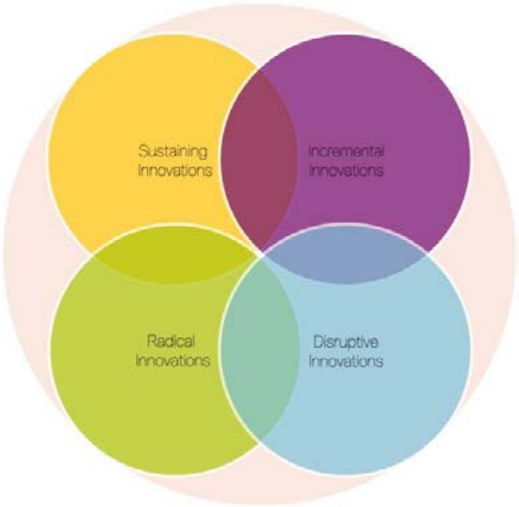

Figure 2: Dichotomies of Innovation

A sustaining innovation focuses on improving products and services of existing firms, also named incumbents (Mitchell, 1991) in the eyes of existing customers. Such innovations enable incumbents to sell more products to their most profitable customers and do not necessarily affect existing markets, as it involves new product releases or improved services. Disruptive innovations are usually targeted at an emerging market. It creates a new market by applying a different set of values for users, which ultimately (and unexpectedly) overtakes an existing market (Christensen & Bower, 1995). These innovations imply a product or service to take root in simple applications at the bottom of the pyramid of a market and then to relentlessly move up in order to eventually displace competitors (Christensen, 2016). An incremental innovation entails a minor improvement or simple adjustment in current technology (Dewar & Dutton, 1986) and concerns those innovations that improve price/performance advance at a rate consistent with existing technical trajectories (Gatignon, Tushman, Smith, & Anderson, 2002). Radical innovations are those that incorporate different technologies, involve

changes in a firm's trajectory, and provide more benefits to the customer than what was previously available in the industry (Chandy & Tellis, 2000; Dewar & Dutton, 1986; Gatignon et al., 2002). They have the potential to shift market structures, induce behaviour changes of customers and are increasingly the outcome of inter firm co-operations in the form of networks (Perks, Gruber, & Edvardsson, 2012).

In this thesis, I focus on innovations that have the potential to disrupt the market and/or bring a radical change to subsystems of the firm: disruptive and radical innovations. As previously described incumbents are typically not the players that bring these types of innovations to the market. Yet, many large-scale services firms have set foot to start exploring these types of innovations to sustain their competitive advantage. During exploration it is oftentimes difficult to assess if an innovation has disruptive or radical impact to subsystems of the firm; ultimately these effects are displayed during exploitation. Therefore, in this thesis, I focus on innovations that during the stages of exploration have the intention and potential to disrupt the market and/or bring a radical change to subsystems of the firm.

Although the aforementioned definitions provide more clarity on what strategic approaches are required to be successful when innovating, boundaries of these definitions are not exclusive (Gatignon et al., 2002). The two dichotomies overlap, but they are also distinct types of innovation: a disruptive innovation could be a radical innovation, but not all radical innovations are disruptive (Govindarajan & Kopalle, 2006). The common denominator of disruptive and radical innovations is the high level of unpredictability and risks, indirect benefits, potential to destabilise existing structures and business models; thus, it requires an explicit management approach to enable this.

2.3 Structural ambidexterity as a foundation for exploration in firms

Enabling firms to develop innovations has received extensive attention of academics as it deals with the complex challenge of balancing short-term and long-term resource allocation. Duncan (1976) first coined the term 'organisational ambidexterity' and argued that 'firms need to shift structures to initiate and, in turn, execute innovation'. To accommodate the conflicting alignments, a dual arrangement for innovation is required to manage trade-offs and the conflicting alignments for innovation and efficiency. This theory has been further enriched by March (1991) who proposed that exploitation and exploration are two fundamentally different activities. In his view exploitation is about efficiency, control certainty and variance reduction; and exploration about search, discovery, autonomy and innovation. The problem with this is that firms need to engage in sufficient exploitation to ensure viability of the existing business model, and, at the same time, devote enough energy to exploration to ensure its future viability.

Building on March's theory, two other views on how firms can manage innovation have been proposed. First, Gibson and Birkenshaw (2004) argue that the tension between exploration and exploitation could be resolved at the individual employee level through contextual ambidexterity; defined as 'the behavioural capacity to simultaneously demonstrate alignment and adaptability across an entire business unit'. They argue that, to create a firm that flourishes in innovation, individuals in the firm need to be encouraged to make their own judgments as to how to best divide their time between exploration and exploitation. Hence, the emphasis is on the ability of individual employees rather than units. Second, Tushman and O'Reilly (1996) argued that organisational

ambidexterity as coined by Duncan (1976), might be ineffective in the face of rapid change and therefore firms need to explore and exploit simultaneously. Firms could accomplish this by establishing autonomous explore and exploit subunits; defined as structural ambidexterity. Moreover, to create an ambidextrous organisation two views have been proposed building on the view of differentiating exploration and exploitation activities. The challenge of choosing an approach has been further investigated by means of empirical studies and different views exist focused on either he employee level, or business unit level.

To innovate, firms may choose different approaches to be effective; and research shows that multiple conditions play a role on the effectiveness. Irrespectively of the approach, research shows that ambidexterity, in its different forms, has a positive effect on firm growth (e.g. Geerts, Blindenbach-Driessen, & Gemmel, 2010), market valuation (e.g. Uotila, Maula, Keil, & Shaker, 2008), firm survival (e.g. Kauppila, 2010) and rating of performance (e.g. Gibson & Birkenshaw, 2004). Yet, ambidexterity may under some conditions be duplicative and inefficient (March, 1991; O'Reilly & Tushman, 2013), and will be more valuable under conditions of environmental uncertainty (e.g. Jansen, Van den Bosch, & Volberda, 2005), increased competitiveness (e.g. Geerts, Blindenbach-Driessen, & Gemmel, 2010), and firm size (e.g. Cao, Gedajlovic, & Zhang, 2009). To explore and exploit radical innovations, Kauppila (2010) argued that structural separation between radical exploration and exploitation is a necessary, but not sufficient, condition: 'it does not really consider how a firm can simultaneously conduct radical forms of exploration and exploitation. It simply assumes that exploratory knowledge is produced somewhere and is available for use'. Contextual ambidexterity might hinder these types of innovations due to its disrupting, cannibalising and radical nature; however, it provides an environment in which integration of innovations into the existing organisation is supported. A separate

'exploration' unit is one of the prevailing views to support radical and disruptive innovations; it creates a safe incubation space for new opportunities, creating new growth options and fosters a more entrepreneurial culture (Hill & Birkinshaw, 2014).

This prevailing view mainly stems from firms that traditionally have separate R&D departments and likewise have successfully organised for more disruptive and radical product innovations. Firms that do not have a tradition with R&D–such as services firms–by nature tend to start innovating from within the core and manage innovation activities in different ways. Hence, hybrid forms can be observed based on the legacy of a firm. Depending on the business model of the developed innovation, firms can choose to integrate or separate businesses and the most frequently adopted perspective is that new business models should be established in new organisational units (Lavie et al., 2010; Markides, 2013; Winterhalter, Zeschky, & Gassmann, 2016). Concluding, when choosing an approach to explore and exploit disruptive and radical innovations certain conditions need to be assessed and ultimately these conditions need to serve as a guidance to manage these innovations. Structural ambidexterity serves as a basis to manage these innovations, and nurturing a supportive relational context is of key importance whenever innovations need to be integrated with current assets.

2.4 Open innovation to capture value beyond oneself

To explore disruptive and radical innovations, a structural ambidexterity approach is the most prevailing form; yet, a single firm is not likely to have all competences internally and therefore should utilise collective intelligence (e.g. Hill & Birkinshaw, 2014; Tushman & Benner, 2015). In addition, these types of innovations are often combinations of service and product elements, as they tend to emerge in networks of providers and suppliers, also called ecosystems (Dattee et al., 2018; Ramirez, 1999). Open systems for innovation, in which firms rely on their external environment to generate ideas, explore innovations, and exploit value from those have been observed since the 1970s (e.g. Allen, 1977). The role of co-creation with users in generating innovations, suppliers in the value chain, and other external organisations has proven crucial for the ability to innovate (von Hippel, 1988). Yet, to exploit value from open innovations coordination mechanisms between the different entities are crucial for success and this is far from abundant in firms (Jaspers & van den Ende, 2010). In line with this work, Chesbrough (2003) assumes that innovation activities in large-scale firms are more like an open system than the traditional vertically integrated model. This entails leveraging external knowledge sources through internal processes and leveraging internal knowledge through external commercialisation processes (Chesbrough & Bogers, 2014). Research shows that large-scale firms augment their traditional R&D practices with inbound sourcing of external technologies (e.g. West, Salter, Vanhaverbeke, & Chesbrough, 2014) and should, as a pre-condition, have the ability to recognise the value of new, external information, assimilate it, and apply it to commercial ends (Spitshoven, Clarysse, & Knockaert, 2009). Outbound open innovation, such as intellectual property licensing, requires opening up the innovation process to external knowledge exploitation (Mortara & Minshall, 2011).

Summarising, firms that pursue disruptive and radical innovations need to become part of innovation ecosystems and leverage the knowledge of these ecosystems. The orchestration of these ecosystems is a key capability for firms to ensure value capture from these innovations (Dattee et al., 2018).

Concluding, large-scale firms have started to structurally manage capturing external knowledge, and externalising internal knowledge to capture more value from innovations. Most open innovation-related research stems from R&D intensive firms; yet, firms without an R&D tradition, such as traditional services firms, perform activities in different ways since, e.g., they have not set up processes to capture value from R&D such as licensing or internal commercialisation (Chesbrough & Crowther, 2006). In spite of open innovation theories mainly stemming from R&D intensive firms, I apply this concept to research how disruptive and radical innovations can be explored in large-scale services firms. And, since researchers have shown that activities are performed in different ways in this services environments, I will provide more insight into how activities are performed in this environment.

2.5 Differences between product and service innovations

In contrast to products, services have intangible characteristics. They differ in ways of customer interaction and they thrive well within a network setting. Therefore, a service innovation cannot be researched, developed, prototyped, and tested in a similar way as physical products (den Hertog et al., 2010). Moreover, the intangible nature makes it difficult to assess beforehand how the end-to-end service will be experienced and what will

be delivered (Alam, 2002). New service development differs from new product development when considering organisational structures, development processes, life cycles, tasks and activities and thus, findings from new product development may be difficult to transfer to new service development (Kuester, Schuhmacher, Gast, & Worgul, 2013). In addition, service innovations are argued to be more dependent on actual and potential users for co-creation of new value propositions (Matthing, Sanden, & Edvardsson, 2004; Michel, Brown, & Gallan, 2008) and they are often new configurations of existing elements, newly bundled, or unbundled and supplied in a new context (Normann, 2002). Reflection of investigated literature up to and including this paragraph shows that researchers typically do not differentiate between radical product- and service innovations; research regards the level of disruptiveness and radicalness of an innovation similar for product and service innovations. Yet, since theories regarding ambidexterity and open innovation, addressed in previous paragraphs, stem from research in product and manufacturing firms, it does not take into account the different characteristics of services. Hence, it might provide a less adequate lens to approach disruptive and radical innovations in services firms.

The influence of IT on service innovation has a significant impact on the approach to effectively explore and exploit innovations. Both products and services are increasingly being digitalised (Iansiti & Lakhani, 2014). Digitalisation–the use of digital technologies to change a business model–has implications for the architecture of innovations (Tilson, Lyytinen, & Sørensen, 2010) and increasingly requires innovators to participate in open-innovation alliances, or ecosystems (Ceccagnoli, Forman, Huang, & Wu, 2012). Such innovations typically are built upon a layered digital infrastructure; which, pushed by technological advancements in computing power and connectivity, have the advantage of quick roll-out and scaling (Yoo, Henfridsson, & Lyytinen, 2010). Hence, service

innovations in a digital world require firms to attract new-to-the-firm capabilities such as data analytics and software development. In addition, firms have to open up their ecosystem and carefully manage multiple stakeholder interactions already during the exploration stage to ensure value capture.

Also, one should distinguish service innovations built on top of existing products in traditional industries, from innovations in the services industry itself. The former has been recognised as the process of creating value by adding services to products, also coined servitisation by Vandermerwe and Rada (1988). Many firms, supported by digitalisation of society, are transforming from providing physical products, to providing integrated product-services offerings (Baines, Lightfoot, Benedettini, & Kay, 2009). A great amount of research captures this phenomenon and provides approaches to manage this. The latter, specially focusing on the growing service industry, creates value by innovating services themselves or introducing new services within services firms. These types of firms are organised, controlled and coordinated in different ways and empirical evidence supports the proposition that the approach for innovation differs in this context (Droege, Hildebrand, & Forcada, 2009). Research shows that success in the service context is more dependent on e.g. innovative culture (Savory, 2009), and tacit knowledge (Leiponen, 2006), than in the product context. In spite of these findings, unlike traditional product-oriented firms, many services firms lack experience and the relevant capabilities for organising innovation activities (den Hertog et al., 2010), and researchers have been called upon to provide a better understanding of the internal organisational dynamics of services firms (Martin, Gustafsson, & Choi, 2016). Concluding, disruptive and radical innovations in services firms should be approached differently than in product firms. This is mainly caused by contextual differences and in the remainder of this thesis these differences will be investigated in more depth.

This chapter has introduced applicable theories available to researchers as a base to understand how large-scale services firms can explore disruptive and radical innovations. It shows that a shift towards open innovation, the interconnectedness of the service ecosystem, and digitalisation have changed the way these innovations are both explored and exploited within firms. Yet, it also presents knowledge gaps; first, services firms tend to lack the experience and relevant capabilities to organise for these types of innovation and second, innovation theories mostly stem from product and R&D intensive industries. Accordingly, a better understanding of the approaches to successfully explore these types of innovation in this context is required, hence the focus of this thesis.

PART II: DESIGNING AN INNOVATION SYSTEM

In the Part I of this thesis, 'Establishing the research', the theoretical foundation was developed. The overall aim of this thesis was explained, and available theories were identified to assist in resolving the research problem. To assess if theories can be applied in a new situation and sequentially enrich theories, one can use one or multiple case studies (Eisenhardt, 1989). Therefore, Part II, 'Designing an innovation system', validates innovation theories in multiple empirical case studies in order to understand to what extent these can be applied to solve the research problem and enrich theory.

Chapter 3 shows a multi-firm case study to understand how large-scale services firms organise for radical and disruptive innovations. Management control systems applied for innovation activities are analysed across firms to reveal how these intend to steer innovation efforts. In **Chapter 4**, a multi-project case study is carried out in a single firm to understand what barriers innovators face in their pursuit of radical and disruptive innovations. Theoretical barriers are validated with these innovators to identify possible discrepancies with theory. In **Chapter 5**, a longitudinal intervention study is conducted in a single firm to investigate the effect of multiple control interventions on the effectiveness of exploring radical and disruptive innovations.

Levels of analysis

To ensure coverage of the full spectrum of the innovation system, research is conducted on different layers of the innovation system (*see Figure 3*). The first study is at organisational-level; research is conducted on how executive-level management of firms organises innovation activities. In the second study, a project-level analysis is conducted; initiative leads of disruptive and radical innovations are studied to understand barriers to their innovations. The third study is a unit/division-level analysis; the effects of management control systems are studied in an innovation group.

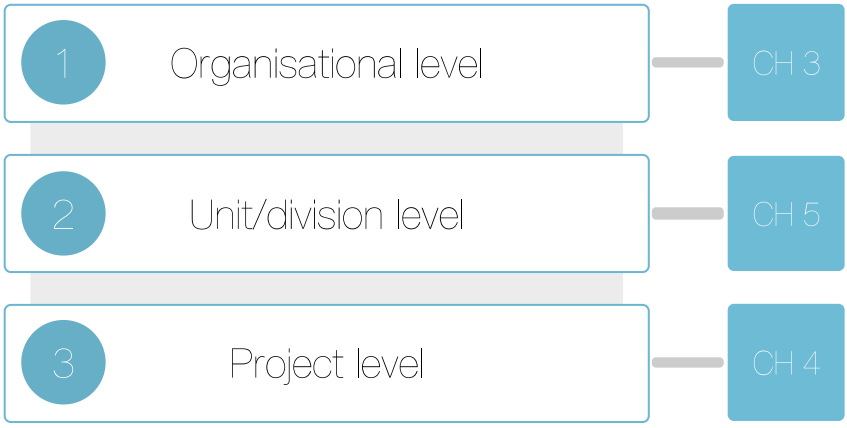

Figure 3: Levels of analysis in study

3 THE APPLICATION OF MANAGEMENT CONTROL SYSTEMS TO EXPLORE INNOVATIONS

In the previous chapter key theories on managing disruptive and radical innovations in large-scale services firms were explained. The next step is to empirically assess how large-scale services firms organise for innovation. To address this issue, this chapter explores how management control systems are used to support radical disruptive innovations. Literature suggests that these types of innovation require different control systems than required by traditional product innovation. I therefore create an innovation control scheme based on best practices from literature and apply this scheme to examine what controls are used for controlling disruptive and radical innovations in ten large-scale firms. This chapter explores the first sub-research question: *What key management control systems do large-scale services firms typically use to support exploration of disruptive and radical innovations?*

Section 3.1 introduces the study and the relevance of solving the research problem. In Section 3.2 the control concept is explained in detail, which will be used to develop a conceptual framework. In Section 3.3 the design of the empirical multi-firm case study is presented; Section 3.4 analyses the results of the study. Section 3.5 further discusses these results, determining what controls large-scale firms apply and how effective this is; Section 3.6 presents conclusions of the study.

The results of this study were presented at the ISPIM Conference in Boston, USA on 28th of March 2018; and at the 19th International Continuous Innovation Network Conference in Dublin, Ireland on the 10th of September 2018; it is featured in the conference proceedings (Das, Verburg, & Verbraeck, 2018).

3.1 Introduction

Should large-scale services firms organise exploration of disruptive and radical innovations separately or should these be integrated within the organisation? And how should these activities be controlled? As shown in Chapter 2, researchers show that structural ambidexterity (i.e. promoting a structural separation of exploration and exploitation activities) serves as a basis to manage disruptive and radical innovations (Tushman & O'Reilly, 1996). In addition, researchers show that nurturing a supportive relational context with the core organisation is of key importance whenever innovations need to be integrated with current assets, see also paragraph 2.4.

In spite of this guidance, the control of innovation activities seems highly challenging due to inherent tensions between innovation and control (Lövstål & Jontoft, 2017). Large-scale firms are effective because of economies of scale, standardisation and systematic control that reduce uncertainty and allow managing risks. Disruptive and radical innovations can be characterised by high levels of uncertainty during their development and have a deep impact on a firm's brand; this has an impact on the nature of control all along the way of the innovation (Chiesa, Frattini, Lamberti, & Noci, 2009). As a result, under these circumstances control is particularly difficult because continued corrective actions are needed throughout the exploration stage and command & control does not fit with this reality (Verburg et al., 2018).

This study illustrates how large-scale services firms apply management control systems to support disruptive and radical innovation. Management control systems (shortened to 'controls' in the remainder of the thesis) can be defined as the set of formal and informal input and output processes

that are used by senior executives to achieve organisational goals (Chenhall, 2003). Although there is some literature available on the impact of controls on product innovations (Bisbe & Otley, 2004), service innovations (Aas, 2011), radical innovations (Chiesa et al., 2009), ambidexterity (Nilsson, Hemph, Magnusson, & Ritz, 2015), and the stages of innovation (Poskela & Martinsuo, 2009), not much is known about the role of management control within large-scale services firms in relation to disruptive and radical innovations during the exploration stages. Yet, not using management control systems, or using them inappropriately, may hamper innovation due to factors such as internal inconsistency, logical progression, historical tendency, dominance, and suppression (Mundy, 2010).

3.2 Theoretical Framework

Management control systems can be divided into formal and informal processes. Formal controls rely on officially documented rules and are often implemented by managers, whereas informal controls are based on norms and often enacted by peers (Baldauf, Cravens, & Piercy, 2005). The general purpose of such controls is to balance creativity and control, and to focus attention of managers and employees to act in the best interest of the organisation. Generally, these systems are available to senior management in order to alter patterns in organisational activities and to support the formulation and implementation of business strategies (Simons, 1995).

In his seminal work, Simons (1995) provides four categories of management control systems that support strategy implementation called the 'levers of control':

1. *Beliefs systems*, communication of core values of the firm used to inspire and direct the search for new opportunities in line with its purpose.
2. *Boundary systems*, used to set limits on opportunity-seeking behaviour.
3. *Diagnostic control systems*, used to motivate and reward achievement of specified goals.
4. *Interactive control systems*, used to focus attention on strategic uncertainties and emergence of new ideas and strategies. Such as formal information systems used by managers to involve themselves in the decision activities.

Although these systems are sometimes criticised for being ambiguous (see e.g. Chenhall, 2003; Chenhall & Moers, 2015), the framework sets out the broad range of different types of controls (Tessier & Otley, 2012). As such, it provides a structured way to analyse and design controls to support strategy implementation. Ever since its appearance, many scholars have proposed new frameworks to mitigate issues such as vagueness and ambiguousness and to provide tools for empirical research. For example, Ferreira and Otley (2009) have proposed a performance management systems tool integrating Simons' levers of control. Their research tool provides key questions to analyse innovation controls in organisations. To support strategy implementation when regarding service innovation activities, Aas (2011) has created a comparable framework that subdivides performance measurement systems by stages of the innovation process. As such, this framework supports the design and assessment of controls for exploration of

innovations. I will combine components of the above-mentioned frameworks in order to create a scheme that allows me to analyse innovation controls in the context of exploring disruptive and radical innovations in large-scale services firms.

3.2.1 Management Controls Systems Scheme

To create a management control systems scheme that supports the design and assessment of controls for exploration, I create a scheme existing of three high-level categories inspired by Simons' levers of control (1995) and the work of Aas (2011) (*see Figure 4*):

1. *Performance monitoring controls*, those include diagnostic and interactive control systems.
2. *Firm and portfolio controls,* those include beliefs systems and boundary systems.
3. *Contextual antecedents*, reflecting the various contextual variables impacting innovation activities in the firm.

The first two categories contain the Simons' traditional levers of controls: the positive and negative controls to steer organisations. The third category contains the contextual antecedents that can produce evidence for the managerial choices of controls in use. Mapping the environmental, organisational and managerial antecedents can support in explaining the tensions that may influence the organisation's tendency to explore versus exploit (Lavie et al., 2010). This provides further insight in the reasons why certain controls are used. In addition, controls should recognise the different levels of radicalness and uncertainty in the development process, to not slow down innovations (Tessier & Otley, 2012). Building on the work of Aas (2011), controls are further divided based on innovation process stages. Per stage different activities are undertaken; in early stages, the

mere focus is on validation of the opportunity and technology, in later stages the focus is on development of the service. Since the nature of activities differs, controls should evolve along with the innovation (Chiesa et al., 2009). Below the scheme is explained in more detail per category from left to right, top to down.

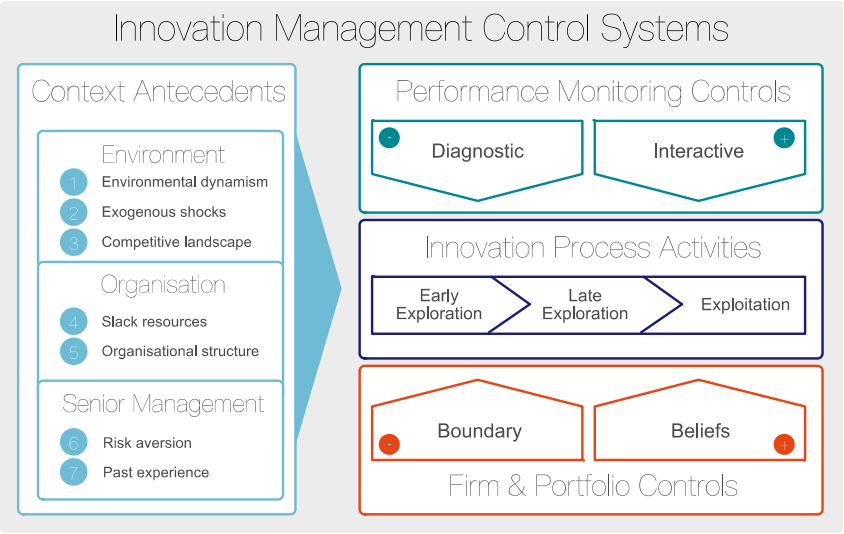

Figure 4: A management control systems scheme for innovation

Innovation Process Activities

Controls are related to three innovation stages: *early exploration*, *late exploration* and *exploitation*; these stages are based on the well-known stage-gate model by Cooper (2012), service-innovation activities as described by Aas (2011), and competence-based activities for radical innovations by O'Connor and DeMartino (2006). These three stages are based on the different characteristics and competences required for the activities in early and late exploration, and exploitation. Early exploration involves both discovery and incubation activities, i.e. activities that search,

generate, recognise, elaborate, and articulate opportunities; and, activities that validate screened opportunities by means of prototyping. Late exploration involves acceleration activities, i.e. transforming working prototypes into a viable business that can stand on its own or that can be integrated with current organisational assets. Finally, exploitation represents commercialisation of innovations, either within the traditional exploit organisation or as separate entities.

Contextual Antecedents

There is an inherent tension between exploration and exploitation. This tension is affected by environmental, organisational and managerial factors (Lavie et al., 2010). In the control systems scheme (*as presented in Figure 3.2*), these contextual factors are included in order to understand the propensity of firms to focus on explore or exploit activities. This balance, or imbalance, may explain why some controls are used and whether these are effective or not. I include the seven antecedents from Lavie, Stettner and Tushman (2010) that have clearly defined constructs and have been validated in previous studies. First, I look at environmental factors: dynamism (i.e. the extent of unpredictable change), exogenous shocks (i.e. sudden and unexpected jolts beyond control of the firm), and the influence of the competitive landscape. Second, I look at organisational factors: slack resources (i.e. excess resources available for innovation), and the influence of the organisational structure. Last, I look at managerial factors: the influence of risk averseness on controls, and the influence of past experience of the firm with innovation and R&D activities.

Performance monitoring controls

Simons (1995) categorises traditional performance measurement systems into both diagnostic and interactive control systems. The former, are used by management in order to monitor organisational outcomes and to spot

deviations from established standards. Examples are quality standards and scorecards. The latter is used in order to deal with strategic uncertainties, focusing on the behaviour of subordinates and joint decision-making. Examples are innovation boards, and project sponsors. Periodically during the year plans are adjusted based on contextual factors to ensure strategic ambitions remain feasible.

Firm and Portfolio controls

In addition to performance monitoring controls, Simons (1995) identifies more general categories of control: beliefs and boundary systems. The first establishes core values, a shared vision and allows managers to transmit beliefs and values to lower levels of the firm. It provides an overall sense of innovation direction in forms of mission statements and credos. Examples are missions, strategies, and growth areas to guide exploration of future growth. The latter establishes the limits to managerial authority, delegation and discretion, especially important in the risk management process. Boundary systems ensure that realised strategies are within the acceptable domain of activities and at acceptable levels of risk. Examples are ring-fenced budgets, processes, and methodologies outlining the way of working.

3.2.2 Synthesis

In spite of the growing research efforts on the relationship between management control and innovation, little is known about the nature of this relation in large-scale services firms. More specifically, it is unknown how controls may enable both disruptive and radical innovation in such firms. Research evidence suggests that the management of service innovation differs from traditional product innovation (see paragraph 2.5). Therefore, it is not likely that large-scale services firms could rely on the same kind of controls as traditional product firms. The question is what controls are

most effective in this context? Are these solely belief, interactive and boundary controls only, or can diagnostic controls also play a role?

3.3 Research Design

To describe the use of control in relation to disruptive and radical innovations in large-scale services firms, an exploratory research approach is chosen. In particular, researching multiple case studies is a suitable approach for investigating complex phenomena and offers the opportunity to ultimately create propositions that can be further investigated (Eisenhardt & Graebner, 2007; Yin, 2003).

To study control in this context and ensure generalisability of results, I aimed for having at least five cases, with a maximum of ten. This allows for rich data gathering while also being able to create an extensive narrative of each case. To have a representative sample of large-scale services firms, firms are selected that meet the following three criteria:

1. Firms should employ over 10.000 people.
2. Firms should have expressed a strategic intent to explore and exploit disruptive or radical service innovations.
3. Firms should have at least five years of experience with innovation evidenced by having an innovation portfolio.

Through personal contacts with peer researchers and practitioners, a total of nine cases were selected that meet the criteria. This set consists of firms within Europe and the US with a multinational market reach. Of these nine firms, seven are service-oriented firms and two are product-oriented

firms. I selected the two firms to provide an additional comparison between product- and service-oriented firms. To ensure the reliability of data I targeted management-level informants, which were involved in both strategy creation and implementation for at least one year and thus would be representative for yielding organisational-level data (*summarised in Table 1*).

Firm I

The first firm is a multinational, publicly traded telecom firm, with headquarters in Europe. In 2017, it had over 10.000 employees and a net result over four-hundred million euros. It offers telecom services mainly in Western Europe and aims to innovate their services and explore and exploit new business models. To accomplish this, it has set up innovation labs, a corporate venturing department, and a new business development department.

Firm II

Firm II is also a multinational, publicly traded, telecom firm, with headquarters in Europe. In 2017, it had over 50.000 employees and a net result of over five billion euros. It offers telecom services mainly in Europe and the Americas and looks at future long term technological developments to have a major social impact and create breakthrough innovations. To achieve this, an innovation department has been set up where new radical and disruptive ideas can land and are developed separate from the core.

Firm III

The third firm is a global, publicly traded airline, with headquarters in Europe. In 2017, it had over 20.000 employees and a net result of over one billion euros. Its innovation strategy is mainly focused at radically improve current offerings focusing on digital and e-commerce. To accomplish this, a small team that supports the business with innovation capabilities has been set up.

Firm IV

This firm is a multinational, publicly traded, mail and parcel firm services customers in multiple European countries. In 2017, it had over 20.000 employees and a net result of over one hundred million euros. Innovation focuses on meeting the changing needs of customers through the process of digitalisation and e-commerce. Therefore, the firm has set up an innovation studio to develop adjacent and transformational initiatives separately from the core.

Firm V

The fifth firm is a global, publicly traded, financial services firm, with headquarters in the US serving corporate clients. In 2017, it had over 12.000 employees and a net result of approximately one billion euros. It has an innovation group to develop and launch emerging business separately from the core.

Firm VI

Firm six is a global, publicly traded, investment firm, with headquarters in the US and has offices in over ten countries. In 2017, it had over 10.000 employees and a net result of over thirty-million euros. It aims to leverage emerging technologies to create next-generation solutions. To accomplish this, an innovation accelerator has been set up to focus on disruptive and radical innovations.

Firm VII

The seventh firm is a state-owned European energy firm operating in Western Europe. In 2017, it had over 20.000 employees and a net result of over nine billion euros. It provides energy services to its customers and aims to lead the way towards sustainable energy production and consumption. To achieve this ambition multiple divisions have their own innovation departments to organise for innovation.

Firm VIII

Firm eight is a global, publicly traded, chemical firm based in Europe. In 2017, it had over 20.000 employees and a net result of over six hundred million euros. It provides ingredients, technologies, and materials to its clients and aims to drive profitable growth and expand its footprint. To accomplish this an innovation department has been set up to develop disruptive and radical innovations based on emerging value areas.

Firm IX

The last firm is a global, publicly traded, oil and gas firm based in Europe. In 2017, it employed over 50.000 employees and had a net result of over 13 billion euros. Next to its traditional technology and product innovation, it supports businesses with digital service innovations and has a team of approximately ten people to support these businesses.

Table 1: Case studies for assessing MCS used for innovation.

No	Industry	Market	Employees	Type of Firm	Informant
I	Telecom	EU	20.000+	Services-oriented	Innovation Manager
II	Telecom	World-wide	50.000+	Services-oriented	VP Innovation
III	Airline	World-wide	20.000+	Services-oriented	Director Innovation
IV	Mail	EU	20.000+	Services-oriented	Innovation Director
V	Finance	World-wide	15.000+	Services-oriented	Executive Director
VI	Finance	World-wide	10.000+	Services-oriented	Head of Innovation
VII	Energy	EU	20.000+	Service-oriented	Innovation Manager
VIII	Chemicals	World-wide	20.000+	Product-oriented	Innovation Manager
IX	Oil & Gas	World-wide	50.000+	Product-oriented	Innovation Manager

The first step was to both analyse the innovation strategy and disruptive and radical innovations explored and exploited by the firms under study. I conducted a text-based analysis of their annual reports in order to understand the strategic intent and the resources committed to innovation activities. The second step was to use the management control systems scheme to design semi-structured interview questions; using semi-structured questions allows to follow up on specific topics, which in return supports in getting a better understanding of the causes and effects of the controls (Bernard, 1988). Each interview took approximately an hour, was recorded, transcribed, and checked with the informant before the analysis. The third, and last step was to compare all cases using the scheme in order to process differences and similarities in control approaches. Findings are presented in the result section only in case more than 1/3 of

the firms apply a control, or are subject to a control. If not named during the interview and not documented I regard the control as having not enough significant impact to take into account for this study; yet, it does not exclude that a firm has the specific control in place. In Appendix C.1 the interview protocol is presented in detail and in Appendix C.2 the informants are further described.

3.4 Results

Influence of contextual antecedents

The nine firms under study use different sets of controls for exploration activities (*see Table 2*). The differences can be explained by the contextual antecedents, which affect the need to innovate, and the ability of firms to institutionalise controls for effective exploration of disruptive and radical innovations.

First, from an environmental contextual perspective, firms I, VII, and IX are subject to dynamism of new regulations, exogenous market changes or new entrants that affect market dynamics. These environmental antecedents impact the innovation ambition of firms; these antecedents appear to be a key driver for firms to start exploring disruptive and radical innovations. As an example the Payments Service Directive in the financial industry has accelerated innovation as it enforces changes to make better use of technological advancements and improve quality of payment services (Donnelly, 2016). Hence, exogenous market changes have a key impact on the presence and design of the innovation system.

Second, from an organisational contextual perspective, firms II, III, V, VI, VIII, and IX have separate innovation groups, and both firms IV and VII have an integrated strategy and innovation group. Firm I has differentiated innovation across multiple entities in the business which results into less room to safeguard innovations, but more involvement from business units to explore innovations. Having a separate group for innovation might improve efficiency of innovations; yet, many aspects of innovations require synergies with the traditional organisation (De Brentani & Ragot, 1996). This oftentimes is a gap that requires effort to bridge in order to test propositions in a lean way, as put forward by an informant of Firm VII: '*it is difficult to get through to support functions and do things in a small way*'. While innovation methodologies push to expose innovations in an early stage to customers, firms require many approvals from functions such as legal, risk, and branding before exposure. To ensure methodologies can be applied, it requires adaptation and waivers to existing controls to experiment often and quickly. Therefore, all firms except firm IV and I, have resources allocated for supporting innovations. This provides the opportunity for firms to safeguard innovations, protect them from 'business-as-usual', and allocate budgets for exploring disruptive and radical opportunities.

Third, from a managerial contextual perspective, firms I, II, VII, VIII, and IX have a tradition in R&D which reflects past experience with exploration and organisational structures that support such activities. A tradition in R&D shows to influence the institutionalisation of innovation controls since management has past experience with these types of controls. However, past experience with R&D typically involves fundamental research and product-oriented innovation. Service innovation, as presented in Chapter 2, has different characteristics and requires different capabilities and controls. As a result controls originating from product innovation may have a counterproductive effect since it requires changing existing innovation

controls, rather than designing innovation controls. In addition, firms V and VI have a risk averseness culture and have no R&D tradition. These contextual antecedents have its effects on the innovation system since findings show that traditional exploit controls, designed to increase efficiency, and control certainty and variance reduction (March, 1991), are also used for exploration activities.

Moreover, contextual antecedents play a key role in understanding the ambition of a firm to innovate and subsequently when designing controls for innovation. Antecedents such as: influence of an R&D tradition, risk averseness, and changing regulations show to affect the urgency to innovate and how controls are used within firms.

With the understanding that contextual antecedents affect controls used by firms to explore innovations, in the remainder I present findings of controls used by firms. First, for the performance monitoring category and second, for the firm and portfolio category; aggregated findings are presented in Table 3.

Table 2: Controls applied by firms under study for exploring disruptive and radical innovations

Innovation management control systems							
Firm No.	Influence of contextual antecedents			Performance monitoring management control systems		Firm & portfolio management control systems	
	Environment	Organisation	Managerial	Diagnostic controls	Interactive controls	Portfolio & process boundary controls	Strategic belief controls
I	• New regulations	• Innovation differentiated across different entities.	• Influence of R&D tradition	• Traditional controls focusing on ROI, supported by new methods ('Lean Startup) • KPI's on successful handovers to receiving units	• Early exploration managed by board ('Innovation board')	• Focus areas • Stage-gate process • Ring-fenced exploration budget Innovation group responsible for investments	• Local business needs • Revenue growth
II	• -	• Separate innovation group • Resource commitment	• Influence of R&D tradition	• Measurements for explore activities based innovation methodologies ('Lean Start-up, Design Thinking, Agile').	• Early exploration managed by group ('Innovation Group') • Late exploration managed by board ('Senior Exec.').	• Stage-gate process • Ring-fenced exploration budget Innovation group responsible for investments	• Societal impact • New customers • Revenue growth
III	• -	• Separate innovation group	• -	• KPI's on number of early and late exploration activities	• Exploration managed by business.	• Traditional budget controls • Business-ownership	• Local business needs
IV	• New entrants • Obsolete services	• Digital and innovation group are integrated.	• -	• Measurements for explore activities based innovation methodologies ('Lean Start-up and Design Thinking').	• Early and late exploration managed by group ('Innovation Director')	• Focus areas • Stage-gate process • Ring-fenced exploration budget Innovation group responsible for investments	• Strategic vision • Revenue growth
V	• -	• Separate innovation group • Resource commitment	• Risk averse • No R&D tradition	• Measurements for early and late explore based innovation methodologies ('discovery-driven planning')	• Early and late managed by Innovation Group ('Head of innovation')	• Stage-gate process • Traditional budget controls for late exploration • Innovation group responsible for early exploration investments	• Revenue growth
VI	• -	• Separate innovation group • Resource commitment	• Risk averse • No R&D tradition	• Measurements for explore activities based innovation methodologies ('3D-model'). • Annual business planning,	• Early and late exploration managed by board ('Innovation Advisory Board')	• Focus areas • Stage-gate process • Innovation board responsible for investments	• Strategic vision • Revenue growth
VII	• Sustainability regulations and demand	• Strategy and innovation group • Resource commitment	• Influence of R&D tradition	• Measurements for explore activities based innovation methodologies ('Lean Start-up).	• Early and late exploration managed by board ('innovation board') • Senior management sponsorship for innovations	• Stage-gate process • Innovation board responsible for investments	• Strategic vision • Local business needs
VIII	• -	• Separate innovation group • Resource commitment	• Influence of R&D tradition	• Traditional controls focusing on ROI, supported by new methods ('Design Thinking') • Risk management	• Early and late exploration managed by board ('Innovation board')	• Focus areas • Ring-fenced exploration budget Innovation board responsible for investments	• Strategic vision • Revenue growth
IX	• Sustainability regulations and demand	• Separate innovation group, • Resource commitment	• Influence of R&D tradition	• Traditional controls focusing on ROI, supported by new methods ('Design Thinking') • Portfolio and risk management	• Early exploration managed by board ('Innovation boards')	• Traditional budget controls in place • Business-ownership	• Strategic vision • Local business needs

Table 3: Aggregated results of controls used in firms under study for exploring disruptive and radical innovation

Control Category	Lever of Control	Control description	Services firms applying control	Product firms applying control	Total firms applying control
Performance monitoring	Diagnostic	Traditional controls focusing on ROI	1 / 7	2 / 2	3 / 9
		KPI's on handovers to receiving entities	1 / 7	-	1 / 9
		Measurement for early and late exploration based on innovation methodologies	5 / 7	-	5 / 9
		KPI's on number of early and late exploration activities	1 / 7	-	1 / 9
		Traditional annual business planning for disruptive and radical innovations	1 / 7	-	1 / 9
		Portfolio and risk management	0 / 7	2 / 2	2 / 9
Performance monitoring	Interactive	Early exploration managed by board	1 / 7	1 / 2	2 / 9
		Early exploration managed by group	1 / 7	-	1 / 9
		Late exploration managed by board	1 / 7	-	1 / 9
		Exploration managed by business	1 / 7	-	1 / 9
		Early and late exploration managed by group	1 / 7	-	1 / 9
		Early and late exploration managed by board	2 / 7	1 / 2	3 / 9
		Senior management sponsorship for innovations	1 / 7	-	2 / 9
		Early and late exploration managed by group	1 /7	-	1 / 9
Firm and Portfolio	Portfolio and Boundary	Focus areas	2 / 7	1 / 2	3 / 9
		Stage-gate process	6 / 7	-	5 / 9
		Innovation group responsible for early exploration investments	2 / 7	-	2 / 9
		Innovation group responsible for early and late exploration investments	2 / 7	-	2 / 9
		Ring-fenced exploration budget	2 / 7	1 / 2	3 / 9
		Traditional budget controls for early and late exploration	1 / 7	1 / 2	2 / 9
		Business-ownership	1 / 7	1 / 2	2 / 9
		Innovation board responsible for investments	2 / 7	1 / 2	3 / 9
		Traditional budget controls for late exploration	1 / 7	-	1 / 9
Firm and Portfolio	Strategic Belief	Strategic vision	3 / 7	2 / 2	5 / 9
		Revenue growth	4 / 7	1 / 2	5 / 9
		Active user / customer growth	1 / 7	-	1 / 9
		Local business needs	3 / 7	1 / 2	4 / 9
		Societal impact	1 / 7	-	1 / 9

Performance monitoring controls

To monitor performance of innovation efforts and ensure management can involve themselves in decision-making, I find that firms have introduced new-to-the-firm controls that acknowledge the nature of these types of innovations (*see Table 3*); nevertheless, traditional controls applied in the exploit organisation are also subjected to exploration activities.

Findings show that all firms have implemented new-to-the-firm methodologies that require different controls (*see Table 2: diagnostic controls*). Firms typically show to install diagnostic measurement controls for early and late exploration based on these newly implemented innovation methodologies.

Five firms have installed controls measuring progress and performance based on new innovation methodologies. To describe the methodologies applied, informants referred to existing methodologies: the informants from firms II, IV, and VII referred to 'Lean startup', see: Ries (2011); to 'Design Thinking', firms II and IV, see: Osorio (2011); to 'Agile', firm II, see: Cervone (2011); to 'Discovery-driven planning, firm V, see: McGrath & MacMillan (1995); and tailor-made processes, firm VI. The derived controls from these methodologies that measure progress and performance, give innovators the degrees of freedom required during the exploration stage to demonstrate feasibility, desirability, and viability of disruptive and radical innovations.

Nevertheless, most firms are subject to traditional installed controls that do not acknowledge the nature of the innovation, nor the innovation methodologies applied. In two firms, I and V, innovations are subjected to traditional return-on-investment and annual business planning controls that are deemed ineffective by informants. This is exemplified by an informant from Firm V: '*I still have to trick the standard process requiring*

five-years business cases', showing that in order to secure budget and resources for innovations, controls used are not adequately aligned with the uncertain nature of disruptive and radical innovations requiring many modifications and re-invention during the diffusion process (e.g. Christensen & Overdorf, 2000; Kinnunen, 1996). Like-wise, the informant from product firm IX describes that traditional controls installed for product and technology innovations, are also applied for exploring disruptive and radical service innovations. As an example of the unsuitability of this, the informant stressed that there is a tendency that high-visibility service innovations are too important to fail and are kept alive. '*The digital manager* (read: member of innovation team) *should be able to take decisions to stop these projects; yet, these decisions are oftentimes postponed by the business and therefore projects continue*'. Moreover, irrespective of invalidation of the feasibility, viability, or desirability in an early stage, service innovations are subjected to expectations of traditional product or technology innovations which tend to have longer throughput times in the environment of firm IX, the oil and gas industry.

To steer innovations and overcome challenges with those traditional controls, six services firms and both product firms have given the budget responsibility for managing innovations during (parts of) the early exploration stage to a dedicated entity. Findings show that in particular firms that just embarked on an innovation journey do not yet have organised for this (e.g. Firm V, VI and VII), which results into a challenge in allocating adequate resources for innovations. Four firms that have assigned budget responsibility for innovation to an entity manage this by a board (existing out of executive-level management); three firms manage this through the innovation group and its management team. These differences are to a large extent based on diverse views on how to nurture innovations, and the corporate governance of a firm prescribing decision-making processes. Two firms manage both early and late exploration by

an innovation board; this allows for room to protect innovations from traditional performance monitoring controls since innovations can thrive in a safe and secure environment. Quoting an informant of firm II: '*we try to keep teams* [innovations] *as much as possible under the radar and let them come up with customer data to prove their value propositions; if opinions and politics come into place, you end up in the wrong discussions*'. Nevertheless, this implies a managerial misunderstanding of the early and late exploration activities since initiatives are kept under the radar to limit influence of top management.

Moreover, new methodologies change the operational process on a project-level and this needs to be reflected in performance monitoring controls used by management of firms. Nevertheless, many firms still are subject to traditional controls enforced by the exploit organisation, not designed for the characteristics of exploring disruptive and radical innovations.

Firm and portfolio controls

To inspire and direct the search for new opportunities, but also to set limits on opportunity-seeking behaviour of employees, firms use various innovation controls. Three services- and both product firms expressed a clear innovation strategy to direct the search of innovation opportunities. Two services- and one product firm go a step further and have defined strategic focus areas to limit the width of opportunities. Also named by firms amongst others: 'emerging business areas' or 'value spaces', these focus areas provide longer term horizon to ensure propositions are developed that target strategic areas of growth, and capitalise on strategic capabilities of the firm.

To ensure that opportunity-seeking behaviour of employees aligns with the ambition and to track progress, six services firms apply stage-gate

processes based on the work of Cooper (1990). In general, these processes are composed of stages and gates with entry and exit criteria restricting resource allocation during a stage. What varies amongst firms are the budgets and timelines allocated; these are dependent on the type of industry, customer segments and technological depth of propositions. In conjunction with this process, firms demonstrate to have ring-fenced exploration budgets for innovations allowing them to provide the necessary means to continue to the next exploration stage. In some cases an innovation board is responsible, in the other cases the innovation group; this depends on the organisational structure (i.e. governance and culture). After the exploration stage, budget allocations typically have to come from other sources such as the receiving business unit, a corporate venturing unit, the management board, or external parties.

Next, four services firms (I, II, IV, V, VI) and one product firm (VIII) direct the search of opportunities by quantifying thresholds for potential revenue growth of innovations. This makes apparent that when firms pursue disruptive and radical innovations, the intention is to exploit it on a large scale. To ensure value can be captured from these innovations after the exploration stages, exploitation processes need to be in place allowing to meet this potential in future. However, of these firms, three service firms (I, III, VII) and one product firm (IX) also require that local business needs are met, showing that although the emphasis is on disruptive and radical innovations, exploiting innovations requires alignment with existing business units. This creates a dependency since these business units typically do not have the appetite to launch disruptive propositions in the market, do not have the means to exponentially grow, nor do they have the long term horizon to await value to be created (Christensen, 2016; O'Reilly & Tushman, 2008). Moreover, while still being subject to traditional controls enforced by the exploitation organisation, as presented in Table 3, I find that many firms have applied firm and portfolio category

controls to encourage opportunity-seeking behaviour within organisational limits acknowledging the characteristics of innovations.

3.5 Discussion and Limitations

By identifying what controls large-scale services firms use to effectively explore disruptive and radical innovations, this study provides insight into how firms create a system for innovation. Firms typically tend to control new exploration activities by applying the same controls as used for their traditional exploitation activities. Those controls typically do not fit with the nature of innovation activities and this results in tensions at the intersection of management-level and project-level expectations. Moreover, firms show to be subject to controls not designed for exploration of disruptive and radical innovations; this results in difficulties with: effective validation of new growth opportunities, delivering impact on the right performance indicators showing progress and potential, and securing adequate time and resources.

Often issues are rooted in the nature of firms, which in many cases have not (yet) fully institutionalised new methodologies suitable for exploration activities. Changing procedures, controls and processes in large-scale firms are cumbersome processes and institutionalisation of controls agnostic to innovation methodologies shows to go through the same trajectory. Hence, institutionalising new-to-the-firm innovation controls is a time-intensive trajectory dependent on the transformational ability of a firm. Findings presented in Table 2 show that all firms implemented new-to-the-firm methodologies; services firms in the sample seem to implement most new-to-the-firm controls and struggle most with getting

acceptance for new controls that are agnostic to these innovation methodologies. Most dominantly present, to secure resources for innovations, innovators are subject to traditional performance monitoring controls not fitting with innovation processes. This clearly shows a discrepancy between used and required controls for exploration activities of disruptive and radical innovations. More 'innovation mature' firms that have had time to institutionalise new-to-the firm innovation methodologies have designed and implemented specific controls for innovation activities. When combining empirical findings with literature, I suggest a number of key controls, which nurture innovations and prepare them for exploitation. In Table 4 key controls are presented that are applied by at least 30% of firms under study to support radical and disruptive innovations.

Table 4: Results: Key controls used to control exploration activities

Control Category	Lever of Control	#	Control description
Performance monitoring	**Diagnostic**	**1**	Traditional controls focusing on ROI
		2	Measurement for early and late exploration based on innovation methodologies
		3	Early and late exploration managed by board
Firm and Portfolio	**Portfolio and Boundary**	**4**	Focus areas
		5	Stage-gate process
		6	Ring-fenced exploration budget
		7	Innovation board responsible for investments
Firm and Portfolio	**Strategic Belief**	**8**	Strategic vision
		9	Revenue growth
		10	Local business needs

Nevertheless, even mature firms tend to keep innovations in the exploration stage under the radar to limit the influence of traditional performance monitoring controls. This might be beneficial on the short term, but may impede: time-to-market, effective exploitation, and the total investments required for impact.

This research follows Nilsson et al. (2015), that argues that controls tend to reflect the ambition level regarding ambidexterity as a proxy for innovation. Especially the presence of controls such as: innovation focus areas, a strategic innovation vision, and innovation boards clearly represent the ambition of firms. In spite of this, it presents only a part of the picture since beliefs of a firm might not be reflected in controls due to contextual antecedents such as organisational culture, governance, and environmental dynamism. This could result in misalignment of controls with organisational goals and misunderstanding of performance and progress of innovation activities.

On the basis of these findings I suggest the following proposition to further investigate in this thesis:

P1. Inertia of large-scale services firms results in the slow translation of innovation methodologies into adequate controls for exploration activities affecting the effectiveness of early disruptive and radical innovations.

P2. Contextual antecedents have an important effect on innovation systems; therefore, innovation controls should be specifically designed to antecedents to increase effectiveness of exploring disruptive and radical innovations.

This exploratory study is not without limitations. Although nine knowledgeable informants (senior managers) of each firm were

interviewed, this study is based on single informants and on available documents, which creates the risk of response bias. Also, data were gathered at one moment in time. Future studies could focus on a single-case to deepen understanding of the design, implementation and effectiveness of controls and validate the findings.

3.6 Conclusions

This chapter contributes in answering the first sub-research question by exploring what controls are used to support exploration of disruptive and radical innovations. Findings show that although new innovation-agnostic controls are installed, traditional controls are misapplied within large-scale services firms for exploration of radical and disruptive innovations. This results into barriers for effective exploration of innovations and has several implications such as: cumbersome processes for innovation activities, misalignment of innovations with organisational goals, and misunderstanding by management of performance measurements for innovation activities.

The results first indicate that contextual antecedents impact the controls used for innovation activities during the exploration stages; second, results show that contextual antecedents are an important category allowing scholars to explain why a certain mix of controls is used within a firm. Managers should understand the contextual antecedents of their firm and design controls accordingly to increase the effectiveness of innovation activities and meeting organisational goals.

Scholars can use the presented control scheme to generate a better understanding of the relationship between controls, innovation, performance, and improve it by providing further empirical evidence. Further research on how large-scale services firms control innovation and what challenges lay ahead of them, will enrich the understanding of what is needed to bring disruptive and radical innovations more effectively to the market and to contribute to solving societal challenges.

4 BARRIERS TO DISRUPTIVE AND RADICAL INNOVATIONS IN LARGE-SCALE SERVICES FIRMS

In the previous chapter both adequate, and inadequate controls for radical and disruptive innovations in large-scale services firms were identified. The findings show that although new innovation-agnostic control are installed firms tend to apply proven control systems, that are designed for exploitation of current business, for exploration activities as well. This implies that controls are misapplied providing challenges in effective organisation of innovation activities.

To deepen the understanding of these challenges within large-scale services firms, the next step of this thesis is to investigate what barriers innovators experience within these controlled environments. Therefore, the aim of this chapter is to explore barriers that limit the effectiveness of radical and disruptive innovations within these firms. While literature has generally focused on barriers within traditional technology and manufacturing firms, few researchers have identified barriers for large-scale services firms. Hence, in this chapter, a framework of barriers is developed and validated by means of an explorative case study. This chapter aims to answer the second sub-research question: *What are the key barriers to the exploration of disruptive and radical innovations within large-scale services firms?*

Section 4.1 introduces the study and presents the object of study. In Section 4.2 theories on innovation barriers are presented. In Section 4.3 the research approach is outlined; case studies are substantiated, the framework to assess key barriers to innovation is explained, and details are provided regarding data collection and analysis. Section 4.4 discusses the findings and shows key barriers to innovation. Section 4.5 discusses the contribution of this study, Section 4.6 discusses the limitations and conclusions, and Section 4.6 presents the conclusions.

The results of this study were presented at the 18th International Continuous Innovation Network Conference in Dublin, Ireland on the 12th of September 2017. It is featured in the Conference proceedings the Annual CINET Conference and it has been published in the European Journal of Innovation Management (Das, Verburg, Verbraeck, & Bonebakker, 2018).

4.1 Introduction & Study Object

Many barriers, challenges and obstacles for effective innovation within established firms have been documented in literature (e.g., Cooper & Edgett, 2012; D'Este et al., 2012; O'Reilly & Tushman, 2013). However, the growing literature in the area of innovation barriers focuses strongly on obstacles related to product firms and R&D teams in manufacturing firms. Less is known about the nature of such barriers for disruptive and radical innovations within large services firms. In particular, within the financial industry this is especially relevant since such firms are continuously challenged by new legislation aimed at increasing market stability and competitiveness (e.g., Basel III[1], MIFID II[2], and PSD II[3]). In addition, the arrival of new parties in existing markets that offer new, better, cheaper, or quicker services enabled by emerging technologies has accelerated the speed of large-scale financial services firms to offer new and better services. Unlike product- and manufacturing oriented firms, established financial services firms generally do not have an R&D tradition and are primarily focused on incrementally improving current offerings. This implies that such firms need to leverage 'new to the firm' capabilities, create structures, and embed processes to enable innovation (Geerts et al., 2010). Consequently, embedding these types of capabilities brings the most changes to a firm's subsystems (i.e., IT, sales and marketing systems) and is associated with devastating organisational change effects (Henderson and Clark, 1990).

[1] A global regulator framework of more resilient banks and banking systems, see: https://www.bis.org/bcbs/basel3.htm
[2] Market in Financial Instruments Directive, see: European Commission - ESMA10-872942901-3
[3] Payment Service Directive II, see: European Commission - Directive 2015/2366

In this study I explore some of the key barriers for the development of disruptive and radical innovations within large-scale financial services firms. I focus on the internal barriers to innovation rather than on the external ones, as I am particularly interested in the internal firm dynamics. First, I identify key traditional barriers to innovation of large firms on the basis of the current literature. Second, I identify a number of additional barriers through an empirical study. I conduct a case study at a large multinational bank in Europe. This particular bank introduced an innovation group in order to explore, develop and commercialise new value-adding services more effectively. I focus on a set of disruptive and radical innovations that were undertaken since 2014 and analyse those to understand the specific barriers.

Study object

ING, or 'Internationale Nederlanden Groep', is a Dutch publicly traded multinational banking and financial services firm, and as such, one of the largest banks in the Netherlands. With its banking services it mainly targets retail consumers, corporates, mid-corporates and small enterprises. ING was founded in 1991 through a merger of two large Dutch banks and by 2008 employed more than 54,000 people. In its 2018 fiscal year, ING had EUR 887 billion of total assets and a net result of EUR 4.7 billion. It serves over 38.4 million retail customers, corporate clients and financial institutions in more than forty countries (ING, 2019).

ING has introduced its innovation ambition in 2014 to meet the challenges of today's world[4]. A Chief Innovation Officer with staff was appointed to deliver upon the innovation strategy. This innovation group consists of four sub-groups: an innovation transformation group, a venturing group, multiple corporate incubation and acceleration groups (named innovation labs), and group support. Innovation labs, the focus of this study, support early and late exploration activities of, amongst others, disruptive and radical service innovations. An innovation board of executive-level management was installed to safeguard innovations (also named: start-ups, ventures, or innovation projects) explored in the innovation labs. Where the innovation board holds accountability of the innovations, innovation program managers hold responsibility for the innovation labs, while innovation managers support a portfolio of innovations part of the innovation labs, and initiative leads are responsible for single innovations. Moreover, ING has developed an innovation system to explore, amongst

[4] See: https://www.ing.com/About-us/ING-Labs.htm, http://www.emerce.com/achtergrond/ing-innovatie-studio-validatie

others, disruptive and radical innovations into propositions that are ready to be scaled and make an impact on the innovation strategy.

Firm's innovation process

To effectively explore innovations and deliver on the innovation strategy, new-to-the-firm methodologies and processes were embraced such as stage-gate processes (R. G. Cooper & Edgett, 2012), Lean startup methodologies (Ries, 2011), Design Thinking (Osorio, 2011), and Agile SCRUM (Cervone, 2011). ING has integrated these methodologies and processes in a standardised tailor-made innovation process named PACE (ING, 2019). The firm's innovation process consists of five distinct stages as visualised in Figure 5. These five stages correspond with the three stages of innovation that were defined in Chapter 3: early exploration, late exploration and exploitation.

Both 'explore opportunities' and 'validate problem/solution fit' correspond with the early exploration stage involving both discovery and incubation activities, i.e. activities that search, generate, recognise, elaborate, articulate opportunities; and activities to mature disruptive and radical screened opportunities into validated business proposals tested with working prototypes. Both 'build minimal viable products (MVP)' and 'pilot MVP' correspond with late exploration; involving acceleration activities, i.e. transforming working prototypes into fledgling business that can stand on their own relative to receiving entity. Finally, 'scale MVP' corresponds with exploitation, representing innovations that are being commercialised, either within the traditional exploit organisation (i.e. spin-in) or within new entities (i.e. spin-outs).

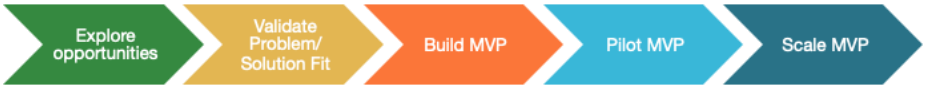

Figure 5: Firm's innovation process

Firm innovation challenges

The challenges noticed by management of the firm to effectively explore innovations that can contribute to the innovation strategy are twofold:

1. Disruptive and radical innovations have characteristics in terms of high uncertainty and risks that do not fit existing institutional structures.

2. Experienced researchers and practitioners have developed innovation theories and methodologies; yet, the users of these theories and methodologies, i.e. employees of the firm, are not highly experienced nor educated in this area. Hence, applying these theories and methodologies by employees is too complex when exploring innovations.

Giving both challenges, together with ING I started to investigate the situation to understand how to improve it. The value of this case study for answering the research questions is that it first allows for rich empirical data gathering on multiple cases, and second, the challenges for ING management aligns with the research goals.

4.2 Literature Review

Giving the rich societal and policy debate on innovation in financial services, there is a lack of empirical studies on internal barriers to innovation within financial services. Studies focus on consumer adoption barriers (Lee, McGoldrick, Keeling, & Doherty, 2003) or cultural differences that result in barriers to implement innovations (Singer, Avery, & Baradwaj, 2008). A number of relevant studies focus on the impact of financial innovations on the market and customer behaviour (e.g. Amin, Hamid, Lada, & Anis, 2008; Gerardi, Rosen, & Willen, 2010), the relationships between financial innovation and growth (Beck, Chen, Lin, & Song, 2016), or the effect of an innovation such as the internet on a banks' profitability (DeYoung, Lang, & Nolle, 2007). Hence, empirical research on the internal difficulties experienced by financial services firms to develop and launch innovations effectively is absent.

4.2.1 Innovation barriers

In order to facilitate innovation and explore new opportunities many firms have started to organise for innovation. They have explored adjacent products and services to their core business, incorporated innovation processes, and launched new business. Nevertheless, large firms such as Kodak and Nokia failed to react in a timely manner to radical market changes and acknowledge that their competitive advantage was fading away (McGrath, 2013). Numerous challenges, impediments and obstacles hampered the process of innovation for such firms (Chandy & Tellis, 2000) and a growing number of studies show the nature of such barriers to innovation in different contexts, such as barriers in relation to manufacturing firms (Baldwin & Lin, 2002; Galia & Legros, 2004), barriers

for product innovation (Nagano, Stefanovitz, & Guimaraes, 2016), barriers in relation to governments (Meijer, 2015) and barriers in small firms (Hadjimanolis, 2003). In addition, D'Este et al. (2012) show that innovation barriers are dynamic, as their presence and relevance tends to vary throughout the innovation process and size of the firm.

Successfully developing and launching innovations depends on a multitude of internal and external firm aspects; for example, a firm needs to be able to explore and embed new technologies, implement new-to-the-firm innovation-oriented practices and to adapt internal mechanisms that allow for exploration and the development of new ideas. Both internal and external barriers to the firm affect the ability to succeed in innovation. Distinguishing internal and external barriers enables recognition of the ones that a firm can influence, and the ones that are partially or completely beyond its influence (Piatier, 1984). The most common internal barriers are: a firm's strategy, organisational architecture, leadership, organisational culture, the organisation of research and development, and performance incentives (Baldwin & von Hippel, 2011; Cohen & Levinthal, 1990; Tushman & Benner, 2015; Tushman & O'Reilly, 1996). The often mentioned external barriers are: market dynamics, competitor behaviour, and market and technology turbulence (Alexiev, Volberda, & Van den Bosch, 2016; Hung & Chou, 2013; Lichtenthaler, 2011).

A literature review by Sandberg and Aarikka-Stenroos (2014) on critical barriers to radical innovation for small and large firms identified a set of critical barriers for large firms in particular. Here I label them as traditional barriers for large firms. Traditional internal barriers are: a restrictive mind-set, a lack of discovery competences and an unsupportive organisational structure. Traditional external barriers are: customer resistance, an undeveloped network, ecosystem dynamics and technological turbulence. In their analysis, Sandberg and Aarikka-Stenroos classify manufacturing

firms, service industries and governments as large firms. This generalisation gives insight into which barriers are specific for large firms and which barriers are specific for small firms. Moreover, they show that barriers are dependent on firm size. Unfortunately, this does not provide us with sufficient understanding why large financial services firms in particular fail to organise for disruptive and radical innovation. Especially since the need to do so has been apparent since the financial crisis in 2008.

4.2.2 Preliminary framework of barriers to innovation

To create a framework of internal innovation barriers for radical and disruptive innovations, I start with creating a preliminary framework based on the barriers for radical and disruptive innovations as put forward in the literature. The search did not reveal any specific literature on barriers to disruptive innovations. From the work of Sandberg and Aarikka-Stenroos (2014) on radical innovations I selected the three traditional internal barriers to innovations that apply to large firms, and disregarded the external barriers. These barriers are: 'a restrictive mind-set', 'a lack of discovery competences' and 'an unsupportive organisational structure'. To further enrich the framework internal innovation barriers identified by Hölzl and Janger (2011) are included. They have identified five potential innovation barriers for firms on the basis of their study across different European countries. I include all internal oriented barriers from their work: 'financial barriers to innovation', 'skill barriers to innovation', 'lack of information on markets', 'lack of information on technologies. Last the six most common internal innovation barriers described in 4.2.1 are also included (*see Table 5 for an overview*).

Table 5: Literature framework of internal barriers in large firms

No.	Description of barrier
LB.1	A restrictive mind-set
LB.2	A lack of discovery competences
LB.3	An unsupportive organisational structure
LB.4	Financial barriers to innovation
LB.5	Skill barriers to innovation
LB.6	A lack of information on markets
LB.7	A lack of information on technologies
LB.8	A firm's strategy
LB.9	Organisational architecture
LB.10	Leadership
LB.11	Organisational culture
LB.12	Organisation of R&D
LB.13	Performance incentives

4.2.3 Organising for change within the financial industry

Since the financial crisis of 2008, established firms in the financial services industry face the challenge of organising for change. Their continuity and stability is at risk due to a variety of reasons.

First, new legislation resulting from the global financial crisis of 2008 requires banks to revisit their strategy and operations. Two major examples of such legislation are: the Payments Service Directive that aims to modernise cross-border EU-wide payments (Donnelly, 2016), and Basel III that aims to improve the banking sector's stability, risk management and transparency (Allen, Chan, Alistair, & Thomas, 2012). In response to this, banks have to re-assess their business model to remain profitable and adapt current processes in order to comply with these new regulations.

Second, new technologies such as Near-Field-Communication (Tan, Ooi, Chong, & Hew, 2014), cloud computing (Berman, Kesterson-Townes, Marshall, & Srivathsa, 2012), and blockchain (Tapscott & Tapscott, 2017) have the potential to not only change society, but could also enable established firms and new entrants to offer new products, services, and business models. However, the challenge for established firms is how to experiment with new technologies and decide which technologies to embed at what moment in time within their established systems. Third, both globalisation and the digitalisation of society have resulted in increasing pressure on revenue streams and growth (partially resulting from competitors that adopt new technologies more quickly). Digital service providers have taken over some of the traditional bank tasks by providing services, such as online payment platforms (e.g. PayPal and Adyen) and alternative ways of financing (e.g. crowd funding). Accelerated by these contextual changes many large financial services firms have started to organise for innovation. Large firms have cautiously forecasted their role in the coming years and have implemented strategies to enhance their organisational innovative capacity. Many of such large firms have started innovation trajectories and play a role in start-up ecosystems (Spender, Corvello, Grimaldi, & Pierluigi, 2017). They have initiated internal innovation programs, such as idea sourcing competitions, incubators, and accelerators to explore new ideas for products, services, and business models that build upon new technologies[4].

More and more are large financial services firms are organising for innovation, but it turns out that disruptive and radical innovations oftentimes do not come from established players, even though they have expressed the need for this to happen[5]. Traditionally, society benefits from stable financial markets, and therefore financial market authorities exercise

[5] Sematic analysis of six annual reports in 2016 (i.e., Banco Santander, BNP Paribas, ING Bank, Barclays PLC, Citibank and Deutsche Bank)

a tight regime. On the flip side, this tight regime has restricted access for new entrants and ideas. The resulting lack of innovative competitive pressure has created inertia within established firms to organise for change.

4.2.4 Synthesis: Exploring internal barriers to innovation

Many large financial services firms have become aware of the need to bring disruptive and radical innovations to the market[4]. However, realising this poses a number of organisational challenges due to various internal and external barriers. External barriers have been widely addressed, but empirical studies focusing on the internal difficulties impeding large financial services to develop and launch innovations effectively is absent. Therefore, in this study, I aim to empirically explore the specific barriers to innovations within banks and then generalise for large financial services firms.

4.3 Research Design

4.3.1 Approach

In order to identify barriers to disruptive and radical innovations in large financial firms, I established a preliminary framework of internal barriers to innovation (*see Section 4.2.2*). To assess, enrich and validate this framework, I will conduct an in-depth case study. Here, I evaluate and compare a number of innovations. The case study method allows us to gain a greater understanding of complex issues such as innovation within large financial firms (Eisenhardt, 1989; Yin, 2003). In order to build theory from case studies, I explore multiple cases to ultimately create propositions (Eisenhardt & Graebner, 2007).

The first step is to select and understand the cases under study. By analysing the firm's innovation governance, multiple innovation controls were identified that both show the strategic ambition and organisational structures to steer innovation. These controls have been identified using the MCS scheme and approach outlined in Chapter 3. As presented in Table 6, five key innovation controls are identified:

1. **An innovation strategy**, including strategic ambitions for disruptive and radical innovations that serve as a guideline for innovation activities.
2. **An innovation group**, with dedicated people focusing their attention on supporting these innovations.
3. **A ring-fenced budget**, budget earmarked and assigned for exploring these innovations.

4. **A senior steering board**, executives from the firm appointed to take decisions on new proposals to explore these innovation and transition to exploitation.
5. **A central support manager**, supporting innovations throughout the firm on a week-to-week basis to ensure alignment with the firm's innovation strategy and to accelerate the innovation process.

Table 6: Innovation controls applied in the firm under study

Control	Control Category	Levers of controls	CIS 1.0
1	Firm & Portfolio	Belief controls	Innovation strategy
2	Firm & Portfolio	Boundary controls	Innovation group
3	Firm & Portfolio	Boundary controls	Ring-fenced budget
4	Performance monitoring	Interactive controls	Senior steering board
5	Performance monitoring	Interactive controls	Central support manager

This analysis confirms the match of the characteristics of required cases, with the object under study. Moreover, the firm strategy clearly outlines the ambition to explore and exploit disruptive and radical innovations to contribute in 'developing beyond banking propositions and disrupting the core'.

Within the selected firm a total of 25 innovations are identified. Of these 25 innovations, a total of eight innovations fit the criteria set for disruptive and radical innovations. The other 17 innovations are focused on improving current services or internal processes; characterised as sustaining and incremental innovations (*see Section 2.2 for definitions of the types of innovations*). The selected eight innovations are being

explored within business units across Europe targeting different customer segments (i.e. Consumer banking, Corporate Banking, SME Banking), geographical and service areas. They all were coordinated via the innovation centre, but physically resided in business units. Typically the throughput time of a project is approximately 18 months in the exploration stage (*see Table 7 and 8 for an overview of details*).

Table 7: Innovations under study

#	Innovation type	Initiation	Area	Segment	Country
1	Disruptive innovation	Top-down	Payment system	Consumer Banking	NL & BE
2	Radical innovation	Top-down	Big data analytics	Corporate Banking	NL
3	Disruptive innovation	Bottom-up	Business dashboards	SME Banking	NL
4	Radical innovation	Top-down	Payment system	Consumer Banking	SPA
5	Disruptive innovation	Bottom-up	Digital client services	SME Banking	NL & BE
6	Disruptive innovation	Bottom-up	Money management	Consumer Banking	IT
7	Radical innovation	Bottom-up	Payment system	Consumer & SME banking	NL
8	Disruptive innovation	Top-down	Money management	Consumer Banking	UK

Table 8: Brief innovation descriptions

#	Description of the innovation under study
1	Enabling mobile payments between merchants and customers with complementary online loyalty programs.
2	Using the potential of big data analytics tools to offer tailored solutions to corporate banking clients.
3	Supporting entrepreneurs with setting up their own business in a few clicks.
4	Enabling peer-to-peer mobile payments for consumers.
5	Supporting business owners to increase turnover with a digital integrated personalised financial dashboard.
6	Overcoming financial illiteracy for children by gamification.
7	Removing the risk for consumers and merchants in the transaction of consumer goods.
8	Supporting customers with better management of their finances by giving instant personal advice.

The second step in assessing and enriching the framework is an analysis of documents of the selected cases. I analyse quarterly innovation reports, meeting minutes, and progress reviews in order to find perceived barriers by the innovations in the sample. I conduct a text analysis of these documents and searched for impediments, obstacles, challenges, issues, and reasons for: not meeting expectations, overruns in terms of budget or time, or initiative failure. Next, this list is discussed with two internal innovation experts that have a coaching and monitoring relationship with the innovations. The goal of this step is to further assess the findings. As a result, I add 13 barriers that affected innovations that were either successful or terminated (*see Table 10 non-literature barrier)*.

The third step is to validate the framework of innovation barriers through interviews with initiative leads of innovations that were not selected for the

main study. Here, I test if the listed barriers are mutually exclusive and properly formulated. As a result, I removed some elements with overlap and reformulated some items for clarification.

To increase clarity, the literature barriers for innovation as defined by Sandberg and Aarikka-Stenroos (2014) are substantiated into eight barriers to innovation and integrated with the most common internal barriers from literature. The four potential barriers as defined by Hölzl and Janger (2011) are substantiated into seven barriers (*see Table 9)*.

Table 9: Literature barriers substantiated

Literature barrier	No.	Substantiated barrier for study
LB.1 A restrictive mind-set **LB.10** Leadership **LB.11** Organisational culture	**B.1**	Overzealous risk management
	B.2	Resistance or lack of support from key internal stakeholders
	B.3	Lack of active management support
LB.2 A lack of discovery competences	**B.4**	A lack of discovery competences
LB.3 An unsupportive organisational structure **LB.9** Organisational architecture	**B.5**	An unsupportive organisational structure
	B.6	Inertia caused by compliance focus
	B.7	Gap between business and IT
	B.8	Too many management layers
LB.4 Financial barriers	**B.9**	Too low business value compared to regular business cases
	B.10	A lack of appropriate sources of finance
LB.5 Skill barriers	**B.11**	A lack of qualified personnel
	B.12	A lack of ability to maintain new technologies
	B.13	A lack of incubation competences
	B.14	A lack of commercialisation competences
LB.6/7 A lack of information on markets and technologies	**B.15**	A lack of information on markets or technologies
LB.8 A firm's strategy	**B.16**	Unsupportive innovation strategies
LB.12 Organisation of R&D	**B.17**	No fundamental R&D
LB.13 Performance incentives	**B.18**	A lack of focus on innovation caused by short term profit priority

In Table 10 an overview of the final framework is presented that is used for the interviews. Here a distinction is made between barriers to innovation gathered from literature and empirical barriers to innovation.

Table 10: Framework of potential internal barriers to disruptive and radical innovation within large firms

No.	Description of barrier	Literature barrier
B.1	Overzealous risk management	✓
B.2	Resistance or lack of support from key internal stakeholders	✓
B.3	Lack of active management support	✓
B.4	A lack of discovery competences	✓
B.5	An unsupportive organisational structure	✓
B.6	Inertia caused by compliance focus	✓
B.7	Gap between business and IT	✓
B.8	Too many management layers	✓
B.9	Too low business value compared to regular business cases	✓
B.10	A lack of appropriate sources of finance	✓
B.11	A lack of qualified personnel	✓
B.12	A lack of ability to maintain new technologies	✓
B.13	A lack of incubation competences	✓
B.14	A lack of commercialisation competences	✓
B.15	A lack of information on markets or technologies	✓
B.16	Unsupportive innovation strategies	✓
B.17	No fundamental R&D	✓
B.18	A lack of focus on innovation caused by short term profit priority	✓
B.19	Lack of commercialisation caused by KPIs	
B.20	Inertia caused by internal project management styles	
B.21	Lack of room for incubation	
B.22	Lack of ability to embed new technologies	
B.23	Too many (local) legacy systems	
B.24	Inertia caused by (local) systems architecture	
B.25	Lack of new and good radical / disruptive ideas	
B.26	No patenting or IP-protection mechanisms	
B.27	Lack of exploiting new ideas	
B.28	Lack of scaling up ideas for large-scale use	
B.29	Firm is more risk-averse than other firms	
B.30	Firm is more trust-oriented than other firms	
B.31	Not-Invented-Here syndrome	

The fourth and final step was to conduct semi-structured interviews with the initiative leads of the selected innovations to gain insight into the barriers perceived. With the final step key identified barriers to innovations were assessed and validated.

4.3.2 Operationalisation of interviews

To validate which innovation barriers apply in the process of exploring innovations and to ultimately gain understanding on how to overcome these barriers, I interview all initiative leads of the innovations under study (*see Table 7*). In the selected cases, all initiative leads follow the same innovation process, but their innovations differ in team composition, reporting lines, business unit, and target market. By applying a semi-structured approach I follow up on topical trajectories in the interviews in order to get a better understanding of the cause and effects of the experienced barriers (Bernard, 1988). Each interview takes approximately an hour, is digitally recorded, and transcribed. Agreement on which barriers to innovation apply is measured by assessing if initiative leads agreed, disagreed or have a neutral opinion on the presence of a barrier in their innovation process. Because the study represents only eight cases, and informants tend to not select extreme values due to personality factors (Hernández, Drasgow, & González-Roma, 2004), I choose to only take these three values into account. In Appendix B, detailed information on the informants is presented.

4.3.3 Internal and external validity of the study

At the time of interviewing all innovations have passed the early-stages of idea formulation and are developing their ideas supported by resources provided by the organisation. All innovations have formed their team, have a functioning project organisation and are minimally six months under way. This is important for the internal validity of the study, as initiative leads have had the time to grasp the complexities of the entire system and form an opinion on key barriers faced in their innovation process. In the invite to the interview both the goal of the study and the nature of the questions are shared to make sure initiative leads could prepare. In addition, I ask questions regarding the respondents experience and role. Last, initiative leads are asked if they are best equipped to participate in the interview, if not alternatives could be suggested. This allows me to validate if the respondents would be the most reliable or suitable sources.

In the sampling model I focus on innovations in a firm that pursue disruptive or radical innovations. The sample, as shown in Table 7, represents cases across five different markets within Europe and different customer segments. Innovations are undertaken at different branches with their own culture and operational model. As these innovations all focus on the European market I control for European legislative changes. As the sample consists of four top-down, and four bottom-up initiated innovations, I can also control for a decision-making bias of top management. Top-down innovations typically have more visibility in the firm and I will assess if this positively or negatively affects innovation barriers.

4.4 Findings about barriers to innovation

In the eight innovations under study I found a clear distinction between barriers to innovation and elements that were not experienced as such. Also, some elements were perceived as indifferent. I focused on the barriers with general consensus among the different innovations in the case study. I assumed consensus when at least five out of eight of the innovations (dis) agree on a certain barrier and when the agree/disagree-ratio is less than three. Following this process, I found consensus for six key barriers to innovation, as well as consensus for the absence of one traditional barrier to innovation. The informants did not mention the absence or presence, of two traditional key barriers to innovation.

The remainder of this section describes the outcomes of the interviews with initiative leads. I will highlight barriers for which I find strong consensus and I will highlight traditional barriers for which I do not find consensus. I include examples in order to provide more insights into the origin, causes and the effects of the barriers. All key barriers highlighted in the next paragraphs of this section are complemented with the score in the following format: (Number of innovations that: Disagree – Neutral/No Opinion – Agree), details can be found in Appendix B.2.

Key identified internal barriers to innovations

Five out of eight innovations experienced a lack of exploiting new ideas by the firm [B.27; n=0-3-5], inertia caused by (local) systems architecture [B.24; n=0-3-5], and three innovations either had no opinion or scored neutral. Five innovations experienced these aspects as a key barrier to innovation. The firm has developed multiple programs to support exploration such as innovation competitions, a fund to protect and support accelerating rough ideas towards implementations and work streams, but

exploiting value from new ideas by effective commercialisation has been lacking. An example given by initiative lead: '*If we look at the power to execute disruptive ideas, the power of realising these ideas within this firm […] this is definitely a barrier to innovation*'.

Local entities of the bank have their own systems architecture due to a variety of reasons. For example, local clearing systems, regulatory restrictions or historical reasons such as mergers and acquisitions have resulted in standalone systems. This proved to be a hurdle and as one initiative lead (IBI-4) put it: '*Everybody wants to protect his or her domain and IT-castle*'. The firm has created a separate department that incubates innovations before handing them over to business. However, as another initiative lead (IBI-1) explained this supports exploration, but hampers exploitation: '*If solution* [X] *is modified to integrate within business unit* [Y] *and has to be modified for each country in which it will be implemented afterwards, that cannot work*'.

In close relation to this, six innovations experienced an unsupportive organisational structure and one innovation did not see this as a barrier [B.5; n=1-1-6). The firm has a decentralised business model with entities in multiple markets. Innovations have to prove their value proposition in one or more markets and integrate their solution with the local banking systems. As an example an initiative lead (IBI-1) explained: '*The way this firm is organised, is very locally oriented with local processes and systems. Fintechs* [read: financial technology firms] *are worldwide oriented; they will provide uniform services everywhere …*'. Another initiative lead amplified this (IBI-3): '*Business units put their own interest first and assess what the impact of an innovation is on their KPIs before embracing it, I call it silo-innovation*'.

Next, six innovations experienced overzealous risk management practices (i.e., too much focus on risk avoidance) [B.1; n=2-0-6). Together with the previous identified barrier: an unsupportive organisational structure, these are the only two traditional barriers to innovation that showed to have strong evidence in this study. To explain the focus on risk-avoidance we can go back to the 2008 financial crises. Consumer trust in the financial services industry had significantly dropped (Edelman, 2015), and as a consequence improving accountability, stability and responsibility was stressed by market authorities. To quote an informant (IBI-6) '*historically, when innovation was not part of the agenda, a lot of processes were driven by legislation and governance on how money was spent* [read: accountability]*, but if you over tighten that tap you hinder speed to get certain things done.*' Hence, in this new world existing risk-avoidance practices should be adapted to innovation processes. One initiative lead used local procurement processes as an example (IBI-6) '*There are impracticalities in procurement processes. If you can avoid certain formalities in the procurement process we can increase speed, as in the innovation process it is extremely important to run lots of experiments in a short time-frame*'. In line with literature on traditional project management the Not-invented-here syndrome was identified as a key barrier for innovations [B.31; n=2-0-6]. A logical explanation is that the firm operates with local entities in different markets experiencing different cultures, organisational structures and processes.

Finally, there is no fundamental R&D function within the firm and five innovations experienced this as a barrier to innovation [B.17; n=1-2-5). Therefore, I regard the absence of fundamental R&D as a key barrier to innovation. Multiple initiative leads stressed this '*There is no central R&D and no focus*' (IBI-3) and '*We miss a comprehensive vision as all are doing innovation and all are doing research for their own purpose*' (IBI-8). The

next quote sums it all up (IBI-1): '*We don't do enough R&D, we need to do more*'.

Absence of consensus for barriers to disruptive and radical innovation innovations

Many elements in the framework were not perceived as a barrier to innovation. One element that requires attention is the lack of appropriate sources of finance [B.10; n=8-0-0], as it was not perceived as a barrier to innovation in the sample. None of the innovations experienced this as a challenge, in line with previous work of Sandberg and Aarikka-Stenroos (2014) that shows this traditional barrier is mainly perceived by small- and medium sized enterprises. Moreover, in the interviews I identified that this barrier is not perceived because of the creation of a separate fund dedicated to innovation innovations by the firm. In short, the innovation group is the primary budget holder for innovations that meet strategic ambitions. It aims to protect innovations from the 'exploit' organisation and allows for exploration of new areas and opportunities. In accordance with Tushman & O'Reilly (1996), this structure aims to allow for an ambidextrous organisation that can successfully pursue both exploration and exploitation activities.

No clear consensus on traditional barriers to disruptive and radical innovation innovations

In the sample no clear consensus was found on two traditional barriers to innovation. A lack of discovery / exploring competences [B.4; n=4-1-3] nor resistance or lack of support from internal key internal stakeholders [B.2; n=3-2-3] were identified as a clear barrier to innovation.

Additionally, I distinguished top-down and bottom-up initiated innovations. Although top-down innovations were granted more resources from the start and had direct top management attention, I did not find any evidence on

differences between experienced barriers to innovation in relation to bottom-up initiated innovations. Nevertheless, the data show that top-down supported innovations got at least five times more funding at the start of the innovations, and easier access to top management as compared to bottom-up supported innovations.

4.5 Discussion

There is limited research available on barriers for disruptive and radical innovations in large-scale financial services firms. I have identified a number of key internal barriers from eight different innovations within a large multinational bank in Europe. These barriers are unique for financial services firms and contribute to the growing literature on the management of innovations within the financial services sector. Prior research on radical innovations primarily focused on the distinction between large firms and SMEs, or internal and external barriers, but not on industry specific barriers. In line with this literature, this chapter echoes that a restrictive mind-set [B.1] (read: overzealous risk management) and an unsupportive organisational structure [B.5] constitute key barriers in large financial services firms as well. However, I did not find evidence that a lack of discovery competences [B.4] could be a barrier to innovation. In addition, I found that four other key barriers were present in the innovations under study: Inertia caused by local systems architecture [B.24], a lack of exploiting new ideas by the firm [B.27], the Not-invented-here syndrome [B.31], and a lack of fundamental internal R&D [B.17], are perceived as key barriers to disruptive and radical innovation (*see Table 11*).

Table 11: Results: Key internal barriers to innovation within large financial services firms

No.	Description of barrier	Literature barrier
B.1	Overzealous risk management (i.e., too much focus on risk avoidance)	✓
B.5	Unsupportive organisational structure	✓
B.17	No fundamental internal R&D	✓
B.24	Inertia caused by (local) systems architecture	✓
B.27	Lack of exploiting new ideas	
B.31	Not-Invented-Here syndrome	

On the basis of the findings I suggest the following three propositions:

P3. Unique industry characteristics result in differentiating sets of key internal barriers to disruptive and radical innovations for large financial services firms.

P4. Separate governance structures for innovation within large financial services firms support exploration, but do not remove barriers that impede exploitation of innovations within a firm with a decentralised organisational structure.

P5. A lack of fundamental internal research and development activities hamper the ability of large financial services firms to exploit disruptive and radical innovation.

These propositions are worth further exploration in future research on barriers to innovations in the area of services firms. Moreover, I see four directions for future research: Researchers can go in-depth to increase understanding of the identified barriers to innovation, they can investigate also external innovation barriers to create an extensive overview, they can

conduct quantitative studies to increase generalisability of the results, and they can investigate if the same results apply to services firms in general.

4.6 Implications and Limitations

The results of this chapter align with the work of Sandberg and Aarikka-Stenroos (2004), yet I have further narrowed down the specific barriers that are unique for innovation within large financial services firms. The work offers a valuable perspective for managers in the area of financial services to further re-establish the natural flow of innovation in order to increase effectiveness and to reduce waste of innovation efforts. When organising for disruptive and radical innovation within large financial services firms, managers need to prioritise mitigating identified key barriers over traditional barriers in the design of an effective innovation process. In addition, as I find no difference in barriers perceived by bottom-up and top-down initiated innovations, managers should carefully decide upon allocation of resources as the latter in the sample structurally have access to more resources.

This study is not without limitations. In this study I did not focus on external barriers, but on internal barriers to innovation that can be influenced by the firm. This focus increases applicability for managers, but limits insights in the effects of external dynamics on internal barriers to innovation. Also, the study was conducted at a single firm, which may limit the scope of the research. However, although I was able to study only a limited amount of innovations, I believe that the results can be generalised further. As selected cases have been undertaken across different European markets operating in various bank entities such as private, corporate and retail

banking, I believe that innovations in other large firms within the financial industry face similar barriers when undertaking disruptive and radical innovations. In addition, due to the fact that I conducted an in-depth case study at a single firm I could control for firm dynamics. All cases in this study are subject to the same internal dynamics such as strategy and leadership changes, and external dynamics in the industry such as market dynamics and regulation that affect the firm.

4.7 Conclusions

Barriers to disruptive and radical innovations have drawn a great deal of attention by researchers. However, the focus has been primarily on traditional product and manufacturing firms, and not so much on how innovation barriers impact the growing number of innovations in the financial services sector. This chapter has explored the unique internal barriers that seem to be key in disruptive and radical innovations in large financial services firms.

I show that organising for disruptive and radical innovation within large financial services firms by means of a separate innovation group partially supports exploration, but not necessarily the exploitation of these types of innovations. This chapter highlights that if an innovation strategy, active management support, and a separate governance structure for innovation is in place, innovations get stimulated in the exploration stages, as innovations do not experience a lack of appropriate resources or competition with traditional projects and programs. But, barriers such as a restricted mind-set, a lack of exploiting new ideas, an unsupportive

organisational structure and inertia caused by (local) systems architecture do hamper exploration of innovations.

The findings can be the start of a theoretical framework of barriers to disruptive and radical innovations within large financial services firms. I have identified six key barriers to these type of innovations: ‘A lack of exploiting new ideas’, ‘Inertia caused by (local) systems architecture’, ‘An unsupportive organisational structure’, ‘too much focus on risk avoidance’, ‘absence of fundamental research and development’ and ‘the Not-invented-here-syndrome’.

5 EFFECTIVENESS OF INNOVATION CONTROLS

The knowledge that was developed in previous chapters will serve as groundwork for this chapter. In Chapter 4 six key barriers to radical and disruptive innovations in large-scale services firms were identified:

1) *Overzealous risk management practices*
2) *Unsupportive organisational structure*
3) *Absence of fundamental R&D*
4) *Inertia caused by (local) systems architecture*
5) *A lack of exploiting new ideas by the firm*
6) *Not-Invented-Here syndrome*

These barriers are thus more important in this specific context than traditionally defined barriers to innovation such as financial means, and lacking exploration competences. The results highlight the need for more in-depth research on how these challenges and barriers can be overcome.

The aim of this chapter is to show what the effect of multiple control interventions is on overcoming addressed firm challenges and identified barriers, and if it can enable more effective exploration. Management Control Systems (in the remainder of this chapter named: controls) are both introduced and removed in a three-year in-depth longitudinal study within ING. Starting from the initial situation in which barriers to innovations on a project level were identified, interventions are proposed on a unit/department level to overcome barriers in two iterations. Moreover, this chapter aims to explore the third sub-research question:

What management control systems support more effective exploration of disruptive and radical innovations in large-scale services firms?

Section 5.1 introduces the study and object under study. In Section 5.2 I introduce the research design for conducting the interventions and introduce the cases. In Section 5.3 the results of the three control intervention cases are presented. Section 5.4 discusses and reflects the findings, Section 5.5 presents limitations and implications to control innovation, and ultimately Section 5.6 concludes the study.

5.1 Introduction & Study Object

Exploration of disruptive and radical innovations cannot happen without controls that drive discipline and creativity. O'Connor and DeMartino (2006) find that accountability of personnel enforces the discipline, and ownership allows for independency that enable creativity. Yet, as identified in Chapter 4, large-scale services firms tend to apply controls designed for exploitation activities, also to exploration activities, creating challenges for effectively undertaking these activities. Therefore, to increase the effectiveness of exploration activities and to overcome innovation barriers, controls should be installed that foster both discipline and creativity to meet a firm's strategic innovation ambitions. These controls should take into account the characteristics of the firm and should be geared not only the exploration stages, but also support in easing the transitioning to the exploitation stages.

In this study, I will install, iterate, and remove controls to understand the effect of controls on the effectiveness of the exploration stages (i.e. both early and late exploration). The firm under study has, from scratch, started to explore disruptive and radical innovations with a separate innovation group and in the first two years doubled their exploration activities. To optimise value from these activities, overcome firm challenges as addressed in Chapter 4.1, and mitigate innovation barriers, room was given to me to intervene in the system by making changes to the applied controls. As a result, during a three-year-in-depth longitudinal study, controls were identified, assessed, changed, and evaluated.

I investigate problems with the current system for innovation in the firm and identify multiple controls from both literature and practice to steer innovations. Literature suggests controls that fit the environment in which these activities are operated; such as ambidextrous structures (e.g. Blindenbach-Driessen & van den Ende, 2014), stage-gates processes (e.g. Cooper, 1990; Griffin, Price, Vojak, & Hoffman, 2014), and innovation methodologies (e.g. Osorio, 2011). However, since these controls mainly stem from product- and manufacturing-oriented research, I research how they can fit into the environment of large-scale services firms and how they can be complemented. Together with controls provided in literature, controls are selected based on best practices; i.e. controls applied by the firms selected in Chapter 3. Ultimately, based on multiple interventions, I present evidence that certain innovation controls better support large-scale services firms in exploring disruptive and radical innovations.

Study object

The firm under study, ING, started their first controlled innovation system (CIS 1.0) based upon existing controls and best practices in the market to support five to ten innovations in parallel. In Section 4.1 this environment was introduced and firm challenges were addressed.

Based on this, room was given to intervene and increase effectiveness of the system to explore disruptive and radical innovations. On account of this request, multiple control interventions were proposed to mitigate the problems diagnosed.

Within innovation systems contextual antecedents impact innovation activities: environmental, organisational, and managerial contextual factors explain the tensions that influence a firm's tendency to explore versus exploit. Since contextual antecedents impact the controls used for innovation activities (*see Section 3.6: Discussion and Limitations),* it is important that these antecedents are constant over the lifetime of the study. Although this study lasted three years, contextual antecedents are relatively stable over the course of the study and did not disrupt exploration activities on a firm, unit/division, or project level:

- No significant impact of environmental changes (i.e. no regulatory changes observed, no shareholder interference, customer interference, or economic shocks).
- No significant impact of organisational changes (e.g. no restructuring of organisational structures, no strategic directional shifts).

- No significant impact of changes in past experience or risk appetite of executive-level management. Innovation executive officers changed over the course of the study, yet, they have not changed the innovation strategy.

The change of the innovation executive officers did not affect key innovation controls, but in fact gave room to propose interventions in the system to increase effectiveness. Accordingly, I did not correct for contextual changes that may bias the outcomes of the control interventions.

5.2 Research Design

5.2.1 Approach

In order to identify controls that have a positive or negative effect on exploration activities I perform action research. In the research context, I actively participate in a change situation to solve the immediate problem addressed by the firm, while simultaneously conducting research. Action research, as an approach, is deemed suitable as this study enters a real-world situation to both improve it and to acquire knowledge (Checkland & Holwell, 2007). Supporting the firm in practical problem-solving simultaneously assists in expanding scientific knowledge. Collaboration during the research with practitioners to advance both the firm and scientific knowledge is extremely powerful since this gives a researcher the power to explain what goes on in organisations and is ideal when focusing on managerial and organisational issues (Myers, 1997). Moreover, when acting in a change situation to expand scientific

knowledge, an action research approach allows for combining theory building and simultaneous problem solving.

Since the effects of multiple controls are tested in sequence on the problem situation, a canonical process is applied. Canonical Action Research (CAR) is unique as it allows for several cycles of activities that are designed to address the problem(s) experienced in organisational settings (Davison, Martinsons, & Kock, 2004). Its iterative character implies a cyclic process of interventions and requires time to build a relationship with the firm and acknowledges that a researcher seldom has complete control over interventions (Mumford, 2001). CAR is conducted through cycles of five steps (Deluca, Gallivan, & Kock, 2008): diagnosing the problem, planning the action, taking the action, evaluation the results, and reflecting on lessons learned. The canonical aspect of this approach proves useful as it allows for the introduction and evaluation of a batch of 'new' innovation controls based on the diagnosed problem; and subsequently, the cyclic process allows diagnosing the changed situation and proposing new interventions to solve pending problems. In Figure 6 the CAR cycle for this study is presented.

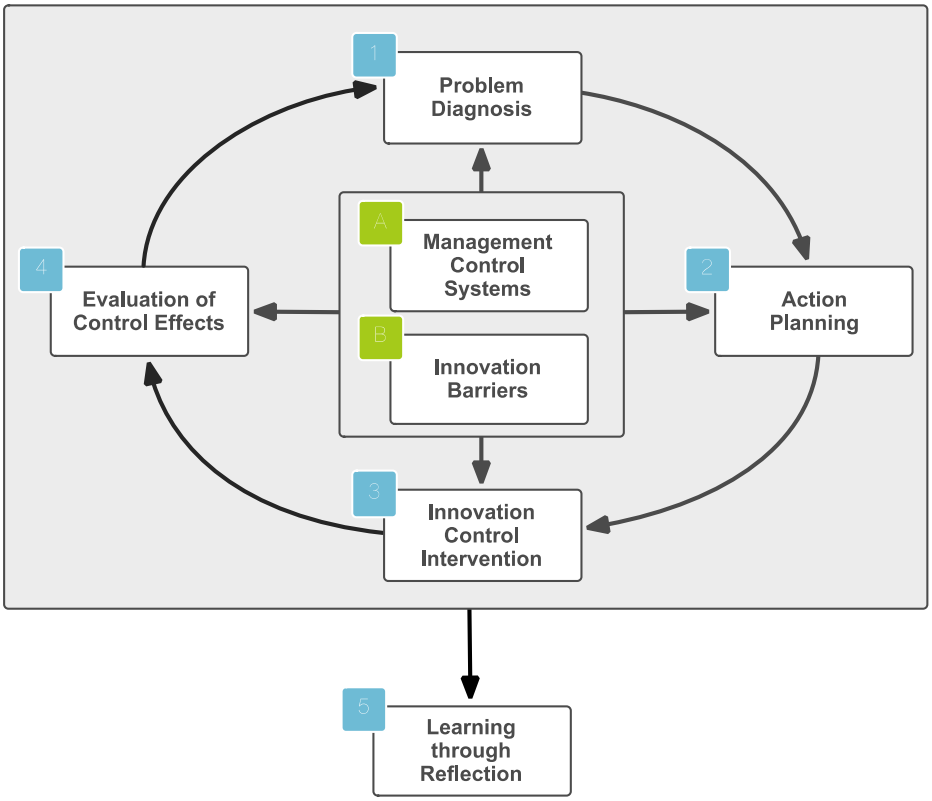

Figure 6: CAR cycle for innovation control study

The first step was to agree on the objective and assess the current problem situation. A mutual objective was agreed upon with the firm to ensure alignment between the firm and the research: *how can the firm move more effective from the exploration stage to the exploitation stage.* In addition, a management control system scheme was agreed upon to assess the problem situation; the scheme used earlier for the multi-firm study on innovation controls was re-used for this purpose (*see Figure 3.1).* This scheme was used to identify used controls in controlled innovation system 1.0 (CIS 1.0) and is based on Simons' levers of control framework

(1995), and the work of Aas (2011) that links this framework to innovation stages. To fully comprehend the problem situation, first in Chapter 4, key barriers to innovators were assessed. Yet, to create a holistic diagnosis, in addition to the findings presented in Chapter 4, workshops with program and innovation managers were held to evaluate the effectiveness of the five controls from a management perspective.

The second step was to create an action plan together with key stakeholders selected by the firm to participate in the research and prepare the innovation control intervention. To create the action plan, together with key stakeholders innovation controls were identified that have the potential to remove or mitigate identified barriers and challenges. These controls were based both on best practices of other firms and innovation controls from literature. The third step was to install and/or remove innovation controls, and ensure these controls were institutionalised. Changes in controls were approved by executive-level management and included into the firm's innovation governance. As a result, it was ensured that responsible program, and innovation managers embedded these controls for the entire portfolio. The intervention was run for at least one year to ensure that innovations were subject to the controls and multiple reports could be analysed.

The fourth step was to evaluate the effect of the innovation controls during the one-year intervention. After the total portfolio of disruptive and radical innovations was subjected to controls, workshops were held with program and innovation managers that manage a portfolio of innovations to evaluate the effectiveness of the intervention on mitigating innovation barriers and firm challenges. Ultimately, two CAR cycles were conducted, CIS 2.0 and CIS 3.0, in which multiple innovation controls were installed to increase effectiveness, and subsequently evaluated. The last step, when the two cycles were finalised, was to reflect on the effect of CIS 2.0

and 3.0. In this reflection the effect of the control intervention study was assessed to understand if certain innovation controls have improved the firm's innovation system, and if it has brought scientific advancements.

5.2.2 Operationalisation of workshops and protocol

In order to evaluate the effect of innovation control interventions on innovation barriers and firm challenges, I conducted interviews with program managers and innovation managers (*see Table 12*). These interviews were conducted in Dutch and English. All interviews were transcribed in English and stored in a case study database (form: CISI-*n* starting from 1). Storing these interviews allows for comparing results between participants later and finding typical quotes providing depth to positive or negative perceptions on innovation controls.

The selected participants managed a portfolio of disruptive and radical innovations; program managers were responsible for an incubator / accelerator containing over ten initiatives in parallel, innovation managers were responsible for a sub-set of innovations and supported approximately five innovations in parallel. Initiatives in their portfolio were either stopped, handed over to exploitation, or still in progress.

Table 12: Workshop participants of innovation control intervention study

No.	Function	Relation to initiatives	CIS 1.0	CIS 2.0	CIS 3.0
CISI-1	Program Manager	7 Handovers 3 Stopped	✓	✓	–
CISI-2	Innovation Manager	4 Handovers 9 Stopped	✓	✓	✓
CISI-3	Innovation Manager	6 Handovers 10 Stopped	✓	✓	✓
CISI-4	Program Manager	10 Handovers 12 Stopped	✓	✓	✓
CISI-5	Program Manager	13 Handovers 16 Stopped	✓	✓	✓
CISI-6	Innovation Manager	5 Handovers 5 Stopped	✓	✓	✓
CISI-7	Program Manager	6 Handovers 9 Stopped	–	✓	✓
CISI-8	Program Manager	4 Handovers 4 Stopped	–	✓	✓
CISI-9	Program Manager	3 Handovers 7 Stopped	–	✓	✓

In the workshop a semi-structured approach was chosen to follow up on topical trajectories in the interview and gain more in-depth knowledge on the experience of informants (Bernard, 1988). Nine managers were interviewed to create a rich overview of different perspectives and to collect various opinions to the same control intervention. Each participant was requested to determine if an installed innovation control removed or mitigated an innovation barrier, and if it supported the firm in reaching its goals more effectively. To support their observations, each participant was asked to describe examples of the effects of controls to innovations; these observations were necessary to assess the relationship between controls and effect. Workshops took approximately one-and-a-half hour, were digitally recorded, and transcribed. Selected workshop participants had to

be involved with at least five innovations that run through the diagnosed CIS (n) and the CIS (n+1) that contained control interventions to improve the diagnosed situation.

All workshops were conducted in the same setting and structure to ensure results could be compared. A workshops protocol was developed existing out of three activities: an introduction, a control-related, and a barrier-related part. Workshops started with introduction questions with the purpose to understand what the roles and responsibilities of participants are and how close they have been involved with the diagnosed problem situation. Next, I identified to which initiatives in the portfolio participants were connected with the aim to provide data to assess the validity of the workshop output.

The control-related part had the purpose to assess if installed controls had a positive, negative or neutral effect on successfulness of innovations in the exploration stages. The aim was to provide data on the effect of all innovation controls installed to ultimately be able to compare data of all workshop participants. Next, the barrier-related part of the workshop had the purpose to assess the effect of innovation controls on identified innovation barriers. Ultimately, the data from all workshops was integrated, compared and evaluated. In Appendix C.1, the workshop protocol is presented.

5.2.3 Validity of intervention study

To ensure validity of the research design and to be able to solve the research question, construct validity, external validity, internal validity, and reliability need to be secured (Yin, 2003). Using multiple sources of evidence ensured construct validity: reports on progress of innovations including retrospectives on barriers and drivers during the lifetime of the initiative were assessed, supplemented with workshops with multiple portfolio managers. External validity is more difficult to attain; however, by continuously iterating between theory with empirical data, running two cycles of interventions, and using repetition logic by conducting multiple workshops, the domain for generalisation was established. Internal validity, i.e. identification that causal relationships are in fact caused by the factors studied, is established by matching patterns between multiple data sources, assurance of internal coherence and consistency of findings, and linking this to identified literature. Using the CAR approach and applying a strict workshop protocol for evaluation ensured reliability of the study, i.e. ensuring that repeating the study will show the same results. This approach allows for repeating the study while yielding similar data. It is of paramount importance that the right stakeholders are involved while applying the CAR approach since changing the rules of the game, while playing the game requires commitment from executive-level management, program managers, innovation managers and innovation initiative leads. In addition, selection of a critical mass of participants for the workshop is a challenging task; the number of stakeholders with portfolio knowledge on disruptive and radical innovations within a single firm tends to be limited to a small group.

5.3 Results

The initial designed system (CIS 1.0) to explore disruptive and radical innovations can be characterised by five key innovation controls. By using the MCS scheme, I identified the controls initially in place to explore disruptive and radical innovations (covering both the early and late explore stage). These key controls were identified by analysis of the firm's innovation governance including the strategy and operational structures, see Table 13.

Table 13: Controls applied in CIS 1.0

Control	Control Category	Lever of control	Description
C.1	Firm & Portfolio	Belief controls	Innovation strategy
C.2	Firm & Portfolio	Boundary controls	Innovation group
C.3	Firm & Portfolio	Boundary controls	Ring-fenced budget
C.4	Performance monitoring	Interactive controls	Senior steering board
C.5	Performance monitoring	Interactive controls	Central support manager

C.1 An innovation strategy,
describes the strategic ambitions for disruptive and radical innovations. It serves as a guideline for innovation activities.

C.2 An innovation group,
describes the group of dedicated people appointed by the organisation to focus their attention on supporting these types of innovations.

C.3 A ring-fenced budget,
describes the budget earmarked and assigned for exploring these types of innovations.

C.4 A senior steering board,
describes the board of executives appointed by the firm to take decisions on new proposals to explore these types of innovations and transition to exploitation.

C.5 A central support manager,
describes the employee that supports innovations throughout the firm on a week-to-week basis to ensure alignment with the firm's innovation strategy and to accelerate the innovation process.

During the existence of this innovation system, a total of eight disruptive and radical innovations were being explored that fit with the criteria set for this study (*find more detail in Table 7*). Of these innovations three were stopped and five were handed over to the exploitation stage.

5.3.1 Findings on Controlled Innovation System 1.0

In general CIS 1.0 was regarded as a great step towards organising for innovation, as it was the first attempt of the firm to institutionalise disruptive and radical innovation on such a scale. However, a professional organisation is needed to solve the challenges that come with this ambition. Experts explained this by: '*we started to try, and see'* (CISI-8), '*the lawless nature made it very flexible'* (CISI-1), and '*CIS 1.0 was about learning'* (CISI-2). Hence, this system is regarded as a great start to steer innovation, but not yet scalable.

During CIS 1.0 I found that two established controls had a negative effect on exploration activities of disruptive or radical innovations, and three had a positive effect (*see Table 14*).

Table 14: Findings on CIS 1.0

Control	Description	Positive	Negative	Indifferent
C.1	Innovation strategy	**9**	**-**	**-**
C.2	Innovation group	**8**	**-**	**1**
C.3	Ring-fenced budget	**8**	**-**	**1**
C.4	Senior Steering board	**2**	**4**	**2**
C.5	Central support manager	**1**	**5**	**2**

At least eight experts regarded the presence of an innovation strategy (C.1; n=9-0-0) and separate innovation group (C.2; n=8-0-1) as having a positive effect on exploring innovations and mutually agree that a separate body to govern these types of innovation is important to safeguard their existence. This aligns with the findings of research on structural ambidexterity (e.g. Blindenbach-Driessen & van den Ende, 2014; Kauppila, 2010; O'Reilly & Tushman, 2008). In addition, all eight experts also regard the existence of ring-fenced budget for innovation as having a positive effect (**C.**3; n=8-0-1). Exemplified by experts in multiple ways: '*for the first time one could fund an innovation from a separate budget; that was huge'* (CISI-4), and: '*a fund is a prerequisite to do* [disruptive and radical] *innovations, without it you cannot do it all'* (CISI-6). Yet, in addition to a strategy, an innovation group, and ring-fenced budget, one needs to have the mandate to launch ideas into the market to be able to disrupt: '*despite having a huge ambition and a strong strategy, not being able to launch propositions in the market cripples the capacity to exploit radical*

and disruptive innovations' (CISI-5). This connects to the fourth identified innovation control: a senior steering board for innovation.

The senior board for innovation (C.4) decides on new proposals to enter the funnel, allocating additional resources to innovations in the funnel and deciding on the transition to exploitation. Four experts regarded this board as having a negative effect, two as having a positive effect, and two were indifferent (n=2-4-2). Having senior commitment and involvement to explore and exploit disruptive and radical innovations is of key importance for gatekeeping (R. G. Cooper & Edgett, 2012) and to ensure assets are reconfigured to sustain a competitive advantage (O'Reilly & Tushman, 2008); yet, changing composition of this group may change criteria for success (Smith-Doerr, Manev, & Rizova, 2004). I found that composition of the board was not consistent and it had no clear-shielded innovation responsibility; '*the board was not really consistent and we had multiple other committees within the firm'* (CISI-4). As experienced by one expert, having the responsibility for delivering disruptive and radical innovations that potentially can disrupt the current firm, and having executive understanding of what this requires was missing: '*members of the board were senior managers, but did not have innovation responsibility and therefore had another focus regarding innovations'* (CISI-2).

Last, all innovations had a central innovation support manager (C.5) that supports innovations with resolving management issues and coaching. The presence of this manager was regarded as fairly negative (n=1-5-2). Innovations, during their exploration stage, have the nature of iterating between various customer segments, industries, business models, and technologies when finding a big enough problem that is viable and feasible to solve (Osorio, 2011). In order to ensure propositions align with strategic ambitions and build, or build upon strategic capabilities, continuous interaction with innovators is required to influence their behaviour towards

organisational goals (Malmi & Brown, 2008). Yet, controlling this via central support managers that touch-base with innovators on a bi-weekly basis was regarded as sub-optimal by experts: '*it was too open ended'* (CISI-6)*, the role was very unclear'* (CISI-2)*,* and '*it did not have any effect*' (CISI-4). Moreover, the process for exploring disruptive and radical innovations is very uncertain and influencing employees' behaviour on a continuous basis supports strategic alignment.

Action plan and intervention (CIS 1.0 towards CIS 2.0)

Of the five identified innovation controls, three were regarded as having a positive effect on exploring innovations (*see Table 14*). Together with key firm stakeholders an action plan was created to remove the two controls with a negative effect (C.4 and C.5), and to install seven new innovation controls (C.6–12) to mitigate identified barriers and firm challenges, see Table 15.

Table 15: Controls applied in CIS 2.0

Control	Control Category	Lever of control	Description
C.1	Firm & Portfolio	Belief	Innovation strategy
C.2	Firm & Portfolio	Boundary	Innovation group
C.3	Firm & Portfolio	Boundary	Ring-fenced budget
C.6	Performance monitoring	Interactive	Senior support board
C.7	Performance monitoring	Interactive	Coach allocation
C.8	Firm & Portfolio	Boundary	Stage-gate implementation
C.9	Firm & Portfolio	Boundary	Methodology implementation
C.10	Firm & Portfolio	Boundary	Single-market approach

C.11	Firm & Portfolio	Boundary	Team dedication
C.12	Performance monitoring	Interactive	Sponsor allocation

C.6 A senior support board,
was installed. The existing senior steering board was dismantled and a new board of senior managers was created. Executive-level managers were selected based on their mandate in reconfiguring firm assets to sustain a competitive advantage and to complement the group (i.e. technology, business, strategy, exploration and exploitation skills and responsibilities). The mission of the board was set to 'steer disruptive and radical innovations', and responsibilities were to 'act as gatekeeper for (new) proposals, allocate resources, and support innovations with their organisation to remove impediments.

C.7 Coach allocation,
was installed instead of a central support manager. The central support manager was turned into a dedicated innovation coach that has the responsibility to support innovations continuously and acts as the link between the board and the team of innovators. This intervention attempts to breach the gap between innovation theories and practitioners (i.e. firm employees and senior managers).

C.8 Stage-gate implementation,
describes the standardised stage-gate process that was installed, as popularised by Cooper (1990), see Figure 7. Previously two phases were distinguished by the firm based on resource needs (i.e. seed funding and implementation funding), decisions in the process were not based on deliverables and timelines as prescribed by applied innovation theories and methodologies (see C.9). Moreover, the innovation steering board did

not take decisions in line with the activities conducted by innovation teams, and deliverables prescribed belonging to the stage of the process. This resulted into a mismatch of expectations on a project and board level. This control translates deliverables of innovation methodologies into stage-gate requirements. Which were translated into score-cards applied by the innovation support board (see C.6).

Figure 7: Implemented Stage-gate process

C.9 Methodology implementation,

describes the uniform innovation methodology that was implemented. Previously multiple ways of working (i.e. Lean start-up, Design Thinking, and Agile) were applied in various ways. In order to align the decision-making on a board level with activities on a project-level a uniform methodology was installed based on the stage-gate process (see C.8). From the previously named innovation methodologies key activities were prescribed to undertake by innovation projects in stages, and key deliverables were set in order to pass gates.

C.10 Single-market approach,

describes the required focus of innovations at first on a single market. In line with Lean startup principle to validate solutions first in a small-scale market, i.e. build, measure, learn cycles integrated with lean manufacturing principles developed by Toyota (Baldassarre, Calabretta, Bocken, & Jaskiewicz, 2017), this control was installed to limit reach of innovations during the exploration stage to one market. Validating problem-solution fit, and solution-market fit of a proposition in one-market

first, attempts to limit influence of the unsupportive decentralised organisational structure, (local) systems architecture, and risk-avoidance mentality.

C.11 Team dedication,

describes the requirement to have full-time innovation teams. To ensure innovators could use their innovation methodology skills more efficient in exploring innovations, teams of innovators were required to fully dedicate their time to innovation; rather than, on top of current jobs.

C.12 Sponsor allocation,

describes the requirement to allocate executive-level management sponsors to these types of innovation. To avoid the Not-invented-here syndrome and ease transitioning to exploitation, executive-level management sponsors were allocated to all innovations. These managers provide support on a bi-weekly basis to remove impediments and ensure viability of the proposition.

All controls were approved by executive-level management and installed for all disruptive and radical innovations steered by the innovation board across geographies. During the intervention, the senior support board, program managers, and innovation managers were supported on a week-to-week basis to ensure smooth installation of controls and to collect information for the evaluation study.

5.3.2 Findings on Controlled Innovation System 2.0

When implementing the second controlled innovation system over ten initiatives were supported by the Innovation Group in an incubator/accelerator. Teams were only hosted at a facility to stimulate cross-pollination, learning and synergies.

In general, experts regarded this system as a key step in further professionalization of the organisation. To exemplify this one expert stated on the system: '*It is a good concept to infuse checks along the way and it provides an opportunity to continuously assess the innovation'* (CISI-2). Experts did not evaluate remaining controls from CIS 1.0 differently. However, experts perceive that improvements can be made: '*there is no link between strategic priorities and innovations'* (CISI-9), complementing this another expert states: '*we need a clear strategic intent for disruptive innovations'* (CISI-7), and confirmed by a third expert: *'strategic intent will provide focus and guidance on which domain innovation should be concentrated on'* (CISI-3). Moreover, controls supported further professionalization and value can be gained by enforcing a strategic focus.

During CIS 2.0 it was evaluated that all new installed controls had a positive effect on exploration activities of disruptive and radical innovations (*see Table 16*); yet, not all barriers were mitigated (*see Appendix C.3)*. Informants had quite opposing views regarding the question if barriers were mitigated due to the installation of new controls. Nevertheless, experts shared the view that in general most barriers are decreasing over time while introducing new controls: '*over the years barriers are fading*' (CISI-6), '*progress has been made, based on for example the relationship with support functions within the organisation'* (CISI-5). During the lifetime of this innovation system, a total of twelve disruptive and radical innovations were being explored that fit with the

criteria set for this study. Of these innovations six were stopped and six were handed over to the exploitation stage.

Table 16: Findings on CIS 2.0

Control	Description	Positive	Negative	Indifferent
C.6	Senior support board	**6**	**2**	**1**
C.7	Coach allocation	**9**	**-**	**-**
C.8	Stage-gate implementation	**8**	**-**	**1**
C.9	Methodology implementation	**7**	**1**	**1**
C.10	Single-market approach	**6**	**1**	**2**
C.11	Team dedication	**9**	**-**	**-**
C.12	Sponsor allocation	**9**	**-**	**-**

Regarding new installed controls first, the senior support board was regarded by six experts as having a positive effect on innovations (C.6; n=6-2-1). The installed board was regarded as having a positive effect when regarding reconfiguring assets in exploring areas for a competitive advantage: '*they set the strategic direction for innovations'* (CISI-4), and increase quality of exploration activities: '*the board helps to ensure teams are sharp and increases healthy pressure as it is the body to support or stop initiatives'* (CISI-6). Nevertheless, composition of the board remains a challenge '*some members are more dominant than others affecting decision-making'* (CISI-3). An expert that regarded it as having a negative effect believes decisions are too often based on prior experience of members, rather than based on data providing evidence on a problem-solution fit, or solution-market fit: '*members support initiatives based on a gut feeling, and are not data-driven enough'* (CISI-8). Finding the right

competences for decision making when exploring new markets, business models or technologies is needed: '*you need to make sure you have the right expertise to judge ideas; hence, a sponsor is needed'* (CISI-6). Thus, having an executive-level management sponsor supports effective exploration; all experts regard this control as having a positive effect (C.12; n=9-0-0): '*Having committed sponsors who are willing to fight for initiatives generally goes well'* (CISI-5), and *'it's a good concept since sponsors can enrich an idea by consistently challenging the team'* (CISI-3). As pointed out by various experts, selection of these sponsors is of key importance for teams '*belief of sponsors on the potential is a key point for the team's success'* (CISI-5), and '*sponsors need to have the right intrinsic motivation and expertise'* (CISI-6). Moreover, findings show that these two controls, supported by the innovation group, create a 'safe' environment to explore high uncertainty and risky innovations. This gives room to explore innovations before being integrated with existing institutional structures that are not designed for this nature.

Next, turning central innovation support managers into innovation coaches (C.7; n=9-0-0), having dedicated innovation teams (C.11; n=9-0-0), implementing a standardised innovation methodology (C.9; n=7-1-1), and linking it to a stage-gate process (C.8; n=8-0-1), are all controls that experts regard as having a mere positive effect. They support in mitigating the gap between innovation theories and practice. The combination of methodology and stage-gate process increases effectiveness: '*It makes transparent for teams what they need to do, and for decision-makers what criteria to use for decisions'* (CISI-6). Dedicated teams and coaches have yielded positive effects: '*allocation of coaches has been very important to support stakeholder management, team dynamics and methodology implementation'* (CISI-6). Yet, the composition of innovation teams requires management attention as corporate innovations differs from non-corporate innovations; propositions need to nurture and thrive within a

corporate environment. Put by one expert as '*composition is as important as being dedicated: they have to understand the reality of a corporate and the perks of entrepreneurship. Only then they are able to speed up the learning curve*' (CISI-9). Accordingly, the findings show that the organisational experience and skills in exploring disruptive and radical innovations have matured in the firm during the innovation system. Newly installed controls have further translated innovation theories and methodologies into practical value to increase experience and education levels of employees of the firm.

Last, all experts regard the focus on one-market first as having a positive impact on exploration activities (C.10; n=9-0-0); it increases speed and mitigates inertia of local systems architectures, unsupportive organisational structures, and the Not-invented-here syndrome. Moreover, typically within large-scale services firms, business units hold responsibility for specific markets and limiting the focus of an innovation to one market limits the number of stakeholders involved for receiving commitment in exploring innovations. One expert summarised this as '*it allows more focus by concentrating efforts'* (CISI-3). Still, one should prevent a '*lock-in effect*' (CISI-1) and ensure scalability of innovations across markets and prepare for integration with organisational assets.

Concluding, the findings on CIS 2.0 show that both firm challenges were being mitigated for exploration activities and innovation barriers are decreasing over time. Although there are opposing views, a slight majority of the informants believe installed controls for the exploration stage support mitigation of: the risk-avoidance culture (B.1), unsupportiveness of the organisational structure (B.5), inertia of the firm's system architecture (B.24), and the Not-Invented-Here syndrome (B.31). This achievement can be related to the primary focus of unbundling traditional exploit structures from explore structures. Since controls are focused on

exploration activities rather than exploitation activities, the absence of fundamental R&D by the firm has not been overcome yet (B.17); as well as a lack of exploiting new ideas (B.27).

Action plan and intervention (CIS 2.0 → CIS 3.0)

Of the ten installed innovation controls, all were regarded as having a positive effect on exploring innovations. Together with key firm stakeholders a second action plan was created to further mitigate existing barriers and challenges. Ultimately, it was decided to install two new innovation controls, see Table 17 C.13 and C.14.

Table 17: Controls applied in CIS 3.0

Control	Control Category	Lever of control	Description
C.1	Firm & Portfolio	Belief	Innovation strategy
C.2	Firm & Portfolio	Boundary	Innovation group
C.3	Firm & Portfolio	Boundary	Ring-fenced budget
C.6	Performance monitoring	Interactive	Senior support board
C.7	Performance monitoring	Interactive	Coach allocation
C.8	Firm & Portfolio	Boundary	Stage-gate implementation
C.9	Firm & Portfolio	Boundary	Methodology implementation
C.10	Firm & Portfolio	Boundary	Single-market approach
C.11	Firm & Portfolio	Boundary	Team dedication
C.12	Performance monitoring	Interactive	Sponsor allocation
C.13	Performance monitoring	Diagnostic	Stage-gate quality standards
C.14	Firm & Portfolio	Belief	Strategic growth areas

Two new controls were installed to ensure resources could be allocated most effectively. The innovation portfolio grew during CIS 2.0 from over ten initiatives and was likely to grow to over twenty initiatives. This growth required the firm to decide where to allocate resources more strategically. Therefore, stakeholders expressed the need to monitor organisational outcomes and to spot deviations from established standards.

C.13 Stage-gate quality standards,
describes the introduction of quality standards of deliverables and the introduction of clear criteria to ensure alignment with the set innovation strategy. This control attempts to spot deviations from established standards more quickly and also attempts to push for data-driven decision making. For example budget, timelines, and staffing standards for stages were set as well as minimal requirements for business case benefits.

C.14 Strategic growth areas,
describes the introduction of areas to guide exploration activities. To ensure resources are allocated strategically and decisions serve the best interest of the firm in fulfilling its long-term strategic objectives, strategic growth areas can be introduced for guiding exploration activities (e.g. Poskela & Martinsuo, 2009). This control attempts to ensure choices in the early stages of exploration are strategically feasible to avoid costly redesign efforts. The firm defined multiple growth areas based on current competences and strategic capabilities.

These two controls were approved by executive-level management and installed for the entire portfolio of disruptive and radical innovations. The senior support board, program managers, and innovation managers were supported on a week-to-week basis to support smooth installation of

controls and to collect information for the evaluation study. Strategic growth areas were named 'value spaces' to align with terminology applied in the firm.

5.3.3 Findings on Controlled Innovation System 3.0

In general, experts regard this system more rigorous than CIS 2.0 with more strategic focus. In about a year, the organisation grew from a one incubator/accelerator supporting over ten initiatives, to three incubators/accelerators supporting over twenty innovations in parallel at three locations. Since the innovation group grew, emphasis was put on standardisation of procedures and scalability of the innovation system. Scarcity of resources increased due to the size of the innovation portfolio and as a result an emphasis on effective resource allocation was enforced. Moreover, the context changed due to scaling of the exploration activities. In addition, during this intervention the environment for innovation was subject to environmental dynamism; a regulatory intervention showed to have two effects on exploitation of disruptive and radical innovations:

1. Appetite to exploit disruptive and radical service innovations has decreased.
2. Resources available to exploit disruptive and radical innovations for exploitation decreased.

Yet, this did not impact exploration activities directly, but rather impacted the easing of transition towards the exploitation stages.

The changes implemented throughout CIS 3.0, were perceived to having negative effects in terms of losing agility required for innovation: '*We are stricter on governance and that means more guidelines that have to be*

met, this turns in that we tend to lose the dynamics of innovative teams' (CISI-7), and put by another experts as: '*too much red tape, rigidity, and a focus on structure and control. Most importantly, it is about the speed of decision-making, this is what goes down'* (CISI-8). Ultimately, this affects throughput time; as highlighted by an expert as '*time-to-market becomes affected and innovations are not able to take-off quickly enough in comparison with competitors who are not subjected to the same scrutiny'* (CISI-3). Positive effects stated by experts focused on the further professionalization: '*the maturity level of how we support innovations has improved'* (CISI-4). Moreover, CIS 3.0 was subject to an increase in scale of the innovation portfolio and rigidity, and this has brought several organisational challenges that were not fully mitigated by installed controls.

When focusing on single controls, stage-gate quality standards were perceived as having both positive and negative effects (C.13); strategic growth areas were merely regarded as having positive effects (C.14) (*see Table 18*). Additionally, remaining controls from CIS 2.0 were evaluated the same during CIS 3.0 by experts.

Table 18: Findings on CIS 3.0

Control	Description	Positive	Negative	Indifferent
C.13	Stage-gate quality standards	**4**	**3**	**2**
C.14	Strategic growth areas	**6**	**1**	**3**

First, the implementation of stage-gate quality standards was perceived as having positive, negative, and indifferent effects (C.13; n=4-3-2). It was regarded as having positive effects by making the process more

transparent, yet in the evaluation experts evaluated the implementation of the control as being too strict which creates tensions for innovations: '*teams need more time to prepare for the gates since the board is more strict'* (CISI-4). Next, standardised timelines and budgets are perceived not to fit the characteristics of disruptive and radical innovations since their nature typically does not fit standardisation: '*it is too rigid for disruptive and radical innovations'* (CISI-1). Thus, stage-gate quality standards support transparent decision-making when a portfolio of innovation grows; yet, too rigorous implementation cripples disruptive and radical innovations due to the difficulty of standardising these types of innovation. During exploration stages it proves hard to set criteria and standards in terms of e.g. time, budget, and technical requirements. Therefore, flexibility is required to ensure innovations are not scaled before reaching proper maturity, and are not stopped too early based on inadequate criteria and standards.

Second, strategic growth areas were regarded as having a mere positive effect on exploration activities (C.14; n=6-1-2). Highlighted by experts as '*it provides focus and guidance on which domain innovation should be concentrated on'* (CISI-3), and '*defining value spaces* [growth areas] *is important to focus and say no* [on proposals that do not meet pre-set areas]*'* (CISI-8). However, the strategic direction needs to be clear in order to guide innovations in the right direction, else feasible innovations might be stopped, and vis-à-vis. '*do we really know what we are aiming for in the long run?'* (CISI-3), and '*the principle is good… however, we should know upfront what the role of our firm is before we start initiatives'* (CISI-4). Moreover, strategic growth areas have a positive effect on exploration activities of disruptive and radical innovations, but do not support mitigating remaining innovation barriers.

Concluding, the findings on CIS 3.0 show that an advanced innovation system was in place to control disruptive and radical innovations. Nevertheless, although strategic intent supports focus of the innovation portfolio in times of growth, standardised quality standards did not show to be effective for disruptive and radical innovations during the exploration stages. Nor did both controls have an additional effect on mitigating innovation barriers. Controlling exploration activities requires significant investments and time to build relevant capabilities; yet, too much control may hamper throughput time to compete in a fast-moving market. Ultimately, it is a balancing act for management to ensure the pendulum does not swing too far out on both sides.

In addition, informants were asked if innovation barriers were reduced or removed because of the removal and installation of controls. Results are presented in Appendix C, Table C.3 and indicate that informants are indifferent. Overall, controls have supported in reducing the effect of barriers, but depending on the relationship of the innovation with the system of innovation, barriers still exist. This mainly depends on questions like: is a technology or business model applied by an innovation new or cannibalising, does an innovation have risks exceeding firm boundaries, and is a similar problem solved in an incremental / sustaining way that might be competitive?

5.4 Discussion

Controls to support innovations have drawn a great deal of research attention. Nevertheless, controlling disruptive and radical innovations within large-scale services firms have received less attention. This is of interest since firms have increasingly started exploring these activities, but traditional organisational structures are typically not designed for this. Few researchers have investigated the relationship between disruptive and radical innovations in large-scale services firms and management control. In light of existing knowledge, I find that eleven controls support more effective exploration of these types of innovations within a large-scale services firm, see Table 19. Eight of these controls were newly added, three existed already in the organisation at study.

Table 19: Results: Key controls for supporting effective exploration of disruptive and radical innovations in large-scale services firms

Control	Control Category	Lever of control	Description
C.1	Firm & Portfolio	Belief	Innovation strategy
C.2	Firm & Portfolio	Boundary	Innovation group
C.3	Firm & Portfolio	Boundary	Ring-fenced budget
C.6	Performance monitoring	Interactive	Senior support board
C.7	Performance monitoring	Interactive	Coach allocation
C.8	Firm & Portfolio	Boundary	Stage-gate implementation
C.9	Firm & Portfolio	Boundary	Methodology implementation
C.10	Firm & Portfolio	Boundary	Single-market approach

C.11	Firm & Portfolio	Boundary	Team dedication
C.12	Performance monitoring	Interactive	Sponsor allocation
C.14	Firm & Portfolio	Belief controls	Strategic growth areas

Although these installed controls are mainly regarded as having a positive effect on exploration activities, how controls are implemented is paramount to effectively explore disruptive and radical innovations. The institutionalisation of controls requires management attention to support alignment with the corporate culture and to provide time to allow institutionalisation. Innovation controls are dependent on contextual antecedents and although these have been relatively stable over time, growth of exploration activities has impacted the implementation of innovation controls. Therefore, implementation of innovation controls is perceived as a delicate task: '*the strategic-growth-area control has not been implemented to its utmost potential'* (CISI-5), '*stage-gates were not implemented properly in the beginning which created stress and the wrong expectations'* (CISI-4), and '*you need innovation controls; however, one should stay sharp on avoiding that means and ends are mixed up'* (CISI-6). Accordingly, organisational learning takes time and is crucial for proper implementation of innovation controls. Comparable to a pendulum swing, the firm has installed controls to ensure disruptive and radical innovations are protected from the exploit organisation during exploration activities; but too much control hampers innovators to effectively develop innovations. Moreover, firms need to balance the need for control with providing room for innovators to try, fail and learn.

Firm challenges

In addition, the interventions accomplished in resolving firm challenges as addressed in Section 5.0. First, it was addressed that the characteristics

of these types of innovations do not fit existing institutional structures. Since, the firm has installed all proposed controls to create a structural ambidextrous organisation with support on different organisational levels (i.e. management and operational level) I may well conclude that organisational structures are now in place to fit these types of innovations. Second, employees of the firm were not experienced in new innovation theories and methodologies. These theories and methodologies proved to be too complex to apply by employees that wanted to explore disruptive or radical innovations. The proposed control interventions were based on innovation theories and methodologies, and experts regard these controls as merely effective. Hence, I believe both experience and educational levels of employees have increased in time. This case shows that building capabilities requires time and commitment from management, and controls support in translation of theories and methodologies into corporate practices.

Innovation barriers

Next, installation of innovation controls partially supported in mitigating identified innovation barriers as addressed in Section 5.0 (*see also Table 28*). This case shows that two barriers were not removed by installing innovation controls. Since the study focuses on the exploration stages and did not intend to solve the first barrier: 'a lack of exploiting ideas' (B.17). The second barrier: 'a lack of fundamental R&D' (B.27), can be argued as a part of the exploration stages; nevertheless, this barrier still exists. The innovation system of the firm is built on principles of lean experimentation and incubators/accelerators, and is targeted at service innovations; this does not give room for fundamental R&D, as timelines for these processes are longer.

I find that informants have opposing views on the removal of innovation barriers. Results indicate that these barriers still exist based on the type

of innovation and type of relationships. A slight majority finds that: 'too much focus on risk avoidance' (B.1), 'inertia cause by (local) systems architecture' (B.24), and 'not-invented-here syndrome' (B.31) have been reduced or removed. Although these barriers might still be present in the exploit part of the organisation, in the designed exploration organisation it has a reduced impact on exploring innovations compared to the initial situation. The last barrier: 'an unsupportive organisational structure' (B.5), shows to be interlinked with 'inertia caused by (local) systems architecture' and remains challenging. In case disruptive and radical innovations do not require interaction with existing system architectures these barriers are mitigated by installation of controls. However, in case innovations anticipate on future integration with existing assets in the exploitation stage, one may be better of preparing for this up-front. This might hamper the effectiveness exploration stage, as focal point of this study, but may improve effectiveness of the exploitation stage, not included in this study.

5.5 Implications and Limitations

Theoretical implications

Despite its exploratory nature, the study offers a valuable perspective for researchers who study the interaction of controls and disruptive and radical innovations by further showing that the described tension between innovation and control can be managed when embedded carefully. Typically, corporate innovation environments need to be controlled to mitigate risk and liabilities of the firm and its brand. Controlled innovation environments can create a corporate environment that allows for controlled risk-taking and explore unknown opportunities of growth. In line with Chiesa et al. (2009), the evidence shows that interactive systems are

important in the early stages and diagnostic, formal types of control are less compatible. In addition, to the best of my knowledge, this study is one of the first that categorises boundary controls based on Simons' taxonomy (1995), as having a positive effect on exploration of disruptive and radical innovations. Shaping the boundaries for these innovations allows for effective resource allocation and mitigating innovation barriers.

Practical implications

The study has valuable managerial implications for practitioners that steer innovation systems. The positive and negative effects of installed controls may provide practitioners with a useful benchmark on how a firm successfully created an environment in which disruptive and radical innovations can thrive. First, it is interesting to notice that certain controls such as stage-gate quality standards from management-level make sense; however, once implemented it may have negative effects on a project level. Second, contextual antecedents are important when designing innovation systems. If contextual antecedents are stable over time innovation controls can sustain, if they change practitioners need to evaluate the controlled innovation system and take action to ensure innovations can thrive. Third, rather than 'just' implementing an innovation control, operationalisation of a control requires most, and continuous, management attention. Institutionalising controls in the firm is a delicate task and practitioners can find useful features in this study.

Limitations

This study is not without limitations. Commonly addressed, canonical action research is not conducted 'behind the glass' (Deluca et al., 2008). However, as highlighted by other researchers, when research is conducted in concert with practitioners, a natural setting is regarded as contributing in developing both conceptual and practical significance (Strauss & Corbin, 1998). Next, qualitative research has the limitation of

non-representativeness, poor generalisability, and challenges to replicate. To this point, I performed a study in a single firm to control for dynamics that changed the environment and I performed multiple control interventions in a longitudinal study to be able to include over forty innovations and overcome that results are specific to a few innovations. I therefore believe results can be generalised further. Moreover, the case has yielded rich in-depth information on how innovation controls impact exploration activities of disruptive and radical innovations. Another criticism is that these types of research often lack an evident theoretical basis (Deluca et al., 2008). In response, this study is based on theoretical innovation theories identified in previous chapters that provide a sound theoretical basis.

5.6 Conclusions

This chapter analysed how management controls systems can be installed to support more effective exploration of radical and disruptive innovations in large-scale services firms. The analysis of the three control interventions has led to three main conclusions: First, the study has investigated the effect of fourteen innovation controls on exploration activities and shows that eleven innovation controls have a positive effect on mitigating innovation barriers and increase effectiveness of exploration activities. Building upon results from Chapter 4 that show an innovation strategy, separate innovation group and a ring-fenced innovation budget support exploration of these types of innovations; also presence of a senior board supporting innovations, strategic growth areas, coaches, a methodology, a stage-gate process, a single-market approach, dedicated innovation teams, and an innovation sponsor have a positive effect on

exploration activities. Second, contextual antecedents have an impact on controlled innovation systems; in response to a changing antecedent, innovation controls should be evaluated in light of the significance of the change and adjusted to meet the new situation. Third, I find that while the principle of an innovation control can have a positive effect on exploration activities; the operationalisation of innovation controls requires management attention to have the prescribed effect. Moreover, while the principle of a control might be conceptually clear, the implementation might require continuous adjustments to evolve over time along with the maturity of the innovation system.

The findings show that there is a need to acknowledge a contingent view of management control systems in large-scale services firms. Theories mainly stem from product- and manufacturing-oriented research and findings show that large-scale services firms by default are not adequately designed for exploring disruptive and radical innovations. These firms typically require installation of many innovation controls and continuous evaluation of controls in light of feasibility with the corporate reality.

From a practical perspective, the identified key controls for innovation can be the start of a theoretical framework for management control systems applicable for exploring disruptive and radical innovations in large-scale services firms. The categorisation based on Simons' levers of control (1995) provides different organisational levels to control innovations for the exploration stage. Future research is therefore encouraged to assess feasibility of this framework in other large-scale services firms. Also, research may follow-up on the importance of operationalisation of innovation controls. More qualitative studies can look into effective translation of single control principles during the exploration stages. Last, researchers should look into the effect of contextual antecedents on effectiveness of innovation controls.

PART III: EPILOGUE

In Part II of this thesis, the theoretical components were validated in multiple empirical case studies to help solving the research problem. The conducted research shows that proven management control systems designed for exploitation of the current business, are also applied for exploration activities. In addition, key barriers were addressed that are unique for these types of innovations in large-scale services firms. To overcome these challenges, innovation controls were tested in a case study; results demonstrate that controls can be designed to increase effectiveness and remove barriers to innovation.

Part III, 'Epilogue', returns to the main purpose of this dissertation: improving the effectiveness of managing disruptive and radical innovations in large-scale services firms. **Chapter 6** provides a discussion including the validity of the research and limitations, it answers the sub- and main research questions, presents the scientific contribution, and will finally recommend areas for future research.

6 DISCUSSION AND CONCLUSIONS

In this chapter the overall research on exploring disruptive and radical innovations in large-scale services firms is discussed and concluded; emphasis is put on: research validity, answering the research questions, and next steps. Section 6.1 discusses the overall validity, reliability, and limitations. In Section 6.2 the scientific contribution of the thesis is discussed. Section 6.3 answers the research question and sub-questions and finally in Section 6.4 recommendations for future research are presented.

6.1 Validity of the research and limitations

The quality of any research can be ensured by a rigorous and relevant research design. In this thesis I have applied a complexity and systems view on the firms under study and I have studied the interactions between its agents and system rules. In particular, in the single-firm study I have isolated the innovation group as a sub-system to provide focus to the research. Only the key interactions of this sub-system essential for effective exploration and exploitation of disruptive and radical innovations were studied. Although there is a risk of oversimplification, this way of working allowed me to focus on the key interactions, agents and system rules that are important to solve the research problem. During the lifetime of the intervention study the sub-system was not affected by significant change, see Chapter 5.1: study object, and hence I did not have to control for changes.

This research has an empirical nature and to assess its quality four tests are commonly used, namely: construct validity, internal validity, external validity, and reliability (Yin, 2003).

Construct validity (i.e. establishing correct operational measures for the concepts being studied), was ensured by various steps along the research. First, to satisfy that the study measures the object that was planned to be studied, disruptive and radical innovations were defined based on existing theories. When selecting cases characteristics of innovations were assessed based on these definitions and discussed with informants before interviews or workshops. Next, to justify the empirical evidence used to answer the research questions, multiple studies have been performed on all levels of analysis within large-scale services firms (i.e. multiple organisations, units/divisions, and projects). Moreover, nine cases were selected on an organisational level to understand how firms control for exploring innovations, eight cases were selected on a project level to understand barriers to innovations, and nine interviews were conducted on a unit/divisional level to understand the effect of new innovation controls. Additionally, to increase construct validity and also reliability, multiple sources of evidence were selected on the same phenomenon (Voss, Tsikriktsis, & Frohlich, 2002). This involved interviews, firm documentation on innovation(s), and expert validation of collected data. Altogether, this triangulation has provided a holistic systems perspective of the object under study.

Testing internal validity of case studies (i.e. identification that causal relationships are in fact caused by the factors studied) can be achieved by pattern-matching logic. Moreover, do patterns coincide with a predicted pattern or not at all (Trochim, 1989)? First, in the studies conducted in Chapter 3 (organisational-level innovation controls) and Chapter 4 (project-level innovation barriers), approaches to control innovations and

barriers to innovations were compared to a prescriptive pattern that was developed based on available theories. Based on the differences between the predicted patterns and empirical data, new relationships were identified and put forward. Second, in the study conducted in Chapter 5 (unit/divisional-level innovation control interventions), multiple cycles of introducing and removing controls were carried out to limit the potential threat of contextual antecedents accounting to the patterns; a longitudinal study was conducted where the environmental context did not significantly change during the study, and influence of minor temporary changes was limited. Last, because of the dataset limitations in the studies, conclusions were carefully drawn in light of this limitation and researchers have been called upon to increase the quantity of the dataset to increase generalisability and internal validity.

Next, how to ensure that results can be generalised beyond the immediate case studies? The first study focused on multiple large-scale services firms, including both financial and non-financial. Findings of this study showed that when organising for exploring disruptive and radical innovations, no particular differences are present between financial and non-financial services firms. Therefore, in the second and third study focus was put on observing multiple innovations in a single firm, while being able to introduce and remove controls. I argue that this large-scale services firm is comparable to other large-scale services firms due to three reasons. First, it is a global stock-listed firm in which the public holds over 50% stake (ING, 2019); resulting in that no single shareholder has significant control. Second, it is a regulated firm, and hence, governed by a set of simple order-generating rules to comply with corporate governance, organisational and procedural that are audited on a yearly basis. Third, its employees have a diverse background and the composition of the management team and the innovation group during the intervention study was heterogeneous in terms of past working

experience, education and geographical origination. The selected firm has provided a unique case of setting up a controlled innovation environment from scratch in which interventions could be performed; it has presented a novel case to assess and enrich theories on disruptive and radical innovations in large-scale services firms. To increase generalisability, the intervention study was replicated three times to cumulate knowledge across experiments and increase external validity.

Finally, reliability of the study (i.e. could it be repeated with the same results?) was ensured by designing strict research protocols for all studies ensuring a big enough sample size. First, interview protocols were set up in accordance with established procedures for building and evaluating a theory in natural, organisational settings (Eisenhardt, 1989; Eisenhardt & Graebner, 2007) and the control intervention study was set up based on established action research methods (Davison et al., 2004; Deluca et al., 2008). To further increase reliability, interviews protocols in all studies were systematically set up (*see Appendices A.1, B.1, C.1*), and interviews were recorded, transcribed, and stored in a database. Second, by asking the same question to multiple informants and assessing documents of multiple innovations reliability was enhanced.

Concluding, while the research design deals with potential threats, it can become a vehicle for examining other cases and provides tools for researchers to empirically assess innovation theories. More than the topic of disruptive and radical innovations in a single case, chapters present topics covering broader theoretical issues such as definitions of innovation, a framework for assessing innovation barriers, a scheme for assessing innovation controls of the innovation process, and a design for an innovation control intervention study.

The main limitations of the research are the limited number of cases resulting from the qualitative nature of the study; these limitations have been described in-depth in the previous chapters. Summarising, this thesis had the purpose to demonstrate how large-scale services firms can enable more effective exploration of disruptive and radical innovations. To collect rich in-depth data, a case-study approach was chosen that has allowed me to deep dive into multiple cases and reflect insights in light of the dynamical innovation context. The number of cases in Chapter 3 was limited to nine large-scale services firms; yet, it provided enough cases to find patterns across cases. In Chapter 4, a set of eight cases was selected in a single firm for identifying innovation barriers. Within any firm only a limited number of disruptive and radical innovations are undertaken compared to incremental and sustaining innovations, which has limited the sample size. Following this, in Chapter 5, a longitudinal single firm intervention study was performed, and researchers are called upon to perform similar research in other firms to increase generalisability.

6.2 Scientific contribution

Exploring disruptive and radical innovations in large-scale services firms requires control to enforce discipline and ensure value add to a firm's strategic goals. The thesis has provided scientific contributions in various areas.

First, researchers have been called upon to provide a better understanding of the dynamic global contexts of service innovations (Martin et al., 2016). This thesis covers a part of this picture by providing understanding of how disruptive and radical innovations can be explored

in large-scale services firms to prepare for exploitation. Moreover, I have shown what key innovation barriers are within financial services firms and how innovation can be controlled to mitigate barriers and increase effectiveness of exploration activities. The findings first echo and further narrow down the specific barriers to innovation as identified in the work of Sandberg and Aarikka-Stenroos (2014).

Second, it aligns with Chiesa et al. (2009) who state the importance of interactive systems during exploration stages; it extends this work by showing that also boundary and belief controls are required during these stages to increase effectiveness of the exploration activities. Boundary controls are required to enforce discipline on innovators and ensure resources are used most efficiently. Belief controls are required to ensure resources are used most effectively, in line with a firm's long-term strategy. I show that since disruptive and radical innovations by nature may disrupt the core of a firm and involve changes to a firm's trajectory, it is important that a clear innovation strategy is institutionalised and consensus is reached on the strategic growth areas to focus on, and perhaps more importantly: which not to focus on. This allows firms to use resources most effectively and deliver disruptive and radical innovations that add value to its strategic ambitions.

Recognising the complex character and different nature of an exploration environment in which disruptive and radical innovations can thrive, shows to be of paramount importance when designing it. Moreover, it requires controls different from exploitation environments. Therefore, innovation exploration activities need to be designed as a separate controlled part of the overall system to ensure managers and employees can deliver firm value without being subjected to traditional exploitation controls. Thus, a controlled environment respecting the nature of innovation has to be designed, while still allowing current business to run most efficient.

Previous work on structural ambidextrous organisations introduced this view for environments subjected to rapid change (Hill & Birkinshaw, 2014; O'Reilly & Tushman, 2013). This thesis has confirmed that structural ambidexterity as an organisational structure in rapidly changing environments supports effective exploration of disruptive and radical innovations. It also has shown what conditions need to be in place to support exploration of these types of innovations, see also the discussion in Chapter 5.4. To recap, exploration of these types of innovations has to be controlled; but it is a balancing act to avoid that control impedes creativity or creates an environment incapable of coping with exploring uncertain areas for growth.

This thesis has also shown that traditional innovation theories are typically based on empirical findings in manufacturing and product-oriented firms. I have built on work describing the innovation processes (R. G. Cooper & Edgett, 2012) for disruptive and radical innovations (Christensen & Bower, 1995; Dewar & Dutton, 1986) in ambidextrous firms (Lavie, Stettner, & Tushman, 2010; March, 1991) and I show that innovation in services firms should be approached differently than in product firms due to contextual antecedents such as the organisational culture, governance, and environmental dynamism. The reasons for this are first, aligning with Droege, et al. (2009), that transforming products into services or innovating products, is different than innovation of services due to its characteristics. Second, I show that services firms typically do not have a tradition in which controlled sub-systems for innovation have been created; therefore they have to implement new-to-the-firm controls that come with innovation methodologies. Last, the thesis has provided tools to assess the applicability of, and enrich, innovation theories (*see Section 6.1*).

6.3 Review of research questions

This thesis has the objective to explore mechanisms that underpin, and to improve the effectiveness of, exploration of disruptive and radical innovations in large-scale services firms. Therefore, the following research question was formulated in Chapter 2:

> **Research question:** *How can large-scale services firms enable more effective exploration of disruptive and radical innovations?*

This question can be divided into multiple components and therefore was broken down into three sub-questions that were answered throughout the chapters of the thesis. These questions will first be answered before returning to the main research question.

Before the sub-questions were answered in Chapter 2, applicable innovation theories were studied to understand how large-scale services firms could explore disruptive and radical innovations. It showed that applicable innovation theories mainly stem from R&D intensive- and product-firms and due to characteristics and dynamics of services firms a better understanding of these firms is required. This need was amplified by the observed shift towards open innovation, the interconnectedness of the service ecosystem, and the impact of digitalisation that all have changed the way these innovations are explored and exploited in firms.

> **Sub-research question one:** *What key management control systems do large-scale services firms typically use to support exploration of disruptive and radical innovations?*

To address this question, in Chapter 3, a management control systems scheme for innovation was created based on available theories, see Figure 4. This scheme connects controls to the different stages of the innovation process and contextual antecedents that influence the innovation system. As shown in Table 4, ten key management control systems were identified as used by large-scale services firms. Findings show that firms apply new innovation methodologies. Although controls agnostic to these methodologies are installed, firms tend to install traditional controls designed for the exploit organisation, also for exploration of disruptive and radical innovations. Misapplying these controls for exploration results into barriers for effective exploration and has implications such as cumbersome processes for innovations, misalignment of innovations with organisational goals, and misunderstanding by management of performance of innovation activities.

The findings also indicate that contextual antecedents (*see Table 2*) impact the controls installed for innovation activities and they prove to be an important category allowing scholars to explain why firms install a certain mix of controls. In addition, managers should pay close attention to the contextual antecedents of their organisation when designing innovation controls.

> **Sub-research question two:** *What are the key barriers to the exploration of disruptive and radical innovations within large-scale services firms?*

To answer the second question, in Chapter 4 a framework to assess internal barriers to disruptive and radical innovations was developed based on literature (*see Table 10*). Findings of the study highlight that if an innovation strategy, active management support, ring-fenced innovation budget, and a separate governance structure for innovation is

in place, innovations get stimulated. This is due to the fact that these types of innovations do not experience a lack of appropriate resources or competition with other projects or programs at the firm. Nevertheless, key barriers such as: a lack of exploiting new ideas, inertia caused by (local) systems architecture, an unsupportive organisational structure, too much focus on risk avoidance, the not-invented-here syndrome, and a lack of fundamental R&D do hamper exploration and further exploitation of innovations, see also Table 11. Managers should prioritise mitigating these key barriers over traditional barriers identified in literature in the design of effective exploration sub-systems for disruptive and radical innovations.

> **Sub-research question three:** *What management control systems support more effective exploration of disruptive and radical innovations in large-scale services firms?*

In Chapter 6, the last sub-question was addressed. Based on the management controls typically applied by firms, see Chapter 4, and innovation barriers identified, see Chapter 5, this study analysed how management control systems can be designed to support more effective exploration activities. A longitudinal study consisting of three control interventions was conducted to assess which controls supported more effective exploration and mitigated innovation barriers. I found that eleven controls support more effective exploration of these types of innovations within a large-scale services firm (*see Table 19*). Building forward on the findings of Chapter 4, also the presence of: a senior board supporting innovations, ring-fenced budget, coaches, a stage-gate process, a methodology, a single-market approach, dedicated innovation teams, an innovation sponsor, and strategic growth areas have a positive effect on effectiveness of exploration activities.

Next, findings show that since contextual antecedents impact the mix of controls applied for innovation and should be taken into account when analysing control systems. In case of contextual changes, controls should be evaluated in light of the significance of the change and adjusted to meet the new situation. As an example, enforced industry regulation may impact the competitive landscape of a firm and may present opportunities for disruption. This tends to provide changes to innovation sub-system or even overall organisational system and requires adjustments to the belief, boundary, diagnostic and interactive controls. Therefore, managers should design innovation sub-systems that respect these antecedents to increase the effectiveness of innovation activities in meeting organisational goals; and once contextual antecedents change, managers should reflect on the impact of this on the sub-system and redesign controls.

The sub-research questions have answered the components of the main research question and therefore let me return to answering the main question.

> **Research question:** *How can large-scale services firms enable more effective exploration of disruptive and radical innovations?*

This thesis showed that existing innovation theories offer a less adequate lens to enable more effective exploration of disruptive and radical innovations in large-scale services firms; it requires tailored innovation controls to overcome barriers and increase effectiveness in reaching organisational goals (*see Table 20*).

I found that available innovation theories mainly stem from industries other than the services industry and findings show that specific barriers and contextual antecedents ask for a contingent view of management control

systems in large-scale services firms. Next, large-scale services firms are typically not designed for exploring disruptive and radical innovations and they require installation of new innovation controls to support effective exploration. Once innovation controls are installed, continuous evaluation of the feasibility of these controls is required; institutionalisation takes time and this time is crucial for proper implementation of controls. Comparable to a pendulum swing, a firm has to install innovation controls that provide enough room to spark creativity, but also has to ensure behaviour of management and employees is steered towards organisational goals. On the one hand, too much control imposed by the traditional exploit organisation hampers innovators; on the other hand, too little control will result into too much deviation from strategic goals and will result into ineffective resource utilisation. Moreover, it is a balancing act to provide room for disruptive and radical innovations to experiment, fail, learn, and succeed while utilising resources most effective.

Table 20: Tailored innovation controls to support exploration of disruptive and radical innovations in large-scale services firms

Control	Control Category	Lever of control	Description
C.1	Firm & Portfolio	Belief	Innovation strategy
C.2	Firm & Portfolio	Boundary	Innovation group
C.3	Firm & Portfolio	Boundary	Ring-fenced budget
C.6	Performance monitoring	Interactive	Senior support board
C.7	Performance monitoring	Interactive	Coach allocation
C.8	Firm & Portfolio	Boundary	Stage-gate implementation
C.9	Firm & Portfolio	Boundary	Methodology implementation
C.10	Firm & Portfolio	Boundary	Single-market approach
C.11	Firm & Portfolio	Boundary	Team dedication
C.12	Performance monitoring	Interactive	Sponsor allocation
C.14	Firm & Portfolio	Belief controls	Strategic growth areas

6.4 Recommendations for future research

All sub-studies have proposed areas for future research in its respective chapter and in this final section I propose two main areas for future research. These areas aim both at supporting researchers in developing theories and supporting firms, as key entities in society, to innovate more effective in order to ensure new technologies can be monetised to gain societal value and increase societal welfare rates.

Advance innovation control scheme, innovation barriers framework, and control intervention study. Although the developed tools (i.e. control scheme, barriers framework, and intervention protocol) have created a vehicle to assess effectiveness of exploring disruptive and radical innovations in firms, its improvement will further increase validity and reliability. Therefore, on an organisational level, researchers are called upon to use the tools in different industries and firms to understand if unique characteristics provide dynamics that require a different contingent view.

Investigate the impact of the complexity of platform business model on the types of innovation controls. Research has shown that relationships are more complex and long-term oriented in business-to-business (B2B) markets, than business-to-consumer (B2C) markets (Fauska, Kryvinska, & Strauss, 2013; Möller & Halinen, 2000); likewise, innovations focusing on platform business models require even more complex relationships since it requires both B2B and B2C relationships (Muzellec, Ronteau, & Lambkin, 2015). There is a growing interest in platform business models, but

understanding on how to manage the complex character that is strengthened by digitalisation and economic globalisation is still underexposed. Organisations are under pressure by firms exploiting these business models and therefore increasingly start exploring these types of innovations without proper guidance on how to design and control this. Hence, researchers are called upon to create an understanding of how to most effectively explore this specific type of innovation. How can they thrive in corporate incubators / accelerators? And how should it be controlled to ensure value add to organisational goals and allow organisations to survive in the face of change?

Early exploitation stages of disruptive and radical innovations: This thesis has focused on the early stages of innovation: the exploration stage, rather than the early stages of exploitation. I observed that while in the 'late exploration' stages it becomes important to start designing for a transition to exploitation stages. After all, it will take years for these types of innovations to grow big enough and show impact to organisational goals and the bottom line. The trajectory for a disruptive or radical innovation to integrate with existing assets has to be prepared with the receiving business unit and proves to be a cumbersome process (i.e. spin-in). Alternatively, in case innovations will be set up as new entities (i.e. spin-out), not operating in the traditional exploit organisation, a different trajectory is required since assets need to be uncoupled from the organisation. There are multiple models available for organisations to spin-in or spin-out (see: Spender et al., 2017; Weiblen & Chesbrough, 2015) and more research is called upon to investigate support organisations in effectively exploiting innovations. Ultimately, at this stage value is captured and innovating is as difficult in this stage as in the early stages.

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LIST OF ABBREVIATIONS AND TERMS

Executive-level management	Represents the chief-level roles in a firm; these are key decision-makers within a firm with strategic responsibilities.
Exploration	The front-end of innovation; early stages in which ideas are generated, substantiated, validated, and brought to first minimal viable products that can be tested with customers.
Exploitation	The back-end of innovation; late stages in which validated minimal viable products are scaled to production levels to reach customers beyond the initial pilot group.
MCS	Management Control System: the set of formal and informal input and output processes that are used by senior executives to achieve organisational goals. Shortened to ‘ controls’ in the thesis.
MVP	Minimal Viable Products; solutions that can be launched to customers based on a minimal set of key requirements needed to provide a working solution.

PART IV: APPENDIX

This part of the thesis presents detailed information regarding the studies that were carried out. All appendices follow the following structure: first the workshop or interview protocol is explained, second the questions are described, and third detailed information on the informants is described.

Appendix A presents information on the study carried out in Chapter 3: the application of management control systems to explore innovation. Appendix B supports Chapter 4: Barriers to disruptive and radical innovations in large-scale services firms, and Chapter C presents information on the study carried out in Chapter 4: Effectiveness of innovation controls.

APPENDIX A: MULTI-FIRM INNOVATION CONTROL SYSTEMS STUDY

A.1 Interview protocol for control study

Background information for interviewee

Thank you for participating in this study, which is part of my PhD-research.

External dynamics such as globalization and digitalization force incumbent firms to innovate their current business in order not become obsolete. In this study we aim to further improve the decision-making process for disruptive and radical innovations from idea until implementation. To successfully explore and exploit these types of innovations a different type of governance is required, and oftentimes this result in changes to a firms' subsystems. As not all contingencies are known in this innovation process decision-making is challenging and continuous corrective actions are crucial.

Therefore, in this study we are interviewing managers involved in the decision-making process of their firms' innovation portfolios. We are digging into the how-questions of decision-making at different stages of the innovation process to understand how managers control this new environment and how decisions are formed.

Ultimately, this will make insightful what key criteria are in different stages of the innovation process and how one can control quality and quantity of

the innovation funnel. It will help managers in understanding how to steer patterns in organizational activities to achieve successful results with an innovation portfolio.

Thank you for participating in this study, which is part of my PhD-research.

Interview Questions

I. Control Questions: Expertise

I. How many years of working experience in innovation do you have?
II. How many years of experience in decision-making of innovation projects?

II. Introduction questions

1. Could you elaborate on your firms' innovation portfolio? What is the size?
2. What is the strategic goal of the innovation portfolio?
3. How do you measure performance and success on a portfolio level, on a firm level? How do you align with the firms' strategy?
4. What criteria are you using to make decisions in different stages- qualitative or quantitative, intuition?
5. How do you make decisions in different stages, based on what input?
6. Who is part of the decision-making meeting? Are these managers that stand with both feet in the exploration and exploitation world?
7. How often do you have no-go situations, at what stage and also at the end? If so, why?
8. Are there projects that had to stop, but did you prefer to continue? Why did they stop?

III. Management Control Mechanisms

1. How is business commitment achieved to take projects further after ‘exploration', and when?
    - *E.g. (informal) communication, meetings and information exchange?*
2. Is a process with stages and gates in place, and applied? And is a reporting system used to monitor projects?
    - *[Influence of a formalized process on decision making]*
3. Are decisions based on the strategic goals of the firm or does it go beyond? How is that enforced and when?
    - *[Influence of the strategic vision on decision making]*
4. Is the strategic goal of the project defined up-front and is success defined for different stages?
    - *[Influence of task definition and initial task achievement]*
5. How are project teams formed? Is team performance measured? Is a team composition changed? When?
    - *[Influence of the team on decision-making]*
6. What are the roles & responsibilities in this process?
    - *[Influence of an innovation governance on the decision]*
7. What is the role of business modeling, and in what stages?
    - *[Influence of the long term business model on the firm – ROI, Market Share]*
8. Are customers involved in the process, and if so when? Are projects doing customer experiments, pilots - when?
    - *Customer engagement*

Closing questions

- Have all issues been addressed or do you want to add something?
- Who would you think would be interested and interesting to talk to?

A.2 Informants

In this study multiple informants provided data, in the below table (*see Table 21)* more detail is provided on the type of innovation they informed on, what their role was, and how it was coded.

Table 21: Informants of control study

No	Industry	Market	Employees	Type of Firm	Informant
I	Telecom	EU	20.000+	Services-oriented	Innovation Manager
II	Telecom	World-wide	50.000+	Services-oriented	VP Innovation
III	Airline	World-wide	20.000+	Services-oriented	Director Innovation
IV	Mail	EU	20.000+	Services-oriented	Innovation Director
V	Finance	World-wide	15.000+	Services-oriented	Executive Director
VI	Finance	World-wide	10.000+	Services-oriented	Head of Innovation
VII	Energy	EU	20.000+	Service-oriented	Innovation Manager
VIII	Chemicals	World-wide	20.000+	Product-oriented	Innovation Manager
IX	Oil & Gas	World-wide	50.000+	Product-oriented	Innovation Manager

APPENDIX B: BARRIERS TO INNOVATION STUDY

B.1 Interview protocol for innovation barriers study

Background information for interviewee

Thanks for participating in this interview, which will help me in conducting a nice piece of research supported by the TU Delft, and help ING (and thus you and ING's customers in the end) in increasing the pace of innovation.

In this interview-workshop I will ask you if you agree or disagree on certain categories and items as barriers or obstacles for innovation. Crisp and clear right?

Definitions

To make sure everybody has the same understanding of what we mean with innovation for this research I use the definitions for innovations as described in Chapter 2.2

Interviewees

Why you? I would like to interview the people that lead "innovation"-projects as they are close to the fire and undergo the entire process themselves. This information will help me to assess discrepancies between barriers or obstacles proven in literature and in your project(s).

Interview / Workshop Setting

This session will take approximately up to an hour and will be conducted privately. This interview is anonymous, the privacy and the confidentiality of your data will be protected and only used by the interviewer. This interview will be recorded and this recording will only be used by the interviewer to script the interview. If requested, it can be sent and checked by the interviewee.

Interview Questions

I. Expertise

0. In which category (Disruptive, Radical, Sustaining) do you see your project?
1. How many years of experience do you have in your field (and in innovation)?
2. How would you rate your expertise regarding organizational challenges for innovation / transformation projects on a 5-point scale.
3. What would you regard as your field of expertise?

II.I Organizational rigidities on a 5-point Likert scale:

4. To what extent do you agree that the next categories are a barrier to increasing the innovative capability of ING?
    A. Strategy & Leadership
    B. Finance (i.e. Funding for innovation + Costs for innovation)
    C. Organizational Structure(s)
    D. Organizational Processes
    E. Human Resources (i.e. People + Culture(s)
    F. Technology (i.e. Systems architecture)
    G. Research & Development

II.II In case a 4 (i.e. "I agree" or 5 "I Strongly agree")

5. Which barriers regarding Strategy & Leadership do you think ING experiences?
6. How would you prioritize those? (on a ranking from 1-5)
7. Would you agree or disagree on the next items as barriers for innovation within ING?
    1) Lack of commercialisation caused by KPI's? [B19]
    2) Lack of active management support [B.3]
    3) Lack of scaling up ideas for large-scale use [B.28]
    4) Unsupportive innovation strategies [B.16]

8. Which barriers regarding Finance do you think ING experiences?
9. How would you prioritize those? (on a ranking from 1-5))
10. Would you agree or disagree on the next items as barriers for innovation within ING?
    5) Innovation projects have too low business value compared to original business cases [B.9]
    6) Lack of focus on innovation caused by local Profit and Loss priority [B.18]
    7) Lack of appropriate sources of finance [B.10]

11. Which barriers regarding Organizational Structure do you think ING experiences
12. How would you prioritize those? (on a ranking from 1-5))
13. Would you agree or disagree on the next items as barriers for innovation within ING?
    8) Overzealous risk management (i.e. too much focus on risk avoidance) [B.1]
    9) Too many management layers [B.8]
    10) Gap between business and IT [B.7]
    11) Unsupportive organisational structure [B.5]

14. Which barriers regarding Organizational Processes do you think ING experiences
15. How would you prioritize those? (on a ranking from 1-5))
16. Would you agree or disagree on the next items as barriers for innovation within ING?
    12) Inertia caused by compliance focus (slowness by mandatory internal processes) [B.6]
    13) Inertia caused by used project management styles [B.20]
    14) Lack of room for incubation [B.21]

17. Which barriers regarding Human Resources do you think ING experiences

18. How would you prioritize those? (on a ranking from 1-5))
19. Would you agree or disagree on the next items as barriers for innovation within ING?
    15) Not-Invented-Here syndrome [B.31]
    16) Resistance or lack of support from key internal stakeholders [B.2]
    17) Firm is more risk-averse than average firm [B.29]
    18) Firm is more trust-oriented than other firms [B.30]
    19) Lack of qualified and available personnel [B.11]
    20) Lack of incubation competences [B.13]
    21) Lack of commercialisation competences [B.14]

20. Which barriers regarding Technology do you think ING experiences
21. How would you prioritize those? (on a ranking from 1-5))
22. Would you agree or disagree on the next items as barriers for innovation within ING?
    22) Lack of ability to maintain new technologies [B.12]
    23) Lack of ability to embed new technologies [B.22]
    24) Too many (local) legacy systems [B.23]
    25) Inertia caused by (local) system architecture [B.24]

23. Which barriers regarding Research & Development do you think ING experiences
24. How would you prioritize those? (on a ranking from 1-5))
25. Would you agree or disagree on the next items as barriers for innovation within ING?
    26) Lack of new and good radical / disruptive ideas [B.25]
    27) Lack of discovery / exploring competences [B.4]
    28) Lack of information on markets or technology [B.15]
    29) No patenting or IP-protection mechanisms [B.26]
    30) No fundamental internal R&D [B.17]
    31) Lack of exploiting new ideas [B.27]

III. ING-improvement oriented Questions

1. Where can the Chief Innovation Office and the ING Customer Experience Center improve its support to you and others?
   - *Prioritize those*
2. Where can ING improve its support to you and others?
   - *Prioritize those*
3. Would you like to add anything? Any advice for new teams?

Closing questions

- Have all issues been addressed or do you want to add something?
- Would you be able to have a look at the results of this meeting and validate it?
- Would you like to have the results of the analysis?
- Who would you think would be interested and interesting to talk to?

B.2 Informants of study

In this study multiple informants provided data, in the below table (*see Table 22*) more detail is provided on the type of innovation they informed on, what their role was, and how it was coded.

Table 22: Informants of barriers study

No.	Innovation type	Informant	Code
1	Disruptive innovation	Initiative lead	IBI-1
2	Radical innovation	Initiative lead	IBI-2
3	Disruptive innovation	Initiative lead	IBI-3
4	Radical innovation	Initiative lead	IBI-4
5	Disruptive innovation	Initiative lead	IBI-5
6	Disruptive innovation	Initiative lead	IBI-6
7	Radical innovation	Initiative lead	IBI-7
8	Disruptive innovation	Initiative lead	IBI-8

B.3 In-depth results of study

Results of the study were captured on Likert-scales ranging from 0 to 5. Find in the table below the results (*See Table 23)*. In each row the number of informants giving the item a certain score is presented.

Table 23: Likert scores of informants

	Likert scores				
#	**1**	**2**	**3**	**4**	**5**
B.1	0	2	0	3	3
B.2	1	2	2	2	1
B.3	2	3	2	1	0
B.4	2	2	1	2	1
B.5	0	1	1	3	3
B.6	0	3	1	2	2
B.7	1	3	1	2	1
B.8	1	3	1	2	1
B.9	3	2	2	1	0
B.10	7	1	0	0	0
B.11	3	1	1	1	2
B.12	1	2	4	1	0
B.13	3	0	3	1	1
B.14	1	2	1	3	1
B.15	2	5	0	0	1
B.16	3	4	0	1	0
B.17	0	1	2	3	2
B.18	1	1	2	4	0
B.19	2	2	2	1	1
B.20	1	2	2	3	0
B.21	3	1	2	1	1
B.22	1	2	1	2	2
B.23	1	1	3	1	2
B.24	0	0	3	1	4
B.25	2	1	0	2	3
B.26	2	1	1	3	1
B.27	0	0	3	2	3
B.28	2	1	2	3	0
B.29	1	1	2	2	2
B.30	2	1	0	3	2
B.31	1	1	0	3	3
Total	49	52	45	59	43
%	20%	21%	18%	24%	17%
	41%			41%	

Next, scores were combined to present a simplified overview. Scores 1 and 2 were combined into 'disagree', scores 4 and 5 were combined into 'agree', and score 3 remained solely as 'neutral' (*see Table 24)*.

Table 24: Combined Likert scores of informants

Combined Likert scores			
#	Disagree	Neutral	Agree
B.1	2	0	6
B.2	3	2	3
B.3	5	2	1
B.4	4	1	3
B.5	1	1	6
B.6	3	1	4
B.7	4	1	3
B.8	4	1	3
B.9	5	2	1
B.10	8	0	0
B.11	4	1	3
B.12	3	4	1
B.13	3	3	2
B.14	3	1	4
B.15	7	0	1
B.16	7	0	1
B.17	1	2	5
B.18	2	2	4
B.19	4	2	2
B.20	3	2	3
B.21	4	2	2
B.22	3	1	4
B.23	2	3	3
B.24	0	3	5
B.25	3	0	5
B.26	3	1	4
B.27	0	3	5
B.28	3	2	3
B.29	2	2	4
B.30	3	0	5
B.31	2	0	6

APPENDIX C: LONGITUDINAL CONTROL INTERVENTIONS STUDY

C.1 Interview protocol for innovation control intervention study

All participants of the workshop were interviewed following the below structure. First, introduction questions were asked to validate if the participant was the right person to participate in the inquiry (*see Table 25)*.

Table 25: Introduction questions control intervention study

#	Question
1	What is success for you in your role, related to exploring disruptive and radical innovations?
2	Which innovations in your portfolio successfully exited the exploration stage, which did not?
3	Are these innovations comparable or totally different, if so what are the key differences to characterise them?
4	Can you point out differences between the three innovation control environments?
5*	If we look at the controls in place at the time of innovations, which controls had a positive effect on the effectiveness of an initiative? Does this account for all innovations during that approach?
6*	And which controls had a negative effect? Does this account for all innovations during that approach?
7*	Are there other controls that have had a positive or negative effect?
8**	Did the controls implemented in the second and third controlled environment reduce or remove one of the key barriers to innovation?
9**	Are there other barriers that impeded successful exploration?

*Questions 5 and 6 are documented in Table 26
**Questions 8 and 9 are documented in Table 27.

Table 26: Single control-related questions

Control	CIS 1.0	CIS 2.0	CIS 3.0
C.1	Innovation strategy	Innovation strategy	Innovation strategy
C.2	Innovation department	Innovation department	Innovation department
C.3	Innovation Fund	Innovation Fund	Innovation Fund
C.4	Sr. Steering Board	X	X
C.5	Innovation Contact	X	X
C.6	X	Sr. Support Board	Sr. Support Board
C.7	X	Coach allocation	Coach allocation
C.8	X	Methodology implementation	Methodology implementation
C.9	X	Stage-gate implementation	Stage-gate implementation
C.10	X	Single-market approach	Single-market approach
C.11	X	Team dedication	Team dedication
C.12	X	Sponsor allocation	Sponsor allocation
C.13	X	X	Stage-gate quality standards
C.14	X	X	Strategic intent
Other			

C.2 Informants of study

In this study multiple informants provided data, in the below table more detail is provided on the type of innovation they informed on, what their role was, and how it was coded (*see Table 27)*.

Table 27: Informants of control intervention study

No.	Intervention environments	Informant	Code
1	CIS 1.0, 2.0	Program Manager	CISI-1
2	CIS 1.0, 2.0, 3.0	Innovation Manager	CISI-2
3	CIS 1.0, 2.0, 3.0	Innovation Manager	CISI-3
4	CIS 1.0, 2.0, 3.0	Program Manager	CISI-4
5	CIS 1.0, 2.0, 3.0	Program Manager	CISI-5
6	CIS 1.0, 2.0, 3.0	Innovation Manager	CISI-6
7	CIS 2.0, 3.0	Program Manager	CISI-7
8	CIS 2.0, 3.0	Program Manager	CISI-8
9	CIS 2.0, 3.0	Program Manager	CISI-9

C.3 Results of barrier-related questions

All but one informant was able to answer if implementing and removing innovation controls reduced a barrier. In the table below results are presented (*see Table 28)*.

Table 28: Barrier-related questions

Barrier	Description	Reduced / Removed	Still present
B.1	Overzealous risk management (i.e., too much focus on risk avoidance)	5	3
B.5	Unsupportive organisational structure	4	4
B.17	No fundamental internal R&D	*n/a*	*n/a*
B.24	Inertia caused by (local) systems architecture	5	3
B.27	Lack of exploiting new ideas	*n/a*	*n/a*
B.31	Not-Invented-Here syndrome	5	3

APPENDIX D: NEDERLANDSE SAMENVATTING

Hoe kunnen grote dienstverlenende bedrijven, zoals banken, het beste disruptieve en radicale innovaties ontwikkelen om nieuwe groeigebieden te betreden, zonder huidige activiteiten te verstoren? Technologische vooruitgang in computerkracht en connectiviteit heeft verder economische globalisering en digitalisering mogelijk gemaakt, waardoor de manier is veranderd waarop mensen met elkaar omgaan, hoe bedrijven werken en hoe diensten worden aangeboden. Deze veranderingen brengen uitdagingen met zich mee voor de business modellen van gevestigde bedrijven, omdat ze voortdurend worden bedreigd door baanbrekende transformaties en nieuwe bedrijven die proberen deze bestaande business modellen verstoren. Om het concurrentievoordeel te kunnen behouden, worden disruptieve en radicale innovaties vaak omschreven als de weg vooruit en organisaties vormen in toenemende mate ecosystemen om deze innovaties te produceren en te kunnen concurreren in de geglobaliseerde economie.

Helaas zijn er interne en externe barrières voor bestaande dienstverlenende bedrijven die hen belemmeren om effectief disruptieve en radicale innovaties te produceren en te lanceren. Ten eerste is bestaande marktregulering ontworpen met het doel om een gelijk speelveld te creëren én om de positie van meerdere actoren in de markt te waarborgen; doorgaans is dit niet ontworpen om innovaties te ondersteunen die de potentie hebben de markt te destabiliseren. Ten tweede is er binnen bedrijven een natuurlijke spanning tussen het exploiteren van het ‘bekende’ bestaande business model en het exploreren van toekomstige ‘onbekende’ groei. Daardoor ontstaat er

spanning tussen investeringen in groei in de toekomst en investeringen in directe baten, wat resulteert in een fundamentele vraag: kunnen we organisaties ondersteunen om te overleven bij toenemende verandering of is hun disruptie onvermijdelijk?

In tegenstelling tot fysieke producten hebben diensten immateriële kenmerken; daarom kan een service innovatie niet op dezelfde manier worden onderzocht, ontwikkeld en getest als fysieke producten. Bovendien missen veel bestaande dienstverlenende bedrijven, in tegenstelling tot traditionele productbedrijven, ervaring en de relevante competenties om zich te organiseren voor disruptieve en radicale innovaties. Dit komt meestal door het feit dat deze bedrijven geen traditie hebben in R&D activiteiten. Ondanks de overvloed aan onderzoeken naar disruptieve en radicale innovatie in product- en R&D-intensieve bedrijven, is er slechts beperkte kennis beschikbaar over het managen van disruptieve en radicale innovaties in dienstverlenende bedrijven.

Het toepassen van bestaande theorieën die niet zijn voortgekomen uit onderzoek bij dienstverlenende bedrijven wordt daarom op zichzelf niet als een geschikte benadering beschouwd om een ambidextere dienstverlenende organisatie te creëren waarin innovaties kunnen gedijen. Het vereist inzicht in de complexiteit en mechanismen die ten grondslag liggen aan het specifieke innovatieproces om diensten te kunnen ontwerpen die deze bedrijven ondersteunen om te overleven bij toenemende verandering.

Het doel van dit proefschrift is daarom om te onderzoeken hoe grote dienstverlenende bedrijven effectievere exploratie van disruptieve en radicale innovaties mogelijk kunnen maken. De belangrijkste doelstellingen van deze studie zijn het verkennen van mechanismen die van belang zijn bij de exploratie van disruptieve en radicale innovatie in

grote dienstverlenende bedrijven, én het verbeteren van de effectiviteit hiervan. Om deze doelstellingen te bereiken, richt ik me op de volgende onderzoeksvraag: *Hoe kunnen grote dienstverlenende bedrijven effectievere exploratie van disruptieve en radicale innovaties mogelijk maken?*

Deze vraag bestaat uit meerdere componenten en deze componenten vereisen onderzoek naar innovatieconcepten, theorieën en het verzamelen van empirische gegevens. Dit proefschrift begint met kennis door beschrijving, door eerst huidige innovatietheorieën in kaart te brengen; gevolgd door kennis uit de praktijk, door te observeren hoe disruptieve en radicale innovaties worden gemanaged binnen grote dienstverlenende bedrijven en door te interveniëren in deze bedrijven om de effectiviteit van het exploratiesysteem te vergroten. Door kwalitatieve empirische generalisaties worden huidige theorieën verrijkt: ik onderzoek hoe actoren op verschillende organisatieniveaus (d.w.z. organisatie, afdeling en project-niveau) het innovatiesysteem ervaren om een holistisch systeemperspectief te creëren.

Hoe bedrijven innovatie beheersen is in de loop van de tijd voortdurend geëvolueerd en bedrijven die consequent innovatie managen presteren beter dan hun concurrenten wat betreft groei en financiële prestaties. Om tegemoet te komen aan het conflict in bedrijven tussen exploratie en exploitatie, moeten bedrijven dubbele structuren creëren om tegelijkertijd te kunnen innoveren en het bestaande business model efficiënt te kunnen exploiteren; dit wordt ook wel een ‘ambidextere organisatie’ genoemd. Het creëren van een exploratie organisatie los van de exploitatie organisatie (d.w.z. de bestaande organisatie) is de meest gangbare visie om radicale en disruptieve innovaties te ondersteunen: het creëert een veilige incubatieruimte gescheiden van de bestaande organisatie. Daarnaast is het van cruciaal belang om een goede relatie met de bestaande

organisatie te koesteren; vooral wanneer innovaties moeten worden geïntegreerd in de bestaande organisatie.

Desalniettemin is het niet waarschijnlijk dat één bedrijf alle competenties intern heeft en daarom zou het collectieve intelligentie moeten toepassen en moeten deelnemen aan open innovatie ecosystemen bestaande uit leveranciers en afnemers.

Hoe kunnen grote dienstverlenende bedrijven, zoals banken, de exploratie van disruptieve en radicale innovaties beheersen? Onderzoek naar disruptieve en radicale innovaties in bedrijven kan niet gebeuren zonder controles en maatregelen die discipline en creativiteit stimuleren. Desalniettemin lijkt het beheersen van innovatieactiviteiten zeer uitdagend vanwege inherente spanningen tussen innovatie en controle om het gedrag van actoren in de organisatie te beïnvloeden om de strategie van de organisatie uit te voeren. Het niet toepassen van controle, of het inadequate gebruiken ervan, kan innovatie belemmeren. Helaas is er niet veel bekend over de rol van controle binnen dit soort bedrijven in relatie tot disruptieve en radicale innovaties. Literatuur suggereert dat dit soort innovatie andere soorten controle vereist dan traditionele productinnovatie. Daarom heb ik een schema van soorten innovatie controle gemaakt op basis van best-practices uit de literatuur en dit schema toegepast om te onderzoeken welke soorten controle worden gebruikt voor het beheersen van disruptieve en radicale innovatie in negen grote bedrijven. De resultaten tonen aan dat er naast nieuwe innovatie-agnostische soorten controles ook traditionele soorten controles voor exploitatiedoeleinden worden toegepast voor het beheersen van radicale en disruptieve innovaties tijdens de exploratie fase. Deze soorten controles passen meestal niet bij de aard van innovatieactiviteiten, wat verschillende barrières tot gevolg heeft en verschillende implicaties heeft, zoals: omslachtige processen voor innovatieactiviteiten, verkeerde

afstemming tussen innovaties en organisatiedoelen, en het verkeerd beoordelen van de prestatie van innovatie activiteiten. Bovendien tonen de resultaten aan dat contextuele antecedenten van invloed zijn op de controles die worden toegepast voor innovatieactiviteiten tijdens de exploratiefase; tevens vormen ze een belangrijke categorie waarmee onderzoekers kunnen uitleggen waarom een bepaalde mix van controles binnen een onderneming wordt gebruikt. Managers dienen op hun beurt gevoel te krijgen voor de contextuele antecedenten in hun organisatie; op basis daarvan dienen ze controles te ontwerpen om de effectiviteit van innovatieactiviteiten te vergroten om uiteindelijk organisatorische doelen te bereiken.

Welke barrières belemmeren bedrijven om radicale en disruptieve innovaties effectief te exploreren? Veel barrières, uitdagingen en obstakels voor effectieve innovatie binnen gevestigde bedrijven zijn gedocumenteerd in de literatuur. De groeiende literatuur op het gebied van innovatie barrières is echter sterk gericht op obstakels die verband houden met productbedrijven en R&D-teams in productiebedrijven. Als reactie hierop heb ik interne barrières onderzocht die de effectiviteit van disruptieve en radicale innovaties binnen grote financiële dienstverleners beïnvloeden.

Een raamwerk van interne barrières is ontwikkeld en gevalideerd door middel van een verkennende case studie. Data zijn verzameld bij een financiële dienstverlener door te onderzoeken hoe innovatie is georganiseerd en welke barrières de effectiviteit van acht innovaties beïnvloeden. De resultaten tonen aan dat het exploreren van disruptieve en radicale innovaties door middel van een afzonderlijke exploratie organisatie (A) gedeeltelijk effectieve exploratie ondersteunt, maar niet noodzakelijkerwijs de exploitatie van dit soort innovaties. Als een innovatiestrategie (B), actieve managementondersteuning (C) en een

afzonderlijke bestuursstructuur voor innovatie (D) aanwezig zijn, worden innovaties gestimuleerd in de exploratiefase; dit omdat innovaties in deze situatie geen gebrek aan geschikte middelen hebben of concurrentie ondervinden met bestaande projecten en programma's. Toch werden in deze context zes items geïdentificeerd als belangrijke barrière: te veel focus op risicovermijding, een niet-ondersteunende organisatiestructuur, een gebrek aan fundamentele R&D, inertie veroorzaakt door (lokale) systeemarchitectuur, gebrek aan exploitatie van nieuwe ideeën, en het Not-Invented-Here syndroom. Als zodanig waren deze in de steekproef belangrijker dan traditioneel gedefinieerde barrières zoals financieringsbronnen en ontbrekende exploratie competenties. Gebaseerd op een klein aantal innovaties binnen één bedrijf benadrukken de resultaten de behoefte aan meer diepgaand onderzoek naar de effecten van barrières en hoe barrières kunnen worden overwonnen binnen deze industrie. Bovendien laten de resultaten zien dat er een discrepantie bestaat tussen de maatschappelijke vraag naar radicale veranderingen binnen de financiële sector en het vermogen van grote financiële dienstverleners om te innoveren.

Welke controles ondersteunen effectievere exploratie van disruptieve en radicale innovaties? Om deze vraag te beantwoorden heb ik bestaande problemen onderzocht en meerdere soorten controles uit zowel literatuur als praktijk geïdentificeerd die innovaties helpen te beheersen. Op basis hiervan heb ik aangetoond wat het effect is van meerdere controle interventies op het wegnemen van barrières in de organisatie, en of het effectievere exploratie mogelijk maakt. Controles zijn zowel geïntroduceerd als weggenomen in een diepgaand longitudinaal onderzoek van drie jaar. Vertrekkend van de beginsituatie waarin belemmeringen voor innovaties op projectniveau werden geïdentificeerd, zijn interventies op afdelingsniveau voorgesteld om de barrières in twee iteraties weg te nemen. Dit heeft tot drie kernconclusies geleid; ten eerste

blijken elf innovatiecontroles een positief effect te hebben op het wegnemen van innovatiebarrières en de effectiviteit van exploratieactiviteiten. Naast de hierboven besproken elementen A, B, C, en D, tonen de resultaten aan dat ook de aanwezigheid van: een bestuur van topmanagement ter ondersteuning van innovaties, strategische groeigebieden, coaches, een methodologie, een stage-gate-proces, focus op één startmarkt, voltijds toegewijde innovatie teams, en tot slot een innovatiesponsor een positief effect hebben op de effectiviteit van exploratieactiviteiten.

Ten tweede hebben contextuele antecedenten een continue impact op innovatiesystemen; in reactie op een veranderend context moeten innovatiecontroles worden geëvalueerd in het licht van het belang van de verandering en derhalve worden aangepast om aan de nieuwe context te voldoen. Ten derde wordt aangetoond dat alhoewel het principe van innovatiecontrole een positief effect kan hebben op exploratieactiviteiten; de operationalisering van een innovatiecontrole vereist managementaandacht om het voorgeschreven effect te hebben. Kortom, het principe van een controle kan conceptueel duidelijk zijn, echter dient de implementatie van een controle continue geëvalueerd te worden in het licht van de volwassenheid van het innovatiesysteem om indien noodzakelijk aangepast te worden naar de nieuwe realiteit. Bovendien tonen de resultaten aan dat er behoefte is aan een contingent beeld van controlesystemen in grote dienstverlenende bedrijven. Innovatietheorieën komen hoofdzakelijk voort uit product- en productiegericht onderzoek en grote dienstverlenende bedrijven zijn van origine niet ontworpen om disruptieve en radicale innovaties te exploreren. Deze bedrijven vereisen doorgaans installatie van vele nieuwe innovatiecontroles in vergelijking met product bedrijven.

Concluderend toont dit proefschrift aan dat bestaande innovatietheorieën een minder geschikte lens bieden om effectievere exploratie van disruptieve en radicale innovaties in grote dienstverlenende bedrijven mogelijk te maken; het vereist op maat gemaakte innovatiecontroles om barrières te overwinnen om de effectiviteit van exploratie activiteiten te vergroten. Vergelijkbaar met een pendulezwaai dient een bedrijf innovatiecontroles te installeren die voldoende ruimte bieden om creativiteit aan te wakkeren, maar die ook zorgen dat het gedrag van het management en de werknemers worden gestuurd op de organisatiedoelstellingen. Enerzijds belemmeren traditionele controles ontworpen voor exploitatiedoeleinden innovators; aan de andere kant zal te weinig controle resulteren in teveel afwijking van strategische doelen en resulteren in ineffectief gebruik van bestaande middelen. Desalniettemin is het uiteindelijk een balansoefening om enerzijds ruimte te bieden om experimenteren, falen en leren mogelijk te maken, en anderzijds te zorgen dat schaarse middelen het meest effectief worden ingezet.

Toekomstig onderzoek kan zich concentreren op drie kerngebieden. Ten eerste kunnen onderzoekers het ontworpen innovatie-controle-schema, het innovatie-barrière-raamwerk en de controle-interventie-studie verder verrijken. Alhoewel de ontwikkelde technieken middelen hebben gecreëerd om de effectiviteit van het exploreren van disruptieve en radicale innovaties in bedrijven te onderzoeken en beoordelen, zal de verbetering ervan de validiteit en betrouwbaarheid verder vergroten. Ten tweede kunnen onderzoekers zich verdiepen in de controles die het exploreren van platform business modellen effectief ondersteunen. Er is namelijk een groeiende belangstelling voor platform business modellen, maar begrip voor het beheer van het complexe karakter ervan is nog steeds onderbelicht. Bestaande bedrijven staan onder druk van bedrijven die deze bedrijfsmodellen exploiteren en beginnen daarom in toenemende

mate dit soort innovaties te exploreren zonder goede begeleiding hoe dit te ontwerpen en te beheersen. Ten derde kan soortgelijk onderzoek zich concentreren op de vroege stadia van het exploiteren van disruptieve en radicale innovaties. Uiteindelijk zal een bedrijf in dit stadium waarde beginnen te ontlenen aan de innovatie en innoveren is in dit stadium net zo belangrijk en moeilijk als in de exploratiefasen.

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