



SCHOOL OF BUSINESS AND SOCIAL SCIENCES  
AARHUS UNIVERSITY

# Why is Forward-Looking Search Practiced and When Does it Enhance Innovation? An Empirical Investigation of Firms and their Innovation Projects

PhD dissertation

Tymen Jissink

Aarhus BSS  
Aarhus University  
Department of Management  
2017



# Acknowledgements

A series of unforeseen events that (in hindsight) started back in 2013 have led to the moment of which the tangible output now lies before you. Ironic, as the central topic of this dissertation is that of foreseeing what may lie ahead. I would like to thank a number of people who have made my PhD-journey possible.

René Rohrbeck. I could not have wished for better support during these three years. Already from the beginning it turned out we had great synergies from working together which persisted throughout this three-year project. Your ability to *always* be constructive, supportive, and inclusive in all of my undertakings has been, to say the least, remarkable to witness. We both challenged each other to great extents but nevertheless both learned a great deal in the process. I was glad it was not only a one-way flow of information from you towards me, but that I could also be of help to you in return. Your vast repertoire of prior experiences, incredible practical insights, and pragmatic view on things was what I really needed to push forward. You have also helped me jump on numerous opportunities – from projects to conferences to coming into contact with people – that have truly allowed me to ‘grow’ academically. It has made my PhD journey a true pleasure to work on. Thank you René.

Eelko Huizingh. It is probably safe to say that without your supervision and encouragement back when I did my masters in Groningen I would not even have started this PhD programme. Your guidance and help along the way of this three-year journey has helped this dissertation to what it is today. You have been a terrific supervisor and co-author for these past three years and want to thank you again for being involved with my project along the entire way. I have learned a great deal from you during this time. The way you always challenged my work made me sometimes go back to the ‘drawing table’, to rethink my work, but always for the better. Your comments were always incredibly structured and constructive and have greatly improved the way I did research. The meaning of the word rigour is something I definitely learned from you. Furthermore, you were able to host me back at the University of Groningen for a period of 6 months, something I am very grateful for. Me being me, I did not excel hugely at planning ahead. Nevertheless, you were still able to facilitate my stay on an extremely short notice without any strings attached. We were able to work together even more closely during this period, wherein I was able to make incredible progress on two of the papers. You were able to present our joint papers on conferences all over the globe, creating awareness of our research, and feeding back constructive comments on how to improve our research even more. It has been the utmost pleasure to keep on working with you Eelko and I hope it will endure for the time to come.

Fiona Schweitzer. I am glad I had the opportunity to work together with you on the project that resulted in the third paper of this dissertation. I learned a great deal from you when we started working together; from building surveys to data collection approaches. It was great to see you optimistic of the topic of forward-looking search. Although it has been a long ride, I believe the rigour we put into our joint undertaking will pay off in the very near future. Thank you for making all of this possible.

I also want to thank John Parm Ulhøi for being there as a co-supervisor for assisting me especially in the early days of my PhD journey. Helping me shape the direction of my research in the beginning was useful as a young and naive researcher and your comments on my work and presentations have certainly helped me drive this dissertation into the right direction.

I want to thank the people from my department at Aarhus University as well. I have grown fond of the Danish working atmosphere which I will surely miss after handing in this dissertation. I am grateful to have met so many great people here, many of whom I can call friends as well. Markus, Peter, Sylvia, Giacomo, Annamaria, Oana, Christos, Christina, Anne, Kenneth, Alexandra, Cita; thanks for the awesome time we have had together, the social events, the intellectual conversations, you name it! Special thanks go to you Siri and Billy for always being there in good or bad, to talk about issues ranging from personal to academic to opportunities in research.

Thanks to all the friends and family back in the Netherlands that made my trips ‘abroad’ a thing to look forward to. Jan Jouke, Vincent, Jabin, Jacqueline, Albert, Klaas Sybrand, Marije and Willemien.

Also thank you to the committee members – Peter Kesting, Per Dannemand Andersen, and Ted Fuller – for reviewing my dissertation and providing me the opportunity to defend it.

Lastly, thank you mom and dad, for showing never-ending support in my journey to Denmark and throughout my PhD journey. I have had plenty of ups, but also downs during these three years. Without you, I would not have been able to do this.

TYMEN JISSINK  
Aarhus  
January 2017

# Executive summary

The concept of search for alternative courses of action, to foresee its consequences, and to raise the likelihood of acting on alternative courses of action, which I refer to as forward-looking search, has eluded organisational researchers for a long time. Established organisational theories such as a behavioral theory of the firm posit against the notion that firms can anticipate alternative courses of action and instead sees firms as formulating their next moves in an evolutionary, learning-based and incremental sense. Yet, acknowledgement of the importance for searching distant alternative courses of action as beneficial for firm performance, or even necessary for longer-term survival, has been around for several decades. Research to date is still rather silent how this forward-looking search occurs, why or why it does not occur within firms, and to what end it is used. This dissertation provides quantitative empirical insights into these aspects.

Informed by literatures on strategic foresight, I introduce a range of *practices* that can be used to facilitate forward-looking search at both the firm and innovation project level. In doing so, I provide a departure from the cognitive perspective – and by that predominantly simulation-based studies – which seems pervasive in recent research on uncovering the search for distant courses of action.

This dissertation consists of an introduction (chapter 1), three research articles (chapters 2-4), and a closing discussion (chapter 5). In the first research article, I investigate the reasons why firms do (or do not) engage in forward-looking search. I take note of existing organizational theories and assumptions which have been largely neglected in foresight- and related literature streams (**chapter 2**). I organize and test propositions of both organizational behaviour and strategic foresight literatures in relation to forward-looking search on a sample of 108 firms. I find that firms are reluctant to engage in high levels of forward-looking search under conditions of performance decline and competitive intensity. Here, firms are reluctant to shift their attention to the future as it takes away attention from current pressing problems or from their immediate competitive situation. In contrast, firms are exceedingly engaging in forward-looking search when firms have slack resources available and expect to outperform in the near future. What I also find is that slack resources offsets the negative tendency to engage in forward-looking search when facing competitive intense situations, as well as heightens the search intensity even more in technological turbulent situations. Slack resources may thus allow firms to devote time and attention towards the future. With these findings, I contribute empirical evidence that confirms recent propositions that the factor of time and attention is important to consider in firm's willingness to engage in forward-looking search. Also strategic foresight literatures may have to take into account the behavioural aspects related to performance and resources – more than has done

so to date to broaden our understanding that perhaps not every firm *wants* or *can* do forward-looking search.

In the second research article, I investigate the contributions of forward-looking search toward innovation outcomes. Here, I take on a firm-level perspective to assess firm-level innovation outcomes and sought to develop a better understanding how forward-looking search can contribute towards innovation performance at the firm-level (**chapter 3**). I positioned forward-looking search as not directly impacting innovation performance, but rather via innovation portfolio management agility. Using a sample of 130 firms, I find that forward-looking search only indirectly positively impacts innovation performance via innovation portfolio agility. Here, I contribute a different view to innovation management literature wherein I posit that forward-looking search leads to a different set of criteria to appraise current innovations in a portfolio. Performance then, can only be accrued if one can be agile in its portfolio of innovations.

In the third research article, I move from the firm as level of analysis to individual innovation projects and assess how forward-looking search can affect the novelty of an innovation project (**chapter 4**). I assess to what extent forward-looking search impacts innovativeness, but also under which project conditions this is most strongly the case. I find that, using a sample of 159 individual innovation projects, forward-looking search significantly positively impacts innovativeness of the project. Here, I contribute empirical evidence that forward-looking search is also ongoing *after* initiating an innovation project to improve innovativeness. Furthermore, because of the empirical setting of individual projects, it allowed me to study the conditions under which forward-looking search is hampered from contributing. I find that excessive planning, or the lack thereof, does not allow forward-looking search to contribute anything additionally to project innovativeness – only medium planned projects allow for that. Similarly, slack resource availability significantly increases the contribution of forward-looking search towards innovativeness, as it allows project teams to think beyond the project's boundaries and incorporate (initially) unforeseen changes to the ongoing project. I contribute to relatively scarce literature that acknowledges forward-looking search within discontinuous settings, such as projects, and provides novel insights into potential new best-practices regarding the management and development of innovations.

Overall, this dissertation contributes insights and empirical evidence of determinants and outcomes of forward-looking search at the firm- and project level, and contributes two distinct measurement models for forward-looking search at the firm- and project level. By positioning forward-looking search within existing literatures of organisational behaviour and strategic foresight, I contribute insights and evidence that both literature streams may benefit from in examining forward-looking behaviour of

firms. Important contributions are also for innovation management, where a forward-looking notion has been largely absent in both portfolio management and the management of innovation projects.



# Resumé

Organisationsforskere har i lang tid vært interesseret i hvordan virksomheder orienterer sig mod fremtiden for at forberede sig på ændring og sikre konkurrenceevnen. Når virksomheder søger efter og vurderer ny information med henblik på at identificere alternative fremtidige handlemåder- og konsekvenser, med etablering af en fælles tankegang omkring mulige fremtidige hændelser og dermed også en øget sandsynlighed for at vælge de nye handlemåder som resultat, kan det kaldes *fremadrettet søgning* (*forward-looking search*). Hvis man tager udgangspunkt i etablerede organisationsteorier, eksempelvis den adfærdsbaserede teori (behavioral theory of the firm), kan der forventes at virksomheder har begrænsede muligheder til at identificere alternative tanke- og handlemåder, da forandring primært bliver set på som evolutionsbetinget og drevet af trinvis læring. Side om side med denne indsigt, har der alligevel i flere tiår også eksisteret en anerkendelse blandt forskere om at søgen efter mere fjerntliggende mulige fremtidsscenarier og dermed også flere alternative handlemåder er positivt for virksomheders konkurrenceevne - og i flere tilfælde helt kritisk for deres overlevelse på lang sigt. Forskningen har indtil videre alligevel vært stiltiende omkring (i) hvordan denne type fremadrettet søgning foregår i virksomheder, (ii) hvorfor den sker eller eventuelt hvorfor den ikke sker, og (iii) til hvilke(t) formål resultaterne af søgeaktiviteterne benyttes. Denne afhandling tilbyder svar på disse spørgsmål ved hjælp af en kvantitativ empirisk tilgang. Jeg introducerer - informeret af litteratur der omhandler *Strategic foresight* (herefter *strategisk fremsyn*) - en række forskellige praksisser som kan bruges til at støtte op omkring fremadrettet søgning både på virksomhedsniveau og i specifikke projekter indenfor virksomheder. Dermed tilbyder jeg et alternativ til det typiske kognitive perspektiv, og til de simulerings-baserede studier, der for en stor del har karakteriseret eksisterende forskning fokuseret på virksomheders fremtidsorienterede søgning.

Afhandlingen består af tre forskningsartikler (kapitel 2-4) samt en introduktion (kapitel 1) og afsluttende diskussion (kapitel 5). I den første artikel (**kapitel 2**) undersøger jeg hvorfor virksomheder engagerer sig i eller lader være med at bedrive fremadrettet søgning. Jeg sætter søgelyset på eksisterende teori om organisationer, og mere specifikt på teoretiske antagelser omkring virksomheders handlemåder og strategiske fremsyn der for en stor del er blevet overset i litteratur relateret til strategisk fremsyn. I artiklen testes så den udviklede teori på et udvalg af 108 bedrifter. Jeg finder at virksomhederne er tilbageholdne med at engagere sig i fremadrettet søgning når de oplever en nedadstigende indtjeningsevne og når mange hellere end få konkurrenter præger deres industrielle omgivelser. Det samme er tilfældet når ressourcerne knappe samtidigt med at teknologien i virksomhedernes miljø ændrer sig hurtigt. På den anden side; når ressourcerne er knap så tyndt fordelt, og når virksomhederne forventer sig at øge sin indtjening i nær fremtid, engagerer de sig i højere grad

i fremadrettet søgning. Det samme gælder også under høj konkurrence og teknologisk turbulens, så længe der er et vist niveau af ressource-overskud i virksomhederne. Med andre ord tyder resultaterne på at fremadrettet søgning er noget virksomheder kan, men ikke altid er villige til at bruge sin tid og opmærksomhed på. Fundene bekræfter dermed at både tid og opmærksomhed er vigtige faktorer at tage i betragtning når fremadrettet søgning skal undersøges. Endvidere giver fundene et hint om at litteraturen omkring strategisk fremsyn i større grad burde inddrage viden omkring hvordan tilgængelige ressourcer og indtjening i virksomhederne påvirker deres fremtidsrettede søgeaktiviteter, og i større grad erkende at måske ikke alle virksomheder *ønsker* eller *kan* engagere sig i disse aktiviteter.

Afhandlingens anden artikel (**kapitel 3**) er motiveret af at bedre forklare hvordan fremadrettet søgning kan føre til højere innovation for virksomheder. Jeg foreslår at fremadrettet søgning ikke direkte kan relateres til innovation som et resultat målt på virksomhedsniveau. Alligevel kan søgning have en betydning for virksomheders totale innovationsevne fordi fremtidsorienterede søgeaktiviteter påvirker hvor hurtigt virksomhederne er i stand til at lave omprioriteringer i hele porteføljen af innovationsprojekter. Baseret på en analyse af data fra 130 virksomheder bekræfter jeg at fremadrettet søgning har en indirekte positiv indvirkning på virksomheders innovationsgrad, via deres evne til at omprioritere i projektporteføljen. Jeg påpeger dermed at fremtidsorienteret søgning kan føre til at virksomheder tager i brug nye kriterier som grundlag for beslutninger omkring eksisterende innovationsprojekter. Gode resultater relateret til innovation kan derfor, på virksomhedsniveau, opnås ved at hurtigt omprioritere innovationsporteføljen. Ved at frembringe disse perspektiver bidrager jeg til litteratur fokuseret på innovationsledelse.

I afhandlingens tredje artikel (**kapitel 4**) fokuserer jeg endnu mere specifikt på virksomheders innovationsprojekter, fremfor deres samlede resultater på bedriftsniveau. Jeg vurderer i hvilken grad og under hvilke omstændigheder fremadrettet søgning påvirker innovationsprojekters innovationshøjde – altså hvor nyskabende de er. Baseret på en analyse af 159 specifikke innovationsprojekter finder jeg at fremadrettet søgning har en signifikant positiv effekt på innovationshøjden. Jeg viser dermed at fremtidsorienteret søgning ikke kun kan foregå inden projekter sættes i gang, men snarere at søgning under selve projektudførelsen kan bidrage til at forbedre innovationshøjden. Endvidere, i og med at jeg undersøgte de enkelte projekter, viser jeg at fremtidsorienteret søgning kan være mindre vigtigt for at gøre innovationsprojekter mere nyskabende under følgende omstændigheder: (i) når der foregår en meget høj grad af planlægning i forbindelse med projekterne og (ii) når der foregår en meget lille grad af planlægning. Med andre ord er det kun når projektplanlægningen holdes på et medium niveau at fremadrettet søgning ser ud til at have reel betydning for innovationshøjden. Til sidst finder jeg at tilgang til ubrugte ressourcer signifikant øger

hvor meget fremtidsorienteret søgning bidrager til projekternes innovationshøjde, på grund af at de ekstra ressourcer tillader projektteamet at vurdere omstændigheder ud over projektets umiddelbare rammer og opdatere projektet med de nye indsigter og oplysninger mens det er i gang. Jeg bidrager dermed til den relativt begrænsede litteratur der anerkender at fremadrettet søgning kan have en rolle i diskontinuerlige aktiviteter (eksempelvis projekter), og tilbyder nye indsigter når det kommer til bedste praksis for ledelse og udvikling af innovation.

Helt overordnet tilbyder afhandlingen dermed både indsigter og empirisk evidens når det kommer til determinanter og resultater af fremadrettet søgning på virksomheds- og projektniveau. For hvert analyseniveau tilbydes desuden en specifik model for at måle fremtidsrettede søgeaktiviteter. Ved at vurdere problemstillinger omkring fremadrettet søgning ud fra eksisterende litteratur om organisationers adfærd såvel som om strategisk fremsyn, bidrager jeg til at udveksle indsigter og evidens på tværs af disse litteraturstrømmer. Endvidere indeholder afhandlingen vigtige bidrag til litteratur der fokuserer på innovationsledelse, fordi sidstnævnte litteratur i stor grad har forbigået at undersøge hvilken rolle fremadrettet søgning har når det kommer til virksomheders forvaltning af sine projektporteføljer og af specifikke projekter.



# Table of contents

<b>Acknowledgements</b> .....	<b>iii</b>
<b>Executive summary</b> .....	<b>v</b>
<b>Resumé</b> .....	<b>ix</b>
<b>Chapter 1</b>	
<b>Introduction to forward-looking search</b> .....	<b>1</b>
1.1 Gaps, aims, and research questions .....	4
1.1.1 Determinants of forward-looking search.....	5
1.1.2 Forward-looking search and firm-level innovation outcomes.....	6
1.1.3 Forward-looking search and project-level innovation outcomes.....	8
1.1.4 Summary of the three research parts .....	9
1.2 Backward-looking search.....	10
1.3 Toward forward-looking search .....	11
1.3.1 Information search and interpretation.....	13
1.3.2 Legitimization and diffusion .....	16
1.3.3 Summary of forward-looking search at the firm-level .....	17
1.3.4 Forward-looking search at the project level .....	18
1.4 A primer on firm’s engagement in forward-looking search.....	19
1.5 A primer on forward-looking search and innovation outcomes .....	23
1.6 Research design and methods.....	27
1.6.1 Empirical setting and data sources of articles 1 and 2.....	28
1.6.2 Empirical setting and data sources of article 3 .....	31
1.7 Overview of the research articles .....	34
1.7.1 Article 1: Why do firms engage in forward-looking search? Internal and external determinants .....	34
1.7.2 Article 2: Forward-looking search and innovation performance: The mediating role of innovation portfolio agility .....	36
1.7.3 Article 3: Forward-looking search during innovation project development: Under which conditions does it impact innovativeness?.....	37
References .....	40
<b>Chapter 2</b>	
<b>Why do firms engage in forward-looking search? Internal and external determinants</b> .....	<b>45</b>
<b>Chapter 3</b>	
<b>Forward-looking search and innovation performance: The mediating role of innovation portfolio agility</b> .....	<b>89</b>

## Chapter 4

<b>Forward-looking search during innovation project development: Under which conditions does it impact innovativeness? .....</b>	<b>133</b>
--	------------

## Chapter 5

<b>Discussion and conclusion .....</b>	<b>181</b>
5.1 Overall contributions .....	181
5.2 Research article's contributions .....	184
5.3 Overall limitations and avenues for future research .....	189
References.....	191
<b>Appendix A: Survey 1 .....</b>	<b>195</b>
<b>Appendix B: Survey 2 .....</b>	<b>205</b>
<b>Appendix C: Co-author statements .....</b>	<b>215</b>

# CHAPTER 1

## Introduction to forward-looking search

*“The only constant in our business is that everything is changing. We have to take advantage of change and not let it take advantage of us. We have to be ahead of the game”* – Michael Dell, CEO of Dell Computer Corporation (1996) (from Brown and Eisenhardt 1998, p. 1).

What do firms do to be ‘ahead of the game’? Recent research on forward-looking behaviour takes on a view that actors anticipate superior future courses of action, but not necessarily as an outcome of actively searching for a new superior future course of action. Rather, it views it as “the ability of a *strategist* to identify a superior course of action, especially one that is markedly different from the status quo, and foresee its consequences” (Gavetti and Menon 2016, p. 207, italics added). This literature argues that actors draw on past experiences from which they can draw analogies to new non-existing future situations, paired with rigorous application of information gathering and analysis to assess the future viability of a new course of action (Gavetti 2012, Gavetti *et al.* 2012, Gavetti and Menon 2016). Both actor’s superior management of cognitive processes by means of analogy thinking helps towards developing this form of strategic foresight (Gavetti 2012), but also its vast range of prior experiences and deep knowledge associated with such experiences (Gavetti and Menon 2016). An unfortunate downside of this line of research is that, therefore, the role of contextual prior experiences, knowledge, information, and cognitive skills plays a dominant role. It precludes us researchers from studying forward-looking mechanisms, when such forward-looking mechanisms in essence only rely on preadaptation (Cattani 2006, Winter 2012). It means that prior experiences leads to the generation of a ‘truly superior insight’, and by that foresight (Gavetti and Menon 2016). While this line of research acknowledges that practices such as economic analysis of

the market and industry along with extensive projections prior to taking any action, it does not acknowledge the possibility per se of creating potentially superior courses of action and foresee its consequences through such practices. Rather, it acknowledges such practices as a way to ‘validate’ a course of action derived through analogy thinking; validate whether or not it is a viable course of action by attempting to foresee its consequences in the future<sup>1</sup> (Gavetti and Menon 2016).

Indeed, it seems that the deliberate *search* – through the use of such practices – of new insights about future courses of action and foreseeing its consequences is largely absent in current literatures (Csaszar and Levinthal 2016, Heuschneider and Herstatt 2016). Although not entirely surprising perhaps as several reasons can be attributed to this finding. First, any distant search is largely absent from traditional strategic formation processes (Gavetti *et al.* 2012). Literature treats actors as understanding exactly “what constitutes the set of possible actions and how performance is measured” (Csaszar and Levinthal 2016, p. 2035). Strategy making then becomes something more akin to optimization whereby current performance is maximised rather than also considering more hypothetical and distant competitive positions to capture superior opportunities (Cyert and March 1963, Gavetti *et al.* 2012, Csaszar and Levinthal 2016). Second, strategy is done by strategists and not strategic planners (Mintzberg 1990), implying that traditional strategy processes use past data to support the use of an established or traditional strategy pattern. Any distant competitive positions are mostly neglected (Cyert and March 1963). Third, strategy is often negotiated as a set of measures and often lacks clarity about the desired ends (Berger 1959). This is part of the reason why, for instance, visual strategy making tools such as business model canvasses enjoy growing popularity (Osterwalder and Pigneur 2010), extensive use of the characteristic two-by-two frameworks in MBA teaching, and an overall focus of education that neglects the more distant (Winter 2012, Csaszar and

---

<sup>1</sup> For instance, in the case of Merrill Lynch’s idea of a ‘financial supermarket’ in the 1940s where the middle-class would be able to start investing into Wall Street (as opposed to only the elite-few) by opening up a range of ‘financial supermarket’ store chains to offer financial services (which was unheard of at the time, as investing was only for the so-called Wall Street elite), a thorough economic analysis of the market and industry was undertaken, along with extensive projections, prior to taking any action on Merrill Lynch’s idea (Gavetti and Menon 2016).

Levinthal 2016). It gives rise to the idea that strategy is merely a pattern of actions and that at the extreme end of the spectrum strategy can be fully emergent through continuous testing of strategic cause-effect hypotheses (Blank 2013). As Gioia and Patvardhan (2013, p. 20) put it, “the overwhelming paradigm of strategy is one that is evolutionary, learning-based, and incremental”.

Yet, there is plentiful literature out there that posits that actively searching and changing future projections may be essential to firm performance and survival not only to avert potential threats under conditions of environmental volatility and turbulence (Brown and Eisenhardt 1997, Gavetti and Levinthal 2000, Tsoukas and Shepherd 2004), but also to be able to identify more distant opportunities which can bring superior performance (Hamel and Prahalad 1994, Gavetti and Levinthal 2000, Day and Schoemaker 2005, Schoemaker and Day 2009, Kaplan and Orlikowski 2013). Yet, Hamel and Prahalad (1994) find that only 3% of CEO’s time is devoted toward creating future perspectives whereas Day and Shoemaker (2008) find that only 23% of the CEOs scan for weak signals in the periphery. It raises the question of why not all organizations are actively searching for signals in their external environment and create future perspectives.

The lack of focus toward the future is also apparent in literature on the concept of search. To make decisions, firms “search for a satisfactory alternative among the limited set of choices available to them at the time each decision is made” (Csaszar and Levinthal 2016, p. 2034). Most prominent is the concept of backward-looking search, or problemistic search. Here, firms search for a satisfactory alternative among a limited set of choices available to them based on how they have been performing in the past (Cyert and March 1963). Others define it in a more proactive manner, where search is “the controlled and proactive process of attending to, examining, and evaluating new knowledge and information” (Li *et al.* 2013, p. 893). In both cases it lacks the explicit evaluation in terms of implications of the future, either in terms of opportunities or threats. Indeed, based on a co-citation and content analysis Heuschneider and Herstatt (2016) find that the search for information on trends and discontinuities and evaluating their future implications is largely absent in existing literatures on

search. It is a surprising find, since literatures on weak signals, peripheral vision, and strategic foresight (now referred to as strategic foresight literatures)<sup>2</sup> have advocated the explicit search of signals in an organization's environment, which in some way or another may then point towards future threats, but also likely superior courses of action (Tsoukas and Shepherd 2004, Day and Schoemaker 2005, Schoemaker and Day 2009). Since these literatures are quite prescriptive in what practices or methods to use to search for signals and consequently interpret them, it may shed light on how organizations can use articulated practices to identify superior courses of action and foresee its consequences. Something which is currently not recognized in most recent research by Gavetti and Menon (2016) or organisational search (Csaszar and Levinthal 2016) outlined before.

Therefore, I assess organization's engagement in what I refer to as forward-looking search and refer to forward-looking search as:

*the practices of collecting, examining and evaluating new information to derive alternative future courses of action and anticipate their consequences to the end of forming shared representations that raise the likelihood of enacting action.*

## **1.1 Gaps, aims, and research questions**

I investigate forward-looking search in three parts in this dissertation; potential antecedents of forward-looking search at the firm-level, its outcomes toward innovation at the firm-level, and its innovation outcomes at the project-level. I will shortly describe the three parts in more detail in the next three sections and introduce the research gaps upon which each of the three parts are founded, the research aims, and each part's specific research questions. Table 1.1 shows the dissertation's three research articles with its titles and guiding research question.

---

<sup>2</sup> Rohrbeck and Bade (2012) find that these literature streams seem to converge under the term 'strategic foresight'

**Table 1.1 Overview of this dissertation's three research articles**

---

---

Paper
<b>1) Why do firms engage in forward-looking search? Internal and external determinants</b> <i>RQ1: To what extent can performance and environmental determinants lead to firms engaging in differing intensities of forward-looking search?</i>
<b>2) Forward-looking search and innovation performance: The mediating role of innovation portfolio agility</b> <i>RQ2: To what extent does forward-looking search contribute to innovation performance via innovation portfolio agility?</i>
<b>3) Forward-looking search during innovation project development: Under which conditions does it impact innovativeness?</b> <i>RQ3: To what extent and under which conditions can forward-looking search during the development of innovation projects lead to project teams creating more novel innovations?</i>

---

---

### **1.1.1 Determinants of forward-looking search**

In the first part, I investigate the reasons why (or rather why not) organizations engage in forward-looking search. Here, I was inspired by the findings of Hamel and Prahalad (1994) and Day and Schoemaker (2008) that find CEOs to be devoting little time towards creating future perspectives. In doing so, I add to the vast repository of research on the nature (i.e. the characteristics) of search itself (Gavetti and Levinthal 2000, Laursen and Salter 2006, Chen 2008, Leiponen and Helfat 2010) by introducing the explicit future-focus as a distinct element of forward-looking search. One of the hallmarks of organisational behaviour literature is that it recognizes search as a process that can vary in differing degrees of intensities and that different kinds of determinants cause these differences<sup>3</sup>. This literature can provide valuable insights into why or why not organisations may engage in forward-looking search. Strategic foresight literatures have been lacking taking insights from the former literature streams into account; these rarely take into account the foundational assumptions of

---

<sup>3</sup> Search intensities can be heightened or lowered, for instance, because the organization fails to attain their aspired performance level (Cyert and March 1963); when organization's performance is relatively stable, they tend to not have any real motivation to search for alternatives (Levinthal and March 1981). Organizations can also engage in search when they have abundant uncommitted resources (slack resources) available (Levinthal and March 1981). Dynamic and volatile environments can also spur organizations to engage in search, as it may deteriorate the current competitive position (i.e. likely losses are expected in the future), or they observe other organizations performing much better and may therefore search in order to attain such a performance as well (likely gains expected) (Tversky *et al.* 1991, Gavetti and Levinthal 2000, Greve and Taylor 2000).

organisational behaviour when it comes to searching for new alternative courses of action and their consequences for the future. Rather, it has predominantly focused on the exogenous signals and events to the organisation that may require an intrusive approach towards its external environment; in other words a contingency approach. This is related to the way strategic foresight literatures treats forward-looking search as something akin to an ability or simply as a set of practices that do not necessarily show this property of potential variation (Tsoukas and Shepherd 2004, Rohrbeck 2010, Rohrbeck *et al.* 2015, Vecchiato 2015). Indeed, it “should be framed as an ongoing activity through which firms relentlessly look for new events that allow them to inform new strategic views” (Vecchiato 2015, p. 33). Bridging both organizational behavior literature on search and strategic foresight may provide a fuller picture on why firms would or would not engage in forward-looking search, and by that provide potentially a more nuanced view than either of these streams provide on the engagement in forward-looking search.

The first aim of this dissertation is to consolidate literature on organisational behavior literature on search and strategic foresight literatures to examine propositions brought forward in both streams why organisations would, or would not, engage in forward-looking search. In doing so, I attempt to cross-fertilize across these research streams, which have been largely disconnected from each other, and create a fuller picture of the reasons for organisations’ engagement in forward-looking search. As such, I address the following question:

***RQ1:** To what extent can performance and environmental determinants lead to firms engaging in differing intensities of forward-looking search?*

### **1.1.2 Forward-looking search and firm-level innovation outcomes**

In the second part, I investigate the potential value contributions of forward-looking search toward innovation outcomes. Literature posits that through the introduction of innovations, organizations can adapt and reposition themselves whereby innovation performance and novelty become critical to

reflect the firm's future competitiveness (Kleinschmidt and Cooper 1991, Courtney 2001, Krishnan and Bhattacharya 2002). Investigating forward-looking search in relation to innovation outcomes is therefore a suitable way to assess how forward-looking insights are used to steer an organization towards a more competitive position in markets of the future. Here, I was inspired by still one of the only empirical studies that demonstrated the *advantages* of forward-looking search in relation to innovation performance (Brown and Eisenhardt 1997)<sup>4</sup> and recent findings that show only 32% of organizations find forward-looking search to be contributing toward innovation management (Rohrbeck and Schwarz 2013).

While prior research mostly focused on forward-looking search as a contributor towards formulating new innovation ideas for the innovation portfolio (Brown and Eisenhardt 1997, Reid and De Brentani 2004, 2012, Yadav *et al.* 2007, Reid and de Brentani 2010, Kock *et al.* 2015), it lacks insights whether current projects in the innovation portfolio may also benefit from forward-looking search. While I acknowledge that forward-looking search can potentially identify new 'superior' innovation ideas, it certainly has its merits in relating future insights against current running projects. Indeed, recent research suggests that forward-looking search can reliably act as a mechanism that can mitigate escalation of current running innovation projects, which resonates well with the view of forward-looking as appraising current actions (Seidl 2004). By continually correcting assumptions about the future of markets, technologies, and competition, paired with monitoring roadmaps and continual benchmarking with the industry, the odds of "throwing good money after bad" can be significantly reduced (Sarangee *et al.* 2014, p. 1034). Also, it allows to better align innovation plans with foresights on technology, market, and competitors (Rohrbeck and Gemünden 2011), thereby providing the firm with competitive-timing advantages (Simonse *et al.* 2015).

---

<sup>4</sup> Brown and Eisenhardt (1997) showed that successful and less-successful firms in product innovation performance showed differences in the way they were engaging with the future. Less successful firms had little sense of the future and did not have a clear sense of direction and therefore were mostly trying to catch-up to their competitors. Firms with more successful innovation portfolios however had a much better sense of the future and a vision of their firm *within* that future.

It therefore seems fruitful to investigate why certain organisations are more successful in terms of innovation than others. As existing literature on search has predominantly focused on a direct link between search and innovation outcomes, I aim to shed light on how forward-looking search (with its specific future-focus) can contribute towards innovation outcomes by acknowledging innovation portfolio agility as a facilitator of this relationship (Kester *et al.* 2014, Kock *et al.* 2015, 2016, Kock and Gemünden 2016). In doing so, I add to a wide range of research on the direct relationship between search and innovation outcomes at the firm-level (Katila and Ahuja 2002, Li *et al.* 2013, Horváth and Enkel 2014, Troilo *et al.* 2014) by introducing search with an explicit forward-looking focus. I also add that the link between search and innovation outcomes is not necessarily a direct link and acknowledge that additional practices that facilitate innovation portfolio agility are necessary to gain the full benefits of forward-looking search. In summary, I formulate the second question that I seek to answer within this dissertation:

***RQ2:** To what extent does forward-looking search contribute to innovation performance via innovation portfolio agility?*

### **1.1.3 Forward-looking search and project-level outcomes**

With RQ2 I investigate the overall relationship between firm-level forward-looking search and innovation performance, wherein I acknowledge the role of innovation portfolio management. Whilst literature acknowledges that forward-looking search helps shape new ideas for innovations, it is depicted as only occurring in the front-end to initialize a new innovation project (Reid and De Brentani 2012, 2015, Kock *et al.* 2015). An ongoing process of forward-looking search is less recognized, especially after a new innovation project is initiated. Rather, it is assumed that an idea based on sound future insights or a well-developed future vision will likely lead to developing more creative and novel innovations which likely lead to higher innovation performance (Reid and de Brentani 2010, Reid and De Brentani 2012, Kock *et al.* 2015). As it takes time to develop a new

innovation, changes in the organization's external environment may have been brought about which could not have been foreseen at the project start. Especially in pursuing more radical innovations, development times are long and much uncertainty exists about the project's outcome (Salomo *et al.* 2007). Planning may therefore not be able to capture these elements, as decision-makers are inherently bounded rational and therefore lack "complete knowledge and anticipation of the consequences that will follow on each choice" (Simon 1947, p. 81). Therefore, selecting ideas in the front-end that may seem successful in the future may not be able to ensure future rents or be sufficiently able to ensure a project's deliverables are still innovative at the project's end. I therefore question whether project teams engage in forward-looking search after innovation projects have been initiated and how this may impact a project's innovativeness:

***RQ3:** To what extent and under which conditions can forward-looking search during the development of innovation projects lead to project teams creating more novel innovations?*

#### **1.1.4 Summary of three research parts**

In summary, I attempt to shed more light on when and why firms engage in forward-looking search by taking note of existing organizational search theories and assumptions which have been largely neglected in foresight- and related literature streams (**chapter 2**). I organize and test propositions of both organizational search behaviour and strategic foresight literatures in relation to forward-looking search using a large-scale dataset. Second, while scholars also note the benefits of forward-looking search, especially in the realm of innovation (Brown and Eisenhardt 1997), large-scale evidence is lacking here as well. Therefore, I also examine how forward-looking search can affect an organization's innovation performance. Here, I take on both a firm-level and innovation project-level perspective to not only assess overall firm-level innovation outcomes (**chapter 3**), but also assess how forward-looking search can affect the novelty of an innovation project (**chapter 4**). This

dissertation thus examines the determinants of forward-looking search and its contributions towards innovation outcomes at different organizational levels. In doing so, I employ a quantitative research design, thereby attempting to overcome the bias towards largely case-based, conceptual, and anecdotal evidence in the field (Gioia and Patvardhan 2013).

In the next two sections, I explore more deeply the foundations of forward-looking search by introducing the contrasting concept of backward-looking search, followed by a more in-depth discussion on what forward-looking search entails both at the firm-level and project-level. Next, I present a primer on existing literature of organizational search behaviour and how it views ‘search’ as essentially backward-looking in nature and consequently explore how recent research has attempted to overcome this backward-looking bias in search, and how this affects a firm’s engagement in forward-looking search. This provides the basis for chapter 2. Next, I explore existing research on the link between search and innovation outcomes, and explore how forward-looking search is a distinct form of search which complements existing research on search. This section provides the basis for chapter 3 and 4. Then, I present in short the dissertation’s research design, methodologies, and samples used. Followed are then the three studies that constitute the bulk of this dissertation. I conclude this dissertation with an overall discussion, avenues for future research, and a conclusion.

## **1.2 Backward-looking search**

The work of Gavetti and Levinthal (2000) has produced a stream of research on search and distinguishes between backward-looking and forward-looking models of search. To understand forward-looking search better, I will briefly put forward the basic foundational assumptions of the backward-looking model. A major hurdle seems to be as Levinthal and March (1993) note; learning processes are often myopic. Any kind of feedback about current actions that is more proximate in time (and space) tends to dominate any of the adaptive processes of an organization. Firms are often

much more willing to engage in “incrementally advancing capabilities – that is firms find it relatively *easy* to do and thus what most actually *will do* most of the time (Winter 2012, p. 291). Most organizations therefore engage in an ongoing process of evaluating the past that consequently forms the basis for deciding on actions to take in the present (Cyert and March 1963). This backward-looking logic reflects incremental trail-and-error learning through past actions and the adaptive selection of routines. The rules upon which decisions are made are dominated by experience and performance feedback, which is well recognized in the evolutionary theory and learning literature (Argote and Greve 2007). In other words, foresights tend to be neglected in favour of known routines and problem solving activities which consequently result in a myopic search of alternatives to pursue (Cyert and March 1963). Indeed, this type of search is *problemistic* search. It is one of the dominant concepts of the behavioural theory of the firm; the search for new information and knowledge to solve a problem. In Cyert and March, a problem constitutes negative performance feedback, being when performance is below performance aspiration levels. Organizations would then not only resort to coping mechanisms, which spare the need for foresight, they would also only search for alternative actions in case of problems. It is perhaps not surprising that this backward-looking sensibility is subject to criticism, as it completely precludes the need for forward-looking decision-making (Gavetti *et al.* 2012). In other words, it reflects a backward-looking decision-model which works on the premise of engaging in actions and consequently evaluating its performance. It does not concern itself with creating representations of the future, or alternative courses of actions and foresee its consequences.

### **1.3 Toward forward-looking search<sup>5</sup>**

In the forward-looking model of search, cognitive representations that incorporate a future

---

<sup>5</sup> This section is relatively short, since the concept of forward-looking search is also explained in detail in each of the three papers. Here, I present mostly the assumptions underlying the concept for forward-looking search both at the firm- and innovation project-level.

perspective are the foundational basis of looking forward, and literature has often treated such representations similarly at both the individual and organisational level. While Gavetti and Levinthal (2000) have refrained from using terms such as ‘future’, they argue that a cognitive representation is a forward-looking “[...] form of intelligence that is premised on actor’s beliefs about the linkage between the choice of actions and the subsequent impact of those actions on outcomes” (Gavetti and Levinthal 2000, p. 113). These representations then are a basis for decision-making; Chen (2008) argues for “cognitive representations of the future as critical determinants of organizational choices and actions”. While these works implicitly incorporate a temporal dimension, they primarily emphasize the dimension of ‘cognitive distance’ rather than ‘temporal distance’, arguing that “cognition helps an organization to identify, on average, superior basins of attraction” (Gavetti and Levinthal 2000, p. 125). Implicitly then, success is implied due to the future prospects of that basin of attraction based on a temporal logic of consequences.

However, how one obtains or changes future-oriented cognitive representations is only hinted at. Gavetti (2012) argues that superior management of mental processes allows for ‘managerial foresight’ which is difficult for the ‘average firm to pursue’ and may rather be a trait of an individual than a learnable skill through a structured set of actions. Founded critiques on Gavetti’s view of superior mental processes as enablers of foresight have been made by Winter, arguing that while the first step would be “to develop an operational definition of the superior management of mental processes” (Winter 2012, p. 295), it may prove difficult since most processes occur within the minds of individuals. How one then obtains “some crude cognitive representation of the broader landscape and make a choice to move to a more distant location based on that representation” (Gavetti *et al.* 2012) is still somewhat a neglected issue. As Gavetti and Levinthal (2000) argue that actors may shift cognitive representations if they are *intelligently* able to do so, we may have to look more closely at how actors may use information to do so. Here, I attempt to draw on the vast range of literatures regarding weak signals, peripheral vision, and strategic foresight.

What will become obvious in this section is that, as opposed to Gavetti's (2012) view of strategic foresight as the result of superior mental processes, I follow more closely literatures on foresight wherein it is acknowledged as a learnable skill – a skill that can be honed towards explaining, exploring, and interpreting future developments, as well as assessing their consequences for decisions and other actions in the present (Duin, van der 2016). It is not a 'black box' as would be the case of Gavetti's proposed mental processes, but rather a proper application of selected methods that can be used to collect information and build knowledge about the futures (Duin, van der 2016, p. 7).

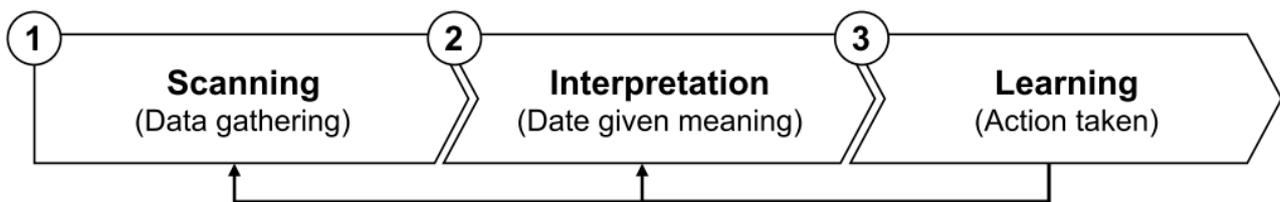
### **1.3.1 Information search and interpretation**

Information, or choice alternatives, do not naturally flow to actors, and thus must actively be searched for (Gavetti *et al.* 2012). Research on search has mostly focused on the search methods that work on the basis of 'online' evaluation (Maggitti *et al.* 2013). That is, for instance, evaluating new courses of action by means of introducing new products. Their performance can only be assessed by means of real market performance, hence 'online'. Indeed, search has been framed as R&D investments (Chen, 2008), product experimentation (Brown and Eisenhardt 1997), and innovation launches (Katila and Ahuja 2002). Yet despite these insights, the search of information pertaining to the location of future opportunities or threats, information that may actually steer decision-making related to R&D investments and innovations, is rather absent (Heuschneider and Herstatt 2016).

Yet, there is plentiful literature that in some way or another finds itself dealing with the distant future and its implications for the firm. For instance, weak signals and strategic issues management (Ansoff 1975, 1980, Day and Schoemaker 2004, 2005), environmental scanning (Hambrick 1982, Daft *et al.* 1988), and strategic foresight (Tsoukas and Shepherd 2004). While at first seemingly scattered literature streams, it seems that a consolidation of these fields is taking around the term of strategic and corporate foresight (Rohrbeck and Bade 2012). What these literatures have in common is that they see organizations as interpretation systems, which involves scanning for external

information, interpreting its meaning for the organization, and consequently learning and acting on this meaning (Daft and Weick 1984). Thus, in essence it entails a process of three stages: 1) scanning, 2) interpretation, and 3) learning. Figure 1.1 depicts this process. Organisations scan the environment by receiving information about the actions of relevant others, such as customers, suppliers, competitors, and regulators (Jain 1984, Daft *et al.* 1988, Day 1994), which they subsequently interpret using their own cognitive schemata (Greve and Taylor 2000, Seidl 2004). Learning is done through determining future actions based on their interpretation of the information received, which may entail either continuing current activities, or by initiating a process of (attempting) to induce change to current activities (March 1991).

**Figure 1.1. A model of organisations as interpretation systems (Adapted from Daft and Weick 1984, p. 286)**



This cycle follows closely existing frameworks on how organizations may go through a process of ‘foresight’, usually depicted by three stages being the scanning for information, the interpretation of its future implications for the organizations, and the dissemination and acting upon the interpretations in organizational useful ways (Horton 1999, Becker 2002, Voros 2003, Tsoukas and Shepherd 2004, Rohrbeck *et al.* 2015, Vecchiato 2015). These literatures feature rich empirical findings on the methods and processes by which organizations obtain and interpret information regarding the future. It largely focuses on the challenges and processes involved with detecting cues from the environment that may contain information to signal possible changes early (i.e. weak signals), and the interpretation of these signals (Seidl 2004, Cunha *et al.* 2009, Schoemaker and Day 2009).

The act of scanning for signals that may indicate or lead to a change in the way the future should be perceived, literature has focused on the processes by which individuals and organizations 'search' for weak signals, where having a sufficient wide reach to information sources is deemed necessary to perceive weak signals (Day and Schoemaker 2005). Organizations can acquire information in a deliberate fashion such as through directed scanning, direct experience, imitation, or problem-solving inquiries (Day 1994, p. 44). Different types of information from the environment can be acquired, such as about the actions of relevant others, such as customers, suppliers, competitors, and regulators, or technologies (Daft and Weick 1984). In other words, typically information about potential new trends, events, opportunities, and threats in their environment. Although such information typically flows inside the organisation through formal data collecting initiatives, personal contacts, networks, or external research agencies can facilitate information flows as well. In essence, it means that any organisation in some form or another acquires information on any of the factors outlined above. Differences, however, are found in the way the organizations go about proactively and systematically obtain such information (Daft and Weick 1984, Day and Schoemaker 2005). Especially acquiring information outside the organisation's immediate environment can be greatly beneficial to spot 'weak signals' (Day and Schoemaker 2005). It simply follows the assumption that 'information is out there' and that it can be found by firms through searching (Day and Schoemaker 2005). Any of these signals can provide input into how the future may be (re)imagined. Usually, if new signals are perceived as not fitting the organisation's current perceptions (i.e. the imagined future direction of a certain market), it may trigger additional interpretation processes as to how the future may likely be re-interpreted (Kaplan and Orlikowski 2013).

This subsequent step, which is interpretation to create an understanding of what, when, and how changes are likely to occur, is at the centre of forward-looking search (Horton 1999, p. 7). It is the interpretation and meaning-making of issues or opportunities from weak signals (Dutton and

Ottensmeyer 1987). Interpretations of the future allow decision-makers to anticipate, in approximate terms, the longer-term implications of (alternative courses) of action (Gavetti *et al.* 2012), and has been shown to be a critical determinant of managerial choice, action, and future consequences of these actions (e.g. Tripsas and Gavetti 2000). Typical approaches to create interpretations of the future include identification of influencing factors that present a given business environment and how they interact (Gordon and Hayward 1968), forecasting (Cuhls 2003), development of probable future projections on the basis of scenarios (Wack 1985, Van Der Heijden 1996) and roadmaps (Groenveld 1997).

### **1.3.2 Legitimization and diffusion**

If any new insights derived through newly acquired information and the subsequent interpretation of these signals in terms of their implications for the future, these must be seen as legit and supported in order to have any effect on actions taken by the organisation. Indeed, the notion put forward that it should be translated into ‘executable actions’ also needs to incorporate the facilitating element of legitimization such a forward-view across the organization (Gavetti *et al.* 2012). Scholars in foresight literatures have argued that not only the usage of methods may give novel insights into the future, organizational context and social factors come into play as well into understanding and facilitating actions towards future (Rohrbeck 2010, Duin, van der 2016). First, organizational support is paramount in making forward-looking search flourish within an organization – search that goes merely beyond collecting information and developing future views. The latter could happen if one solely focuses on methods, leading to ‘method fetishism’ (Duin, van der 2016). Organisational support and commitment is needed because any representation of a future issue or opportunity, however novel or distant, is likely to be “[...] hard to see through more standard lenses [and] also need other relevant constituencies to embrace similar representations” (Gavetti *et al.* 2012, p. 27). Otherwise, any new insights of the future may simply be neglected. Indeed, as March (1981, p. 575) puts it, “*If a leader tries to march toward strange destinations, the organization is likely to deflect*

*the effort*". Legitimization of forward-looking search is therefore needed to persuade other organizational members (e.g. decision-makers) that a certain representation of the future has merit. Rohrbeck (2010) found that organizations which used more structured approaches and methods facilitated increased transparency of 'what has been interpreted and why it was done in such a way'. In turn, it facilitates commitment of other organizational actors who were not participating in these structured approaches. Institutional rhetoric provides a complementary view, which describes the role of plans and planning (Gephart *et al.* 2010). Organizational support in the form of planning, either functional such as resource allocation, or fantasy or symbolic such as scenarios that have been developed by 'experts' based on their 'expertise' can act as a legitimization of the ability of an organization to control the future. Such plans or documents promise organizations can reduce uncertainty and control things by legitimating organizational action and managerial control of the future (Gephart *et al.* 2010). Indeed, adequately diffusing future insights and gaining commitment is key in turning future insights into actions (Horton 1999). Not only to have key decision-makers view future insights as legitimate, but also to facilitate learning. Learning about what changes the organisation should take today to set a superior course of action.

### **1.3.3 Summary of forward-looking search at the firm level**

Coming back to the definition of forward-looking search,

*the practices of collecting, examining and evaluating new information to derive alternative future courses of action and anticipate their consequences to the end of forming shared representations that raise the likelihood of enacting action,*

we find that 1) organizations can use an array of methods to facilitate the identification of (weak) signals that may indicate potential change early and may therefore be relevant for the organization's future, 2) interpretation in terms of determining the signals' likely future trajectories and the creation of scenarios and roadmaps to create a novel representation of different future states, and 3) and the

likelihood of enacting action through organizational commitment via determining of possible organization-specific responses by developing and sharing plans or scenarios and diffusing of future insights.

#### **1.3.4 Forward-looking search at the project level**

This dissertation not only examines forward-looking search at the firm-level, but also at the level of individual projects wherein project teams can engage in any of the practices outlined before as part of forward-looking search. At the firm-level, I have outlined practices that organisations can employ to facilitate scanning, interpretation, and learning (i.e. commitment and diffusion of future insights). Project teams may still benefit from firm-level practices, such as those that facilitate the gathering of information (e.g. Boe-Lillegraven and Monterde 2015), as well as firm-level interpretation practices such as scenarios and roadmaps (e.g. Simonse *et al.* 2015). Project teams however, may also engage in information gathering practices themselves during projects as well as interpretation practices (e.g. Kaplan and Orlikowski 2013, Sarangee *et al.* 2014). However, an important addition in studying forward-looking search in a context of projects is that of the social processes surrounding the interpretation of different futures and gaining commitment towards new future representations (Kaplan and Orlikowski 2013). At the firm-level, support and commitment towards future-related insights are an important factor to consider since the practices of scanning and interpretation are often only done by a select view within the organisation (Becker 2002). At the project-level however, commitment and support may take on a different form. Given that at the project-level the practices employed to facilitate forward-looking search are already bound by the scope of the project-team, I will dive deeper into social-process among team members; the social processes that facilitate the interpretation, learning, and commitment as part of forward-looking search.

Social and human factors greatly contribute towards understanding how forward-looking search works and gains commitment at the social level. Especially within settings such as projects, which is one of the studies in this dissertation, it may shed light on how groups of individuals can

socially make sense of different futures – complementary to the usage of methods – and engage in negotiations to converge on interpretations of the future (Gephart *et al.* 2010, Kaplan and Orlikowski 2013). Recent work by Gephart *et al.* (2010) and Kaplan and Orlikowski (2013) show how individuals engage in negotiation with one another in project settings and negotiate on their own interpretations of the past, present, and future. It is a form of future-oriented sensemaking where future projections are shaped by means of conversation (Gephart *et al.* 2010, p. 285). Convergence in how one thinks of the future is facilitated by these ongoing interactions, which can lead to individuals re-interpreting their own view of the future (Kaplan and Orlikowski 2013, p. 990). It closely relates to ‘distributed sensemaking’, which is concerned with the possibility of creating a shared understanding and how different individuals are able to collectively construct new meaning (Maitlis and Christianson 2014, p. 102).

In project settings, individuals can thus engage in conversations, discussions, and negotiations that allows them to potentially reinterpret their own representation on the future, but also the potential for a group of individuals to come to a shared understanding of the future. It involves open-mindedness towards new insights, but also the willingness to challenge any assumptions one may hold about the future (Kaplan and Orlikowski 2013, Sarangee *et al.* 2014). The social practices described here are then potentially a powerful mechanisms by which project teams can create future representations that may hold superior courses of action, and able to foresee the consequences of such actions.

## **1.4 A primer on firm’s engagement in forward-looking search**

Having conceptualized and defined forward-looking search, it opens up the question when and why forward-looking search occurs within firms. While I explore this question in much more depth in chapter 2, here I will give a short introduction on main propositions that have been set forth regarding a firm’s engagement in forward-looking search. First, the behavioural theory of the firm

and organizational learning literatures would posit against the notion of firms engaging in forward-looking search (Argote and Greve 2007). The behavioural theory of the firm notes the foundational assumptions of decision-maker's capabilities, namely that they are 1) boundedly rational and therefore cannot anticipate the consequences of distant courses of action (Simon 1947, Cyert and March 1963) and 2) retrospective meaning they only infer their decisions based on past information (Weick 1995). Furthermore, organizational learning posits that organizations rather engage in incrementally improving "existing skills and capabilities [which] offers a more limited kind of success that is often realized with very high reliability" (Winter 2012, p. 292). This form of learning "does little to enable sophisticated foresight, logically structured deliberation and/or the improvisation of novel action patterns" (Nelson and Winter 2002, p. 29). In other words, organizations are inherently myopic (Levinthal and March 1993) and negate what Gavetti and Levinthal (2000) refer to as distant intelligence. Instead, superior performance stems from the ability of a firm to optimize local actions and incrementally improving ones capabilities (Gavetti and Levinthal 2004); one of the hallmarks of the resource-based view (Barney 1991). With this backward-looking logic, it leads to firms engaging in search that is *myopic* and *problemistic* in nature (e.g. Greve 2003, Chen 2008). Here, a problem is when an organization fails to meet its aspired performance levels. Organisations then engage in search based on evaluating the past, which consequently forms the basis where and what to search for to fix the problems. This search process usually leads to fixes that are close to their existing experiences (Cyert and March 1963, Nelson and Winter 1982). One would therefore not suspect firms engaging in forward-looking search if they have seen past performance operating below their aspired levels. However, the behavioural theory of the firm also notes that *slack* search can occur, that is search that can deviate from known ways of doing things (Levinthal and March 1981). It is stimulated by a firm's excess resources and can facilitate exploring new ways of doing things that "may facilitate adaptation to future environmental changes but may not be recognized as necessary in the short term" (Chen 2008, p. 611). But even

though research acknowledges the ability of slack resources to facilitate more distant search of novel new pathways such as radical innovations (Troilo *et al.* 2014), it goes against the assumptions of bounded rationality, retrospectivity, and thus firm's inherent myopic nature. Furthermore, since slack is a form of performance feedback; firms that have been successful are able to build up such slack stocks and therefore may believe that it insulates them from future performance disruptions (Arrfelt *et al.* 2013). Therefore, even slack resources may negate the necessity to engage in forward-looking search. Taken together, existing theories on organizational search are predominantly backward-looking in nature in its propositions of drivers of search. One would therefore also not expect that under the behavioural assumptions set forth here, firms would engage in engage in forward-looking search.

However, research has started to increasingly criticise this backward-looking decision-model (Gavetti *et al.* 2012, Kaplan and Orlikowski 2013, Gavetti and Menon 2016). It is advocated to include a more 'forward-looking' decision making model to create a fuller understanding of also pursuing more distant and uncertain benefits (Gavetti *et al.* 2012). Indeed, while still operating under the assumptions of bounded rationality and retrospectivity, it is argued that actors *can* create cognitive representations of linkages between actions and consequences – that is consequences in the future (Gavetti and Levinthal 2000). Actors can shift such cognitive representations if they are able to intelligently do so; “Intelligence in the shift to a new representation should presumably reflect some insight about the possibility for performance improvement latent in a shift to an alternative representation” (Gavetti and Levinthal 2000, p. 129). And here we see a less stringent assumption of bounded rationality; one *can* acquire insights into potential future performance improvements (or foresee performance failure of continuing a current path). Acquiring such representations intelligently then, rely on scanning and search mechanisms (Narayanan *et al.* 2011), but more importantly, on the interpretation and meaning making (Daft and Weick 1984, Seidl 2004, Narayanan *et al.* 2011) of any information acquired and its *future* implications (Tsoukas and

Shepherd 2004, Cunha *et al.* 2009, Rohrbeck *et al.* 2015). In other words, it is a forward-looking model of search which does not rely on engaging in actions, learning, and performance feedback but rather one that relies on acquiring and evaluating information on its future implications *offline*. While these literatures still acknowledge that past performance can be trigger to engage in forward-looking search (Gavetti and Levinthal 2000, Dixit *et al.* 2015), it is mostly concerned with how a firm's external environment necessitates a firm's engagement in forward-looking search. Indeed, environments marked by high volatility and frequent disruption may require forward-looking search (Ansoff 1975, 1980, Brown and Eisenhardt 1997, Gavetti and Levinthal 2000, Costanzo 2004, Day and Schoemaker 2005, Cunha *et al.* 2009).

Taking the above into account, it becomes evident that existing organizational theories on search posit against firms engaging in forward-looking search all-together. Even though this view is recently increasingly criticized and advances have been made in theorizing when firms *would* engage in forward-looking search, there is little evidence to support either proposition. Furthermore, whereas literatures on strategic issue management, weak signals, and foresight posit that firms are likely to engage more in forward-looking search when their external environment is volatile and turbulent these literature streams rarely incorporated the behavioural assumptions of the organizational behaviour literature into account. Given these highly complex, contradicting, or theoretical lacking propositions of firm's engagement in forward-looking search, I aim to explore these within chapter 2.

I examine more fully when and why varying intensities of forward-looking search occur within firms. Building on the propositions set forth in the behavioral theory of the firm and prospect theory, I explore how existing propositions of search based on performance feedback may still be able to explain a firm's engagement in forward-looking search, even when it is deemed 'backward-looking' in nature. I frame these determinants as 'internal' to the firm. Furthermore, while the behavioural theory of the firm is largely silent on exogenous factors, literature on strategic issue management, weak signals, and foresight posit the firm's volatile and turbulent external environment acts as a

critical determinant of forward-looking search. Therefore, building on contingency theory, I include turbulence and competition characteristics of a firm's external environment as explanatory for a firm's engagement in forward-looking search. These determinants are framed as 'external' to the firm. Lastly, I introduce the notion that both internal and external determinants are highly interdependent, and that acknowledging their interdependency bridges the two separate research streams and provide a fuller picture of why firms may engage to greater extents in forward-looking search.

## **1.5 A primer on forward-looking search and innovation outcomes**

Prior literature on 'search' has predominantly employed distal proxies that *infer* search, such as new product introductions (Rosenkopf and Nerkar 2001, Katila and Ahuja 2002), R&D investments (Greve 2003, Chen and Miller 2007, Chen 2008), or patents (Kim *et al.* 2013). This work conceptualizes search as the inseparable link between the acquisition and evaluation of information *and* outcomes such as creating new products or increasing R&D investments. Research to date has rarely examined more closely the *actual* search processes in separation from any potential outcome, and by that obfuscating insights into the inner workings of the search – outcome link. Only recently it is increasingly acknowledged that the search for information is separate from the innovation process (Li *et al.* 2013, Maggitti *et al.* 2013, Dahlander *et al.* 2016).

Existing literature which treats search as consisting of both the information or knowledge search *and* its associated outcomes has typically classified search among the dimension of scope. Here, scope defines whether the search is *distant*, i.e. the exploration of new opportunities that emphasize experimental and distant innovation beyond the current organizational boundaries; and *local* search, i.e. the refinement of existing innovations or new proximate innovations, which is consistent with Cyert and March's (1963) *problemistic* search and draws heavily on learning (Nelson and Winter 1982). However, while at first distant search seems similar to forward-looking search as I

have defined, it is conceptually very distinct. Existing literatures have treated distant search not so much in terms of *temporal* distance, but rather *cognitive* distance. Then, distant search is the search of new and unfamiliar information or knowledge (i.e. knowledge sources beyond familiar technology domains and across diverse technology domains) (Rosenkopf and Nerkar 2001, Kim *et al.* 2013). In other words, it is the breadth of search. Then, typically, it is acknowledged that greater scope or breadth (thus cognitively distant search) increases innovation performance on the firm level (Laursen and Salter 2006, Leiponen and Helfat 2010). Conversely, reduced scope or breadth (thus cognitively *local* search) is detrimental to innovation performance (Rosenkopf and Nerkar 2001, Katila and Ahuja 2002).

While search in this work thus draws heavily on exploring the link between searching for *unfamiliar* information or knowledge to the firm (i.e. cognitively distant) and how this may affect innovation outcomes, it does not necessarily acknowledge the search for information that is *distant in time* (i.e. temporal distant). And this is an important distinction to add to this growing body of literature on search:

*“While issues of cognitive distance are most likely to involve issues of temporal distance as well, the converse may not hold true. For example, while some issues may be high on temporal distance (e.g., the probability of continuing with a vendor ten years down the line), it may be low on cognitive distance as the event does not involve dealing with novelty or unfamiliarity. On the other hand, a firm attempting to launch an innovative product in three months, may experience more challenges due to cognitive distance than temporal distance. The nature of relationship between them calls for deeper investigation”* (Gioia and Patvardhan 2013, p. 9).

By considering this crucial distinction in the scope of search, I add significant insights to the vast repository of research on search in relation to innovation outcomes, both at firm-level (Katila and

Ahuja 2002, Li *et al.* 2013, Troilo *et al.* 2014) and project level (Kaplan and Orlikowski 2013, Horváth and Enkel 2014, Sarangee *et al.* 2014). The acknowledgement of the future as a distance is also becoming more apparent in recent research on innovation management. More specifically, while it acknowledges that novel and unfamiliar knowledge can lead to innovations; firms also need to assess the future implications of pursuing those *cognitively distant* innovations. Indeed, increasing emphasis is placed on how innovations within portfolios should also be assessed in terms of future-preparedness (Rank *et al.* 2015); that is, whether the innovation will contribute positively to the firm's future performance, as well as making new future innovation paths available to the firm. Also a-priori assessment of how ideas may contribute to a firm's future *before* entering an innovation portfolio is increasingly emphasized (Reid and de Brentani 2010, Reid and De Brentani 2012, Kock *et al.* 2015). However, this work rarely recognizes also how forward-looking search may contribute to an already existing portfolio of innovations, and via that its impact on innovation performance. Indeed, it rarely recognizes that even when one makes an a-priori assessment of an idea before it is formally initiated as an innovation project, it may lead to a 'blind alley' along the way (Blackman and Henderson 2004). In other words, decision-makers are not able to anticipate all uncertainty inducing events before a project is formally entered into the portfolio, making them boundedly rational (Simon 1947). This not only holds true at the innovation portfolio level, but also at the level of the individual project itself. Even though an innovation project may have formally been initiated, it does not necessarily mean the intended outcome will still be novel and relevant after a project's development comes to an end. Therefore, ongoing forward-looking search practices may be needed to uphold any initiated innovation project's novelty and relevancy.

Therefore, I study forward-looking search – with its distinct temporal search component – and contribute to existing search literature first by examining the link between forward-looking search and a firm's overall innovation performance as mediated by a firm's portfolio management practices. Second, I examine the explicit call on the nature of the relationship between cognitively distant and

temporal distant. Here, I examine individual innovation projects whose outcomes range from incremental to radical (i.e. the more radical a project, the more unfamiliar and therefore cognitively distant it is) and the extent of forward-looking search (temporal distance) employed within these projects for the duration of their development.

At the firm-level, I examine a firm's engagement in forward-looking search in relation to its innovation performance. Building on the notion that firms (and decision-makers alike) have imperfect knowledge on the future consequences of their current actions (i.e. they are boundedly rational), I consider the link between forward-looking search and innovation performance as orchestrated via the management practices of a firm's innovation portfolio of ongoing developments. I view the firm's innovation portfolio as a set of 'pre-adopted' opportunities foreseen in different time periods. As all firms have to spend some time to develop new solutions, new forward-looking insights may render ongoing developments obsolete, or provide new insights into new opportunities to pursue. Therefore, I view forward-looking search's contributions not only as potentially spotting more distant opportunities to be added to the innovation portfolio, but more importantly its contribution towards assessing previously initiated innovations in terms of future-preparedness. Firms, then, need adequate innovation portfolio management practices in place that facilitates such a contribution. Such practices are geared towards facilitating agility within a portfolio of innovations; being flexible and speedy in making changes to a current portfolio, in adding new innovations, or even terminating existing projects. Having such practices in place allows forward-looking search to ultimately affect innovation performance and signals a firm's willingness to critically review, change, or even terminate innovation projects in response to new future insights.

At the project-level, I examine how project teams may engage in forward-looking search to develop an increasingly novel innovation, ranging from incremental to radical innovations. However, while a direct relationship between forward-looking search and project innovativeness is fruitful to investigate, it is likely that not every project will benefit from forward-looking search

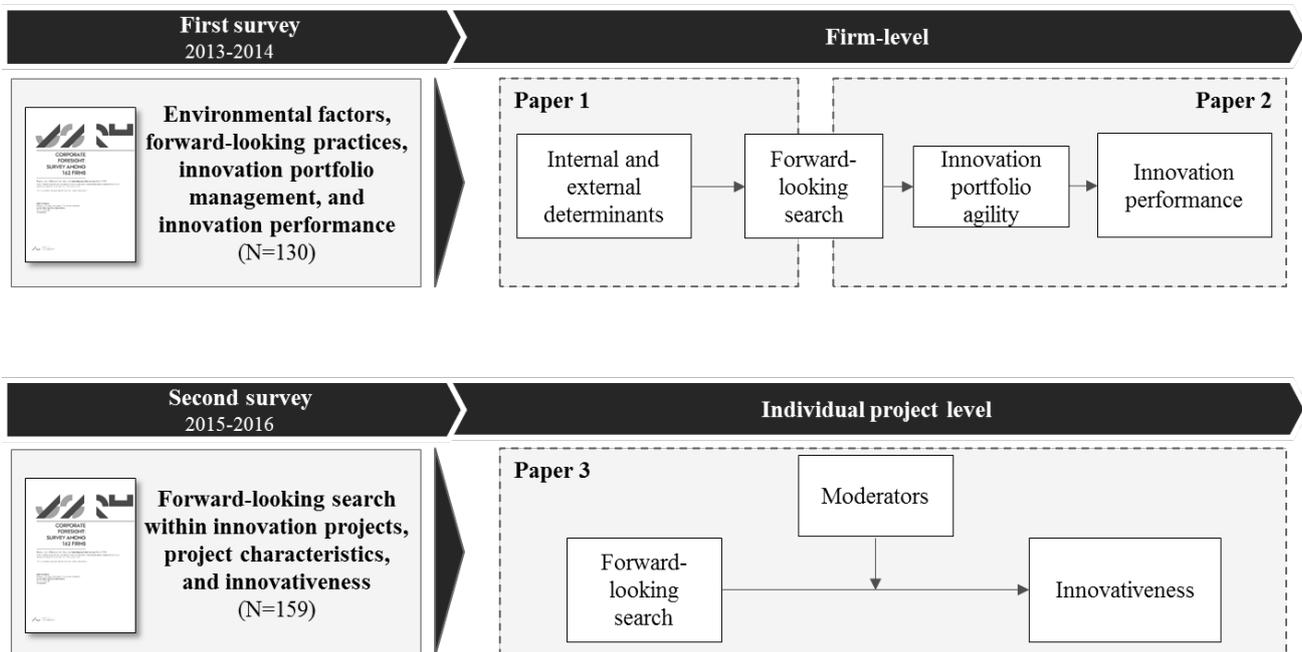
practices during development. In other words, there may be factors that can severely hamper or contribute to the relationship between forward-looking search and innovativeness. I build on the notion that the innovativeness pursued with an innovation project is a measure of task uncertainty as higher degrees of innovativeness entail more unfamiliar information and knowledge (Salomo *et al.* 2007), therefore forward-looking search can positively contribute by providing additional information on temporally and cognitively distant matters. Furthermore, I also build on the well-known bounded rationality assumption (Simon 1947) and states that not all consequences of actions can be foreseen or anticipated. Forward-looking search, then, can keep the project up to date throughout development by providing future insights that could not have been generated at the project start. Taken together, the two assumptions lead to the following three situations wherein innovativeness of the project may become threatened: 1) deficiencies in planning (i.e. not having been able to foresee all possible uncertainty inducing events and consequences), 2) deficiencies in project budgeting (i.e. not have been able to account for emerging issues or opportunities that require additional costs to counteract), and 3) deficiencies in understanding the external environment and all its constituents at the project start (i.e. not fully able to grasp and understand the complexity and heterogeneity of the environment to ensure that other competitor's novel products are not overlooked). These three situations therefore become factors to take into account under which forward-looking search then can contribute optimally: there must be room in project planning, there has to be budget available to act on foreseen changes (i.e. slack resources), and the external environment requires an ongoing search of new information and interpretation of its implications.

## **1.6 Research design and methods**

In this dissertation, I adopt a research design that relies on a mixture of survey data and objective secondary data with a quantitative methodology for the three main research articles. More specifically, the first two articles (as depicted in chapters 2 and 3) are both using the same survey

which was conducted between 2013 and 2014 among European firms that engage in new product and/or service development. This survey (from here on referred to as survey 1) is mostly concerned with phenomena occurring at the firm-level. My third research article (as depicted in chapter 4), is based on a second survey (from here on referred to as survey 2) which was conducted between 2015 and 2016 among Danish manufacturing firms. Here, the focus is on project-level phenomena. The research articles in their respective chapters elaborate extensively on the empirical setting, sample characteristics, measure development, measures, validation procedures, and potential limitations, I will not elaborate on these matters in this section. Rather, in the following sections I will elaborate on the overall sampling strategy and usage of additional data next to the surveys. I will do so separately for each research article. Figure 1.2 shows how the two surveys are used for each of the research three research articles.

**Figure 1.2 Overview of survey data and this dissertation’s three research articles**



### 1.6.1 Empirical setting and data sources of articles 1 and 2

*Empirical setting.* Articles 1 and 2 draw on a sample of European firms active in a variety of

industrial sectors with a focus on innovation and excluded firms that had not introduced at least three new products or services over the past five years. These two criteria were necessary for several reasons. For article 1, two reasons apply. First, a cross-industry sample allowed us to sample firms facing widely varying environmental forces, as we posit the firm's external environment as one of the major determinants of forward-looking search. Second, as forward-looking search is the dependent variable in the study of article 1, we were concerned that random sampling would provide us with insufficient variance in the dependent variable (i.e. mostly skewed to the right) as few firms were found to engage in forward-looking search (Rohrbeck and Schwarz 2013). Therefore, we followed prior research which found varying extents of forward-looking search in the context of innovation (Brown and Eisenhardt 1997) and sampled firms engaged in new product or service development. For article 2, the criterion that firms had to have at least three new products or services introduced in the past five years was necessary to measure the study's dependent variable – innovation performance. Moreover, it provided us with a reasonable indication that the firm had management practices in place to manage several new product/service development projects simultaneously (i.e. a portfolio).

To construct the sample, we randomly drew a sample of 300 firms from the European Commission Economics of Industrial Research and Innovation R&D top 1000 EU Scoreboard for identifying firms from a variety of industries in an R&D/innovation context (European Commission 2013). Additionally, we contacted firms which had participated in an earlier study by the authors and other firm representatives whom the authors of this study have had contact (at conference presentations, interviews, or via social networks). Given our mixed sample approach, it is probable that the firms in this sample differ from the general population by having a higher interest in and sensitivity to the process of forward-looking search than the average firm does. Multiple respondents were identified in senior managerial functions that could potentially facilitate forward-looking search depending on the respondent's firm type. For instance, in industrial companies, mainly managers

from areas such as innovation and R&D management were targeted. Since we needed to verify the firm had introduced innovations in the past years, and this kind of information requires the direct contact of all firms and the cost of this process is very high, all firms were contacted in order to assess the criteria prior to inviting them to participate in our study.

Phone and email contact was used to establish the suitability of the respondent for our survey and that the respondents were confident that they could accurately respond to the survey questions. We contacted 1030 potential respondents (corresponding to 522 unique firms) and invited them to participate in our survey (web based). We received 130 usable questionnaires, indicating a response rate of 13%. For article 1, we had to discard a further 26 survey responses because we were unfortunately not able to obtain additional objective performance data for our 3-year timeframe prior to the survey collection through either the ORBIS database or annual reports. The total usable number of survey responses for article 1 is therefore 108. For article 2, we were able to use the entire sample of 130 responses.

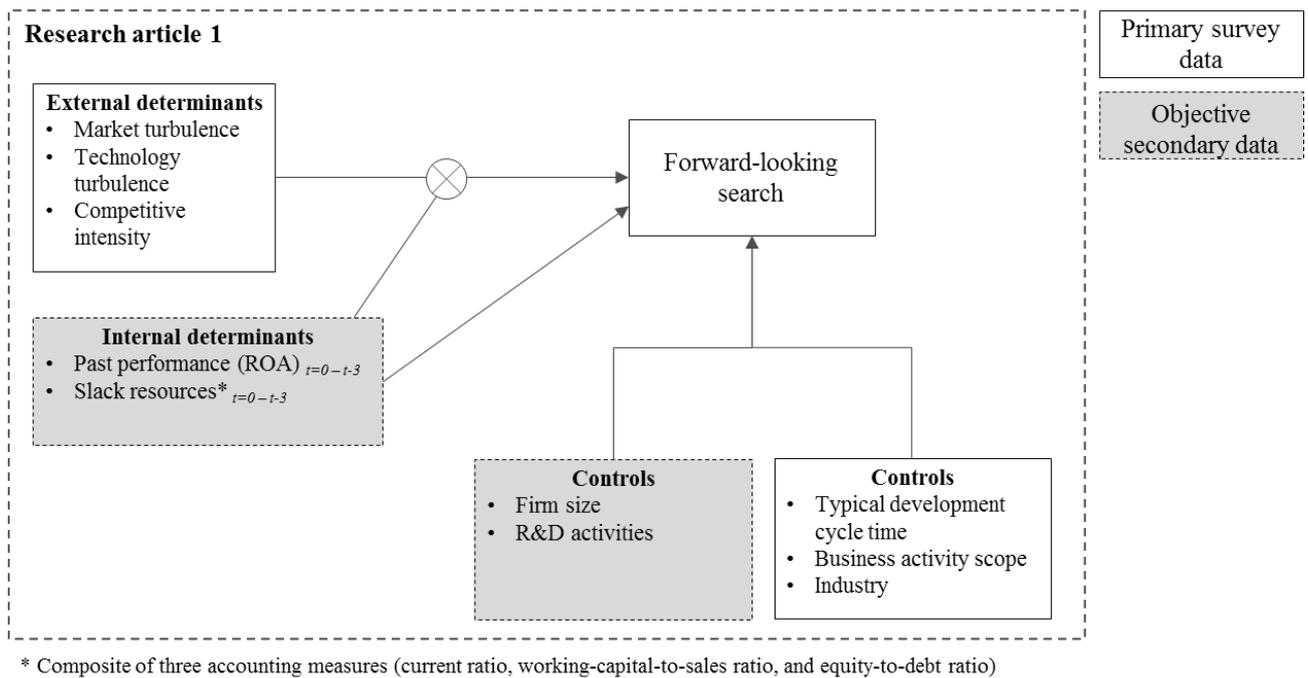
**Data sources.** For articles 1 and 2 we use a mix of primary survey data and secondary objective data: 1) the cross-sectional survey distributed in 2013-2014, 2) Bureau van Dijk's ORBIS database which contains detailed operational and financial information of both public and private companies worldwide, and 3) firm's annual reports. The survey data employed in article 1 and 2 originate from a larger multi-faceted survey which entailed questions on a wide variety organizational aspects<sup>6</sup>. The full survey is added to appendix A<sup>7</sup>. For article 1, the survey data we employ in this study regards activities and practices of forward-looking search and how different environmental facets are perceived. To assess the behavioural arguments in this article, we collected objective performance data for a time period of three years prior to the response year of the survey. Figure 1.3 shows for article 1 the study's variables and the origin of their measurement data. For article 2, we mainly rely

---

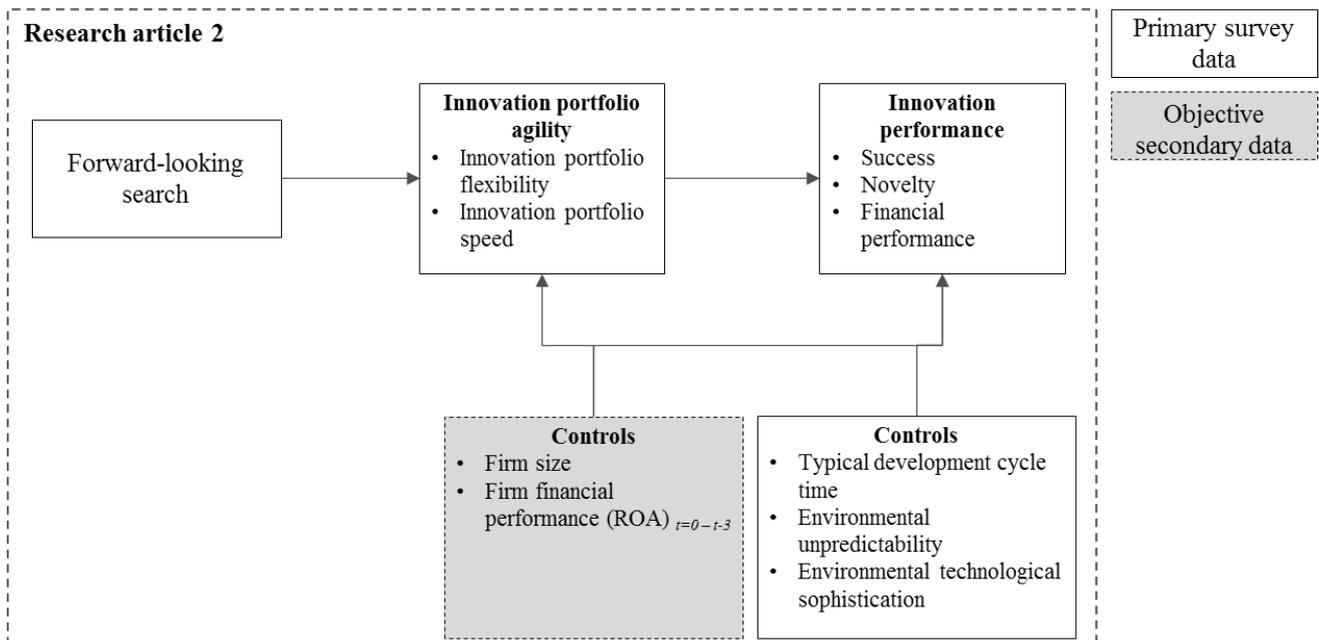
<sup>6</sup> The full survey includes other organisational-level measures additionally to those used in the article 1 and 2.

<sup>7</sup> The layout and appearance is different than from the originally web-based survey.

**Figure 1.3 Origin of data for variables of research article 1**



**Figure 1.4 Origin of data for variables of research article 2**



on the survey data (the only construct that is shared with article 1 is forward-looking search). Figure 1.4 shows for article 2 the study's variables and the origin of their measurement data.

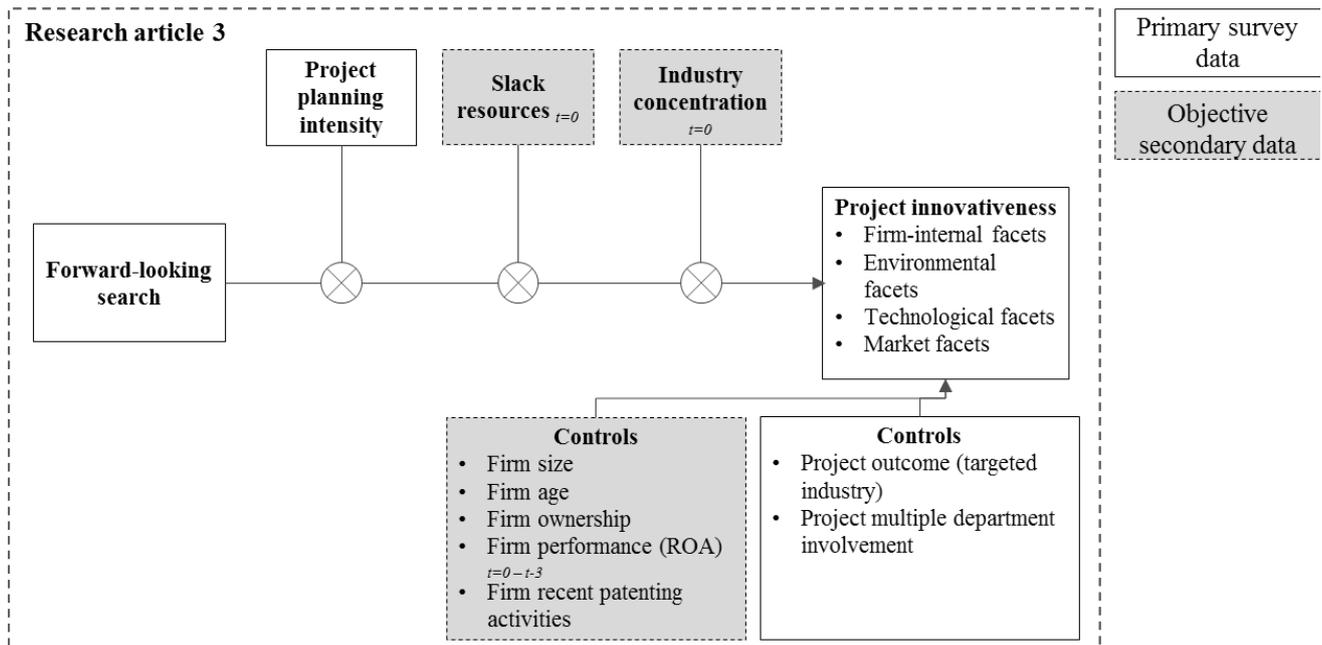
### 1.6.2 Empirical setting and data sources of article 3

*Empirical setting.* For article 3, we draw on a sample of Danish firms from the manufacturing

industry (constituting the NACE Rev. 2 C-section) as these firms are most likely to engage in new product or service development. Using Bureau van Dijk's ORBIS database and Danish NN Markeddata, a list was compiled of the largest manufacturing firms in Denmark. From this, we drew a random sample of firms that exceeded at least the following two criteria: revenue in the prior financial year of at least 75 million DKK (equivalent to ~10 million Euro), or at least 50 employees. This resulted in a list with 1175 firms. Although smaller firms (either in size or revenues) also engage in innovation activities, in the context of this article, our focus on larger firms is sensible because larger firms in Denmark are arguably disproportionately more engaged in innovation activities and more likely to have adopted organizational practices of search to facilitate innovation.

As our unit of analysis is a new product or service development project, we required fine-grained data on the projects. Therefore, we targeted only project managers or project members that had been involved with a project for the majority of its development time. Suitable respondents were identified upfront where possible. For a period between late 2015 and beginning of 2016, a private research firm (Wilke AS) contacted and administered the questionnaire to our sample of 1175 target firms for which we identified suitable respondents upfront. After verification by phone, respondents were given a formal invitation by email during the phone call and, where possible, verified if the email had been received. We asked respondents to fill out the questionnaire by referring to a project with which they had been involved for the majority of the development time. Consequently, we thus did not employ a selective sampling strategy by asking respondents to fill out the questionnaire of a project that resulted in an 'incremental' innovation or a 'radical' innovation. Rather, we allowed any projects to be selected by the respondent, whether or not it was innovative. We also did not mention to the respondents that the research it was about 'innovation' or 'innovativeness' (or any synonyms), but rather about development projects of a new product or service for their company. As such, we are confident we alleviated potential priming biases. Ultimately, after having identified a suitable respondent by phone calls and usually after two reminders, a total of 214 responses to the

**Figure 1.5 Origin of data for variables of research article 3**



questionnaire were recorded, indicating a response rate of 18%. These responses represent 206 unique innovation projects from 214 unique firms. However, because of missing answers, the final sample for article 3 is 159.

**Data sources.** The data were collected through a cross-sectional survey, conducted in 2015 and 2016, of the selected firms in Denmark, annual reports of each firm from the Danish Central Business Register for our objective performance measures, and Bureau van Dijk’s ORBIS database for industry and patent data. We developed the questionnaire during February to June 2015. To the extent possible, the questions were based on previous studies<sup>8</sup>. The full questionnaire as administered is added to Appendix B. For our objective data, we gathered data up to three years prior to what we refer to as time  $t=0$ , which we set as the year in which the innovation project was under development<sup>9</sup>. Figure 1.5 shows the study’s variables and the origin of their measurement data.

<sup>8</sup> Not all scales from the survey are used in research article 3.

<sup>9</sup> Respondents were allowed to select projects which were undergoing development at time of filling out the questionnaire or for which the project’s outcome had been launched on the market for less than three years. Therefore,  $t=0$  can be any year ranging between 2013 and 2016.

## 1.7 Overview of the research articles

This dissertation features three separate research articles that constitute the bulk of this dissertation. While they are stand-alone research articles, they all revolve around the central theme of forward-looking search. In research article 1 I investigate and test why firms engage in differing intensities of forward-looking search whereas in article 2 I investigate and test how differing intensities of forward-looking search is related to a firm's innovation portfolio management and consequently the firm's innovation performance. In article 3, I take on a project-level perspective and investigate and test to what extent forward-looking search by a project team can influence the project's innovativeness under a variety of conditions. In the following three sections, I will provide the status and summary of the three research articles.

### 1.7.1 Article 1: Why do firms engage in forward-looking search? Internal and external determinants

*Authors:* Tymen Jissink, Eelko K.R.E. Huizingh, and René Rohrbeck

*Status:* Ready for submission to a major journal

*RQ1:* To what extent can performance and environmental determinants lead to firms engaging in differing intensities of forward-looking search?

This study examines to which extent firm- internal search determinants (performance below aspiration, performance expectations, and slack resources) and external search determinants (market turbulence, technological turbulence, and competitive intensity) predict a firm's engagement in forward-looking search. While the internal search determinants stem from organisational search literature, the external determinants are drawn from foresight-related literatures. While the former seems to dismiss the notion of firms engaging in forward-looking search, foresight-related literatures posit the exact opposite and claim it is both recommended and needed in order to survive in volatile and turbulent environments. It thus seems that on the one hand firms are not engaging in forward-looking search, whereas the contrasting perspective is that they should and must. This study aims to examine this contrasting view on forward-looking search, and tests propositions and assumptions

brought forward by both organisational search and foresight-related literatures in relation to a firm's engagement in forward-looking search.

We find that firms that have performed below aspirations are less likely to engage in forward-looking search, suggesting that forward-looking search is not a form of problemistic search. In contrast, firms that have abundant slack resources as well as firms expecting to outperform in the near future are engaging more into forward-looking search. We also find interaction effects between slack resources and environmental characteristics. Firms with a high level of slack resources increasingly engage in forward-looking search if they are in technologically turbulent environments, but interestingly also negates the negative effect of competitive intensity on forward-looking search.

Our contributions are threefold. First, we add to organisational search literature that search in a forward-looking manner occurs to differing degrees, and provide evidence that a firm's engagement in forward-looking search *can* be driven by internal determinants as postulated by the behavioural theory of the firm and prospect theory. Second, by testing the axiomatic notion of foresight literature that the external environment drives firm's engagement in forward-looking search, we show that specific elements of a firm's environment increases firm's engagement in forward-looking search and some do not. For instance, competitive intense situations can lead firms to shift attention away from searching for information and determining likely futures. Third, we show that while internal and external determinants have independent effects on forward-looking search, their interaction is considered as well. Internal and external determinants can have profoundly different or even inverse effects on forward-looking search when thought of independently. We suggest that a firm's engagement in forward-looking search is dependent on its slack resources in relation to the environment. The interactions suggest a more holistic consideration of a firm's engagement forward-looking search. With these findings, we contribute to recent research on search literature that posits firm's ability to have the time to shift their attention towards more distant courses of action are likely to be outperformers in the longer-term. One managerial implication of this result is that firms should

not engage in forward-looking search processes that alter future representations (and by that current criteria for appraisal), unless there is plenty of time available to search.

Earlier versions of this research article were submitted and presented by the first author at the annual ISPIM conference in Dublin, Ireland, June 2014 and by the first co-author at the annual Asia-Pacific ISPIM conference in December 2017.

### **1.7.2 Article 2: Forward-looking search and innovation performance: The mediating role of innovation portfolio agility**

*Authors:* Tymen Jissink, Eelko K.R.E. Huizingh, and René Rohrbeck

*Status:* Ready for submission to a major journal

*RQ2:* To what extent does forward-looking search contribute to innovation performance via innovation portfolio agility?

Prior research mostly focused on forward-looking search as a contributor towards formulating new innovation ideas for the innovation portfolio with the assumption that these new ideas will bring future performance. However, it lacks insights whether current projects in the innovation portfolio may also benefit from forward-looking search. While still acknowledging that forward-looking search can provide future insights for formulating new innovation projects, we posit that forward-looking search can enhance the innovation portfolio as it can lead to adjustments or terminations to running projects in response to future insights; signalling potential for a lack of strategic fit of certain projects in the future, or potential lack of performance of the innovation project outcome in markets of the future. Then, improved innovation performance can be facilitated.

We build on recent research of innovation portfolio management (IPM) and focus specifically on the role of agility in innovation portfolio decision-making. We thus link forward-looking search to innovation performance via innovation portfolio agility as an important mediator. We find that forward-looking search positively influences innovation performance on the dimensions of success, innovativeness, and financial performance, but only does so via IPM agility. Exercising IPM agility is an important indicator for an organization's willingness and ability to respond to external signals,

and therefore acts as a mediator in translating future insights into innovation performance.

The key contribution of this paper is therefore to introduce the notion that forward-looking search should not merely be done in absence of referencing to the firm's current array of innovations. It acknowledges that a superior future course of action may be found through forward-looking search, but that it at the same time also leads to a different set of criteria to appraise current actions in a portfolio. Forward-looking search efforts should therefore be complemented with IPM practices that promote the assimilation of forward-looking insights in referencing to current projects. We therefore contribute to most recent research on IPM, which has surprisingly been largely silent on the potential role of forward-looking search in enhancing IPM. We complement this research by positing that innovation portfolio agility can be enhanced by forward-looking search, which explicitly emphasizes the future as a temporal aspect, and allows for better decision-making and more effective additions or alterations to the current innovation portfolio.

Earlier versions of this research article were presented at a research seminar at the University of Groningen in December 2014, accepted and presented by the first co-author at the annual Asia-Pacific ISPIM conference December 2014 (Kuala Lumpur, Malaysia), accepted and presented by the first author at the annual Academy of Management conference (TIM division) August 2016 (Anaheim, CA), and accepted for the ISPIM Americas conference March 2017 (Toronto, Canada).

### **1.7.3 Article 3: Forward-looking search during innovation project development: Under which conditions does it impact innovativeness?**

*Authors:* Tymen Jissink, Fiona Schweitzer, and René Rohrbeck

*Status:* Ready for submission to a major journal

*RQ3:* To what extent and under which conditions can forward-looking search during the development of innovation projects lead to project teams creating more novel innovations?

A stream of literature focuses, from an innovation portfolio perspective, how a vision of future market applications is developed by individuals and organisations and how that future vision can provide the firm with the potential of introducing successful new products. Whilst literature

acknowledges forward-looking search helps shape a future vision of a market-technology opportunity, it is depicted as only occurring in the front-end to initialize a new innovation project. An ongoing process of forward-looking search is less recognized, especially after a new innovation project is initiated. We posit that forward-looking search hinges on the critical assumption – and especially for a radical innovation project – that not all consequences of choices made before development can be foreseen at the start of the project. A gap is therefore, what happens after an innovation project is initiated? Do project teams engage in forward-looking search after innovation projects have been formally initiated? If so, how and to what extent can forward-looking search impact a project's innovativeness?

We build on two notions to build our model. First, the pursuit of an innovation is a measure of task uncertainty and therefore the greater the novelty pursued the greater the project's outcome becomes uncertain. Second, decision-makers are boundedly rational and therefore cannot foresee all uncertainty inducing events that may occur during development after having initiated an innovation project. Therefore, we posit that in pursuing increasingly innovative projects, project teams need to engage in forward-looking search during project development to ensure their project's outcome remains novel and relevant. However, we argue that it is only relevant if there is 1) room in project planning to facilitate forward-looking search, 2) slack resources available to implement any changes, and 3) the external environment demands such a forward-looking external perspective. Findings indicate that forward-looking search significantly impacts innovativeness. The effect follows an inverted-U shape curve where forward-looking search has the greatest positive effect on innovativeness in moderately planned projects and significantly lower effects in low- and highly planned projects. Furthermore, slack resources available during project development significantly increases forward-looking search's impact on innovativeness.

We contribute to literature on search and innovation management in several ways. First, we provide a multi-dimensional measure of forward-looking search that can be applied to project-level

research. Second, we provide a complimentary view on existing research that focuses on the selection and initiation of potentially future-successful innovations and show that project teams themselves *also* engage in forward-looking search during innovation projects. Third, we show that even while forward-looking search can positively impact innovation outcomes, potential constraints that can hamper this relationship have to be taken into account. Here, we find that room in project planning and additional slack resources are two important factors that allow forward-looking search to optimally affect innovation outcomes. We acknowledge that project planning as a project-level factor and slack resources as a firm-level factor can facilitate or hamper the relationship between forward-looking search and innovativeness. Organisational context should therefore be taken into account in future research on innovation projects. Lastly, we also contribute to more recent literature on practices employed during innovation projects that may lead to de-escalation of innovation projects. Forward-looking search can contribute to spotting relevant other opportunities that the project can potentially tap into to facilitate innovativeness even further. Likewise it can allow project teams to perceive when the current development of the project is deemed unsatisfactory in the project's future market. Our findings therefore add to case study research where such forward-looking mechanisms were found to occur at the organisational level within an NPD context (Sarangee *et al.* 2014), and provide empirical insights into the occurrence of such forward-looking mechanisms taking place at the project level as well. Literature on de-escalation may also benefit from taking a project's innovativeness into account as innovativeness is a major factor that contributes to the uncertainty surrounding a project. A managerial implication could therefore be that the more novel a project, the more project teams and managers could benefit from engaging in forward-looking search during development to avoid potential escalation of costs and risks.

The current research article is submitted for the annual ISPIIM conference to be held in Vienna, June 2017 and the annual Academy of Management conference (TIM division), to be held in Atlanta, August 2017.

## References

- Ansoff, H.I., 1975. Managing strategic surprise by response to weak signals. *California Management Review*, 18 (2), 21–33.
- Ansoff, H.I., 1980. Strategic Issue Management. *Strategic Management Journal*, 1 (2), 131–148.
- Argote, L. and Greve, H.R., 2007. ‘A Behavioral Years and Theory of the Firm’: 40 Years and Counting: Introduction and Impact. *Organization Science*, 18 (3), 337–349.
- Arrfelt, M., Wiseman, R.M., and Hult, G.T.M., 2013. Looking backward instead of forward: Aspiration-driven influences on the efficiency of the capital allocation process. *Academy of Management Journal*, 56 (4), 1081–1103.
- Barney, J., 1991. Firm Resources and Sustained Competitive Advantage. *Journal of Management*, 17 (1), 99–120.
- Becker, P., 2002. *Corporate foresight in Europe: a first overview*. Brussels: European Commission.
- Berger, G., 1959. L’attitude prospective. In: A. Gourmand and M. Lévy, eds. *Shaping the Future. Gaston Berger and the Concept of Prospective*.
- Blackman, D. a. and Henderson, S., 2004. How foresight creates unforeseen futures: the role of doubting. *Futures*, 36 (2), 253–266.
- Blank, S., 2013. Why the Lean Start-Up Changes Everything. *Harvard business review*, (May), 1–10.
- Boe-Lillegraven, S. and Monterde, S., 2015. Exploring the cognitive value of technology foresight: The case of the Cisco Technology Radar. *Technological Forecasting and Social Change*, 101, 62–82.
- Brown, S.L. and Eisenhardt, K.M., 1997. The Art of Continuous Change: Linking Complexity Theory and Time-Paced Evolution in Relentlessly Shifting Organizations. *Administrative Science Quarterly*, 42 (1), 1–34.
- Brown, S.L. and Eisenhardt, K.M., 1998. *Competing on the edge*. Boston, MA: Harvard Business School Press.
- Cattani, G., 2006. Technological pre-adaptation, speciation, and emergence of new technologies: How Corning invented and developed fiber optics. *Industrial and Corporate Change*, 15 (2), 285–318.
- Chen, W.R., 2008. Determinants of firms’ backward-and forward-looking R&D search behavior. *Organization Science*, 19 (4), 609–622.
- Chen, W.R. and Miller, K.D., 2007. Situational and institutional determinants of firms’ R&D search intensity. *Strategic Management Journal*, 28 (4), 368–381.
- Costanzo, L. a, 2004. Strategic foresight in a high-speed environment. *Futures*, 36 (2), 219–235.
- Courtney, H., 2001. *20/20 Foresight: Crafting Strategy in an Uncertain World*. Cambridge, MA: Harvard Business School Press.
- Csaszar, F.A. and Levinthal, D.A., 2016. Mental representation and the discovery of new strategies. *Strategic Management Journal*, 37 (10), 2031–2049.
- Cuhls, K., 2003. From forecasting to foresight processes?new participative foresight activities in Germany. *Journal of Forecasting*, 22 (2–3), 93–111.
- Cunha, M.P., Cunha, J.V. Da, and Clegg, S.R., 2009. Improvisational bricolage: A practice-based approach to strategy and foresight. In: L. a Costanzo and R.B. MacKay, eds. *Handbook of Research on Strategy and Foresight*. Edward Elgar Publishing, 182-.
- Cyert, R. and March, G., 1963. *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice Hall.
- Daft, R., Sormunen, J., and Parks, D., 1988. Chief executive scanning, environmental characteristics, and company performance: an empirical study. *Strategic Management Journal*, 9 (2), 123–139.
- Daft, R. and Weick, K., 1984. Toward a model of organizations as interpretation systems. *Academy*

- of Management Review*, 9 (2), 284–295.
- Dahlander, L., O’Mahony, S., and Gann, D.M., 2016. One foot in, one foot out: how does individuals’ external search breadth affect innovation outcomes? *Strategic Management Journal*, 37 (2), 280–302.
- Day, G. and Schoemaker, P., 2008. Are You a ‘Vigilant Leader’? *MIT Sloan Management Review*, 49 (3), 43–51.
- Day, G.S., 1994. The Capabilities of Market-Driven Organizations. *Journal of Marketing*, 58 (4), 37–52.
- Day, G.S. and Schoemaker, P.J.H., 2004. Driving Through the Fog: Managing at the Edge. *Long Range Planning*, 37 (2), 127–142.
- Day, G.S. and Schoemaker, P.J.H., 2005. Scanning the periphery. *Harvard Business Review*, 83 (11), 135–148.
- Dixit, J., Markovitch, D., and O’Brien, J., 2015. Do Increases in R&D Search Intensity Signal Future Problems? A Behavioral Theory Perspective. *Academy of Management Proceedings*, 2015 (1), 17030–17030.
- Duin, van der, P., 2016. *Foresight in Organizations: Methods and Tools*. New York: Routledge.
- Dutton, J.E. and Ottensmeyer, E., 1987. Strategic Issue Management Systems: Forms, Functions, and Contexts. *Academy of Management Review*, 12 (2), 355–365.
- European Commission, 2013. *EU R&D Scoreboard: The 2013 EU Industrial R&D Investment Scoreboard*. EUR 26211 EN, ISSN 1831-9424.
- Gavetti, G., 2012. Toward a Behavioral Theory of Strategy. *Organization Science*, 23 (1), 267–285.
- Gavetti, G., Greve, H.R., Levinthal, D.A., and Ocasio, W., 2012. The Behavioral Theory of the Firm: Assessment and Prospects. *The Academy of Management Annals*, 6 (1), 1–40.
- Gavetti, G. and Levinthal, D., 2000. Looking forward and looking backward: Cognitive and experiential search. *Administrative Science Quarterly*, 45 (1), 113–137.
- Gavetti, G. and Levinthal, D. a., 2004. The Strategy Field from the Perspective of Management Science: Divergent Strands and Possible Integration. *Management Science*, 50 (10), 1309–1318.
- Gavetti, G. and Menon, A., 2016. Evolution Cum Agency: Toward a Model of Strategic Foresight. *Strategy Science*, 1 (3), 207–233.
- Gephart, R.P., Topal, C., and Zhang, Z., 2010. Future-oriented Sensemaking: Temporalities and Institutional Legitimation. In: T. Hernes and S. Maitlis, eds. *Perspectives on Process, Sensemaking, and Organizing*. Oxford: Oxford University Press, 275–311.
- Gioia, D.A. and Patvardhan, S., 2013. PROSPECTING FOR THE FUTURE: How Do We Make Organization Theories Forward-Looking? *Academy of Management Proceedings*, 2013 (1), 11662–11662.
- Gordon, T.J. and Hayward, H., 1968. Initial experiments with the cross impact matrix method of forecasting. *Futures*, 1 (2), 100–116.
- Greve, H.R., 2003. A Behavioral Theory of R&D Expenditures and Innovations: Evidence from Shipbuilding. *Academy of Management Journal*, 46 (6), 685–702.
- Greve, H.R. and Taylor, A., 2000. Innovations as Catalysts for Organizational Change: Shifts in Organizational Cognition and Search. *Administrative Science Quarterly*, 45 (1), 54–80.
- Groenveld, P., 1997. Roadmapping integrates business and technology. *Research Technology Management*, 50 (6), 49–58.
- Hambrick, D.C., 1982. Environmental Scanning and Organizational Strategy. *Strategic Management Journal*, 3 (2), 159–174.
- Hamel, G. and Prahalad, C., 1994. *Competing for the future*. Harvard business review. Boston: Harvard Business School Press.
- Van Der Heijden, K., 1996. *Scenarios: The Art of Strategic Conversation*. Chichester: John Wiley & Sons Ltd.
- Heuschneider, S. and Herstatt, C., 2016. *External search for exploration of future discontinuities and*

- trends: Implications from the literature using co-citation and content analysis.* Hamburg, No. 92.
- Horton, A., 1999. A simple guide to successful foresight. *foresight*, 1 (1).
- Horváth, A. and Enkel, E., 2014. When general recommendations fail: How to search in single innovation project settings. *R and D Management*, 409–426.
- Jain, S., 1984. Environmental scanning in US corporations. *Long Range Planning*, 17 (2), 117–128.
- Kaplan, S. and Orlikowski, W.J., 2013. Temporal Work in Strategy Making. *Organization Science*, 24 (4), 965–995.
- Katila, R. and Ahuja, G., 2002. Something Old, Something New: a Longitudinal Study of Search Behavior and New Product Introduction. *Academy of Management Journal*, 45 (6), 1183–1194.
- Kester, L., Hultink, E.J., and Griffin, A., 2014. An Empirical Investigation of the Antecedents and Outcomes of NPD Portfolio Success. *Journal of Product Innovation Management*, 31 (6), 1199–1213.
- Kim, S.K., Arthurs, J.D., Sahaym, A., and Cullen, J.B., 2013. Search behavior of the diversified firm: The impact of fit on innovation. *Strategic Management Journal*, 34 (8), 999–1009.
- Kleinschmidt, E.J. and Cooper, R.G., 1991. The impact of product innovativeness on performance. *Journal of Product Innovation Management*, 8 (4), 240–251.
- Kock, A. and Gemünden, H.G., 2016. Antecedents to Decision-Making Quality and Agility in Innovation Portfolio Management. *Journal of Product Innovation Management*, 0 (0), 670–686.
- Kock, A., Heising, W., and Gemünden, H.G., 2015. How Ideation Portfolio Management Influences Front-End Success. *Journal of Product Innovation Management*, 32 (4), 539–555.
- Kock, A., Heising, W., and Gemünden, H.G., 2016. A Contingency Approach on the Impact of Front-End Success on Project Portfolio Success. *Project Management Journal*, 47 (2), 115–129.
- Krishnan, V. and Bhattacharya, S., 2002. Technology Selection and Commitment in New Product Development: The Role of Uncertainty and Design Flexibility. *Management Science*, 48 (3), 313–327.
- Laursen, K. and Salter, A., 2006. Open for innovation: the role of openness in explaining innovation performance among U.K. manufacturing firms. *Strategic Management Journal*, 27 (2), 131–150.
- Leiponen, A. and Helfat, C.E., 2010. Innovation objectives, knowledge sources, and the benefits of breadth. *Strategic Management Journal*, 31 (2), 224–236.
- Levinthal, D. a. and March, J.G., 1993. The myopia of learning. *Strategic Management Journal*, 14, 95–112.
- Levinthal, D. and March, J.G., 1981. A model of adaptive organizational search. *Journal of Economic Behavior & Organization*, 2 (4), 307–333.
- Li, Q., Maggitti, P.G., Smith, K.G., Tesluk, P.E., and Katila, R., 2013. Top management attention to innovation: The role of search selection and intensity in new product introductions. *Academy of Management Journal*, 56 (3), 893–916.
- Maggitti, P.G., Smith, K.G., and Katila, R., 2013. The complex search process of invention. *Research Policy*, 42 (1), 90–100.
- Maitlis, S. and Christianson, M., 2014. Sensemaking in Organizations: Taking Stock and Moving Forward. *The Academy of Management Annals*, 8 (1), 57–125.
- March, J.G., 1991. Exploration and Exploitation in Organizational Learning. *Organization Science*, 2 (1), 71–87.
- Mintzberg, H., 1990. the Design School: Reconsidering the Basic Premises of Strategic Management. *Strategic Management Journal*, 11 (3), 171–195.
- Narayanan, V.K., Zane, L.J., and Kemmerer, B., 2011. The Cognitive Perspective in Strategy: An Integrative Review. *Journal of Management*, 37 (1), 305–351.
- Nelson, R.R. and Winter, S.G., 1982. *An Evolutionary Theory of Economic Change*. Cambridge, MA: Harvard University Press.

- Nelson, R.R. and Winter, S.G., 2002. Evolutionary Theorizing in Economics. *Journal of Economic Perspectives*, 16 (2), 23–46.
- Osterwalder, A. and Pigneur, Y., 2010. *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*. A handbook for visionaries, game changers, and challengers.
- Rank, J., Natalie, B., Georg, H., Unger, B.N., and Gemünden, H.G., 2015. Preparedness for the future in project portfolio management: The roles of proactiveness, riskiness and willingness to cannibalize. *Journal of Project Management*, 1–38.
- Reid, S.E. and de Brentani, U., 2010. Market Vision and Market Visioning Competence: Impact on Early Performance for Radically New, High-Tech Products. *Journal of Product Innovation Management*, 27 (4), 500–518.
- Reid, S.E. and De Brentani, U., 2004. The fuzzy front end of new product development for discontinuous innovations: A theoretical model. *Journal of Product Innovation Management*, 21 (3), 170–184.
- Reid, S.E. and De Brentani, U., 2012. Market vision and the front end of NPD for radical innovation: The impact of moderating effects. *Journal of Product Innovation Management*, 29, 124–139.
- Reid, S.E. and De Brentani, U., 2015. Building a measurement model for market visioning competence and its proposed antecedents: Organizational encouragement of divergent thinking, divergent thinking attitudes, and ideational behavior. *Journal of Product Innovation Management*, 32 (2), 243–262.
- Rohrbeck, R., 2010. Corporate foresight: towards a maturity model for the future orientation of a firm. Berlin: Springer-Verlag.
- Rohrbeck, R. and Bade, M., 2012. Environmental scanning, futures research, strategic foresight and organizational future orientation: a review, integration, and future research directions. In: *ISPIM Annual Conference 2012*.
- Rohrbeck, R., Battistella, C., and Huizingh, E., 2015. Corporate foresight: An emerging field with a rich tradition. *Technological Forecasting and Social Change*, 101, 1–9.
- Rohrbeck, R. and Gemünden, H.G., 2011. Corporate foresight: Its three roles in enhancing the innovation capacity of a firm. *Technological Forecasting and Social Change*, 78 (2), 231–243.
- Rohrbeck, R. and Schwarz, J.O., 2013. The value contribution of strategic foresight: Insights from an empirical study of large European companies. *Technological Forecasting and Social Change*, 80 (8), 1593–1606.
- Rosenkopf, L. and Nerkar, A., 2001. Beyond local search: Boundary-spanning, exploration, and impact in the optical disk industry. *Strategic Management Journal*, 22 (4), 287–306.
- Salomo, S., Weise, J., and Gemünden, H.G., 2007. NPD Planning Activities and Innovation Performance: The Mediating Role of Process Management and the Moderating Effect of Product Innovativeness. *Journal of Product Innovation Management*, 24 (4), 285–302.
- Sarangee, K.R., Woolley, J.L., Schmidt, J.B., and Long, E., 2014. De-escalation mechanisms in high-technology product innovation. *Journal of Product Innovation Management*, 31 (5), 1023–1038.
- Schoemaker, P. and Day, G., 2009. How to make sense of weak signals. *MIT Sloan Management Review*, 50 (3), 81–88.
- Seidl, D., 2004. The Concept of ‘Weak Signals’ Revisited: A Re-description From a Constructivist Perspective. In: H. Tsoukas and J. Shepherd, eds. *Managing the Future: Foresight in the Knowledge Economy*. Oxford: Blackwell, 151–168.
- Simon, H.A., 1947. *Administrative Behavior: A Study of Decision-making Processes in Administrative Organizations*. 4th ed. New York: The Free Press.
- Simonse, L.W.L., Hultink, E.J., and Buijs, J.A., 2015. Innovation Roadmapping: Building Concepts from Practitioners’ Insights. *Journal of Product Innovation Management*, 32 (6), 904–924.
- Tripsas, M. and Gavetti, G., 2000. Capabilities, cognition, and inertia: evidence from digital imaging. *Strategic Management Journal*, 21 (10), 1147–1161.
- Troilo, G., De Luca, L.M., and Atuahene-Gima, K., 2014. More innovation with less? A strategic

- contingency view of slack resources, information search, and radical innovation. *Journal of Product Innovation Management*, 31 (2), 259–277.
- Tsoukas, H. and Shepherd, J., 2004. *Managing the Future: Foresight in the Knowledge Economy*. Oxford: Blackwell.
- Tversky, A., Kahneman, D., Krantz, D., and Rahin, M., 1991. Loss Aversion in Riskless Choice: A Reference-Dependent Model. *Quarterly Journal of Economics*, 106 (4), 1039–1061.
- Vecchiato, R., 2015. Creating value through foresight: First mover advantages and strategic agility. *Technological Forecasting and Social Change*, 101, 25–36.
- Voros, J., 2003. A generic foresight process framework. *Foresight*, 5 (3), 10–21.
- Wack, P., 1985. Scenarios: Shooting the Rapids: How Medium-Term Analysis Illuminated the Power of Scenarios for Shell Management. *Harvard business review*, (November-December), 139–151.
- Weick, K.E., 1995. *Sensemaking in Organizations*. Thousand Oaks, CA: Sage.
- Winter, S.G., 2012. Purpose and progress in the theory of strategy: comments on Gavetti. *Organization Science*, 23 (1), 288–297.
- Yadav, M., Prabhu, J., and Chandy, R., 2007. Managing the future: CEO attention and innovation outcomes. *Journal of Marketing*, 71 (4), 84–101.

# Why do firms engage in forward-looking search? Internal and external determinants<sup>1</sup>

Tymen Jissink<sup>a</sup>, Eelko K.R.E. Huizingh<sup>b</sup>, René Rohrbeck<sup>a</sup>

<sup>a</sup> Aarhus University, School of Business and Social Sciences, department of Management, Aarhus, Denmark

<sup>b</sup> University of Groningen, faculty of Economics and Business, department of Strategic Innovation Management, Groningen, Netherlands.

## ABSTRACT

This study examines to which extent firm- internal search determinants (*performance below aspiration, performance expectations, and slack resources*) and external search determinants (*market turbulence, technological turbulence, and competitive intensity*) predict a firm's engagement in forward-looking search. We draw our empirical frame from recent propositions of the behavioural theory of the firm, prospect theory, and contingency theory. We surveyed 108 firms in 2013-2014 about their forward-looking search practices and the state of their environment and combined this with past performance data three years prior to our survey. We find that firms having performed below aspirations are less likely to engage in forward-looking search, suggesting that forward-looking search is not a form of problemistic search. The same holds true for firms operating under intense competitive situations. In contrast, firms operating in increasingly technological turbulent environments, that have abundant slack resources, and expecting to outperform in the near future are engaging more in forward-looking search. We also find interaction effects between slack resources and environmental characteristics. Firms with a high level of slack resources increasingly engage in forward-looking search if they are in technologically turbulent environments or competitive intense situations. Conversely, firms with a low levels of slack resources engage to an even lower extent in forward-looking search, if they operate in high-competitive-intensity environments. Our findings carry important considerations for predicting a firm's engagement in forward-looking search and bring forward the notion that certain firms cannot pay attention to more distant courses of action as their environment or resource endowments do not allow them to do so.

**Keywords:** *Forward-looking search, behavioural theory of the firm, prospect theory, performance feedback, slack resources, performance expectations, environmental characteristics.*

---

<sup>1</sup> Earlier versions were submitted and presented at the annual ISPIM conference in Dublin, Ireland, June 2014 by the first author; annual Asia-Pacific ISPIM conference in December 2017 by the first co-author.

## 2.1 Introduction

In recent years, research has started to increasingly criticise the ‘backward-looking’ decision-model that works on the premises of a behavioural theory of the firm (Gavetti *et al.* 2012, Gavetti and Menon 2016). To counteract the ‘backward-looking’ focus of the field of strategy researchers advocate for more ‘forward-looking’ decision models to create a fuller understanding of pursuing more distant and uncertain benefits (Gavetti *et al.* 2012). At the centre of this forward-looking premise is how alternatives are searched for and evaluated (Gavetti and Levinthal 2000). The search and assessment of alternatives happens "*off-line*" where actors do not need to engage in real actions or activities to evaluate them by means of experimentation and implementation. The latter would be the case in the backward-looking logic, where alternatives are searched for and assessed based on experiential learning<sup>2</sup>. In the forward-looking model, alternatives are evaluated by using a current understanding and information on what alternatives may be considered, and the implications on current and future courses of action (Gavetti and Levinthal 2000, Gavetti and Menon 2016). In essence, forward-looking is one step ahead of actual organizational actions and behaviours (Lord *et al.* 2014).

However, existing literature on organisational search is largely silent on the process of search and how this may lead to seeing distant alternative courses of action and also foresee its consequences (Gavetti *et al.* 2012). Rather, firm’s search behaviour is depicted as evolutionary, incremental, and learning-based (Cyert and March 1963, Gavetti *et al.* 2012). It sees actors as inherently boundedly rational, incapable of foreseeing distant futures and foreseeing consequences of alternative courses of action (Simon 1947, Gavetti *et al.* 2012). At the extreme, this form of search implies that only one alternative at a time may be explored, when alternatives are explored sequentially. In contrast, forward-looking search may invoke a broad set of alternative actions based on a much larger set of factors, including technologies, capabilities, and market situations (Winter 2012). More recent research also

---

<sup>2</sup> Backward-looking evaluation refer to the evaluation of alternative choices based on the knowledge generated on the link between action and outcomes of prior actions taken (Gavetti and Levinthal 2000).

shows that strategists who are able to perform this distant form of search, explore alternative courses of action, and potentially foresee its consequences may lead their firm to perform better in the future (Gavetti and Levinthal 2000, Gavetti and Rivkin 2007, Gavetti 2012, Csaszar and Levinthal 2016, Gavetti and Menon 2016). Yet, much of this research takes on a cognitive search perspective wherein ‘lonely’ strategists are able to identify a superior new course of action and have the ability to foresee its consequences. Little attention is paid to potential practices that may facilitate such a search process.

Literature on strategic foresight posits that organizations have to engage in practices aimed at perceiving and making sense of information which in some way or another may point at future problems or opportunities (Tsoukas and Shepherd 2004). It may be essential to firm performance and survival; not only to avert potential threats under conditions of environmental volatility and turbulence (Brown and Eisenhardt 1997, Gavetti and Levinthal 2000, Tsoukas and Shepherd 2004), but also to be able to identify more distant opportunities which can bring superior performance (Hamel and Prahalad 1994, Gavetti and Levinthal 2000, Day and Schoemaker 2005, Schoemaker and Day 2009). There is a range of practices available to individuals, groups of individuals, or even firms to facilitate the detection of external signals, interpret and create alternative future scenarios, and examine what kind of implications this may have for the current business. Therefore, in an attempt to bridge both organisational search literature and strategic foresight literatures, we introduce and refer to forward-looking search as *the practices of collecting, examining and evaluating new information to derive alternative future courses of action and anticipate their consequences to the end of forming shared representations that raise the likelihood of enacting actions*.

Yet, why and when do firms find themselves wanting to consider such a broader range of factors? Hamel and Prahalad (1994) already posited the notion that firms have to be more forward-looking in order to be market leaders in market of the future. Yet, they find only 3% of CEOs time devoted to exploring the future. Similarly, Day and Schoemaker (2008) find only 23% of the CEOs actively searching for potential signals in their external environment. Scholars also still debate about how to

define the value added of forward-looking search and to provide empirical evidence for this (Vecchiato 2012a, p. 784). The question of when and why firms are more forward-looking has received much less attention in literature, yet the notion that firms *have* to engage in it seems to be pervasive over the last two decades. Such research could further our understanding by showing that firms may not always need or want to engage in forward-looking search. In order to do so, we draw on the existing well established behavioral theory of the firm that depict how firms search (e.g. Cyert and March 1963, Greve 2003a, Chen 2008) which sees firm's engaging in search behaviours mainly because of failures to attain performance aspirations or as a function of having abundant (slack) resources. On the other hand, strategic foresight literatures have predominantly advocated that the external environment necessitates firms to engage in forward-looking search, such as dynamic, volatile, or competitive intense situations (e.g. Makridakis 2004, Tsoukas and Shepherd 2004, Day and Schoemaker 2005, Schoemaker and Day 2009, Vecchiato 2015). Yet, both literature streams have rarely incorporated each other's propositions. This may be particularly beneficial to further our understanding why firms do, or why they do not engage in forward-looking search, as these literature stream seems to focus on either internal performance differentials or external environmental characteristics as necessary conditions to engage in search behaviours.

Therefore, in our study, we focus on performance and resources as 'internal' drivers of search and environmental characteristics as 'external' drivers of search. Cyert and March's (1963) behavioural theory of the firm suggests that in a situation of performance decline (a backward-looking performance trigger), firms engage in *problemistic* search that is myopic in both cognitive and temporal terms. In this sense, one would expect that firms do not engage in forward-looking search when they find themselves in a position of negative performance feedback. Indeed, prior studies find that problemistic search is more focused on learning-by-doing and the evaluation of those actions (Brown and Eisenhardt 1997, Katila and Ahuja 2002, Greve 2003a, 2003b, Maggitti *et al.* 2013). Yet, some indications from foresight literatures posit the exact opposite; situations of performance decline

trigger firms to explore alternative future paths (e.g. Amsteus 2011, 2014). A seemingly stark contrast which warrants further investigation. However, given that forward-looking search involves evaluating a much larger set of alternatives to be considered, Cyert and March's (1963) *slack search* argument may explain why firms would engage in forward-looking search. Firms may permit themselves to explore and search – *slack search* – for alternative courses of action and solutions, using their excess resources. These courses of action are not necessarily myopic; the future may be taken into account to a greater extent and signals a firm's ability to engage in and to act on forward-looking. Consideration of future alternatives may call for non-sequential actions, i.e. firm actions taken in hope of catalysing to something fruitful in the future that may be done in parallel to the current way doing business. As such, firms may be more forward-looking when they have slack resources to deploy, rather than from a *problemistic* point of view where the firm chooses to respond to declining performance. However, research to date has not sought to explore or provide evidence on the relationships between performance feedback and slack resources with forward-looking search.

The environment can also influence the extent to which firms engage in forward-looking search. While strategic foresight literatures have rarely investigated performance or resource considerations, they suggest that firms must engage in forward-looking search because of an uncertain and dynamic environment calls for such an approach. In other words, a contingency perspective on forward-looking search. It is argued that the pay-off of forward-looking search would be larger in such environments where it functions to understanding how the future may develop and what the consequences of alternative courses of action could be (e.g. Costanzo 2004, Makridakis 2004, Day and Schoemaker 2005, Vecchiato 2012a, 2015). Again, similarly here we find a stark contrast with established organisational behaviour theories. The behavioural theory of the firm postulates that managers wish to avoid the uncertainty that unpredictable and turbulent environments bring about. Therefore, decision-makers rather avoid trying to anticipate future projections and consequences of alternative courses of action in uncertain, dynamic environments. Given these countervailing arguments it is unclear whether

firms engage more heavily in forward-looking search in turbulent environments. Will they engage in forward-looking search to reduce uncertainty in dynamic and turbulent environments? These questions are also addressed in Chen's (2008) call for research on whether firms prefer a more forward-looking or backward-looking decision-making approach in contingent situations such as environmental turbulence. We attempt to fill this gap by investigating how a variety of environmental forces affect the need for forward-looking search.

The effects of both groups of determinants to forward-looking search – 1) performance and resource considerations, and 2) environmental forces – may be related to each other, as recent research argues that slack search is contingent on environmental turbulence (George 2005, Voss *et al.* 2008). In essence, it would constitute a cross-fertilization between the behavioural theories of the firm and propositions from strategic foresight literatures. It is argued that firms with more slack resources perceive greater value in expanding their business rather than being risk-averse and protecting their stock of slack resources to ensure long-term survival in turbulent environments (Voss *et al.*, 2008). In doing so, they may engage to greater extents in forward-looking search to identify alternative distant courses of action. Therefore, we propose and test the interaction between slack resources and environmental factors.

To summarize, the aim of this study is to determine which factors influence firm engagement in forward-looking search by considering performance and resource considerations suggested by the behavioural theory of the firm (Cyert and March 1963), various environmental forces as the main determinant put forward by strategic foresight literatures, as well as the interaction between slack resources and environmental forces. Our contributions are threefold. First, we add to the organisational search literature that search in a forward-looking manner occurs to differing degrees through the use of practices (rather than only in a cognitive manner), and provide evidence on firm's engagement (or non-engagement) in forward-looking search driven by internal determinants postulated by the behavioural theory of the firm. Second, by testing the axiomatic notion of foresight literature that the

external environment drives firm's engagement in forward-looking search, we show that specific elements of a firm's environment increases firm's engagement in forward-looking search. Highly turbulent or competitive intense situations can lead firms to shift attention away from searching for information and determining likely futures. Third, we show that while internal and external determinants have independent effects on forward-looking search, their interaction is considered as well. Internal and external determinants can have profoundly different or even inverse effects on forward-looking search when thought of independently. We suggest that a firm's engagement in forward-looking search is dependent on its slack resources in relation to the environment. The interactions suggest a more holistic consideration of a firm's engagement forward-looking search as it attempts to combine two seemingly disparate literature streams; the behavioral theory of the firm and strategic foresight literatures.

## **2.2 Background**

### **2.2.1 Forward-looking search**

Information, or choice alternatives, do not naturally flow to actors, and thus must actively be searched for (Gavetti *et al.* 2012). Interestingly, because search draws on the learning foundation, research on organisational search has mostly focused on search methods based on experiential evaluation (Maggitti *et al.* 2013). More specifically, search has been framed as R&D investments (Chen 2008), product experimentation (Brown and Eisenhardt 1997), and innovation launches (Katila and Ahuja 2002). Here, search involves both the search of new information and the subsequent actions resulting from obtaining that new information, such as introducing new innovations or engaging in R&D. The firm's search activities are typically measured in terms of its own past behaviour, such as how new the search is relative to the search paths that the firm has tried before.

Gavetti and Levinthal (2000) propose that organizations need to build the ability to exercise forward-looking search. While search literature indeed recognizes the need to proactively search for new knowledge and information (Li *et al.* 2013), what seems absent is the search of information

pertaining to the location of future opportunities or threats (Heuschneider and Herstatt 2016). Such information may actually steer decision-making in a forward-looking manner related to R&D investments and innovations. Actors acquire information by following a cycle of environmental scanning, interpretation, and learning (Daft and Weick 1984). Actors may scan the environment and receive information about the actions of relevant others, such as customers, suppliers, competitors, and regulators. The assumption that 'information is out there' and that it can be found by firms through searching, can provide input into how the future may be (re)imagined (Day and Schoemaker 2005). This information can subsequently be interpreted using their own cognitive representations (Greve and Taylor 2000). It is the interpretation and meaning-making of issues or opportunities from weak signals (Dutton and Ottensmeyer 1987). Interpretations of the future allow decision-makers to anticipate, in approximate terms, the longer-term implications of (alternative courses) of action (Gavetti *et al.* 2012). The processes of searching and identifying signals from the environment are dependent on one's interpretation, rather than that such signals are a direct representation of the world (Seidl 2004). The signals can be interpreted to avoid strategic surprises (Ansoff 1980), or as new opportunities (Hamel and Prahalad 1994). Learning is done through determining future actions based on the interpretation of the information received, which may entail either continuing current activities, or by initiating a change to current activities (March 1991).

Research dealing with environmental signals pertaining to the future has often been labelled as 'strategic foresight' and 'corporate foresight'. This research discusses the processes by which organizations obtain information about the future and the organizational configurations that may enhance the ability to harvest and effectively use future-related information. Typical approaches to create interpretations of the future include identification of influencing factors that present a given business environment and how they interact (Gordon and Hayward 1968), forecasting (Cuhls 2003), development of probable future projections on the basis of scenarios (Wack 1985, Van Der Heijden 1996) and roadmaps (Groenveld 1997), and the development of courses of action based on these

insights (Tsoukas and Shepherd 2004). The studies in this field tend to be strongly practice based, and deal less with theoretical underpinnings.

## **2.3 Theory and Hypotheses**

What drives forward-looking search? Based on various literature streams, we develop a series of hypotheses that are then tested in a field study. We start by discussing various internal determinants which build on the well-established behavioural theory of the firm and prospect theory. First, drawing on the search argument of the behavioural theory of the firm, performance feedback can act as a trigger for search that allows firms to decide on what actions to take (Gavetti *et al.* 2012). Second, following the slack search argument from the behavioural theory of the firm, we focus on the distinct role of slack resources as a determinant for forward-looking search. Third, we consider performance expectations as a potential determinant of forward-looking search where we introduce prospect theory.

Second, we consider the external environment as a determinant of forward-looking search. Drawing on contingency theory, we posit that forward-looking search is a function of a firm's external environmental characteristics. Firms frequently face new stimuli that inject uncertainty into the future consequences of current or alternative actions (Greve and Taylor 2000) and therefore should engage in forward-looking search (e.g. Gavetti and Levinthal 2000, Costanzo 2004, Makridakis 2004, Vecchiato 2012b). Following Zhou *et al.* (2005), we distinguish three fundamental characteristics of a firm's environment; market turbulence, technological turbulence, and competitive intensity.

Last, we introduce the interaction between slack resources and environmental factors as determinants to forward-looking search. We draw on recent findings suggesting that slack resources alleviate the inability to take on a more forward-looking perspective when operating in stringent environmental conditions (Miller *et al.* 1996, Audia and Greve 2006, Voss *et al.* 2008).

### **2.3.1 Past performance, slack resources, and performance expectations**

*Performance below aspiration.* Most organizations engage in an ongoing process of evaluating the

past as the basis for deciding on actions to take in the present. While in the behavioural theory of the firm anticipation of distant futures and the consequences of distant courses of actions is largely absent, it does not prevent decision-makers from coarsely foreseeing under the bounded rationality assumption (Gavetti *et al.* 2012). First, in Cyert and March's (1963) problemistic search, organizations use simplified rules to adapt behaviour in response to performance; past performance provides firms an indication of how well they are doing and whether they need to search for alternatives courses of action and make changes accordingly (Chen 2008, p. 610). However, this type of search is built on the backward-looking logic of decision-making, which is typically myopic (both cognitive and temporal) as organizations seek to adjust their behaviour without a great deal of reference to the future (Levinthal and March 1993). The greater the difference between an aspired level of performance and a firm's current performance, the more likely it is to engage in search processes aimed at efficiency optimization and short-term fixes (Cyert and March 1963, Levinthal and March 1981). As such, the greater the difference between aspiration and actual performance, the lesser a firm's engagement in forward-looking search. Therefore, we assume the following hypothesis:

*Hypothesis 1A: The greater firm performance is below aspiration levels, the lesser the firm engages forward-looking search.*

However, there are also some indications that negative performance can lead to processes of forward-looking search. For instance, Gavetti and Levinthal (2000) posit that performance below industry population may trigger 'forward-looking search', and thus in essence is analogous to problemistic search, it provides a countervailing argument for when firms engage in forward-looking search. Similarly, Kaplan and Orlikowski (2013) show that sudden negative performance changes (e.g. when established strategies no longer fit the changes in the external environment) lead to activities of forward-looking search. Performance feedback may thus trigger processes leading to shifts in mental models (Weick 1995, Gavetti and Levinthal 2000, Greve and Taylor 2000). This suggests that disappointing past performance may induce forward-looking search.

Thus, there is no consensus whether firms engage in forward-looking search based on performance feedback. Therefore, it leads to the question of whether forward-looking search may represent a form of problemistic search. As such, we introduce a countervailing hypothesis to that of hypothesis 1A:

*Hypothesis 1B: The greater firm performance is below aspiration levels, the more the firm engages forward-looking search.*

*Slack resources.* Cyert and March (1963) also posit that firms may engage in slack search which is not necessarily driven by ‘a problem’ (i.e. performance falling below aspiration levels). Rather, slack search is when a firm engages in both information search and actions that may facilitate adaptation to future environmental changes that may not necessarily be recognized as necessary in the short term (Chen 2008). Slack resources – excess inputs such as underutilized capacity, facilities, or labour and financial reserves like working capital or borrowing capacity (Levinthal and March 1981) – allow firms to adapt to complex competitive landscapes (Levinthal 1997). Such resources allows for flexibility to decide on a course of action when trying to adapt to environmental changes (Thompson 1967, George 2005). Firms with more slack resources are more likely to have freedom in their response to competitor strategies, as well as become more proactive in their strategic choices (George 2005). Therefore, firms with more slack resources may engage in more exploratory behaviour to secure long-term survival, and may therefore engage to higher degrees in forward-looking search (Troilo *et al.* 2014).

Additionally, prior research has focused on ‘absolute’ levels of slack resources (relative to other firm’s levels), rather than acknowledging patterns in the generation and deployment of slack resources (Levinthal and March 1981, Gavetti and Levinthal 2000, Greve 2003a). Limited research to date has acknowledged the importance of considering slack resources over time relative to the firm’s demand. Following George (2005), we suggest that the pattern of an organization’s slack resource generation and deployment provides additional arguments for its effect on forward-looking search. Over a period

of time, firms may notice that their demand for resources outweigh that of the generation of slack resources, such as in growth-oriented firms, and therefore may formulate new strategic choices in rather different ways (George 2005). In such situations, decision-makers will perceive themselves to be more resource constraint. Therefore, such firms become much more efficiency oriented, not only in the deployment of their resources but also in searching for formulating their strategic choices (Starr and Macmillan 1990, George 2005). In contrast, firms where slack resources are building up over time (i.e. the availability of slack resources exceeds that of the operational demands) may become more proactive in formulating their strategic choices (George 2005, p. 664). In doing so, firms may be able to devote ‘time’ and ‘attention’ towards exploring more distant courses of action, as slack resources insulate them to some extent from current pressing business matters (Ocasio 2011, Csaszar and Levinthal 2016).

Slack resources influence managerial choice; they stimulate thinking towards the more distant and therefore may influence a firm’s engagement in forward-looking search. We therefore hypothesize:

*Hypothesis 2: The more positive the slack resources generation pattern, the more the firm engages in forward-looking search.*

*Performance expectations.* In the behavioural theory of the firm, actors make performance expectations by comparing performance in a future environment with the status quo. However, these expectations are rather limited and rely mostly on simple pattern-recognition (Cyert and March 1963, p. 163). Only global expectations are formed in the initial phases of a decision process, thereby rejecting most alternatives (Gavetti *et al.* 2012) and therefore potentially neglecting alternative future projections. Prospect theory (Tversky and Kahneman 1991) suggests that decision-making is affected by framing a future state compared to the status quo as ‘likely gains’ or ‘likely losses’. Actors tend to be risk- and uncertainty averse when the future is framed as ‘likely gains’, whereas tend to be risk-seeking when the future is framed as ‘likely losses’ (Tversky and Kahneman 1991). Forward-looking

search can be thought of as an uncertainty-reduction mechanism (Vecchiato 2012a), ultimately to limit potential risks. Through systematically exploring new potential future courses of action and their future prospects before making substantial investments may alleviate potential investment risks. Similarly, forward-looking search may identify potential future threats that may negatively affect future firm performance. As forward-looking search can be a precursor of firm behaviour, firms that expect to outperform themselves in the near future may be more risk-averse and therefore rely more on exploring potential future alternatives to alleviate future uncertainties and risks. As such, we hypothesize:

*Hypothesis 3: Firm's whose performance expectations exceed that of the status quo engage more in forward-looking search.*

### **2.3.2 Environmental considerations**

Stimuli from a firm's external environment can continuously inject uncertainty into the future consequences of a firm's current actions or alternative actions (Cyert and March 1963, Greve and Taylor 2000). Such stimuli can result from turbulence in the firm's external environment, where turbulence refers to the frequency of new stimuli presented to managers. Contingency theory suggests that the appropriate organizational structure and management style depend on a set of "contingency" factors (Tosi and Slocum 1984) and depends on the nature of the firm's task environment. Literature on foresight has predominantly advocated the utility forward-looking under these uncertain and dynamic environmental conditions (e.g. Courtney 2001, Costanzo 2004, Cunha *et al.* 2009, Vecchiato and Roveda 2010, Vecchiato 2012, Peter and Jarratt 2014). Therefore, the degree of stability of the environment in which the firm operates may have an important effect on a firm's engagement in forward-looking search.

We therefore explore if certain environmental dynamics impact the extent to which a firm engages in forward-looking search. We follow Zhou et al's (2005) and distinguish between market turbulence, technological turbulence, and competitive intensity.

*Market turbulence.* In highly turbulent markets customer preferences and expectations shift rapidly in an unstable way (Zhou *et al.* 2005). Identifying potential future customer needs and preferences becomes increasingly difficult, as well as predicting or projecting on current customer preferences into the future (Wind and Mahajan 1997, Zhou *et al.* 2005). Identifying customer preference trajectories is difficult as many customer's preferences are latent, these are preferences that customers seemingly have but do not surface until they are triggered by some form of newly introduced innovation in the market (Howells 1997, Paap and Katz 2004). Furthermore, because customers are inherently short-sighted, focusing highly on a current customer base may risk the firm to lose valuable foresight in an attempt to serve existing customer's needs (Hamel and Prahalad 1994, Zhou *et al.* 2005). Focusing on current customers and current market demands does not inform by which mechanism shifts in supply or demand curves change, or that they are even knowable (Howells 1997). In the case of rapidly shifting customer preferences or needs, firms usually engage in the matching of established patterns of user needs and incorporate these established patterns into an 'intended' use of a new offering introduced by the firm (Howells 1997, Paap and Katz 2004). Such a matching process is inherently backward-looking. Given the difficulty in identifying future customer preferences and the inherent short-sightedness of customers, it is unlikely that only a highly turbulent market would entice firms to increasingly engage in forward-looking search but instead rather satisfice on changing market conditions with a backward-looking sensibility. As such, we hypothesize:

*Hypothesis 4A: Higher degrees of market turbulence lessens a firm's engagement in forward-looking search.*

*Technological turbulence.* In industries with rapid changes in technologies and advancements in technological developments, firms face issues such as shortened product life cycles and the introduction of new technologies that could affect competitive advantages (Tushman and Anderson 1986). Firms operating in technological turbulent environments emphasize R&D to a higher degree which allows them to "place bets on possible future opportunities" (Chen 2008). In contrast to

turbulent markets, technological trajectories are more easily identifiable and interpretable, making it easier to assess future states and consequences in terms of innovation dynamics and technology substitution (Paap and Katz 2004) or their impact on scale economies (Porter 1985, p. 171). Since technological developments can be better analysed in terms of technological trajectories and potential saturation points (Brenner 1996, Paap and Katz 2004), firms can more easily make sense of technological dynamics and their potential impacts. We therefore hypothesize:

*Hypothesis 4B: Higher degrees of technological turbulence increases a firm's engagement in forward-looking search.*

*Competitive intensity.* Competitive intensity increases with the degree to which a firm faces competition within its industry, and becomes manifest through price wars, heavy advertising, diverse product alternatives, and the introduction of added services (Porter 1980, Zhou *et al.* 2005). In situations of competitive intensity, competitor moves and innovations are closely monitored by the other firms in the same industry. Companies pay special attention to costs because of the threat of price wars (Porter 1985). Product introductions or specific marketing strategies by competitors may be perceived by others as profitable and adopted, based on limited effectiveness information (Greve 2003a). As a result of price pressures and close monitoring of competitor innovations, mimetic adoption becomes the obvious choice for firms to pursue (Day and Wensley 1988). Thus, in highly competitive intense situations, firm behaviours tend to be reactionary, for which the future needs to be explored to only a very limited extent. Given these arguments, we hypothesize:

*Hypothesis 4C: Higher degrees of competitive intensity lessens a firm's engagement in forward-looking search.*

### **2.3.3 Environmental considerations and slack resource patterns**

In the previous sections we have developed hypotheses about the impact of separate relevant factors. However, recent research calls for the joint consideration of slack resources and environmental

dynamics (George 2005, Voss *et al.* 2008). Therefore, this section discusses the potential interaction effects of slack resource on the three dimensions of environmental dynamics; market turbulence, technological turbulence, and competitive intensity.

According to hypothesis 4A, firms are less inclined to engage in forward-looking search when dealing with highly turbulent markets. While market turbulence can erode a firm's competitive advantage, prospect theory would posit that firms should be more risk-taking in such situations (Tversky and Kahneman 1991). However, while slack resources provide a firm some insulation of the potential performance eroding dangers associated with a turbulent market environment (Voss *et al.* 2008), the search for alternative distant course of action of a given turbulent market is neither increased nor diminished by slack resource availability. Rather, firms with slack resources likely still focus towards coping with a turbulent environment (Voss *et al.* 2008). Again, consideration of the future is less likely. Given these arguments, we expect that the availability of slack resources does not affect the hypothesized negative effect of market turbulence on forward-looking search:

*Hypothesis 5A: Slack resources neither enhance nor diminish the negative effect of market turbulence on forward-looking search.*

Hypothesis 4B postulates that firms will do more forward-looking search in technological turbulent environments. A technological turbulent environment can be characterized as opportunity-laden, as opportunities arise “that new technologies create to advance next-generation products” and “fast-changing technologies make breakthrough innovations more possible by changing the way the existing value chain works” (Zhou *et al.* 2005, p. 47). However, since we posited that forward-looking search is more prevalent in technological turbulent environments, the future opportunities arising from new technologies are likely to be seized by firms that have enhanced strength in R&D. In technological turbulent environments, firms are likely to engage in risky investments as the environment “heighten expectations of successful outcomes and promise greater control over the organization's situation” (Voss *et al.* 2008, p. 152). R&D is a risky investment and numerous studies have found it to be a

function of slack resources (e.g. Chen 2008; Greve 2003). Firms with large slack stocks perceive greater value in expanding rather than protecting their stock of slack resources to ensure long-term survival (Voss *et al.* 2008), indicating that such firms put more effort in longer-term prospect thinking. As such, we hypothesize that slack resources increase the (positive) effect of technological turbulence on the extent to which a firm is engaged in forward-looking search:

*Hypothesis 5B: Slack resources increase the positive effect of technological turbulence on forward-looking search.*

According to hypothesis 4C, forward-looking search is negatively associated with competitive intensity. For mimetic behaviour or competing on price and cost, anticipating future developments is less needed. However, when high amounts of slack resources are available, managers in competitive situations can perceive it as a guarantee of firm survival (March 1991, George 2005). It is therefore likely that regardless of the negative effect of competitive intensity on forward-looking search, the converse may hold true if high amounts of slack resources are available. Indeed, when facing constant threats, firms with large amounts of slack resources will view exploring new future avenues more desirable, as it leaves the firm's current strategic position (which is subject to fierce competition still) largely unaffected (Voss *et al.* 2008). Such firms may thus engage more in forward-looking search. It is therefore likely that the availability of slack resources negates the negative effect of competitive intensity on a firm's engagement in forward-looking search. As such, we hypothesize:

*Hypothesis 5C: Slack resources negate the negative effect of competitive intensity on forward-looking search.*

## **2.4 Data and measures**

### **2.4.1 Data**

The data we use in this paper are drawn from three major sources; 1) a cross-sectional survey distributed in 2013-2014, 2) Bureau van Dijk's ORBIS database which contains detailed operational

and financial information of both public and private companies worldwide, and 3) firm's annual reports. The survey data employed in this study originates from a larger multi-faceted survey which entailed questions on a wide variety organizational aspects. The survey data we employ in this study regards activities and practices of forward-looking search and how the environment is perceived on a range of aspects<sup>3</sup>. To assess the behavioural arguments in this study, we collected objective performance data for a time period of three years prior to the response year of the survey.

To ensure the wider applicability of the study's findings, the hypotheses are tested with a sample of European firms active in a variety of industrial sectors with a focus on innovation. We excluded firms that had not introduced at least three new products or services over the past five years. Our concern was that random sampling would provide us with insufficient variance in our study's dependent variable (i.e. mostly skewed to the right) as very few firms were found to engage in forward-looking search (Rohrbeck and Schwarz 2013). Therefore, we follow prior research which found greatly varying extents of search in the context of R&D (Chen 2008) and innovation (Brown and Eisenhardt 1997). Using a cross-industry sample also allowed us to sample firms that were facing widely varying environmental forces, as we posit it as one of the determinants of forward-looking search.

To build the sample, first, we randomly drew a sample of firms 300 firms from the European Commission Economics of Industrial Research and Innovation R&D top 1000 EU Scoreboard for identifying firms from a variety of industries in an R&D/innovation context (European Commission 2013). Multiple respondents were identified in senior managerial functions that could potentially facilitate forward-looking search depending on the respondent's firm type. For instance, in industrial companies, mainly managers from areas such as innovation and R&D management were targeted. Since we needed to verify the firm had introduced innovations in the past years, and this kind of information requires the direct contact of all firms and the cost of this process is very high, we initially

---

<sup>3</sup> The full survey includes measures additionally to those used in the current study of 1) organizational orientations (learning orientation, market orientation, technology orientation, and strategic posture), 2) innovation portfolio management practices, and 3) innovation performance.

extracted the random sample of 300 firms. Additionally, we contacted firms which had participated in an earlier study by the authors and other firm representatives whom the authors of this study have had contact (at conference presentations, interviews, or via social networks). Given our mixed sample approach, it is probable that the firms in this sample differ from the general population by having a higher interest in and sensitivity to the process of forward-looking search than the average firm does.

Phone and email contact was used to establish the suitability of the respondent for our survey and that the respondents were confident that they could accurately respond to the survey questions. We contacted 1030 potential respondents (corresponding to 522 unique firms). Typically, 2 reminders were sent out in case of non-response within a 4-week period. Potential concerns about common methods variance were in part decreased via the instrument development process which involved careful instrument design, with particular attention paid to question wording and sequence by means of complete randomization to reduce interconstruct correlations (Podsakoff *et al.* 2003).

We received 134 usable questionnaires, indicating a response rate of 13.1%, which is typical in this kind of study. However, a further 26 survey responses were unfortunately discarded due to our inability to obtain additional objective performance data for our 3-year timeframe prior to the survey collection using either the ORBIS database or annual reports. The total usable number of survey responses is therefore 108.

Our final sample includes mostly larger firms (More than 3000 employees = 75.9%) from the following primary SIC (1-digit) industries: manufacturing (55%), service industries (17%), transportation and public utilities (16%), and others (12%). Respondents are in most cases senior managers or directors of their respective areas. Respondents originate from varying functional areas; innovation and technology management (64%), strategy and business development (19%), CEO (7%), and others (10%). On average, 81% of their business activities take place abroad, which indicates that they are highly internationally oriented. Furthermore, 74% are predominantly B2B oriented, with 50% or higher share of their sales coming from B2B transactions.

#### 2.4.2 Common method bias and additional sample checks

Because surveys are prone to common method bias, we assessed the extent to which respondents accounted for explaining variance between our study's variables. Using a range of tests, first, we performed Harman's one-factor test on our self-reported items. We conduct a principal components analysis according to Harman's one-factor test, where all the indicators for our self-reported constructs (*forward-looking search*, *market turbulence*, *technological turbulence*, and *competitive intensity*) are simultaneously entered without rotation. The results of analysis show that the first factor is able to explain 27.2% of the variance, which is well below the 50% threshold, and reduces the possibility of common method variance being a concern (Podsakoff *et al.* 2003). Second, we find that the smallest correlation between our model's main variables from our survey data (e.g. the constructs of *forward-looking search*, *market turbulence*, *technological turbulence*, and *competitive intensity*) is  $r = -.03$  (e.g. the correlation between *forward-looking search* and *market turbulence*), which can be used as a proxy for common method bias. Given the low correlation, this finding does not suggest evidence for common method bias (Lindell and Brandt 2000).

We also assessed for nonresponse bias by dividing respondents into quarter tiles (1<sup>st</sup>; 0-12 days, 2<sup>nd</sup>; 12-20 days, 3<sup>rd</sup>; 20-34 days, 4<sup>th</sup>; 34 days till highest) based on the number of days till a survey response was completed. An ANOVA was conducted for our study's main variables. The ANOVA analyses showed no significant differences on any of the model's key self-reported variables and other descriptive variables (*firm-size*, *firm performance*). We also assessed whether there were significant differences in our objective performance measures. We find significant differences in our performance expectation measure. However, a further investigation shows that the differences exhibit no clear pattern as to why these occur within our response quartiles. Therefore, we find no clear indication of a potential response bias.

Furthermore, because our sample includes respondents from different functional areas and have different managerial responsibilities, we assessed whether managerial functions show difference in our

self-reported measures. We conducted an ANOVA analysis using the managerial function as grouping variable. Results of the one-way ANOVA tests showed no significance differences between the mean scores of our self-reported variables. Therefore managerial functions do not seem to explain additional variance of our study's self-reported items.

### **2.4.3 Variables**

We employ a mix of constructs based on survey measures, and a range of objective performance measures gathered independently. All of our survey measures are Likert-type items, measured using a 7-point Likert scale from 1 '*strongly disagree*' to 7 '*strongly agree*'.

#### ***Dependent Variable***

*Forward-looking search:* This variable measures the extent to which effort is being directed towards searching, interpretation, and disseminating information on relevant future threats or opportunities. Conceptualizing forward-looking search as a unidimensional construct, defined as *the practices of collecting, examining and evaluating new information to derive alternative future courses of action and anticipate their consequences to the end of forming shared representations that raise the likelihood of enacting the chosen course of action*, we formulated items 6 (see Table 2.1) that fit this operationalization. The items reflect the extent to which an organization is engaged in detecting future signals and trends (items 1 and 2; inspired by the concept of scanning in foresight literatures (e.g. Hambrick 1982, Horton 1999, Rohrbeck and Gemünden 2008)), interpreting these signals for future implications (items 3 and 4 inspired by interpretation processes of e.g. Horton (1999), Voros (2003), Oner and Gol (2007)), and the support for triggering subsequent organizational responses to future insights (items 5 and 6; inspired by Horton (1999) and Becker (2002)). Exploratory principal component analysis (PCA) was carried out which extracted a single factor for the 6 items with an eigenvalue of 1.0 as a cut-off value and explained 50.75% of the total variance. This indicates that forward-looking search is a unidimensional construct.

### ***Independent variables***

*Performance below aspiration.* We used return on assets (ROA) as a performance measure as ROA avoids distortions caused by differences in financial leverage across firms (Greve 2003a, Chen 2008). We follow Chen (2008), and model performance aspiration as an exponentially weighed moving average of past performances. As such, firm performance aspiration at time  $t-1$  is a weighted combination of the focal firm's performance at  $t-2$  with weight 0.6 and at  $t-3$  with weight 0.4. As the difference between past performance and performance aspiration is the main backward-looking determinant for search,  $performance < aspiration$  represents performance below aspiration level (i.e. zero and below). We applied a logarithmic transformation as the original calculated variable is skewed to the right.

*Performance expectation.* We use the limited accounting information available to the firm to predict its own short-term performance expectations. As firms develop performance targets based on historical time series of performance, we operationalized performance expectation as a one-year forecast ROA ( $t + 1$ ) as the predicted value by regressing on firm's past ROA from time  $t$  to  $t - 3$ . This measure follows in essence Tversky and Kahneman's (1991) prospect theory, which suggests that the status quo serves as a reference point for benchmarking performance.

*Slack resources.* Following previous research (Chen 2008), we used a composite of accounting data variables to create a proxy for slack resources. We used *current ratio* (current assets divided by current liabilities) to measure liquid resources uncommitted to liabilities to represent available slack, *working-capital-to-sales ratio* to capture the absorption of slack related to capital utilization to measure recoverable slack, and *equity-to-debt ratio*, which reflects the ability of further borrowing to represent potential slack. However, whereas a summed index of all three variables in standardized form would represent slack resources at a single point in time (Chen 2008), we want to account for slack resource generation patterns. Therefore, we build on George's (2005) concept of transient slack which

represents the excess resources available after resource demands for operations have been met. However, given that our data does not have such fine grained measures, we construct three proxy variables. For current ratio, working-capital-to-sales ratio, and equity-to-debt ratio, we calculate the slope of each variable over a period of 3 years ( $t - 1 \dots t - 3$ ). Then, these slope variables were standardized and summed into a general index of slack generation over the past three years. We summed these slopes as prior research argues that slack is a summated variable of multiple indicators, each distinctly adding towards an organization's slack resources (Chen and Miller 2007, Chen 2008). The measure thus reflects the accumulation of slack resources over the past three years, and provides a proxy whether the firm's slack accumulation has exceeded operational demands over the past three years.

*Market turbulence.* This construct measures the perceived turbulence in the market pertaining to customer preferences and demand uncertainty. We employed a two-item scale from Han *et al.* (1998)<sup>4</sup>.

*Technological turbulence.* We included the three-item measure from Citrin *et al.* (2007) to determine the extent of technological changes and turbulence in the firm's environment.

*Competitive intensity.* This construct measures to what extent the focal firm is pressured by competitor's offerings and pricing strategies. Two items from Zhou *et al.* (2005) and one item from Auh and Menguc (2005) were included to measure competitive intensity.

### ***Control Variables***

We include several control variables that may account for a firm's engagement in forward-looking search over and above our independent variables. Control variables that were retained include firm size, business scope, industry effects, typical NPD development cycle time, and a measure whether the

---

<sup>4</sup> The original scale consists of two additional items, we left these out due to not referring to turbulence within a market, but rather a firm's abilities. The items that were left out are "*ability to reduce market uncertainty*" and "*ability to respond to market opportunities*" (Han *et al.* 1998, p. 37).

firm engages in R&D activities.

*Firm size:* The logarithm of the number of employees at time  $t$ , to account for potential firm size-effects, such as capabilities related to act upon or invest in future opportunities or threats.

*Industry effects:* A range of dummy variables is used to distinguish between industrial, trade, service, and other types of firms (Volberda *et al.* 2012). Because prior research on forward-looking has predominantly focused on industrial firms, we include this control variable as we employ a cross-industry sample of firms that includes non-industrial firms.

*Business activities scope:* We include a series of dummy variables to indicate the firm's scope of business activities. Firms that operate beyond the regional scope may have a much greater information need to investigate the future of their business activities. Therefore, we asked respondents to indicate their firm's principal area in which its business activities take place. We include 4 categories: Regional, national, continental, and global business activities.

*Typical development cycle time.* Some firms may inherently engage more in forward-looking search because their industry and/or their product/service offerings have long development trajectories (e.g., airplanes or petrochemical industries). Therefore, forward-looking search may be driven by industry and/or firm characteristics. We include a categorical variable reflects the typical development time for new products or services (the elapsed time from ideation to the market launch of a new product) in years for the respondent's firm. We used the categories of <1 year, 1-3 years, 4-9 years, 10-14 years.

*R&D Activities:* R&D activities are aimed at securing potential future rents (Chen 2008), and since our sample contains either firms that engage or do not engage in R&D, we control for the potential effects of R&D activities. We use a dichotomous variable, zero for firms that do not engage in R&D activities, while one represents firms engaged in R&D activities. We base this on the information from annual reports whether it was mentioned if the firm engaged in R&D or reported R&D expenditures.

**Table 2.1 Items and Constructs**

Constructs	Factor loadings <sup>1</sup>	Item corr. with total score
<b>Forward-looking search (<math>\alpha = .84</math>, composite reliability = .88, AVE = .56)</b>		
Our organization performs environmental scanning proactively in both time horizons, long- and short-term	.616	.481
In our organization, we acquire information on future themes, future opportunities, and future threats	.769	.637
In our organization, we interpret future-related information to determine its implications for our business	.744	.622
In our organization, we create outlooks on multiple possible futures	.751	.627
In our organization, we ensure that results from future-related research reach relevant decision-makers	.772	.647
In our organization, top management strongly supports future-related research	.819	.705
<b>Market turbulence (<math>\alpha = .50</math>, composite reliability = .80, AVE = .66)</b>		
The extent of turbulence in the market is high	.814	.327
The frequency of changes in customer preferences is high	.814	.327
<b>Technological turbulence (<math>\alpha = .71</math>, composite reliability = .84, AVE = .64)</b>		
Technological changes provide big opportunities in our industry	.819	.563
The technology in our industry is changing rapidly	.761	.491
A large number of new product/service ideas have been made possible through technological breakthroughs in our industry	.823	.560
<b>Competitive intensity (<math>\alpha = .64</math>, composite reliability = .81, AVE = .58)</b>		
There are too many similar products/services in the market, therefore it is very difficult to differentiate our brand	.824	.526
This market is too competitive; price wars often occur	.717	.402
Anything that one competitors can offer, others can match easily	.744	.423

<sup>1</sup> Principal component analysis with varimax rotation

#### 2.4.4 Survey measure validation

For each of our survey measures, we investigated the psychometrics properties of the scales using exploratory factor analysis with principal component analysis and varimax rotation (Table 2.1). First, we investigate the measurement model by first assessing indicator reliability through factor loadings on their respective reflective constructs, which are all above the accepted threshold of .50 (Hair *et al.* 2010). Second, we assessed the reliabilities of the scales using both Cronbach's  $\alpha$  and composite reliability. Cronbach alpha scores vary between 0.50, .64, .71, and 0.84, providing additional evidence of construct validity (Nunally 1967). While our market turbulence scale (adopted from (Han *et al.* 1998)) shows low reliability ( $\alpha = 0.50$ ), values for CR range between 0.81 to 0.88, exceeding the

**Table 2.2 Descriptive Statistics and Matrix of Correlations**

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
1 Firm size <sup>a</sup>	–																					
2 R&D activities	.43	–																				
3 Industrial dummy	-.03	.19	–																			
4 Trade dummy	-.04	-.11	-.23	–																		
5 Service dummy	.02	-.07	-.72	-.12	–																	
6 Miscellaneous dummy	.03	-.13	-.42	-.07	-.21	–																
7 TDCT <1 year dummy	-.14	-.17	-.13	-.10	.19	.00	–															
8 TDCT 1-3 year dummy	.16	.25	.21	-.14	-.17	-.01	-.72	–														
9 TDCT 4-9 year dummy	-.14	-.17	-.13	-.10	.19	.00	1.00	-.72	–													
10 TDCT 10-14 year dummy	.01	.14	.04	-.05	.04	-.09	-.24	-.18	-.24	–												
11 Regional dummy	.09	.08	-.17	-.03	.07	.19	.00	.04	.00	-.03	–											
12 National dummy	-.09	-.28	-.19	.21	.13	-.03	.10	-.17	.10	-.10	-.05	–										
13 Continental dummy	-.16	-.25	-.06	.10	-.06	.12	-.01	.03	-.01	-.08	-.05	-.13	–									
14 Global dummy	.15	.37	.24	-.23	-.09	-.11	-.07	.10	-.07	.14	-.24	-.68	-.57	–								
15 Forward-looking search	.10	.20	-.02	-.08	.03	.04	.07	.00	.07	.14	-.18	-.19	-.03	.23	(.75)							
16 Performance < aspiration <sup>b</sup>	-.08	.09	.09	.10	-.07	-.10	.07	-.10	.07	.01	-.04	-.16	.10	.07	-.08	–						
17 Slack resources	.09	-.08	-.03	.03	.01	.01	-.05	.04	-.05	-.19	.04	.19	.04	-.19	.16	.12	–					
18 Performance expectation	-.19	-.11	-.06	-.07	.00	.14	-.06	-.01	-.06	.05	.02	.08	-.11	.01	.18	-.31	-.10	–				
19 Market turbulence	.18	.00	.01	.03	.08	-.13	-.13	.03	-.13	-.04	.06	-.01	.00	-.01	-.03	.21	.23	-.06	(.78)			
20 Technological turbulence	.21	.05	-.13	-.26	.17	.11	-.13	.16	-.13	-.08	.19	-.13	.05	.01	.20	-.04	.21	.08	.49	(.80)		
21 Competitive intensity	-.01	-.10	-.02	.03	-.03	.05	.16	-.19	.16	-.21	.08	-.09	.10	-.02	-.26	.23	.03	-.23	.20	-.11	(.76)	
Mean	8.53	.74	.58	.04	.27	.11	.50	.50	.34	.06	.02	.13	.10	.75	5.24	.34	-.02	-.55	3.95	4.74	4.15	
SD	2.24	.44	.49	.19	.45	.32	.50	.50	.48	.23	.14	.34	.29	.43	.94	1.31	1.54	2.93	1.22	1.22	1.21	

Notes: square root of the AVE on the diagonals for latent constructs. Off-diagonal elements are correlations between variables. Correlations of |.19| are significant at the .05 level.  $N = 108$ . TDCT = Typical development cycle time.

<sup>a</sup> Logarithm transformed variable; mean and S.D. for the non-logarithmic transformed variable: Mean = 34769.30; SD = 83459.31.

<sup>b</sup> Logarithm transformed variable; mean and S.D. for the non-logarithmic transformed variable: Mean = -2.55; SD = 5.10.

minimum value of 0.7 and indicating adequate reliability of our constructs (Hair *et al.* 2013). Therefore, we argue that the slightly lower Cronbach's alpha for market turbulence is of less concern, whereas the CR value is exceeding recommended values. Third, we assess convergent validity by examining the average variance extracted (AVE) (Fornell and Larcker 1981). We find adequate convergent validity for all our reflective constructs, with AVE ranging from 0.56 to 0.66, thus exceeding the minimum value of 0.5 (Fornell and Larcker 1981). Fourth, we analyse discriminant validity using the Fornell-Larcker criterion for the reflective constructs (Fornell and Larcker 1981). Using this criterion, we find the square root of the reflective constructs' AVE value exceed the value of the highest correlation with other constructs, and thus indicates adequate discriminant validity. Table 2.2 reports these findings. Lastly, we employ a confirmatory factor analyses to assess the overall measurement model structure fit using SPSS Amos 21. We allow all latent factors to correlate with each other and all indicators are loading onto their respective latent factors. We find satisfactory model fit indices:  $\chi^2/d.f. = 1.591$ ; CFI = .901; SRMR = .069; RMSEA = .075 CI<sub>0.90</sub>[.047 - .100] ( $p_{close} = .070$ ). The CFI of 0.90 is considered an indication of good fit, and the RMSEA of 0.075 indicates good model fit as it does not exceed the critical value of 0.08 (Bentler and Bonett 1980), and the SRMR value is less than .07 which is generally considered a good fit (Hu and Bentler 1999).

## **2.5 Results**

### **2.5.1 Findings**

We tested our hypotheses using ordinary least squares (OLS) regression analysis. According to common practice all variables were mean-centered before computing the interaction variables (Aiken and West 1991). Table 2.3 reports the OLS regression results for forward-looking search. To assess the distinct and additive effects of internal and external determinants and their interaction, we employ several separate models. Model 1 contains only the control variables. Model 2 contains the internal determinants, consisting of performance below aspiration, slack resources, and performance

**Table 2.3 Regression results on Forward-Looking Search (Unstandardized Betas)**

	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	3.070 (.886)***	2.702 (.089)***	2.736 (1.132)**	2.460 (1.096)**	2.406 (0.780)***
<i>Controls</i>					
Firm size	0.020 (.048)	0.020 (.046)	0.007 (.047)	0.011 (.046)	0.020 (.043)
R&D Activities	0.003 (.003)	0.004 (.003)	0.003 (.003)	0.004 (.002)	0.003 (.002)
TDCT (ref.: < 1 Year)					
1-3 Years	0.676 (.358)*	0.917 (.337)***	0.720 (.357)**	0.912 (.343)**	1.103 (.330)***
4-9 Years	0.534 (.384)	0.665 (.360)*	0.412 (.386)	0.564 (.371)	0.663 (.345)*
10-14 Years	0.986 (.537)*	1.314 (.508)**	0.899 (.551)*	1.228 (.531)**	1.282 (.501)**
Business activities (ref.: Regional)					
National	1.181 (.758)	1.050 (.702)	1.287 (.749)*	1.166 (.712)	1.316 (.655)**
Continental	1.537 (.773)**	1.742 (.717)**	1.630 (.745)**	1.774 (.709)**	1.828 (.653)***
Global	1.602 (.709)**	1.726 (.656)***	1.722 (.691)**	1.807 (.655)***	1.830 (.603)***
Industry (ref.: Miscellaneous)					
Industrial firms	-0.425 (.323)	-0.316 (.302)	-0.320 (.319)	-0.246 (.305)	-0.133 (.286)
Trade firms	-0.056 (.611)	0.351 (.576)	0.357 (.627)	0.617 (.602)	0.941 (.561)*
Service firms	-0.254 (.344)	-0.162 (.320)	-0.281 (.336)	-0.187 (.321)	-0.274 (.300)
<i>Internal (main effects)</i>					
Performance below aspiration		-0.077 (.075)		-0.056 (.076)	-0.097 (.071)*
Slack resources		0.201 (.061)***		0.178 (.061)***	0.144 (.057)***
Performance expectation		0.079 (.033)***		0.064 (.033)**	0.049 (.031)*
<i>External (main effects)</i>					
Market turbulence			-0.042 (.094)	-0.054 (.092)	-0.070 (.086)
Technological turbulence			0.218 (.101)**	0.174 (.096)**	0.235 (.090)***
Competitive intensity			-0.140 (.086)*	-0.092 (.084)	-0.111 (.079)*
<i>Interaction effects</i>					
Slack resources * MT					-0.029 (.124)
Slack resources * TT					0.112 (.056)**
Slack resources * CI					0.147 (.051)***
<i>R</i> <sup>2</sup>	0.166	0.314	0.264	0.363	0.483
<i>F</i> -Value	1.525	2.643***	2.077**	2.615***	3.510***
$\Delta R^2$	–	0.147*** <sup>a</sup>	0.098** <sup>a</sup>	0.197*** <sup>a</sup>	0.120*** <sup>b</sup>
<i>N</i>	108	108	108	108	108

Notes: standard error values in parentheses; \*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$  (one-tailed for hypothesized paths, two-tailed for controls). TDCT = Typical development cycle time. MT = Market turbulence. TT = Technological turbulence. CI = Competitive intensity. <sup>a</sup> Compared to model 1. <sup>b</sup> Compared to model 4.

expectation. We find no significant negative effect of performance below aspiration ( $B = -.077, p >.10$ ), however we do find a marginally negative effect ( $B = -.097, p <.10$ ) in model 5. Taken both findings into account, we provide cautious and partial support for hypothesis 1A; the greater the distance between actual performance and aspiration level based on the performance in the prior three years, the lesser a firm engages in forward-looking search. Furthermore, slack resources exhibits a positive and significant effect ( $B = .201, p <.01$ ) and remains positive and significant in all models and provides support for hypothesis 2. Firms that were able to create larger pools of slack resources over the past three years engage significantly more in forward-looking search. Lastly, we find a significant and positive effect of performance expectation ( $B = .079, p <.01$ ) and remains significant in all models. This finding provides support for hypothesis 3. This indicates that, due to our way of operationalizing our measure, firms who have been performing well in the prior three years, and consequently expect to perform well in the next year, are increasingly engaging in forward-looking search.

Model 2 reports the effects of the external environment on forward-looking search. Each of the three environmental factors – market turbulence, technological turbulence, and competitive intensity – shows robust results with no sign or significance changes across all models. First, market turbulence is not exhibiting any significant effects in model 3 or in the other models. Therefore, we find no support for hypothesis 4A<sup>5</sup>. Second, technological turbulence is consistently significant and positive ( $B = .218, p <.05$ ), thereby confirming hypothesis 4B. Lastly, competitive intensity marginally negatively impacts forward-looking search ( $B = -.140, p <.10$ ), supporting hypothesis 4C.

---

<sup>5</sup> We conducted additional analyses to minimize the potential risk that the slight tendency towards unreliability for our market turbulence measure, according to Cronbach's alpha, would lead to erroneous results. Using three items from the environmental dynamism scale from Green *et al.* (2008), were able to construct a similar measure to our market turbulence scale. The items were “*actions of our competitors are generally quite easy to predict*”, “*product/service demand is easy to forecast*”, “*customer requirements/preferences are easy to forecast*” (Cronbach's alpha .68). All items were reverse-coded and measured using a 7-point Likert scale from 1 ‘*strongly disagree*’ to 7 ‘*strongly agree*’. Easily forecastable and predictable changes in the market place provide an indication for little market turbulence. By reversing the scoring of this measure, we reran all of our regression analyses by replacing the original market turbulence scale with our new measure. We found no significant differences in our hypothesized effects compared to the model presented in this paper.

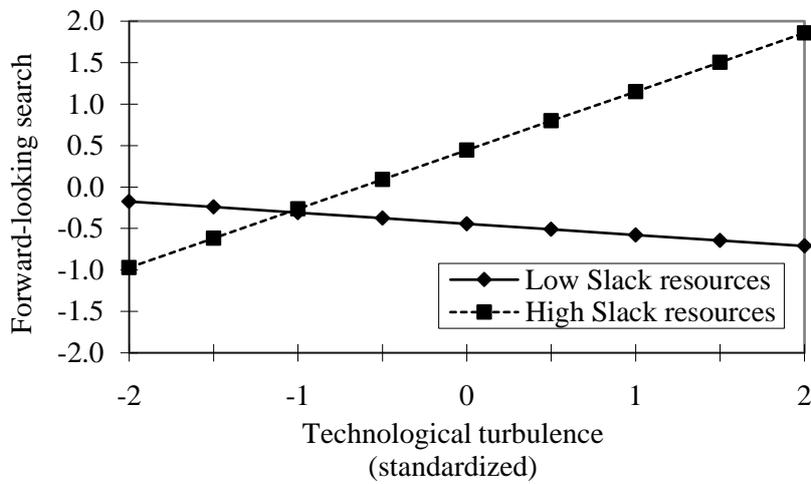
Model 4 reports the results of joining the previous models together. The joint model shows a significant increase in predictive power over model 1 ( $\Delta R$ -square = .197,  $p < .01$ ), as well as over model 3 ( $\Delta R$ -square = .099,  $p < .01$ ). This finding signals that both external and internal determinants exhibit distinct effects on forward-looking search.

Model 5 includes the interaction effects between slack resources and the three external environmental variables. The incremental R-square increases should be significant for the specific interaction model in order to conclude whether the interaction effect is exhibiting a significant impact, rather than solely relying on the significance of the interaction coefficient (Hair *et al.* 2010). The interaction model provides a significant improvement in predicting forward-looking search compared to the non-interaction model ( $\Delta R$ -square = .120,  $p < .01$ ). This signals the importance of simultaneously considering a firm's slack resources and the environment to predict a firm's engagement in forward-looking search. First, the interaction term of market turbulence and slack resources is insignificant and thereby does not support hypothesis 5A. Second, the interaction term between technological turbulence and slack resources is positive and significant ( $b = .112$ ,  $p < .05$ ), supporting hypothesis 5B. Lastly, the interaction between competitive intensity and slack resources is significant and positive ( $b = .147$ ,  $p < .01$ ), and therefore provides support for hypothesis 5C. Thus, while competitive intensity by itself has a significant negative effect on forward-looking search, slack resources negate the negative effect.

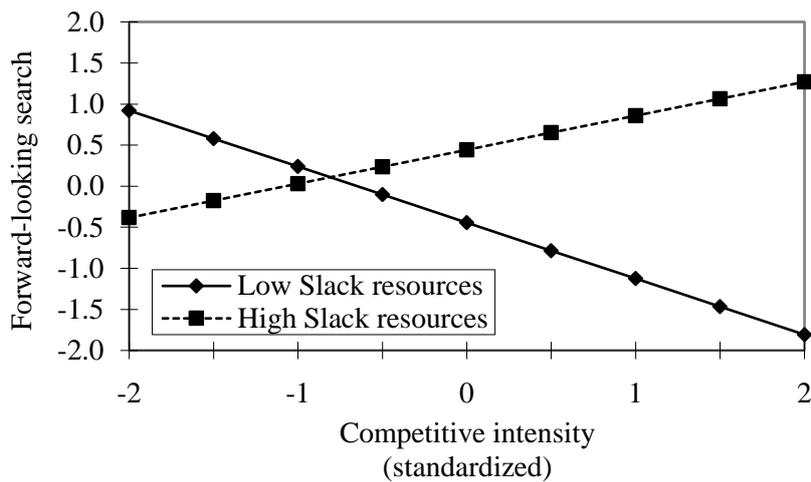
To illustrate the significant interaction effects, we plot the slopes in Figure 2.1. We plotted the slopes for high- and low levels of slack resources (two standard deviations below and above the mean) and calculated the slope coefficients to assess whether the differences are significant between the two levels (Aiken and West 1991). Figure 2.1 (Panel A) shows at high levels of technological turbulence, a high level of slack resources is strongly positively related to a firm's engagement in forward-looking search ( $\beta = .580$ ,  $t = 2.968$ ), but low levels of slack resources is not significantly related to forward-looking search at high levels of technological turbulence ( $\beta = -.110$ ,  $t = 0.571$ ). This finding suggest

**Figure 2.1 Plots of significant interaction effects**

**(A) Effect of technological turbulence and slack resources on forward-looking search (means plot)**



**(B) Effect of competitive intensity and slack resources on forward-looking search (means plot)**



that firm’s engagement in forward-looking search is contingent on its slack resources. Figure 2.1 (Panel B) shows at high levels of competitive intensity, high levels of slack resources positively and significantly increases a firm’s forward-looking search ( $\beta = .342, t = 1.574$ ). At low levels of slack resources however, higher levels of competitive intensity significantly decrease a firm’s engagement in forward-looking search ( $\beta = -.564, t = -4.652$ ). Higher levels of slack resources thus counteract the negative effect of competitive intensity on forward-looking search, as predicted.

**2.5.2 Robustness checks**

*Alternative explanations.* We test whether the results could be explained by other factors not present

in our models. An alternative explanation could be that some firms in our sample were heavily affected by the financial crisis between financial years 2008 and 2009 and may therefore be more prone to short-term thinking in the years after the crisis (as an antithesis to the models).

*Financial crisis.* Our analyses include for some predictor variables archival performance data dating back to 2010. Because the financial year 2010 is close to the financial crisis of 2008, the crisis could have had a significant impact. Firms finding themselves in a crisis are prone to short-term thinking because such major jolts in the environment are likely to be perceived as threatening and therefore firms act more conservatively (e.g. Meyer *et al.* 1990, Amburgey and Miner 1992, Audia *et al.* 2000). Such major jolts can have a long-lasting effect on a firm's operations. To assess the impact of the 2008 financial crisis, we analysed a subset of firms in our sample ( $N = 83$ ) for which we were able to gather performance one year prior to the financial crisis. We use *net income* (profit/loss for financial period) to assess the severity of the impact of the financial crisis on firms. We regressed on *net income* using the financial data between 2007 and 2014. Then, we calculated whether *net income* one year after the financial crisis (year 2008 or 2009 depending on the firm's financial year start-date), was 2 or more standard deviations below the regression-predicted net-income value. We found 29 firms were underperforming 2 standard deviations or more 1 year after the financial crisis. A one-way ANOVA test between these affected firms and the other firms in our subsample showed, however, no significant differences in our study's self-reported variables and objective performance variables. We only found a significant difference for slack resources ( $p < .05$ ). Firms heavily affected by the financial crisis built up much less slack resources in the years 2010-2013 compared to the other firms in our sample. To account for this effect, we included a dummy variable for heavily affected firms in our final regression model (not reported). The analysis shows no significant differences for our hypothesized relationships. Furthermore, because the ANOVA analysis showed a potential relationship between firms being affected heavily by the financial crisis and transient slack, we assessed for multicollinearity in our regression model. Collinearity diagnostics show no potential effect

between firms affected heavily by the financial crisis and slack resources.

## **2.6 Discussion and avenues for future research**

In this paper, we studied the determinants of forward-looking search, thereby distinguishing between internal (performance below aspiration, slack resources, and performance expectation) and external (market turbulence, technological turbulence, and competitive intensity) determinants. We aimed to answer the question why firms may engage in more forward-looking search. Conversely, also why firms may actually not engage to higher degrees in forward-looking search. We based our study on a combination of survey data and a panel dataset for objective performance, the latter which allowed us to test the behavioural effects of internal determinants. Our study shows that internal and external determinants cause a significant portion of a firm's engagement in forward-looking search, where this effect is further strengthened by considering the interaction between a firm's slack resources and its environmental characteristics.

### ***Internal determinants***

Our study highlights the importance of prior organizational behaviour as determinant for forward-looking search. We extend current organisational search literatures by introducing the notion that *forward-looking* search also happens, wherein an explicit future focus is embedded. Furthermore, we find support for several hypotheses that are based on the behavioural theory of the firm. These findings are especially relevant for the field of foresight, where notions of performance driving search are absent. Research in the area of foresight may therefore greatly benefit from our results and incorporate also the theoretical propositions set forth in this study to better understand why firms engage to a greater or lesser degree based on the internal determinants studied here. Going by our results, we find slack resources to be an important determinant of forward-looking search. Consistent with Cyert and March (1963) and more recent findings (Chen and Miller 2007, Chen 2008, Voss *et al.* 2008, Troilo *et al.* 2014), firms tend to promote exploring more distant and uncertain avenues when slack resource

availability is abundant. Although prior research has mainly considered absolute slack levels, we investigated specifically how a firm's slack resources evolved in years prior to measuring forward-looking search. Building on George's (2005) concept of transient slack resources, we incorporate the resource-constraint argument into our hypotheses. When firms are able to accumulate slack resources over a period of time, managers will feel less resource constrained. In such cases, firms may be more inclined to explore alternative futures because they need to worry less about the short run. Indeed, this finding adds empirical insights to more recent suggestions that firms may only search for more distant opportunities if they have the *time* to do so (Csaszar and Levinthal 2016). Slack resources allows for such time; it allows a firm to "dislodge itself from a local peak – but that doing so is worthwhile only if enough time remains to find a better peak" (Csaszar and Levinthal 2016, p. 2044). Indeed, slack resources can keep a firm insulated from potential shocks in performance (Thompson 1967, George 2005), allowing for time to search for a potential superior courses of action. Conversely, when without slack resources, firms rather engage in search that leads to performance maximization of a current strategy (Csaszar and Levinthal 2016). Especially in relation to forward-looking search, slack resources are important to consider. One important reason for this is that the future exists in a state of potential; it simply does not exist yet (Lord *et al.* 2014). The future, for instance a future market, simply cannot be occupied before actions are taken to position oneself there. Slack resources are needed to enhance a firm's ability to engage in probing and experimentation, which is a fundamental part of creating entirely new and different futures (Nohria and Gulati 1996, Brown and Eisenhardt 1997, Gavetti and Levinthal 2000, Lord *et al.* 2014). Therefore, when talking about the future, the availability of slack resources becomes apparent and therefore can be seen as integral part of plotting a firm's future.

Our results also show that performance expectation has a positive effect on forward-looking search. The notion is that firms that have been performing well and are expected to continue their upward trend are risk averse in their decision-making Tversky and Kahneman's (1991). Prior studies

have found risk-averse effects (e.g. Chen 2008), where firms expecting to outperform in the near future invest less in risky investments such as R&D. However, we study the effects of performance expectation on forward-looking search – a precursor to *actual* actions taken by the firm. Our study finds a significant result that is opposite of prior research studying behaviour; we find that a positive performance expectation (i.e. having performed well and likely outperforming one year ahead) to positively affect forward-looking search. This suggests that forward-looking search could be a way for firms to decrease potential risks by carefully considering alternative futures, and the consequences of alternative courses of action or the continuation of current actions (March 1991, Greve and Taylor 2000).

Lastly, performance below aspiration levels leads to firms engaging less in forward-looking search, supporting the notion that firms typically search ‘close-to-home’ in response to problems as reflected in Cyert and March’s (1963) problemistic search logic. Although this result is not fully consistent throughout our models it provides partial evidence. Prior research argued that declining performance can be a powerful determinant of engaging in foresight (Amsteus 2014), however based on the behavioural theory of the firm and our findings, we can only conclude the opposite.

### ***External determinants***

Contingency theory posits that firms fit a certain set of organizational characteristics to achieve optimal performance, such as more focus on forward-looking mechanisms under uncertain or complex environmental conditions (Lindsay and Rue 1980). We operationalized the environment by using three distinct characteristics – market turbulence, technological turbulence, and competitive intensity. These three factors capture the essence of a firm’s competitive environment (Zhou *et al.* 2005). Especially literature on corporate and strategic foresight has considered the external environment as a main driver for forward-looking search to reduce potential uncertainty (e.g., Vecchiato 2012). While the behavioural theory of the firm has been mostly silent on environmental characteristics, we find that environmental characteristics capture an important and distinct element in explaining why firms are

engaged in forward-looking search. This affect is above and beyond that of the performance feedback indicators, suggested by the behavioural theory of the firm and prospect theory.

We find that turbulence in the market (i.e. rapidly changing customer preferences) has little bearing on firm's engagement in forward-looking search. Given the suggestion that customer preferences are inherently short-sighted (Zhou *et al.* 2005), this finding was expected. On the other hand, turbulent technological environments do spur firms to engage more heavily in forward-looking search. This may be due to the far-reaching implications new technological developments can have on an entire value chain (Zhou *et al.* 2005) and because technological developments typically follow easier interpretable trajectories as opposed to consumer preferences. Staying abreast of technological developments, as well as their future direction and what implications this may have for the firm, is potentially critical for firm performance. Lastly, we find that intense competition leads firms to be less forward-looking. Typically, such situations lead to price competition and mimicking competitors who are seemingly doing well (Greve and Taylor 2000). Such actions require little foresight. Conversely, forward-looking search may potentially have detrimental effects in fierce competitive settings, where attention is diverted away from pressing, short-term competitive matters crucial to a firm's survival.

### ***Slack resources and environmental determinants***

Prior literature on forward-looking search has been largely silent on the joint effect of environmental uncertainties arising from turbulent environments and the ability to cope with such uncertainties. We attempted to bridge this gap by exploring the interactions between the availability of slack resources and the various environmental characteristics.

*Technological turbulence and slack.* Firms operating in highly turbulent environments that also have high amounts of slack resources engage more in forward-looking search. This finding suggests that firms are more invested in the search for alternative future courses of action, when they have the resources to back up and seize potentially fruitful future prospects. Slack resources could be used to

invest in R&D, which is a way of adaptation to future changes (Chen 2008, p. 611). Firms in a position of high technological turbulence and high levels of slack resources may envision the future as an investment opportunity, driven by the ability to pursue future prospects, rather than from a strict necessity point-of-view. This finding potentially signals forward-looking search as a way to uncover new opportunities (Hamel and Prahalad 1994, Gavetti *et al.* 2012), thereby showing that firms with higher levels of slack resources likely perceive greater value in exploring other avenues that may ensure long-term survival, especially under conditions of turbulence as we find here.

*Competitive intensity and slack.* Results indicate a positive interaction between slack and competitive intensity. Whereas competitive intensity alone leads firms to do less forward-looking search, the interaction with slack resources counteracts this negative effect as the interaction slope becomes significantly positive. Firms with abundant slack resources in highly competitive intense situations can potentially exert control over competitors, whereby the firm can invest in other potentially fruitful future prospects without disregarding its core business or market that is subject to fierce competition and price wars. Indeed, whereas in the situation of high competitive situation without considering a firm's slack resources, it means that a firm simply has very little 'time' to search for a more distant course of action (Csaszar and Levinthal 2016); more distant search that may go beyond the current competitive intense position a firm is in. However, by considering the interaction of competitive intensity with slack resources, the converse holds true. Slack resources provide a firm to not only search for more distant courses of action (by being insulated from current competitive shocks), but importantly also the ability to implement actions to facilitate an alternative course of action. These firms thereby potentially want to stay in a dominant position and thus engage more heavily in understanding potential future prospects of their environment. In contrast, firms operating in a highly competitive environment but with fewer slack resources are more likely to focus solely on its closest competitors. Indeed, we find a significantly negative interaction slope for this scenario. As a result of close monitoring innovations introduced by competitors and price pressures, mimetic adoption

becomes an obvious choice (Day and Wensley 1988). Firms in such situations are much less engaged in forward-looking search. One managerial implication of this result is that firms should perhaps not engage in forward-looking search processes that alter future representations (and by that current criteria for appraising the firm's current actions), unless there is plenty of time available to search.

### **2.6.1 Limitations and future research**

Several limitations apply to this study that open new avenues for future research. The cross-sectional design of our study raises some issues in regards to the determinants we studied. As we used a three-year time period to measure the internal determinants prior to measuring forward-looking search at a single point in time, we implicitly assume that the level of engagement in forward-looking search then is varying in the prior three years as well. In other words, if a firm had been performing below their aspirations in the three years prior to when we measure forward-looking search, we implicitly assume the firm has decreased its level of forward-looking search over that period of three years. Recent research shows persistency of search processes is important to consider (Li *et al.* 2013). The question thus arises if forward-looking search tends to change over time in relation to the internal determinants we examined. Future research may seek to explore when and why forward-looking search processes may remain persistent and when not. One fruitful avenue to consider is how forward-looking search is organized within a firm, as it may be expected that firms who have delegated such search processes appointed to others in the organization may see higher persistency, and potentially be affected differently by our hypothesized determinants.

We also do not investigate whether forward-looking search is followed by organizational actions. Whereas the internal determinants examined in this study are frequently linked directly to organizational outcomes such as innovation introductions or R&D expenditures, we are not able to discern whether forward-looking information is used or not. While our measure of forward-looking search does account for forward-looking search to be strongly supported top management and future insights are communicated to relevant decision-makers, it does not necessarily capture any follow-up

actions. As prior research also points towards managers' irrational optimism when abundant slack resources are available (Nohria and Gulati 1996) and a lower tendency to engage in experimentation (Levinthal and March 1993, George 2005), there may be a disconnect between forward-looking search as we conceptualize and actual actions taken. As the latter is crucial to facilitate further discovery of more new future opportunities to pursue (Lord *et al.* 2014), future research should investigate when and why forward-looking search is followed up by actual probing and experimentation.

## **2.7 Conclusion**

In this paper we have carefully considered why some firms are more heavily engaged in forward-looking search than others, based on internal and external effects. In doing so, we attempted to bridge the gap between organisational search and foresight literature streams which both benefit from our findings. Whereas organisational search literatures posits performance and resources as determinants of search, foresight literatures posit the external environment as a dominant determinant. We examined both stream's main determinants of forward-looking search as well as the specific interaction between slack resources and the external environment. With this, we increased our understanding on why firms are more engaged in forward-looking search, specifically when firms 1) have slack resources available, 2) have been performing well and expect to outperform again, 3) operate in technological turbulence environments and increasingly when slack resources are available, and 4) have slack resources available in competitive intense situations. The overall pattern suggests that firms search more to (re)think the future when they have the financial freedom to do so without risking the firm's current viability. With these findings, we contribute to recent research on search literature that posits firm's ability to have the time to shift their attention towards more distant courses of action, and consequently potentially more likely to be outperformers in the longer-term.

## **References**

Aiken, L. and West, S., 1991. *Multiple Regression: Testing and Interpreting Interactions*. Newbury

Park, CA: Sage.

- Amburgey, T. and Miner, A., 1992. Strategic momentum: The effects of repetitive, positional, and contextual momentum on merger activity. *Strategic Management Journal*, 13 (5), 335–348.
- Amsteus, M., 2011. Managers' foresight matters. *Foresight*, 13 (2), 64–78.
- Amsteus, M., 2014. Subjective Performance, Managerial Foresight, and Objective Performance. *Strategic Change*, 23 (3–4), 133–146.
- Ansoff, H.I., 1980. Strategic Issue Management. *Strategic Management Journal*, 1 (2), 131–148.
- Audia, P.G. and Greve, H.R., 2006. Less Likely to Fail: Low Performance, Firm Size, and Factory Expansion in the Shipbuilding Industry. *Management Science*, 52 (1), 83–94.
- Audia, P.G., Locke, E.A., and Smith, K.E.N.G., 2000. The Paradox of Success : An Archival and a Laboratory Study of Strategic Persistence Following Radical Environmental Change. *Academy of Management Journal*, 43 (5), 837–853.
- Auh, S. and Menguc, B., 2005. Balancing exploration and exploitation: The moderating role of competitive intensity. *Journal of Business Research*, 58 (12), 1652–1661.
- Becker, P., 2002. *Corporate foresight in Europe: a first overview*. Brussels: European Commission.
- Bentler, P.M. and Bonett, D.G., 1980. Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin*, 88 (3), 588–606.
- Brenner, M., 1996. Technology intelligence and technology scouting. *Competitive Intelligence Review*, 7 (3), 20–27.
- Brown, S.L. and Eisenhardt, K.M., 1997. The Art of Continuous Change: Linking Complexity Theory and Time-Paced Evolution in Relentlessly Shifting Organizations. *Administrative Science Quarterly*, 42 (1), 1–34.
- Chen, W.R., 2008. Determinants of firms' backward-and forward-looking R&D search behavior. *Organization Science*, 19 (4), 609–622.
- Chen, W.R. and Miller, K.D., 2007. Situational and institutional determinants of firms' R&D search intensity. *Strategic Management Journal*, 28 (4), 368–381.
- Citrin, A.V., Lee, R.P., and McCullough, J., 2007. Information Use and New Product Outcomes: The Contingent Role of Strategy Type. *Journal of Product Innovation Management*, 24 (3), 259–273.
- Costanzo, L. a, 2004. Strategic foresight in a high-speed environment. *Futures*, 36 (2), 219–235.
- Courtney, H., 2001. *20/20 Foresight: Crafting Strategy in an Uncertain World*. Cambridge, MA: Harvard Business School Press.
- Csaszar, F.A. and Levinthal, D.A., 2016. Mental representation and the discovery of new strategies. *Strategic Management Journal*, 37 (10), 2031–2049.
- Cuhls, K., 2003. From forecasting to foresight processes?new participative foresight activities in Germany. *Journal of Forecasting*, 22 (2–3), 93–111.
- Cunha, M.P., Cunha, J.V. Da, and Clegg, S.R., 2009. Improvisational bricolage: A practice-based approach to strategy and foresight. In: L. a Costanzo and R.B. MacKay, eds. *Handbook of Research on Strategy and Foresight*. Edward Elgar Publishing, 182-.
- Cyert, R. and March, G., 1963. *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice Hall.
- Daft, R. and Weick, K., 1984. Toward a model of organizations as interpretation systems. *Academy of Management Review*, 9 (2), 284–295.
- Day, G. and Schoemaker, P., 2008. Are You a 'Vigilant Leader'? *MIT Sloan Management Review*, 49 (3), 43–51.
- Day, G.S. and Schoemaker, P.J.H., 2005. Scanning the periphery. *Harvard Business Review*, 83 (11), 135–148.
- Day, G.S. and Wensley, R., 1988. Assessing Advantage: A Framework for Diagnosing Competitive Superiority. *Journal of Marketing*, 52 (April), 1–20.
- Dutton, J.E. and Ottensmeyer, E., 1987. Strategic Issue Management Systems: Forms, Functions, and Contexts. *Academy of Management Review*, 12 (2), 355–365.
- European Commission, 2013. *EU R&D Scoreboard: The 2013 EU Industrial R&D Investment*

*Scoreboard*. EUR 26211 EN, ISSN 1831-9424.

- Fornell, C. and Larcker, D., 1981. Structural Equation Models With Unobservable Variables and Measurement Error: Algebra and Statistics. *Journal of Marketing Research*, 18 (3), 328–389.
- Gavetti, G., 2012. Toward a Behavioral Theory of Strategy. *Organization Science*, 23 (1), 267–285.
- Gavetti, G., Greve, H.R., Levinthal, D.A., and Ocasio, W., 2012. The Behavioral Theory of the Firm: Assessment and Prospects. *The Academy of Management Annals*, 6 (1), 1–40.
- Gavetti, G. and Levinthal, D., 2000. Looking forward and looking backward: Cognitive and experiential search. *Administrative Science Quarterly*, 45 (1), 113–137.
- Gavetti, G. and Menon, A., 2016. Evolution Cum Agency: Toward a Model of Strategic Foresight. *Strategy Science*, 1 (3), 207–233.
- Gavetti, G. and Rivkin, J.W., 2007. On the Origin of Strategy: Action and Cognition over Time. *Organization Science*, 18 (3), 420–439.
- George, G., 2005. Slack resources and the performance of privately held firms. *Academy of Management Journal*, 48 (4), 661–676.
- Gordon, T.J. and Hayward, H., 1968. Initial experiments with the cross impact matrix method of forecasting. *Futures*, 1 (2), 100–116.
- Green, K.M., Covin, J.G., and Slevin, D.P., 2008. Exploring the relationship between strategic reactivity and entrepreneurial orientation: The role of structure–style fit. *Journal of Business Venturing*, 23 (3), 356–383.
- Greve, H.R., 2003a. A Behavioral Theory of R&D Expenditures and Innovations: Evidence from Shipbuilding. *Academy of Management Journal*, 46 (6), 685–702.
- Greve, H.R., 2003b. Organizational Learning from Performance Feedback. *Cambridge University press*, 1–213.
- Greve, H.R. and Taylor, A., 2000. Innovations as Catalysts for Organizational Change: Shifts in Organizational Cognition and Search. *Administrative Science Quarterly*, 45 (1), 54–80.
- Groenvelde, P., 1997. Roadmapping integrates business and technology. *Research Technology Management*, 50 (6), 49–58.
- Hair, J., Black, W., Babin, B., and Anderson, R., 2010. *Multivariate data analysis*.
- Hair, J.F., Ringle, C.M., and Sarstedt, M., 2013. Partial Least Squares Structural Equation Modeling: Rigorous Applications, Better Results and Higher Acceptance. *Long Range Planning*, 46 (1–2), 1–12.
- Hambrick, D.C., 1982. Environmental Scanning and Organizational Strategy. *Strategic Management Journal*, 3 (2), 159–174.
- Hamel, G. and Prahalad, C., 1994. *Competing for the future*. Harvard business review. Boston: Harvard Business School Press.
- Han, J.K., Kim, N., and Srivastava, R.K., 1998. Market Orientation and Organizational Performance: Is Innovation a Missing Link? *Journal of Marketing*, 62 (4), 30–45.
- Van Der Heijden, K., 1996. *Scenarios: The Art of Strategic Conversation*. Chichester: John Wiley & Sons Ltd.
- Heuschneider, S. and Herstatt, C., 2016. *External search for exploration of future discontinuities and trends: Implications from the literature using co-citation and content analysis*. Hamburg, No. 92.
- Horton, A., 1999. A simple guide to successful foresight. *foresight*, 1 (1).
- Howells, J., 1997. Rethinking the market-technology relationship for innovation. *Research Policy*, 25, 1209–1219.
- Hu, L. and Bentler, P.M., 1999. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6 (1), 1–55.
- Kaplan, S. and Orlikowski, W.J., 2013. Temporal Work in Strategy Making. *Organization Science*, 24 (4), 965–995.
- Katila, R. and Ahuja, G., 2002. Something Old, Something New: a Longitudinal Study of Search

- Behavior and New Product Introduction. *Academy of Management Journal*, 45 (6), 1183–1194.
- Levinthal, D.A., 1997. Adaptation on Rugged Landscapes. *Management Science*, 43 (7), 934–950.
- Levinthal, D. a. and March, J.G., 1993. The myopia of learning. *Strategic Management Journal*, 14, 95–112.
- Levinthal, D. and March, J.G., 1981. A model of adaptive organizational search. *Journal of Economic Behavior & Organization*, 2 (4), 307–333.
- Li, Q., Maggitti, P.G., Smith, K.G., Tesluk, P.E., and Katila, R., 2013. Top management attention to innovation: The role of search selection and intensity in new product introductions. *Academy of Management Journal*, 56 (3), 893–916.
- Lindell, M.K. and Brandt, C.J., 2000. Climate quality and climate consensus as mediators of the relationship between organizational antecedents and outcomes. *Journal of Applied Psychology*, 85 (3), 331–348.
- Lindsay, W.M. and Rue, L.W., 1980. Impact of the organization environment on the long-range planning process: A contingency view. *Academy of Management Journal*, 23 (3), 385–404.
- Lord, R.G., Dinh, J.E., and Hoffman, E.L., 2014. A Quantum Approach to Time and Organizational Change. *Academy of Management Review*, 40 (2), 263–290.
- Maggitti, P.G., Smith, K.G., and Katila, R., 2013. The complex search process of invention. *Research Policy*, 42 (1), 90–100.
- Makridakis, P., 2004. Foreword: Foresight Matters. In: H. Tsoukas and J. Shepherd, eds. *Managing the Future: Foresight in the Knowledge Economy*. Oxford: Blackwell, xii–xiv.
- March, J.G., 1991. Exploration and Exploitation in Organizational Learning. *Organization Science*, 2 (1), 71–87.
- Meyer, A.D., Brooks, G.R., and Goes, J.B., 1990. Environmental Jolts and Industry Revolutions: Organizational Responses to Discontinuous Change. *Strategic Management Journal*, 11 (4), 93–110.
- Miller, D., Lant, T.K., Milliken, F.J., and Korn, H.J., 1996. The evolution of strategic simplicity: Exploring two models of organizational adaption. *Journal of Management*, 22 (6), 863–887.
- Nohria, N. and Gulati, R., 1996. Is slack good or bad for innovation? *Academy of Management Journal*, 39 (5), 1245–1264.
- Nunally, J., 1967. *Psychometric Theory*. New York: McGraw-Hill.
- Ocasio, W., 2011. Attention to Attention. *Organization Science*, 22 (5), 1286–1296.
- Oner, M.A. and Gol, S., 2007. Pitfalls in and success factors of corporate foresight projects. *International Journal of Foresight and Innovation Policy*, 3 (4), 447.
- Paap, J. and Katz, R., 2004. Anticipating disruptive innovation. *Research Technology Management*, 32, 13–22.
- Peter, M.K. and Jarratt, D.G., 2014. The practice of foresight in long-term planning. *Technological Forecasting and Social Change*, In press.
- Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y., and Podsakoff, N.P., 2003. Common method biases in behavioral research: a critical review of the literature and recommended remedies. *The Journal of Applied Psychology*, 88 (5), 879–903.
- Porter, M.E., 1980. *Competitive Strategy*. New York: The Free Press.
- Porter, M.E., 1985. *Competitive Advantage*. New York: The Free Press.
- Rohrbeck, R. and Gemünden, H.G., 2008. Strategic Foresight in Multinational Enterprises: Building a Best-Practice Framework from Case Studies. In: *R&D Management Conference 2008 'Emerging methods in R&D management'*.
- Rohrbeck, R. and Schwarz, J.O., 2013. The value contribution of strategic foresight: Insights from an empirical study of large European companies. *Technological Forecasting and Social Change*, 80 (8), 1593–1606.
- Schoemaker, P. and Day, G., 2009. How to make sense of weak signals. *MIT Sloan Management Review*, 50 (3), 81–88.

- Seidl, D., 2004. The Concept of ‘Weak Signals’ Revisited: A Re-description From a Constructivist Perspective. In: H. Tsoukas and J. Shepherd, eds. *Managing the Future: Foresight in the Knowledge Economy*. Oxford: Blackwell, 151–168.
- Simon, H.A., 1947. *Administrative Behavior: A Study of Decision-making Processes in Administrative Organizations*. 4th ed. New York: The Free Press.
- Starr, J.A. and Macmillan, I.C., 1990. Resource cooptation via social contracting: Resource acquisition strategies for new ventures. *Strategic Management Journal*, 11, 79–92.
- Thompson, J., 1967. *Organizations in action*. New York: McGraw-Hill.
- Tosi, H.L. and Slocum, J., 1984. Contingency Theory: Some Suggested Directions. *Journal of Management*, 10 (1), 9–26.
- Troilo, G., De Luca, L.M., and Atuahene-Gima, K., 2014. More innovation with less? A strategic contingency view of slack resources, information search, and radical innovation. *Journal of Product Innovation Management*, 31 (2), 259–277.
- Tsoukas, H. and Shepherd, J., 2004. *Managing the Future: Foresight in the Knowledge Economy*. Oxford: Blackwell.
- Tushman, M.L. and Anderson, P., 1986. Technological Discontinuities and Organizational Environments. *Administrative Science Quarterly*.
- Tversky, A. and Kahneman, D., 1991. Loss Aversion in Riskless Choice: A Reference-Dependent Model. *Quarterly Journal of Economics*, 106 (4), 1039–1061.
- Vecchiato, R., 2012a. Strategic foresight : matching environmental uncertainty. *Technology Analysis & Strategic Management*, 24 (8), 783–796.
- Vecchiato, R., 2012b. Environmental uncertainty, foresight and strategic decision making: An integrated study. *Technological Forecasting and Social Change*, 79 (3), 436–447.
- Vecchiato, R., 2015. Creating value through foresight: First mover advantages and strategic agility. *Technological Forecasting and Social Change*, 101, 25–36.
- Vecchiato, R. and Roveda, C., 2010. Strategic foresight in corporate organizations: Handling the effect and response uncertainty of technology and social drivers of change. *Technological Forecasting and Social Change*, 77 (9), 1527–1539.
- Volberda, H.W., van der Weerd, N., Verwaal, E., Stienstra, M., and Verdu, a. J., 2012. Contingency Fit, Institutional Fit, and Firm Performance: A Metafit Approach to Organization-Environment Relationships. *Organization Science*, 23 (4), 1040–1054.
- Voros, J., 2003. A generic foresight process framework. *Foresight*, 5 (3), 10–21.
- Voss, G.B., Sirdeshmukh, D., and Voss, Z.G., 2008. The Effects of Slack Resources and Environmental threat on Product Exploration and Exploitation. *Academy of Management Journal*, 51 (1), 147–164.
- Wack, P., 1985. Scenarios: Shooting the Rapids: How Medium-Term Analysis Illuminated the Power of Scenarios for Shell Management. *Harvard business review*, (November-December), 139–151.
- Weick, K.E., 1995. *Sensemaking in Organizations*. Thousand Oaks, CA: Sage.
- Wind, J. and Mahajan, W., 1997. Issues and Opportunities in New Product Development: An Introduction to the Special Issue. *Journal of Marketing Research*, 34 (1), 1–12.
- Winter, S.G., 2012. Purpose and progress in the theory of strategy: comments on Gavetti. *Organization Science*, 23 (1), 288–297.
- Zhou, K., Yim, C., and Tse, D., 2005. The effects of strategic orientations on technology-and market-based breakthrough innovations. *Journal of Marketing*, 69 (2), 42–60.



# Forward-looking search and innovation performance: The mediating role of innovation portfolio agility<sup>1</sup>

Tymen Jissink<sup>a</sup>, Eelko K.R.E. Huizingh<sup>b</sup>, René Rohrbeck<sup>a</sup>

<sup>a</sup> Aarhus University, School of Business and Social Sciences, department of Management, Aarhus, Denmark

<sup>b</sup> University of Groningen, faculty of Economics and Business, department of Strategic Innovation Management, Groningen, Netherlands.

## ABSTRACT

This study examines the impact of forward-looking search on innovation performance. We build on recent research of innovation portfolio management (IPM) and focus specifically on the role of agility in innovation portfolio decision-making. Surprisingly, this research has been largely silent on the potential role of forward-looking search in enhancing IPM. We posit that forward-looking search can enhance the innovation portfolio as it can lead to adjustments or terminations to running projects in response to future insights, signalling potential for a lack of strategic fit of certain projects in the future, or potential lack of performance of the innovation project outcome in markets of the future. Forward-looking search can then positively contribute to innovation performance, not only by potentially providing avenues for new innovation projects, but more importantly to facilitate future-preparedness of its current portfolio. We thus link forward-looking search to innovation performance via innovation projects agility as an important mediator. We test our model using survey data from a sample of 130 firms that engage in product and service innovation and apply a structural model using PLS estimation. We find that forward-looking search positively influences innovation performance on the dimensions of success, innovativeness, and financial performance, but only does so via IPM agility. Exercising IPM agility is an important indicator for an organization's willingness and ability to respond to external signals, and therefore acts as a mediator in translating future insights into innovation performance. Our findings complement research on IPM and show that forward-looking search enhances IPM agility by providing future insights to which the current portfolio may be held against, and may therefore be considered a complementor to IPM decision-making quality.

**Keywords:** *Forward-looking search; innovation portfolio management agility; innovation performance.*

---

<sup>1</sup> Earlier versions of this paper were presented at a research seminar at the University of Groningen in December 2014, accepted and presented at the annual Asia-Pacific ISPIM conference December 2014 (Kuala Lumpur, Malaysia) by the first co-author, accepted and presented annual Academy of Management conference (TIM division) August 2016 (Anaheim, CA) by the first author, and accepted for the ISPIM Americas conference March 2017 (Toronto, Canada).

### 3.1 Introduction

Literature suggests that innovation requires the anticipation of future events (Yadav *et al.* 2007, p. 86) paired with a proactive and open-minded stance towards the future to act in response to what has been perceived and interpreted (Lumpkin and Dess 1996, Zhou *et al.* 2005, Spanjol *et al.* 2012). But exercising a forward-looking view requires a deliberate, intensive, and proactive engagement with the future. Gavetti and Levinthal (2000) referred to such a forward-looking view as ‘forward-looking intelligence’; the evaluation of a number of alternative actions based on their anticipated or expected future benefits. However, how one obtains such forward-looking views is only hinted at. Literature on foresight however posits that organizations have to engage in practices aimed at perceiving and making sense of information which in some way or another may point at future problems or opportunities. Then, forward-looking views can be obtained and action enacted to take advantage of foreseen opportunities or threats (Tsoukas and Shepherd 2004, Cunha *et al.* 2009, Rohrbeck *et al.* 2015). We therefore refer to the practices that constitute such a forward-looking way of searching, and define forward-looking search as the practices of collecting, examining and evaluating new information to derive alternative future courses of action and anticipate their consequences to the end of forming shared representations that raise the likelihood of enacting action.

The identification of potentially fruitful new ideas for new product development has been linked to forward-looking search (Brown and Eisenhardt 1997, Costanzo 2004, Andriopoulos and Gotsi 2006, Salomo *et al.* 2008, Reid and de Brentani 2010, Reid and De Brentani 2012, Kock *et al.* 2015). Literature would posit that indeed, through the introduction of innovations, organizations can adapt and reposition themselves whereby innovation performance and novelty become critical to reflect the firm’s future competitiveness (Kleinschmidt and Cooper 1991, Krishnan and Bhattacharya 2002). However, the view of forward-looking search as able to continually supply the innovation portfolio with new ideas – which are seen as able to provide the firm with future success (Reid and De Brentani 2012, Kock *et al.* 2015) – is difficult to substantiate. Indeed, scholars have

criticised that the perceived ability forward-looking search to spot ‘distant’ opportunities for superior performance may not be that separate from luck and serendipity (Winter 2012). As Simon defines the limits of rationality as the lack of “complete knowledge and anticipation of the consequences that will follow on each choice” (Simon 1947, p. 81), it becomes difficult to envision that each newly initiated innovation *will* provide future successes. Because by contrast, “the exercise of established or incrementally improvements offers a more limited kind of success that is often realized with very high reliability—so much so that it becomes taken for granted” (Winter 2012, p. 292). Organizations are often more interested, and able to do more reliably, in factors that nurture the continuation and success of ongoing projects, rather than initiate new uncertain ones for which the gains may not be likely (or simply not known well enough).

However, organizations frequently face new stimuli that may simply invalidate current pursued innovations – opportunities that were seen at fruitful to pursue at first. While Gavetti (2012) argues that distant foresight can bring superior performance, he describes the organizational landscape as not only free of competitors but also stationary. This is also implicitly assumed in the case of forward-looking search as a provider for new product ideas; it is assumed that initiating such a new project will provide benefits in the future. However, both the feasibility and the returns of any particular pursued innovation are subject to change by uncertain environmental dynamics. New opportunities are continuously being created by the general advance of knowledge. Even opportunities pursued based on the deepest knowledge on the logic of the opportunity itself can easily become worthless because of unanticipated inventions and strategic moves by rivals and other unanticipated events (Winter 2012). Indeed, one of the main research streams on foresight, the French school of *la prospective* posits that “what matters is to anticipate what would happen if one did nothing to change the course of the future, then determine which human actions would be required to provoke the desired future” (Godet and Durance 2011, p. 5).

In the context of innovation therefore, we suggest that firms that show willingness to critically

review, question, change, or even terminate ongoing innovation projects are most likely to have forward-looking search contributing to innovation performance. These adjustments or terminations to running projects may have been in response to future insights, signalling potentials for a lack of strategic fit of certain projects in the future, or potential lack of performance of the innovation project outcome in markets of the future. While prior research mostly focused on forward-looking search as a contributor towards formulating new innovation ideas for the innovation portfolio (Brown and Eisenhardt 1997, Reid and De Brentani 2004, 2012, Yadav *et al.* 2007, Reid and de Brentani 2010, Kock *et al.* 2015), it lacks insights whether current projects in the innovation portfolio may also benefit from forward-looking search. While we acknowledge that forward-looking search can potentially identify new ‘superior’ innovation ideas, it certainly has its merits in relating future insights against current running projects. Indeed, recent research suggests that forward-looking search can reliably act as a mechanism that can mitigate escalation of current running innovation projects, which resonates well with the view of forward-looking as appraising current actions (Seidl 2004). By continually correcting assumptions about the future of markets, technologies, and competition, paired with monitoring roadmaps and continual benchmarking with the industry, the odds of “throwing good money after bad” can be significantly reduced (Sarangee *et al.* 2014, p. 1034). Also, it allows to better align innovation plans with foresights on technology, market, and competitors (Rohrbeck and Gemünden 2011), thereby providing the firm with competitive-timing advantages (Simonse *et al.* 2015).

Therefore, if forward-looking search is to have an impact on innovation performance, either by means of being the catalyst of new innovation avenues or updating current innovation projects, these insights need to be held against a current portfolio. Practices of critically reviewing and questioning the innovation portfolio seems therefore ever more important. Indeed, recent research argues that initial decisions to initiate new innovation projects were based may change, and therefore new decisions to adapt to these changes are needed (Kock and Gemünden 2016). Indeed, agility in

innovation portfolio management is needed to address “changes of customer needs, competitive conditions, resource situations, technological opportunities and threats, or strategic goals” (Kock and Gemünden 2016, p. 672). A key point is that the relevant practices of agility are complementary with respect to leveraging forward-looking insights in the context of innovation, as they describe neither a specific situation of decision-making nor the success of portfolio decisions (Kock and Gemünden 2016).

The key contribution of this paper is therefore to introduce the notion that forward-looking search should not merely be done in absence of referencing to the firm’s current array of innovations. This implies that while firms may engage in forward-looking search, these efforts must be complemented with practices that promote the assimilation of forward-looking insights in referencing to current projects. We add to recent advances in NPD portfolio management (Kester *et al.* 2014, Kock and Gemünden 2016) where agility with a development portfolio is deemed part of effective innovation portfolio decision-making. We complement this research by positing that innovation portfolio decision-making quality and agility can be enhanced by forward-looking search, which explicitly emphasizes the future as a temporal aspect, and allows for better decision-making and more effective additions or alterations to the current innovation portfolio.

The article is structured as follows. A background on forward-looking search is given, innovation portfolio agility, and innovation performance. Next, hypotheses are developed and empirically tested to further our understanding how forward-looking search may influence innovation performance by means of exercising agility in the innovation portfolio. Then, we discuss the results, followed by a discussion of the findings. We conclude with a reflection on the implications for current research on forward-looking search and product development, as well as managerial implications and avenues for future research.

## 3.2 Background

### 3.2.1 Forward-looking search and its components

Gavetti and Levinthal (2000) specified two logics with which firms deal with the future; either with a backward-looking or with forward-looking decision-making logic. The backward-looking logic reflects incremental trail-and-error learning through past actions and the adaptive selection of routines. The rules upon which decisions are made are dominated by experience and performance feedback; this is well recognized in evolutionary theory and learning literature (Levinthal and March 1981, Argote and Greve 2007). Organizations following this logic typically search myopically for alternative actions to adjust their current behaviour with, which do not take the future a great deal into consideration (Cyert and March 1963). The forward-looking model represents a form of forward-looking intelligence which works on the premise of how actors perceive the linkage between alternative actions and its subsequent consequences in markets of the future (Gavetti and Levinthal 2000). An emphasis is increasingly placed on the creation of possibilities that are either enhanced or attenuated by actor's representations of the future, rather than on the accuracy of forecasts (Kaplan and Orlikowski 2013).

Literature on forward-looking practices largely focuses on the challenges and processes involved with detecting cues from the environment that may contain information to signal possible changes early (i.e. weak signals), and the interpretation of these signals (Seidl 2004, Cunha *et al.* 2009, Schoemaker and Day 2009). Forward-looking practices can thus be conceptualized as directed towards perceiving and interpreting weak signals which in some way or another point at future problems or opportunities (Tsoukas and Shepherd 2004). Typically, the search for information paired with the interpretation on its future implications and learning from this is related to the concept of 'organizations as interpretation systems' (Daft and Weick 1984). It represents a sequential process of 1) scanning, 2) interpretation, and 3) learning. Indeed, research on foresight within organizations depicts a similar process view (e.g. Horton 1999, Voros 2003, Andriopoulos

and Gotsi 2006). We therefore consider forward-looking search as the practices of collecting, examining and evaluating new information to derive alternative future courses of action and anticipate their consequences to the end of forming shared representations that raise the likelihood of enacting a chosen course of action.

The act of scanning for signals that may indicate or lead to a change in the way the future should be perceived, literature has focused on the processes by which individuals and organizations 'search' for weak signals, where having a sufficient wide reach to information sources is deemed necessary to perceive weak signals (Day and Schoemaker 2005). Essentially all organizations acquire information in a deliberate or non-deliberate way about trends, events, opportunities, and threats in their market environment through either directed scanning, direct experience, imitation, or problem-solving inquiries (Day 1994, p. 44). Information from the environment is acquired about the actions of relevant others, such as customers, suppliers, competitors, and regulators, or technologies (Daft and Weick 1984). Typically through formal data collecting initiatives within an organization, but also through personal contacts. Differences, however, are found in the way the organizations go about proactively and systematically obtain such information (Daft and Weick 1984, Day and Schoemaker 2005). The assumption that 'information is out there' and that it can be found by firms through searching, can provide input into how the future may be (re)imagined (Day and Schoemaker 2005). These signals can thus trigger subsequent interpretation processes when those who perceive the signals as not fitting current perceptions of how the future may develop (Kaplan and Orlikowski 2013).

This subsequent step, which is interpretation to create an understanding of what, when, and how changes are likely to occur, is at the centre of forward-looking search (Horton 1999, p. 7). It is the interpretation and meaning-making of issues or opportunities from weak signals (Dutton and Ottensmeyer 1987). Interpretations of the future allow decision-makers to anticipate, in approximate terms, the longer-term implications of (alternative courses) of action (Gavetti *et al.* 2012), and has

been shown to be a critical determinant of managerial choice, action, and future consequences of these actions (e.g. Tripsas and Gavetti 2000). Interpretation draws heavily on both informal social processes and formal processes. In formal settings, which has been the dominant focus in the field of foresight, structured approaches and methods facilitate the creation, articulation, and settlement on ‘what might be’ (Tsoukas and Shepherd 2004). Typical approaches to create interpretations of the future include identification of influencing factors that present a given business environment and how they interact (Gordon and Hayward 1968), forecasting (Cuhls 2003), development of probable future projections on the basis of scenarios (Wack 1985, Van Der Heijden 1996) and roadmaps (Groenveld 1997), and the development of courses of action based on these insights (Tsoukas and Shepherd 2004). While these approaches and methods reflect to a certain extent a formalized approach to interpretation, the usage of the methods itself can also facilitate informal social processes that lead to settlements on representations of the future. Particularly in the literature on scenario foresight, scenarios are designed and used to surprise those who read it by challenging their assumptions about how the world works and change their perceptions by means of ‘scenario thinking’ and ‘strategic conversations’ (Burt and van der Heijden 2003). Indeed, Rohrbeck (2010) found that organizations used more structured approaches and methods to increase transparency of what has been interpreted and why it was done in such a way in order to facilitate commitment of other organizational actors who were not participating in these structured approaches. The latter, which is needed in order for any insights generated to have an actual impact on decisions and consequently organizational outcomes.

### **3.2.2 Context: The role of forward-looking search in innovation**

Innovation portfolio management is concerned with “doing the right things” in contrast to the purpose of project management where the focus is on “doing things right” (Cooper *et al.* 2001). It is therefore none surprising that forward-looking search has primarily been linked to facilitating the identification of potentially fruitful new ideas for new product development (Brown and Eisenhardt

1997, Salomo *et al.* 2008, Reid and de Brentani 2010, Reid and De Brentani 2012, Kock *et al.* 2015, Reid *et al.* 2015). In other words, the generation and selection of ideas to enter the portfolio of innovations which may bring the organisation future successes. In essence then, a portfolio of innovations becomes a collection of opportunities that have been ‘pre-adopted’ at different points over time. One of the issues with this view is that not necessarily recognize the dynamics of a firm’s external environment which may discredit any of the ongoing innovation developments. The view of forward-looking search as able to continually supply the innovation portfolio with new ideas – which are seen as able to provide the firm with future success – is therefore difficult to substantiate. As Simon defines the limits of rationality as the lack of decision-makers’ “complete knowledge and anticipation of the consequences that will follow on each choice” (Simon 1947, p. 81), it becomes difficult to envision that each newly initiated innovation *will* provide future successes. However, not only environmental dynamics and bounded rationality may lead to ideas (that were initially seen as being successful in the future) to become less viable; also a different way of envisioning the future may cause for shifts in the portfolio. More specifically, if through forward-looking search decision-makers come to a different future representation it means that any criteria by which current innovation projects are appraised are changed as well (Csaszar and Levinthal 2016). Re-prioritization, termination, or adjusting projects then becomes necessary for which agility within the innovation portfolio is needed (Vecchiato 2015).

However, the literature on innovation portfolio agility faces some limitations as it has rarely been brought in relation to forward-looking search. For example, Kester *et al.* (2011, 2014) build a model of portfolio decision-making, where agility in adjusting the portfolio (either adding, adjusting or terminating projects) in a quick way due to some changes in the environment is part of portfolio decision-making effectiveness. However, agility is typically seen as a way to respond to myopic signals, such as short-term market changes. Kock and Gemünden (2016) also study within innovation portfolio management the antecedents to innovation portfolio agility. However, also here

little attention is paid to the potential role of future insights into facilitating agility which seems essential since agility is all about “*firms to quickly adapt their innovation project portfolio to changing customer needs and competitive conditions, changing resource conditions, changing technological opportunities and threats, and changing strategic goals*” (Kock and Gemünden 2016, p. 675). Rohrbeck and Gemünden (2011) postulate three different roles foresight can fulfil to enhance a firm’s innovation capacity. While also they found that they could not establish whether foresight is so much an *initiator* of new innovation projects – similar to the critique we have postulated before, as a distant opportunity is unlikely to be convinced as attractive – the role of *opponent* was deemed to be a highly effective mechanism. Foresight challenges NPD teams, or portfolio managers, by providing insights on emerging customer needs, or rival firm’s innovation trajectories. Regular participation of teams involved in foresight and those in R&D in joint meetings and review workshops, the impact of forward-looking on innovation performance was facilitated.

Furthermore, future-preparedness as a success factor of innovation projects is increasingly emphasized (Rank *et al.* 2015), which refers to the ability project’s outcome to seize opportunities that arise *after* the completion of its development project (Teller and Kock 2013, p. 820). It refers to the ability of the new product, for instance, putting the firm a step ahead of its competitors in terms of new products (or technologies or services), or that it may allow for the discovery of further market or technology opportunities after the innovation project’s completeness (Shenhar *et al.* 2001, Rank *et al.* 2015). Similarly here, the role of making sure current innovation projects are *state-of-the-art* and provide future avenues for next iterations of innovation projects seems paramount. Innovation portfolio agility is thus seemingly an important facilitator of enhancing a firm’s innovation performance by the arguments outlined above. Innovation portfolio agility practices promote reviewing *current* innovation projects in the light of newly acquired future insights, and therefore seems to be warranted to explore further.

### **3.2.3 Innovation portfolio agility as organizational practice**

The terms ‘flexibility’ and ‘agility’ have been used numerous times in innovation project portfolio management. Kester *et al.* (2011) define innovation portfolio agility as “the firm readily changes the composition of its NPD portfolio to reflect potential opportunities and threats” (2011, p. 648). Agility in innovation portfolios has been related to two components; flexibility and speed (Kester *et al.* 2011, 2014, Kock and Gemünden 2016). Thomke and Reinertsen (1998) define flexibility as a “[...] function of the incremental economic cost of modifying a product as a response to changes that are external (e.g. a change in customer needs) or internal (e.g. discovering a better technical solution) to the development process” (1998, p. 8), and reflects the overall ability to change or terminate innovation projects when this is warranted. Of course, flexibility is limited to the extent an innovation project is adjustable within acceptable costs, which can arise from both costs related to the development, technologies used, designer choices, managerial preferences, as well as the development schedule (Thomke and Reinertsen 1998). Speed is defined as a firm’s ability to quickly adjust or eliminate innovation projects that have been deemed unfit in its current form in the portfolio, for instance due to external events making the project outcome uncertain (Kester *et al.* 2011, Kock and Gemünden 2016), as such that decisions to change or terminate projects are made fast.

### **3.2.4 Innovation performance as an outcome**

Innovation performance of a firm is a performance indicator, which refers to the degree of success attained by firms in achieving goals related to new products or services (Montoya-Weiss and Calantone 1994). While innovation performance can be defined and measured on a wide range of dimensions, we focus on a specific sub-set of two innovation performance dimensions that are suitable for our research given their predominance in related studies on information gathering practices and innovation portfolios; new product/service success, new product/service innovativeness, and new product/service financial performance. New product/service success is a

dimension of performance that involves the firm's ability to compete in the marketplace (Baker and Sinkula 1999), and has been widely used studies related to intelligence gathering processes (Slater and Narver 1994, Moorman and Miner 1997, Ottum and Moore 1997, Droge *et al.* 2008), as well as in studies on NPD portfolios (Riel *et al.* 2004, Salomo *et al.* 2007, Kester *et al.* 2014), making it a suitable indicator for the study we propose here. New product innovativeness refers to the level of novelty of the resulting innovations (Salomo *et al.* 2008), and is similarly used as an outcome measure in studies on intelligence gathering processes (Hult *et al.* 2004), and NPD portfolios (Kleinschmidt and Cooper 1991, Salomo *et al.* 2007). New product/service financial performance refers to the financial success of innovations in terms of profitability and return on investment (Im and Workman Jr. 2004).

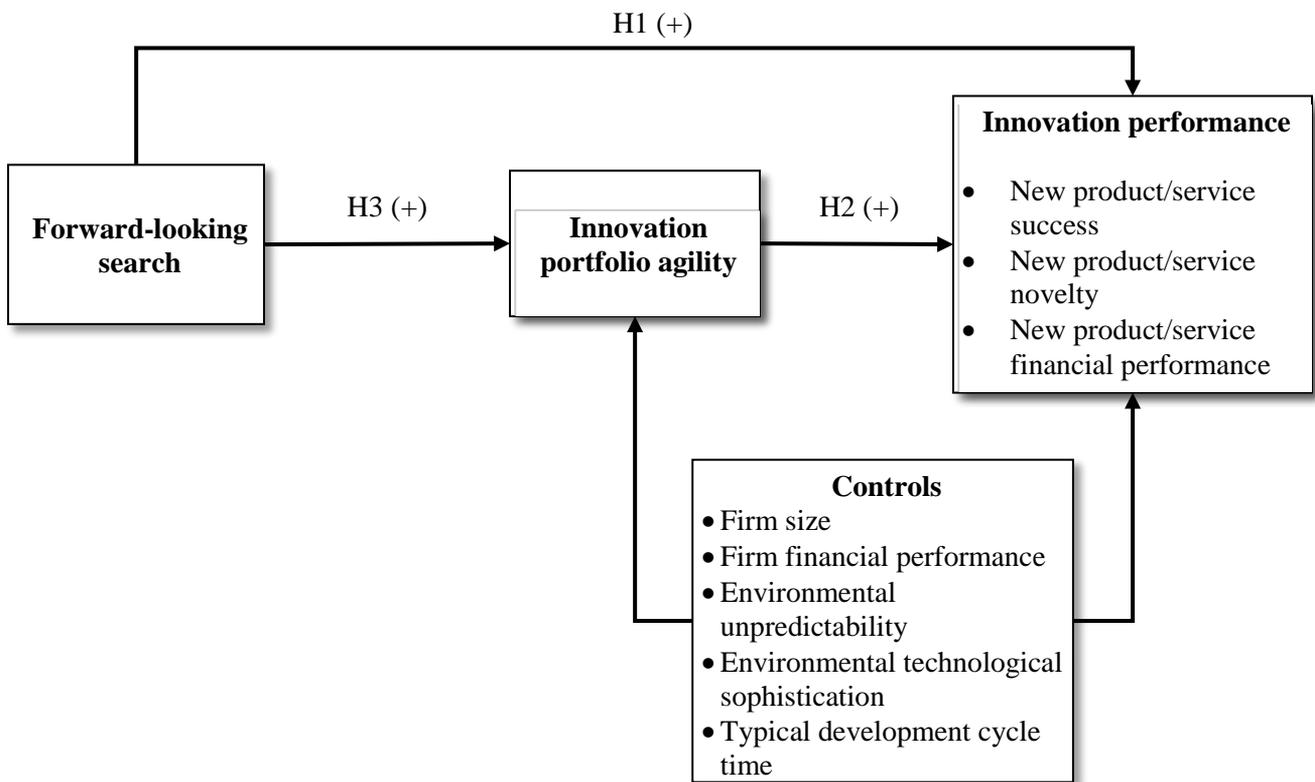
### **3.3 Theory and Hypotheses**

In the previous section we have given a general overview of forward-looking search, innovation portfolio agility, and innovation performance. In this section, given that we propose a mediation model, first, we develop hypotheses to relate forward-looking search on an overall level to innovation performance. Next, we relate innovation portfolio agility to innovation performance. Last, we develop hypotheses relating forward-looking search to innovation performance by introducing innovation portfolio agility as a mediator in the forward-looking search – innovation performance relation. Figure 3.1 shows the hypothesized model.

#### **3.3.1 Forward-looking search and innovation performance**

The empirical study of Brown and Eisenhardt (1997) underscores the importance of looking into the future to create and sustain successful and innovative product portfolios. They found that successful firms, in terms of product innovation success, were more focused towards and engaged with the future. These firms owed their innovation successes by identifying multiple possible futures to drive their innovation projects, which would lead to quicker development and deployment of innovations.

**Figure 3.1 Hypothesized path model**



Less performing firms were found to be negligent towards the future which left them behind the competition. Hamel and Prahalad (1994) argue that learning about trends and patterns before competitors do is key to achieve success in the marketplace. Other studies argue similarly that foresight in areas such as opportunities in technologies, potential competitive situations, and other potential profitable situations can lead to better investment decisions, especially in the realms of research and development (R&D) and innovation investments (Courtney 2001, Mcgrath and Nerkar 2004). Overall, the finding is that forward-looking search contributes adding new projects to the portfolio but also changing or terminating running projects to ultimately achieve their goals related to new products or services, such as success and financial performance.

While success in the market place may be facilitated by looking forward more extensively, the concept of ‘newness’ in product, service, or process innovations is also found to explain gains or losses of competitive advantage (Greve and Taylor 2000). Forward-looking search can contribute to

innovativeness by means of generating novel ideas for innovation projects (Brown and Eisenhardt 1997, Andriopoulos and Gotsi 2006, Rohrbeck and Gemünden 2011, Kock *et al.* 2015). It may lead a firm to see new opportunities that were at first distant, unthinkable, and undiscovered (Gavetti 2012). These opportunities would allow a firm to depart from dominant ways of thinking in its own business environment and consequently become more innovative and successful than its competitors (Hamel and Prahalad 1994, Gavetti 2012), and allows for future opportunities to be extended into product development to deploy them well in markets of the future (Yadav *et al.* 2007). This leads to our first hypothesis, emphasizing the possibility of a *direct* link:

*H1: Forward-looking search positively impacts innovation performance.*

### **3.3.2 Innovation portfolio agility and innovation performance**

Whereas innovation portfolio agility has been related to two components; flexibility and speed (Kester *et al.* 2011, 2014), research in the areas of new product development has investigated both components and its impact on innovation performance. Salomo *et al.* (2007) argue that organizations must maintain a certain degree of flexibility to react appropriately to shifting conditions, such as to external changes (e.g., pioneering competitors) or internal changes (e.g., technological inventions based on serendipity) which cannot be fully anticipated a-priori and must be accounted for during project execution. Little to no flexibility in the development process may be detrimental to the success of the development outcome, as there is little room to cope with uncertainty inducing issues that may arise during the development (Eisenhardt and Tabrizi 1995, Salomo *et al.* 2007, Yadav *et al.* 2007). Similarly, speed can positively influence innovation performance by means of faster reaction time to uncertainty inducing issues to the current development projects (Eisenhardt and Tabrizi 1995) ensuring up-to-date products (Yadav *et al.* 2007), but also to realise time-to-market advantages and increase new product profitability (Griffin 2002). As such, we hypothesize:

*H2: Innovation portfolio agility positively impacts innovation performance.*

### 3.3.3 Forward-looking search, innovation portfolio agility, and innovation performance

Making the ‘right’ investment decisions and developing the ‘right’ products is central to portfolio management (Cooper *et al.* 2001). However, it is difficult as firms constantly need to decide within certain resource constraints where development efforts for NPD are directed towards and at what point in time (Chao and Kavadias 2008). These decisions need to be made while also considering other development projects within the innovation portfolio, which may otherwise run the risk of seeing unbalanced development efforts directed towards them (Kester *et al.* 2014).

A portfolio consists of *ongoing* projects in development which may or may not be subject to continuation, adjustment, or termination decisions. Decisions that result in changing or terminating ongoing development projects by means of exercising agility (Kester *et al.* 2014), may be regarded as the result of *doubting*. Doubting is a development process that results from the difference between what is predicted by current representations of ‘what is’ and ‘what might be’ (Blackman and Henderson 2004). If the original novel idea of an innovation under development proves to be flawed by means of insights generated about the future, and the firm does not have any feedback loops in place that promote ‘doubting’ of the current development efforts, it will mean that the organisation cannot adapt and so an expected future success becomes another failed innovation or blind alley (Blackman and Henderson 2004). Indeed, the study of Kaplan and Orlikowski, suggest that “Though the future will likely not turn out the way it was projected, this does not mean that projections do not matter. Articulating projections shapes attention, deliberation, investment, and effort.” (2013, p. 990).

Organizations *can* foresee the possible failures of sustaining current perceptions of the environment and its future – they can know in advance that their own perceptions may become non-viable (Seidl 2004, p. 160). Therefore, agility to appropriately adjust innovation projects based on perceived shifting conditions is needed, as possible shifts in perceptions of the future cannot be fully known before the development project starts (Salomo *et al.* 2007, Kock and Gemünden 2016). As

such, for forward-looking search to be effective and influence innovation performance, there must be focus upon challenging and doubting. Existing future expectations of innovation projects may be falsified, which is then reflected in an organization's ability to promote agility in its development efforts (Salomo *et al.* 2007, Yadav *et al.* 2007).

Furthermore, forward-looking search may also promote agility in redirecting development efforts. For instance, regarding flexibility (i.e. adjusting NPD projects in response to external changes), forward-looking search can enhance flexibility in the development of innovations after the innovation idea is already established. By assisting firms in maintaining their knowledge on future developments external to their own organizations, they can take advantage of emerging developments and avoiding technological surprises (Salomo *et al.* 2007, Yadav *et al.* 2007). In a similar vein, Rohrbeck and Gemünden (2011) found that foresight practices may take on an opponent or strategist role to promote flexibility by challenging and exposing portfolios of projects to future interpretations to assess how well it may hold up against signals of potential disruptions being brought about. Forward-looking search can thus promote flexibility which may result in a decision to terminate a particular development project. Kaplan and Orlikowski (2013) found that the investment decisions, or rather disinvestment decisions, were driven by forward-looking practices revolving around continuous discussion and negotiation between future projections and the project's current development state. This process led to first, project budget cuts, and later a complete shut-down of the project, preventing further escalating development costs. Sarangee *et al.* (2014) relate such practices to de-escalation, where continuously looking forward can mitigate escalation drivers such as self-justification. Changing or even terminating running projects were the result of forward-looking search; foreseeing potential the future failure of keeping investing into the wrong projects (Sarangee *et al.* 2014). Forward-looking search may thus trigger processes that lead to a termination decision of a development project, resultant from learning that early signals of emerging trends jeopardize the outcome of the current development projects to become obsolete or non-viable in the

markets of the future.

While forward-looking search may not only promote flexibility in redirecting development efforts, it may also promote a sense of speed in redirecting such efforts (i.e. adjusting projects in a timely fashion in response to external change). The inherent assumption of forward-looking search is that it spots signals of impending change before they become reality, i.e. they exist in a state of potentiality (Lord *et al.* 2014). Grasping such signals before competitors is paramount to success (Hamel and Prahalad 1994) and may promote speedy settlements on ‘what to do’ (Kaplan and Orlikowski 2013, p. 965): “Settling [...] even if provisional, allows actors to shift from disagreeing or deliberating about meanings to implementing strategic choices, thus enabling the organization to move forward in the face of uncertainty.” Forward-looking search can thus enhance innovation portfolio agility by means of making informed decisions on what direction current innovation projects should take. Actions are decided based on interpretations of the information perceived, which may entail either continuing current activities, or by initiating a process of (attempting) to induce change to current activities (March 1991), in turn promoting agility. As such, we hypothesize the positive influence of forward-looking practices on innovation portfolio agility:

*H3: Forward-looking search is positively related with innovation portfolio agility.*

Furthermore, as we argue that 1) innovation portfolio agility can improve innovation performance, 2) forward-looking search can promote agility in new product/service development, and 3) innovation portfolio agility functions as set of practices to translate future insights into innovation performance, we expect that innovation portfolio agility mediates the forward-looking search– innovation performance relationship:

*H4: Innovation portfolio agility positively mediates the relationship between forward-looking search and innovation performance.*

## 3.4 Data and measures

### 3.4.1 Data collection and sample

The data we use in this paper are drawn from three major sources; 1) a cross-sectional survey distributed in 2013-2014, 2) Bureau van Dijk's ORBIS database which contains detailed operational and financial information of both public and private companies worldwide, and 3) firm's annual reports. We collected objective performance data for a time period of 3 years prior to the response year of the survey (the previous financial year as per the annual report's date serves as time  $t$ ).

To ensure the wider applicability of the study's findings, the hypotheses are tested with a sample of European firms active in a variety of industrial sectors with a focus on innovation. We excluded firms that had not introduced at least three new products or services over the past five years. All firms had to fulfil this criterion as it was necessary for measuring our study's endogenous constructs being innovation portfolio management agility and our measures for innovation performance. Furthermore, instead of using a typical timeframe of three years we used five years to distinguish innovators and non-innovators, whereas the former has higher chances of assuming latecomers (i.e. within 3 years) to be innovators and early adopters (more than 3 years ago) to be non-innovators (Armbruster *et al.* 2008). Especially since product development cycle times can differ widely from a variety of industries, we alleviated the potential concern of only sampling latecomers.

To build the sample, first, we randomly drew a sample of firms 300 firms from the European Commission Economics of Industrial Research and Innovation R&D top 1000 EU Scoreboard for identifying firms from a variety of industries in an R&D/innovation context (European Commission 2013). Multiple respondents were identified in senior managerial functions that could potentially facilitate forward-looking search depending on the respondent's firm type. For instance, in industrial companies, mainly managers from areas such as innovation and R&D management were targeted. Since we needed to verify the firm had introduced innovations in the past years, and this kind of

information requires the direct contact of all firms and the cost of this process is very high, we initially extracted the random sample of 300 firms. Additionally, we contacted firms which had participated in an earlier study by the authors and other firm representatives whom the authors of this study have had contact (at conference presentations, interviews, or via social networks). Given our mixed sample approach, it is probable that the firms in this sample differ from the general population by having a higher interest in and sensitivity to innovation management practices and potentially forward-looking search than the average firm does.

Phone and email contact was used to establish the suitability of the respondent for our survey and that the respondents were confident that they could accurately respond to the survey questions. We contacted 1030 potential respondents (corresponding to 522 unique firms). Typically, 2 reminders were sent out in case of non-response within a 4-week period. Potential concerns about common methods variance were decreased via the development process which involved careful instrument design, with particular attention paid to question wording and sequence by means of complete randomization to reduce interconstruct correlations (Podsakoff *et al.* 2003).

We received 134 usable questionnaires, indicating a response rate of 13.1%, which is typical in this kind of study. A further 4 responses were discarded because ultimately the firm did not fit the sampling criteria we imposed. The total usable number of survey responses is therefore 130. Our final sample includes mostly larger firms (More than 3000 employees = 67.7%) with annual revenues over 1 billion Euros accounting for 64.8% of our sample. Major representing industries are manufacturing/production (33.1%), R&D and engineering (27.7%), and information technology (16.9%). Furthermore, regarding innovation portfolio size, we can deduct from the indicated typical development cycle time of innovations that firms have very differing portfolio sizes. Paired with our screening criterion of having at least introduced three innovations in the past five years, we can deduct, for instance, that firms with 4-9 years of typical development time have a portfolio of at least 3 projects to fulfil the criteria. It is reasonable to expect that firms with longer development cycle

**Table 3.1 Sample Characteristics (N=130)**

	No. of firms	%		No. of firms	%
<b>(a) Firm size</b>			<b>(c) Annual revenues</b>		
<100	9	6.9	< 10 million Euros	7	5.4
100-249	5	3.8	10-99 million Euros	16	12.3
250-499	7	5.4	100-999 million Euros	20	15.4
500-999	6	4.6	1-9.9 billion Euros	42	32.3
1000-1499	4	3.1	> 10 billion Euros	45	34.6
1500-2999	11	8.5			
>3000	88	67.7			
<b>(b) Industry</b>			<b>(d) Typical development cycle length</b>		
Consumer services	9	6.9	Less than 1 year	10	7.7
Business services	7	5.4	1-3 years	66	50.8
Manufacturing/production	43	33.1	4-9 years	44	33.8
R&D, engineering	36	27.7	10-14 years	6	4.6
Information Technology	22	16.9	15-20 years	6	2.3
Energy/public utilities	8	6.2	More than 20 years	1	0.8
Retail/sales	5	3.8			

times to have portfolios with more concurrent innovation projects compared to firms with very short (e.g. less than 1 year) cycle times. Table 3.1 shows the sample characteristics.

We assessed nonresponse bias by comparing early and late respondents. The t-tests between early (within seven days) and late (after three weeks) respondents showed no significant differences on any of the model's key variables (Armstrong and Overton 1977).

### 3.4.2 Measure development

Multi-item reflective scales were used for all the first-order constructs in our model, whereas we defined the second-order construct of innovation portfolio agility as reflective. All the items, unless otherwise stated, asked on a seven-point Likert scale ("strongly disagree"/"strongly agree") to extent to which the respondent agreed with a statement. New scales were developed for both forward-looking search and innovation portfolio agility.

To assess face and content validity, we performed a pilot study. First, the initial pool of items went to through several iterative feedback sessions with 4 academics holding positions in marketing, innovation management, and strategy with extensive knowledge on foresight approaches within

organizations, in order to assess content validity and face validity. Item wording was adjusted to make it generally applicable to a broad range of industries. The items were pretested with a convenient sample of 6 participants in academic and industry positions with knowledge and experience in foresight and innovation management practices. Participants were asked to comment on their ability to understand and answer the questions from the complete questionnaire. Their feedback was processed by means of face-to-face interviews after the participant had filled out the questionnaire. Some changes were made after this pre-test to the questionnaire with regard to wording and formulation.

*Forward-looking search.* We developed items for forward-looking search due to the absence of a comprehensive measure. We focus on forward-looking search as the set of techniques, practices and processes that organizations use for detecting new events and changes in their external environment; exploring their likely evolution and effects; and defining response options (Horton 1999, Vecchiato and Roveda 2010, Rohrbeck and Gemünden 2011, Rohrbeck *et al.* 2015). Conceptualizing forward-looking search as a unidimensional construct, defined as *the practices of collecting, examining and evaluating new information to derive alternative future courses of action and anticipate their consequences to the end of forming shared representations that raise the likelihood of enacting the chosen course of action*, we ultimately ended up with items 6 (see Table 3.2) that fit this operationalization. The items reflect the extent to which an organization is engaged in detecting future signals and trends (items 1 and 2; inspired by the concept of scanning in foresight literatures (e.g. Hambrick 1982, Horton 1999, Rohrbeck and Gemünden 2008)), interpreting these signals for future implications (items 3 and 4 inspired by interpretation processes of e.g. Horton (1999), Voros (2003), Oner and Gol (2007)), and the support for triggering subsequent organizational responses to future insights (items 5 and 6; inspired by Horton (1999) and Becker (2002)). Exploratory principal component analysis (PCA) was carried out which extracted a single factor for the 6 items with an eigenvalue of 1.0 as a cut-off value and explained 50.53% of the total variance. This indicates that

forward-looking search is a unidimensional construct. Although it may have been the case that the PCA extracted three factors rather than one (i.e. detecting of signals, interpretation, and triggering responses), it seems that firms do not necessarily engage in only one of the factors in absence of the others. Rather, if they do the detection of signals, they follow up on the other steps as well.

Additionally, in order to address a potential concern that our measure of forward-looking search is able to ascribe any effect to our innovation performance measures, since the latter measure performance aspects over the prior three years, we performed an additional check. More specifically, we asked respondents to indicate for how many years they, or their firm, had been engaged in forward-looking search in a formalized manner. Using a one-way ANOVA, we find 25 firms indicating less than three year experience. These firms score significantly lower on forward-looking search than those with more experience (Less than 3 years: mean = 4.11, S.D. = 1.11; more than 3 years: mean = 5.19, S.D. = .79). We also find a positive Pearson correlation or  $r = .445$  ( $p < .001$ ) between experience (in number of years) and forward-looking search. As such, we alleviate potential concerns of our forward-looking measure not being able to ascribe any effect to innovation performance over the prior three years.

*Innovation portfolio management agility.* We developed measurement items for innovation portfolio agility based on the studies of Kester *et al.* (2011) and Rohrbeck and Gemünden (2011). We created initial pools of items reflecting both the flexibility and speed components, thereby envisioning innovation portfolio agility as a second-order construct with both flexibility and speed components as its first-order constructs (Kester *et al.* 2014)<sup>1</sup>. An exploratory principal component analysis (PCA)

---

<sup>1</sup> While the work of Kester *et al.* (2014) develops a scale for NPD portfolio agility, their items measure specific activities only triggered when external changes are perceived (i.e. “*We rapidly change our NPD portfolio priorities when we detect a new market opportunity*”, and “*We readily change the composition of our NPD portfolio to respond to new strategic opportunities*” Kester *et al.* 2014, p. 1213). In order to alleviate conceptual overlap between our measure of forward-looking search and innovation portfolio management agility, our items do not refer to activities in response to externally perceived signals.

was carried out which extracted 2 factors, as expected, pertaining to flexibility and speed with an eigenvalue of 1.0 as a cut-off value and explained 65% of the total variance.

### 3.4.3 Measures

Other scales we use in this study originate from existing studies. For measuring innovation performance, we use 4 items for *new product/service innovativeness* from Salomo *et al.* (2008), 6 items for *new product/service success* from Baker and Sinkula (1999), and 4 items for *new product/service financial performance* (Im and Workman Jr. 2004). The wording of items from these scales has been slightly modified where necessary to fit our survey format and research context. For instance, if an item referred to ‘product’ or ‘service’, but not both, we replaced the wording with ‘product/service’.

Lastly, we include a number of control variables to account for variance of our endogenous constructs innovation portfolio agility and innovation performance. We include *typical product development cycle time* to act as a crude proxy to the cost (development expenses, development scheduling) of modifying ongoing innovation projects, as development flexibility is argued to be a negative function of such costs (Thomke and Reinertsen 1998). A categorical variable is used asking respondents for the “*Typical development time for new products or services (the elapsed time from ideation to the market launch of a new product) in years*”, with categories of less than 1 year, 1-3 years, 4-9 years, 10-14 years, 15-20 years, more than 20 years. This categorical variable was recoded into dummy variables. Due to the low number of responses for categories 10-14 years, 15-20, and more than 20 years, we left these out of the analysis due to estimation problems. To control for size effects, we include a firm’s logarithmic value for *total revenue* one year prior to our survey measures ( $t_{-1}$ ) as a measure for organizational size. Furthermore, since our study’s dependent variable is the financial performance of recently launched products or services, we include a measure of overall firm financial performance as *return-on-assets* (ROA) to control for the potential that innovation performance is driven by firm’s existing revenue streams, and those resulting from newly launched

products or services. ROA is used extensively in innovation studies (Ahuja 2000, Katila and Ahuja 2002). ROA was averaged for three years prior to survey response year, to decrease the chance of a one-year fluctuation influencing results. Furthermore, we include a measure for *environmental unpredictability* based on three items from environmental dynamism scale of Green *et al.* (2008) to account for the effect that an unpredictable environment causes the established firm to be more vested in agile new product development. Lastly, we include 4 items of *environmental technological sophistication* (Kreiser *et al.* 2011). We excluded items referring to dynamism in the technological area (product, technology, and industry dynamism). We included this control as a proxy for describing a firm's R&D expenditures, which are usually linked to innovation performance (Verdu *et al.* 2012), a firm's absorptive capacity to take in external knowledge (Laursen and Salter 2014), and capacity of scientists and engineers to develop new products.

## **3.5 Data analysis and results**

### **3.5.1 Measurement model assessment and construct validity**

Table 3.2 reports the newly formulated items for forward-looking search and innovation portfolio agility with its item loadings. The remaining items used in this study are reported in Appendix 3A.

First, we assess convergent validity in two ways. First, the internal consistency reliability through composite reliability (CR) scores of all reflective constructs, as this is the preferred approach over Cronbach's alpha in PLS (Hair, Ringle, *et al.* 2013). Values for CR range between 0.79 to 0.92, exceeding the minimum value of 0.7 and indicating adequate reliability of our constructs (Hair, Ringle, *et al.* 2013), and indicates adequate shared variance among our set of items for each reflective construct (Fornell and Larcker 1981). We also assess convergent validity for the reflective constructs by examining the average variance extracted (AVE) (Fornell and Larcker 1981). We find adequate convergent validity for all our reflective constructs, with AVE ranging from 0.50 to 0.8 and thus exceeding the minimum value of 0.5 (Fornell and Larcker 1981).

**Table 3.2 Items and constructs (PLS estimates)**

Constructs	Item loading
<b>Forward-looking search</b> (CR = .87 AVE = .54) (1 = strongly disagree; 7 = strongly agree)	
Our organization performs environmental scanning proactively in both time horizons, long- and short-term	.652
In our organization, we acquire information on future themes, future opportunities, and future threats	.682
In our organization, we interpret future-related information to determine its implications for our business	.765
In our organization, we create outlooks on multiple possible futures	.691
In our organization, we ensure that results from future-related research reach relevant decision-makers	.772
In our organization, top management strongly supports future-related research	.827
<b>Innovation portfolio agility (flexibility)</b> (CR = .89 AVE = .63) (1 = strongly disagree; 7 = strongly agree)	
We regularly review our innovation portfolio	.828
We regularly have strategic discussions about innovation projects	.810
We regularly challenge the assumptions of our innovation projects	.848
We regularly challenge the state-of-the-art of our innovation projects	.834
We regularly terminate potentially unsuccessful innovation projects before the target date	.618
<b>Innovation portfolio agility (speed)</b> (CR = .86 AVE = .68) (1 = strongly disagree; 7 = strongly agree)	
We are often faster than our competitors in generating promising innovative ideas	.848
We are often faster than our competitors in assessing the feasibility of innovation projects	.854
We have a good track record in spotting threats to our innovation projects early	.761

CR = Composite reliability, AVE = Average variance extracted.

Second, for assessing discriminant validity, we use the Fornell-Larcker criterion for the reflective constructs (Fornell and Larcker 1981), cross-loadings (Henseler *et al.* 2009), as well as the heterotrait-monotrait ratio of correlations (Henseler *et al.* 2015). First, using the Fornell Larcker criterion, we find the square root of the reflective constructs' AVE value exceed the value of the highest correlation with other constructs and thus indicates adequate discriminant validity. Table 3.3 reports these findings. This is additionally supported by the cross-loadings (not reported). The loading of each indicator is greater than all of its cross-loadings (Henseler *et al.* 2009). Lastly, we employ the heterotrait-monotrait ratio of correlations (HTMT) as an approach to assess discriminant validity (Henseler *et al.* 2015). We find that none of the 95% bias-corrected confidence intervals contains the value of 1, which indicates that all of our study's constructs are empirically distinct and

therefore discriminant validity is established<sup>1</sup>.

### 3.5.2 Common method variance

The measures in our study for both dependent and independent variables are collected at a single point in time with one survey instrument from a single respondent, which leads to possible common method variance (Podsakoff *et al.* 2003). We conduct a principal components analysis according to Harman's one-factor test, where all the indicators for our key constructs (*forward-looking search, innovation portfolio agility, new product/service success, new product/service innovativeness, and new product/service financial performance*) are simultaneously entered without rotation. The results of the analysis show that the first factor is able to explain 32.6% of the variance, which is well below the 50% threshold, and reduces the possibility of common method variance being a concern (Podsakoff *et al.* 2003).

---

<sup>1</sup> While we report the results of estimates generated by the partial-least-squares method using SmartPLS 3 (Ringle *et al.* 2014), we report additionally confirmatory-factor analyses (CFA) based on covariance estimation procedures using SPSS Amos 21. Although it is less preferable to employ both as they can provide differing results (Hair *et al.* 2011) and preferably not used prior to employing variance-based structural analyses with PLS (Ringle *et al.* 2012), nevertheless provide in short the results of CFA. Following previous research (e.g. Cheng and Huizingh 2014), we divide the variables into four related groups (forward-looking search, innovation portfolio agility, innovation performance measures, and control variables). We use SPSS Amos 2012 with maximum-likelihood estimation and set each item to load unto its intended construct with correlations between the latent constructs. Overall, the additional CFA indicate adequate fit of our data. More specifically, the fit indices for the groups are the following: Forward-looking search:  $\chi^2/d.f. = 2.273$ ; CFI = .96; SRMR = .053; RMSEA = .099 (CI<sub>0.90</sub> [.037 – .161];  $p_{close} = .084$ ). *Innovation portfolio agility*:  $\chi^2/d.f. = 2.370$ ; CFI = .95; SRMR = .052; RMSEA = .10 (CI<sub>0.90</sub> [.056 – .151];  $p_{close} = .034$ ). As treating both components separately did not improve the model's fit indices, we decided to treat innovation portfolio agility as a second-order reflective-reflective construct (Kester *et al.* 2014). *Innovation performance*  $\chi^2/d.f. = 1.506$ ; CFI = .95; SRMR = .063; RMSEA = .06 (CI<sub>0.90</sub> [.036 – .086];  $p_{close} = .192$ ). *Control variables* ( $\chi^2/d.f. = 1.314$ ; CFI = .97; SRMR = .060; RMSEA = .05 (CI<sub>0.90</sub> [.000 – .106];  $p_{close} = .458$ ). All factor loadings are significant ( $p < .01$ ) and well above the recommended value of .45 (Joreskog and Sorbom 1993).

**Table 3.3 Matrix of correlations of constructs and square root of average variance extracted**

Construct	1	2	3	4	5	6	7	8	9	10	11	12
1 Forward-looking search	(.74)											
2 Innovation portfolio agility	.61	(.87)										
3 New product/service success	.41	.60	(.75)									
4 New product/service innovativeness	.44	.59	.38	(.81)								
5 New product/service financial performance	.25	.34	.44	.13	(.82)							
6 Firm financial performance (avg. $ROA_{t-1,t-3}$ )	.09	.09	.08	.00	.16	(1.00)						
7 Firm size (ln total revenue $_{t-1}$ )	.03	-.08	-.05	-.01	-.02	-.21	(1.00)					
8 Environmental unpredictability	-.17	-.17	-.10	-.02	-.11	-.06	.07	(.75)				
9 Environmental technological sophistication	.39	.49	.43	.54	.33	.00	.06	.03	(.74)			
10 Typical development cycle time (<1 years)	-.21	-.18	.01	-.03	.11	-.08	.14	.10	-.17	(1.00)		
11 Typical development cycle time (1-3 years)	.04	.08	-.05	-.05	-.11	.00	-.07	-.04	-.20	-.29	(1.00)	
12 Typical development cycle time (4-9 years)	.05	.00	.00	.04	.02	.09	.02	-.01	.18	-.21	-.73	(1.00)
Mean	5.23	4.65	4.74	4.04	4.98	5.28	14.52	3.82	4.71	.08	.51	.34
SD	.95	.98	1.04	1.21	.90	10.66	2.26	1.01	1.19	.27	.50	.47
N	130	130	130	130	130	111	104	130	130	130	130	130

Note: square root of the AVE on the diagonals. Off-diagonal elements are correlations between the latent constructs.

### 3.5.3 Structural model

We use partial least squares (PLS) estimation techniques to test our hypotheses using SmartPLS 3 (Ringle *et al.* 2014). For our second-order factor (innovation portfolio agility) and structural model, we used a two-stage approach (Becker *et al.* 2012). Following Hair, Ringle, *et al.* (2013), there are several reasons why PLS is a more suitable approach in our study. While we have developed and will test formal hypotheses, we pursue an exploratory goal that focuses on prediction. Therefore, using PLS as a soft-modelling technique is highly suitable in such a research setting. An additional beneficial feature is the robustness of PLS with smaller sample sizes that are not perfectly normally distributed. Furthermore, due to some missing data in our objective performance measures (as we were unable to obtain these), we resorted to using pairwise-deletion in estimating our structural models. This allowed us to retain as much data as possible. Significance of the parameter estimates is tested using a nonparametric bootstrapping technique with 5000 subsamples.

For our structural model we evaluate the predictive ability through  $R^2$  values for the endogenous constructs, the effect size  $f^2$  to evaluate the extent to which a predictor variable impacts an outcome variable, and the predictive relevance ( $Q^2$ ) of the endogenous constructs. First, Chin (1998) regards  $R^2$  values of 0.67, 0.33, and 0.19 of endogenous constructs in PLS path models as substantial, moderate, and weak, respectively. We find for all our endogenous constructs moderate to substantial  $R^2$ , ranging from  $R^2=.21$  to  $.49$ . As such, we find very satisfactory predictability of our key constructs. Second, for effect sizes,  $f^2$  values of  $.02$ ,  $.15$ , and  $.35$  indicate a weak, medium, or large effect of a predictor variable on an outcome variable (Hair, Ringle, *et al.* 2013). We find medium effect sizes for forward-looking search on innovation portfolio agility ( $f^2 = .33$ ) indicating good predictability. However, as expected due to mediation effects of innovation portfolio agility, we find below weak effect sizes of forward-looking search on our innovation performance measures ( $f^2 = .002 - .014$ ). However, for innovation portfolio agility we find adequate predictability of our innovation performance measures ( $f^2 = .02 - .262$ ).

**Table 3.4 Result of structural model**

<i>Dependent variable</i>	Innovation portfolio agility $\beta$ (t-value)	New product/service success $\beta$ (t-value)	New product/service innovativeness $\beta$ (t-value)	New product/service financial performance $\beta$ (t-value)
<b>Controls</b>				
Firm size	-0.100 (1.355)	-0.020 (.239)	-0.009 (.130)	0.008 (.091)
Firm financial performance	0.030 (.407)	0.041 (.488)	-0.039 (.507)	0.173 (1.753)†
Development cycle time (Reference: < 1 year)				
1-3 years	0.121 (1.183)	-0.168 (1.966)*	-0.056 (.629)	-0.256 (1.905)†
4-9 years	0.003 (.028)	-0.156 (1.596)	-0.055 (.609)	-0.222 (1.689)†
Environmental unpredictability	-0.093 (1.279)	-0.019 (.207)	0.047 (.466)	-0.075 (.586)
Environmental technological sophistication	0.340 (4.990)**	0.167 (1.787)†	0.311 (3.265)**	0.208 (1.895)†
<b>Main effects</b>				
Forward-looking search	0.459 (6.467)**	0.041 (.432)	0.078 (.823)	0.036 (.310)
Innovation portfolio agility	–	0.506 (5.374)**	0.403 (3.819)**	0.207 (1.722)*
<b>R-square</b>	0.480	0.411	0.436	0.206

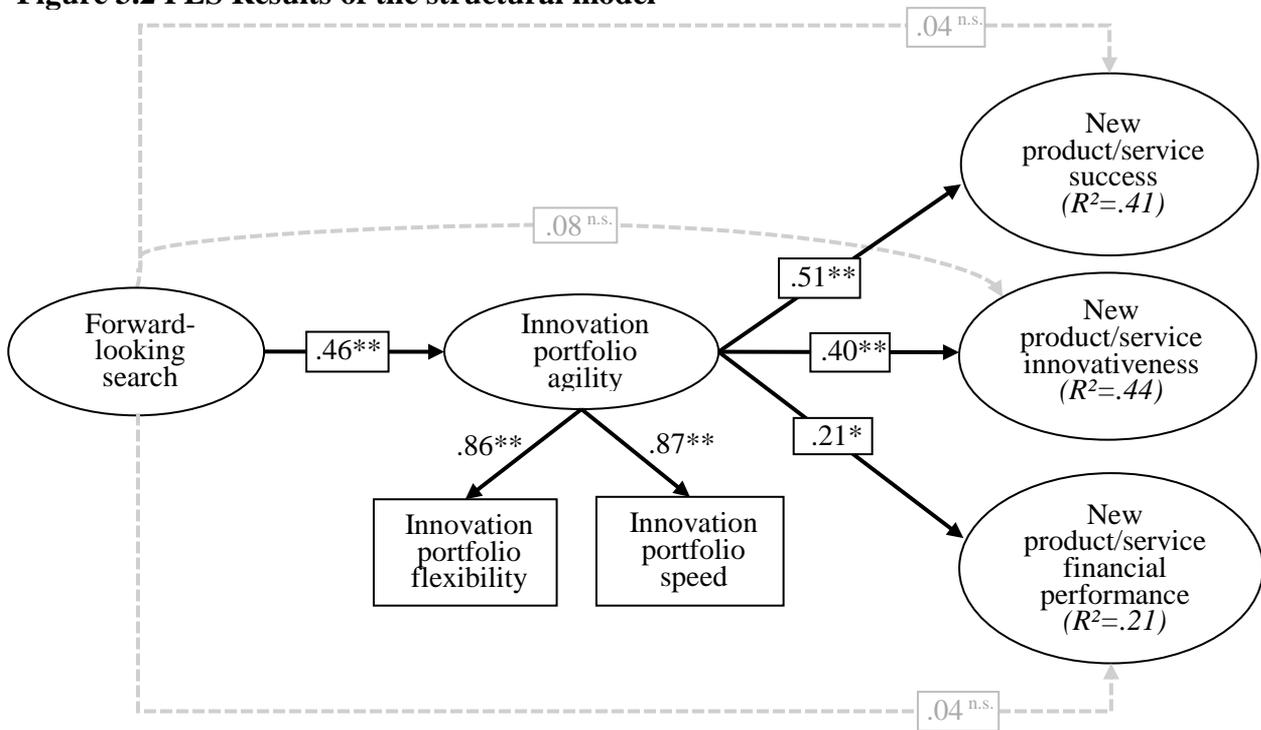
Notes: t-test values in parentheses – one-tailed for hypothesized paths, two-tailed for controls. †  $p < .10$ , \*  $p < .05$ , \*\*  $p < .01$

Last, in assessing the predictive relevance of our model, we examine the cross-validated redundancy index  $Q^2$  of predictive relevance (Chin 1998). After running the blindfolding procedure (Chin 1998), we obtained  $Q^2$  values in our mediated model of innovation portfolio agility ( $Q^2 = .31$ ), new product/service success ( $Q^2 = .20$ ), new product/service innovativeness ( $Q^2 = .25$ ), and new product/service financial performance ( $Q^2 = .11$ ), which are well above zero and indicates the PLS path model's predictive relevance (Hair, Ringle, et al. 2013).

### 3.5.4 Hypotheses testing

Table 3.4 reports the results for the path coefficients and their significance. Figure 3.2 shows the model with direct path coefficient estimates and their significance. Table 3.5 shows the

**Figure 3.2 PLS Results of the structural model**



n.s. = not significant, †  $p < .10$ , \*  $p < .05$ , \*\*  $p < .01$  (one-tailed)

decomposition of total and indirect effects with their significance for our mediated model. For assessing the significance of direct, indirect, and total effects, we use a bootstrapping procedure and select 5,000 samples and the no sign changes option to assess the significance of the path coefficients (Hair, Hult, *et al.* 2013).

Regarding our hypotheses, first, we find no support for a direct significant link between forward-looking search and our three innovation performance measures. This implies that forward-looking on its own is not a sufficient condition for securing innovation performance.

For hypothesis 2, stating that innovation portfolio agility is positively related to innovation performance, we find evidence to support this hypothesis. We find significant and positive relationships to all three innovation performance measures;  $\beta = .506$  ( $p < .01$ ) for new product/service success,  $\beta = .403$  ( $p < .01$ ) for new product/service innovativeness, and  $\beta = .207$  ( $p < .05$ ) for new product/service financial performance.

For hypothesis 3, stating that forward-looking search is positively impacting innovation

**Table 3.5 Decomposition of Direct, Indirect, and Total Effects of Forward-Looking Search on Innovation Performance**

<i>Predictor</i>	Direct	Mediator: Innovation portfolio agility	Overall
	Direct effect ( <i>t-value</i> )	Specific indirect effect ( <i>t-value</i> )	Overall total effect ( <i>t-value</i> )
Dependent variable: New product/service success			
<i>Forward-looking search</i>	0.041 (.432)	0.232** (3.957)	0.273** (3.154)
Dependent variable: New product/service innovativeness			
<i>Forward-looking search</i>	0.078 (.823)	0.185** (3.370)	0.263** (3.057)
Dependent variable: New product/service financial performance			
<i>Forward-looking search</i>	0.036 (.310)	0.095 <sup>†</sup> (1.564)	0.131 (1.216)

Notes: t-test values in parentheses – one-tailed for hypothesized paths. <sup>†</sup>  $p < .10$ , \*  $p < .05$ , \*\*  $p < .01$

portfolio agility, we find strong evidence to support this hypothesis. We find a strong positive relation between forward-looking search and innovation portfolio agility ( $\beta = .466$ ,  $p < .01$ ). As such, we therefore also find support for hypothesis 4, stating that innovation portfolio agility mediates the relationships between forward-looking search and innovation performance. In sum, the overall model supports the idea that the link between forward-looking search and innovation performance is *indirect*; it is mediated through the set of innovation portfolio practices we consider here which constitute innovation portfolio agility.

### ***Mediation effects in detail***

To assess the mediation effects we find, we follow the procedure of Baron and Kenny (1986) for assessing partial or full mediation of innovation portfolio agility in the forward-looking search – innovation performance relationship. This approach involves 4 stages that have to be met to confirm either full or partial mediation. The first stage involves assessing whether forward-looking search is a statistically significant predictor of new product/service success, new product/service

innovativeness, and new product/service financial performance. This is supported<sup>1</sup>. In the second stage we assess whether forward-looking search is a statistically significant predictor of innovation portfolio agility, which is already met by support for H3. The third stage calls for innovation portfolio agility being a statistically significant predictor of innovation performance, which is supported through H2. In the last stage, we assess the direct effects of forward-looking search on new product/service success and new product/service innovativeness, to evaluate the mediation effect as full or partial. The direct effects of forward-looking search on all our innovation performance measures become insignificant, indicating full mediation (Hair, Hult, *et al.* 2013). While the direct effect between forward-looking search and new product/service success changes sign, albeit insignificant, this finding indicates a potential suppressing effect (MacKinnon *et al.* 2000, Hair, Hult, *et al.* 2013).

In addition, we tracked the total effect (the sum of direct and indirect effects) of forward-looking search on innovation performance via innovation portfolio agility (see Table 3.5). For all our innovation performance measures we find significant *indirect* effects of forward-looking search, as well as significant *total* effects. More specifically, we find the strongest indirect effect of forward-looking search on new product/service success ( $\beta = .232, p < .01$ ), followed by new product/service innovativeness ( $\beta = .185, p < .01$ ), and a marginal indirect effect on new product/service financial performance ( $\beta = .095, p < .10$ ). For the total effects, we find for new product/service success a significant and positive total effect ( $\beta = .273, p < .01$ ), similarly for new product/service innovativeness ( $\beta = .263, p < .01$ ), however an insignificant total effect on new product/service financial performance ( $\beta = .131, p > .10$ ).

In sum, these results imply that the majority of the variance of forward-looking search on new

---

<sup>1</sup> These direct paths are significant when a model is estimated without paths from innovation portfolio agility to innovation performance. More specifically, we obtain the following parameters when estimating such a model: Path from forward-looking search to new product/service success  $\beta = .288, p < .01$ ; new product/service innovativeness  $\beta = .265, p < .01$ ; and new product/service financial performance  $\beta = .133, p > .10$ .

product/service success is transmitted via our mediator (i.e. variance accounted for via indirect effects is 85%). For new product/service innovativeness, variance accounted for via indirect effects is 70%. The indirect effect on new product/service financial performance accounts for 73% of the variance, however the total effect is insignificant. Nevertheless, due to the significant indirect effects we find, we can conclude that our mediator is key in transmitting forward-looking search effects to innovation performance.

### **3.6 Discussion and conclusion**

Our results offer an understanding of why organizations that seemingly have a better ‘sense’ or ‘vision’ of the future potentially perform better, as well as how such organizations are seemingly able to act upon the insights gained by looking forward and how this subsequently translates in performance benefits. We contribute to literature in the following ways. First, we find that forward-looking search may account for differences in the performance of an organization’s new products or services, but only when there is a facilitating link in place that allows future insights to be translated into innovation decisions and outcomes. Our findings are an important contribution to the research stream focusing on the processes and benefits of forward-looking practices on innovation performance by means of new product development (Brown and Eisenhardt 1997, Costanzo 2004, Andriopoulos and Gotsi 2006, Rohrbeck and Gemünden 2011, Kock *et al.* 2015). Our findings explain how and why forward-looking search is influential to performance of new products or services and helps to understand how future-preparedness of innovation projects may be facilitated (Teller and Kock 2013, Rank *et al.* 2015). Future preparedness refers to the ability of the project’s outcome to seize opportunities that arise *after* the completion (Teller and Kock 2013, p. 820). Such an ability of the newly developed products are, for instance, putting the firm a step ahead of its competitors in terms of new products (or technologies or services), or that it may allow for the discovery of further market or technology opportunities (Shenhar *et al.* 2001, Rank *et al.* 2015).

Forward-looking search therefore, may greatly contribute to this end.

Second, our research highlights that exercising agility in new product development efforts is important, and quite possibly a prerequisite, in putting forward-looking insights to use in attaining innovation performance. Specifically, our findings show that forward-looking practices influence innovation performance by means of an indirect effect through innovation portfolio agility. This complements earlier findings on foresight facilitating more successful products (Brown and Eisenhardt 1997). We also found dissimilar total effect sizes of forward-looking on the three dimensions of innovation performance we employed; the indirect effect to new product/service innovativeness was significantly smaller than to new product/service success. This possibly indicates that innovativeness is not as much about redirecting development efforts to ensure innovativeness in the marketplace based on future projections. As Yadav *et al.* (2007) found, a predominant ‘internal’ focus saw faster development of technological opportunities, thereby enhancing innovativeness. As such, innovativeness may rather be attributed to the capacity of scientists and engineers to develop innovative new products rather than by means of adjusting development efforts. Financial performance also shows significantly smaller effects. Here, it may be that changing developments has significant costs associated with it (Thomke and Reinertsen 1998).

Third, while we recognize that forward-looking search can lead to the identification and initiation of novel new innovation avenues (Brown and Eisenhardt 1997, Rohrbeck and Gemünden 2011, Kock *et al.* 2015), we must also recognize that the development of innovations is not a one-time effort or a discrete event. Indeed, as Gavetti and Levinthal (2000) call for, a better understanding is needed how organizations that spot a superior distant opportunity subsequently engage in refinement of that opportunity. Rather, it should be seen a process that is more than new product development alone; firms should exercise an outward forward-looking view to detect opportunities or threats and then refine and extend new and existing products to deploy them well (Yadav *et al.* 2007). In other words, not only initiating new ideas based on sophisticated insights of

the future (Kock *et al.* 2015), but also refining, extending, or potentially terminating ongoing innovations (Kock and Gemünden 2016).

Fourth, we extend research on innovation portfolio management where a prospective stance has been lacking in guiding decision-making efforts. More specifically, by positing forward-looking search as a way to promote innovation portfolio agility, it may be seen as part of portfolio decision-making quality (Kock and Gemünden 2016). In turn, by providing potentially relevant signals and future interpretations that may lead to doubting current development efforts (Blackman and Henderson 2004), better decision-making regarding adjustment, continuation, or termination of ongoing development projects is facilitated (Kester *et al.* 2014, Kock and Gemünden 2016). Articulating, sharing, and negotiating different interpretations of what might happen in the future in relation to current development efforts allows for dominant ways of thinking to be refined, and subsequently helps shaping investments and effort (Kaplan and Orlikowski 2013).

Lastly, as our study focuses on an organization's previous and current innovation projects (by means of looking at innovation portfolios), the stance we take on forward-looking search as a facilitator for doubting current development efforts is different from other research linking forward-looking practices to performance. Research on forward-looking behaviour has seen interest in terms of identification of 'superior basins of attraction' for mostly business reframing purposes (Hamel and Prahalad 1994, Gavetti and Levinthal 2000, Gavetti 2012). However, succeeding in attaining such 'big gains' may also be a matter of luck or serendipity rather than foresight (Winter 2012). Especially since not all the future consequences can be known (Simon 1947) and uncertainties during development may be induced (Greve and Taylor 2000). Other studies position forward-looking search as a facilitator for success by means of driving continuous innovation introductions (Brown and Eisenhardt 1997, Costanzo 2004, Andriopoulos and Gotsi 2006). Rather, we add that forward-looking can lead to 'doubting' and the actual changing of current development efforts, which only recently has seen increased attention (Rohrbeck and Gemünden 2011; Kaplan and

Orlikowski 2013). This stance provides a different point of departure for forward-looking search, where the interpretation of what has happened in the past, what is currently happening, and what might happen are referenced to current development efforts. Without such a frame of reference to interpret signals against (Kaplan 2008) – where otherwise forward-looking search may take on the predominant role of spotting opportunities for breakthrough innovation or ‘big gains’ – organizations and its members alike may engage in ‘undirected search’ or ‘too much peripheral vision’, and end up wasting precious attention and resources to unimportant signals (Day and Schoemaker 2005). As actor’s cognitive limits tend to mandate selectiveness and a focus on the immediate competitive environment the organization finds itself in (Garg *et al.* 2003), our stance towards forward-looking search as doubting current development effort seems warranted.

### **3.6.1 Practical implications**

This study offers several implications for practitioners. First, by showing the positive effects of forward-looking search on three innovation performance indicators, we provide some evidence for managers who aim to facilitate forward-looking practices within their organizations. However, we do find that having practices in place that promote agile innovation management is paramount in translating and increasing the utility of forward-looking search on innovation performance. Forward-looking search can focus on ongoing developments for organizational members as a frame-of-reference to interpret the past, present, and signals in terms of future implications. In contrast, firms wanting to incorporate forward-looking search as a way to come up with ground-breaking ideas or aiming for ‘big wins’ may find it is detrimental to organizational attention (Day and Schoemaker 2005, Dahlander *et al.* 2016). Promoting forward-looking search in light of current development efforts provides an attainable stepping stone to implementation. Further advanced and more widespread forward-looking practices with goals extending those of challenging current development efforts may be a subsequent implementation step after that.

Second, our findings suggest that most benefit of forward-looking search is to be had in

promoting success of new products or services in the market place, whereas innovativeness is less benefitted. Innovativeness may be more related to current endowments of the organization, such as having highly skilled engineers and scientists to apply highly innovative aspects into their products. Managers may therefore wish to pay attention to what end forward-looking practices are used and to what extent these may redirect development efforts.

### **3.6.2 Limitations and future research**

While our findings and implications are extensive, the design of this study is subject to several limitations which may be addressed in future research. First, this is a cross-sectional study that looks particularly at constructs that are dynamic. Forward-looking search and innovation portfolio agility both revolve around social processes and decision-making that occur over time, while innovation performance is only attainable over time. A longitudinal research design would be more appropriate for future research. Whereas such a study would be able to establish causality to a greater degree, we can only hint at causality with our arguments. Especially due to the complexity of the interrelationships between the constructs in our study, our data is only able to account for crude proxies of more elaborate processes that form the studied constructs and interrelationships between them. Nevertheless, our research provides a starting point for similar conceptual models that may be tested using more extensive datasets.

Second, our study does not investigate the difference in effect strengths of both forward-looking practices and innovation portfolio agility on our innovation performance measures. Further research could elaborate more on the differences we find, especially why new product/service success seems to be predicted to a higher degree by forward-looking and innovation portfolio agility than new product/service innovativeness. Certain firms may put more emphasis on achieving market success, rather than innovativeness. Potentially, our study may suffer from a selection bias towards entrepreneurial firms due to the inclusion criterion of having introduced a number of new innovations in the past years (Jennings and Lumpkin 1989, Covin and Miles 1999). Future research

may need to incorporate a multi-group analysis to uncover how differences in firms, unrelated to the key constructs in our model, account for these differences, or uncover what specific organizational or managerial attributes and actions may account for the differences in our findings. A fruitful avenue for future research would be to include strategic aspirations and orientations as a means to uncover differences in the way forward-looking search and innovation portfolio agility is utilized for achieving benefits on innovation performance indicators.

Future research may also aim at overcoming the limitations in this study related to our methodology. First, single informant bias could be a concern for the validity of our results since only managers in relevant fields for our study completed our survey. An obvious alleviation of the concern of single informant bias would be for future research to employ informants from multiple departments relevant to the study, such as managers from R&D for the perspective on internal development projects, managers from innovation portfolios for the perspective on redirecting development efforts, and managers or informants who may play a key role in conveying important signals that may be of importance to the firm's current development projects. Furthermore, our study is mainly based on the subjective perceptions of managers, which may cause for concern in evaluating our key constructs, where especially our performance indicators may be subject to subjective biases. A multiple informant study could alleviate such concerns, as well as including multiple objective information sources, such as reports on development redirection decisions. While we did control for overall objective firm performance, there may be a discrepancy between firm performance and innovation performance for which we cannot account.

## References

- Ahuja, G., 2000. Collaboration Networks, Structural Holes, and Innovation: A Longitudinal Study. *Administrative science quarterly*, 45 (3), 425–455.
- Andriopoulos, C. and Gotsi, M., 2006. Probing the future: Mobilising foresight in multiple-product innovation firms. *Futures*, 38 (1), 50–66.
- Argote, L. and Greve, H.R., 2007. 'A Behavioral Years and Theory of the Firm': 40 Years and Counting: Introduction and Impact. *Organization Science*, 18 (3), 337–349.

- Armbruster, H., Bikfalvi, A., Kinkel, S., and Lay, G., 2008. Organizational innovation: The challenge of measuring non-technical innovation in large-scale surveys. *Technovation*, 28 (10), 644–657.
- Armstrong, J.S. and Overton, T.S., 1977. Estimating Nonresponse Bias in Mail Surveys. *Journal of Marketing*, 14 (3), 396–402.
- Baker, W.E. and Sinkula, J.M., 1999. The Synergistic Effect of Market Orientation and Learning Orientation on Organizational Performance. *Journal of the Academy of Marketing Science*, 27 (4), 411–427.
- Baron, R.M. and Kenny, D.A., 1986. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51 (6), 1173–1182.
- Becker, J.-M., Klein, K., and Wetzels, M., 2012. Hierarchical Latent Variable Models in PLS-SEM: Guidelines for Using Reflective-Formative Type Models. *Long Range Planning*, 45 (5–6), 359–394.
- Becker, P., 2002. *Corporate foresight in Europe: a first overview*. Brussels: European Commission.
- Blackman, D. A. and Henderson, S., 2004. How foresight creates unforeseen futures: the role of doubting. *Futures*, 36 (2), 253–266.
- Brown, S.L. and Eisenhardt, K.M., 1997. The Art of Continuous Change: Linking Complexity Theory and Time-Paced Evolution in Relentlessly Shifting Organizations. *Administrative Science Quarterly*, 42 (1), 1–34.
- Burt, G. and van der Heijden, K., 2003. First steps: towards purposeful activities in scenario thinking and future studies. *Futures*, 35 (10), 1011–1026.
- Chao, R.O. and Kavadias, S., 2008. A Theoretical Framework for Managing the New Product Development Portfolio: When and How to Use Strategic Buckets. *Management Science*, 54 (5), 907–921.
- Chin, W., 1998. The partial least squares approach to structural equation modeling. In: G.A. Marcoulides, ed. *Modern Methods for Business Research*. Mahwah, NJ: Lawrence Erlbaum Associates, 295–358.
- Cooper, R.G., Edgett, S., and Kleinschmidt, E.J., 2001. *Portfolio management for new products*. Cambridge, MA: Perseus Pub.
- Costanzo, L. a, 2004. Strategic foresight in a high-speed environment. *Futures*, 36 (2), 219–235.
- Courtney, H., 2001. *20/20 Foresight: Crafting Strategy in an Uncertain World*. Cambridge, MA: Harvard Business School Press.
- Covin, J. and Miles, M., 1999. Corporate Entrepreneurship and the Pursuit of Competitive Advantage. *Entrepreneurship Theory and Practice*, 23 (3), 47–63.
- Csaszar, F.A. and Levinthal, D.A., 2016. Mental representation and the discovery of new strategies. *Strategic Management Journal*, 37 (10), 2031–2049.
- Cuhls, K., 2003. From forecasting to foresight processes? new participative foresight activities in Germany. *Journal of Forecasting*, 22 (2–3), 93–111.
- Cunha, M.P., Cunha, J.V. Da, and Clegg, S.R., 2009. Improvisational bricolage: A practice-based approach to strategy and foresight. In: L. a Costanzo and R.B. MacKay, eds. *Handbook of Research on Strategy and Foresight*. Edward Elgar Publishing, 182–.
- Cyert, R. and March, G., 1963. *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice Hall.
- Daft, R. and Weick, K., 1984. Toward a model of organizations as interpretation systems. *Academy of Management Review*, 9 (2), 284–295.
- Dahlander, L., O'Mahony, S., and Gann, D.M., 2016. One foot in, one foot out: how does individuals' external search breadth affect innovation outcomes? *Strategic Management Journal*, 37 (2), 280–302.
- Day, G.S., 1994. The Capabilities of Market-Driven Organizations. *Journal of Marketing*, 58 (4), 37–52.

- Day, G.S. and Schoemaker, P.J.H., 2005. Scanning the periphery. *Harvard Business Review*, 83 (11), 135–148.
- Droge, C., Calantone, R., and Harmancioglu, N., 2008. New product success: Is it really controllable by managers in highly turbulent environments? *Journal of Product Innovation Management*, 25, 272–286.
- Dutton, J.E. and Ottensmeyer, E., 1987. Strategic Issue Management Systems: Forms, Functions, and Contexts. *Academy of Management Review*, 12 (2), 355–365.
- Eisenhardt, K.M. and Tabrizi, B.N., 1995. Accelerating Adaptive Processes - Product Innovation in the Global Computer Industry. *Administrative Science Quarterly*, 40 (1), 84–110.
- European Commission, 2013. *EU R&D Scoreboard: The 2013 EU Industrial R&D Investment Scoreboard*. EUR 26211 EN, ISSN 1831-9424.
- Fornell, C. and Larcker, D., 1981. Structural Equation Models With Unobservable Variables and Measurement Error: Algebra and Statistics. *Journal of Marketing Research*, 18 (3), 328–389.
- Garg, V.K., Walters, B. a., and Priem, R.L., 2003. Chief executive scanning emphases, environmental dynamism, and manufacturing firm performance. *Strategic Management Journal*, 24 (8), 725–744.
- Gavetti, G., 2012. Toward a Behavioral Theory of Strategy. *Organization Science*, 23 (1), 267–285.
- Gavetti, G., Greve, H.R., Levinthal, D.A., and Ocasio, W., 2012. The Behavioral Theory of the Firm: Assessment and Prospects. *The Academy of Management Annals*, 6 (1), 1–40.
- Gavetti, G. and Levinthal, D., 2000. Looking forward and looking backward: Cognitive and experiential search. *Administrative Science Quarterly*, 45 (1), 113–137.
- Godet, M. and Durance, P., 2011. *Strategic foresight for corporate and regional development*. Unesco Publishing.
- Gordon, T.J. and Hayward, H., 1968. Initial experiments with the cross impact matrix method of forecasting. *Futures*, 1 (2), 100–116.
- Green, K.M., Covin, J.G., and Slevin, D.P., 2008. Exploring the relationship between strategic reactivity and entrepreneurial orientation: The role of structure–style fit. *Journal of Business Venturing*, 23 (3), 356–383.
- Greve, H.R. and Taylor, A., 2000. Innovations as Catalysts for Organizational Change: Shifts in Organizational Cognition and Search. *Administrative Science Quarterly*, 45 (1), 54–80.
- Griffin, A., 2002. Product Development Cycle Time for Business-to-Business Products. *Industrial Marketing Management*, 31 (4), 291–304.
- Groenveld, P., 1997. Roadmapping integrates business and technology. *Research Technology Management*, 50 (6), 49–58.
- Hair, J.F., Hult, G.T.M., Ringle, C.M., and Sarstedt, M., 2013. *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*. Sage, Thousand Oaks.
- Hair, J.F., Ringle, C.M., and Sarstedt, M., 2011. PLS-SEM: Indeed a Silver Bullet. *The Journal of Marketing Theory and Practice*, 19 (2), 139–152.
- Hair, J.F., Ringle, C.M., and Sarstedt, M., 2013. Partial Least Squares Structural Equation Modeling: Rigorous Applications, Better Results and Higher Acceptance. *Long Range Planning*, 46 (1–2), 1–12.
- Hambrick, D.C., 1982. Environmental Scanning and Organizational Strategy. *Strategic Management Journal*, 3 (2), 159–174.
- Hamel, G. and Prahalad, C., 1994. *Competing for the future*. Harvard business review. Boston: Harvard Business School Press.
- Van Der Heijden, K., 1996. *Scenarios: The Art of Strategic Conversation*. Chichester: John Wiley & Sons Ltd.
- Henseler, J., Ringle, C.M., and Sarstedt, M., 2015. A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, 43, 115–135.

- Henseler, J., Ringle, C.M., and Sinkovics, R.R., 2009. The Use of Partial Least Squares Path Modeling in International Marketing. *New Challenges to International Marketing Advances in International Marketing*, 20, 277–319.
- Heuschneider, S. and Herstatt, C., 2016. *External search for exploration of future discontinuities and trends: Implications from the literature using co-citation and content analysis*. Hamburg, Working Paper No. 92.
- Horton, A., 1999. A simple guide to successful foresight. *foresight*, 1 (1).
- Hult, G.T.M., Hurley, R.F., and Knight, G. a., 2004. Innovativeness: Its antecedents and impact on business performance. *Industrial Marketing Management*, 33 (5), 429–438.
- Im, S. and Workman Jr., J., 2004. Market Orientation, Creativity, and New Product Performance in High-Technology Firms. *Journal of Marketing*, 68 (2), 114–132.
- Jennings, D.F. and Lumpkin, J., 1989. Functioning Modeling Corporate Entrepreneurship: An Empirical Integrative Analysis. *Journal of Management*, 15 (3), 485–502.
- Joreskog, K.G. and Sorbom, D., 1993. *LISREL 8: Structural equation modeling with the SIMPLIS command language*. Lincolnwood, IL: Scientific Software International, Inc.
- Kaplan, S., 2008. Framing contests: Strategy making under uncertainty. *Organization Science*, 19 (5), 729–752.
- Kaplan, S. and Orlikowski, W.J., 2013. Temporal Work in Strategy Making. *Organization Science*, 24 (4), 965–995.
- Katila, R. and Ahuja, G., 2002. Something Old, Something New: a Longitudinal Study of Search Behavior and New Product Introduction. *Academy of Management Journal*, 45 (6), 1183–1194.
- Kester, L., Griffin, A., Hultink, E.J., and Lauche, K., 2011. Exploring Portfolio Decision-Making Processes. *Journal of Product Innovation Management*, 28, 641–661.
- Kester, L., Hultink, E.J., and Griffin, A., 2014. An Empirical Investigation of the Antecedents and Outcomes of NPD Portfolio Success. *Journal of Product Innovation Management*, 31 (6), 1199–1213.
- Kleinschmidt, E.J. and Cooper, R.G., 1991. The impact of product innovativeness on performance. *Journal of Product Innovation Management*, 8 (4), 240–251.
- Kock, A. and Gemünden, H.G., 2016. Antecedents to Decision-Making Quality and Agility in Innovation Portfolio Management. *Journal of Product Innovation Management*, 0 (0), 670–686.
- Kock, A., Heising, W., and Gemünden, H.G., 2015. How Ideation Portfolio Management Influences Front-End Success. *Journal of Product Innovation Management*, 32 (4), 539–555.
- Kreiser, P., Kuratko, D., Covin, J., and House, J., 2011. Operationalizing Corporate Entrepreneurship Strategy (CES): A Configurational Approach. In: *Presented at the Academy of Management Meetings, San Antonio, TX, August 12–16*.
- Krishnan, V. and Bhattacharya, S., 2002. Technology Selection and Commitment in New Product Development: The Role of Uncertainty and Design Flexibility. *Management Science*, 48 (3), 313–327.
- Laursen, K. and Salter, A.J., 2014. The paradox of openness: Appropriability, external search and collaboration. *Research Policy*, 43 (5), 867–878.
- Levinthal, D. and March, J.G., 1981. A model of adaptive organizational search. *Journal of Economic Behavior & Organization*, 2 (4), 307–333.
- Li, Q., Maggitti, P.G., Smith, K.G., Tesluk, P.E., and Katila, R., 2013. Top management attention to innovation: The role of search selection and intensity in new product introductions. *Academy of Management Journal*, 56 (3), 893–916.
- Lord, R.G., Dinh, J.E., and Hoffman, E.L., 2014. A Quantum Approach to Time and Organizational Change. *Academy of Management Review*, 40 (2), 263–290.
- Lumpkin, G. and Dess, G., 1996. Clarifying the Entrepreneurial Orientation Construct and Linking It to Performance. *Academy of management Review*, 21 (1), 135–172.
- MacKinnon, D.P., Krull, J.L., and Lockwood, C.M., 2000. Equivalence of the mediation,

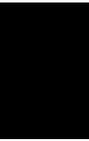
- confounding and suppression effect. *Prevention Science*, 1 (4), 173–181.
- March, J.G., 1991. Exploration and Exploitation in Organizational Learning. *Organization Science*, 2 (1), 71–87.
- Mcgrath, R.G. and Nerkar, A., 2004. Real options reasoning and a new look at the R&D investment strategies of pharmaceutical firms. *Strategic Management Journal*, 25 (1), 1–21.
- Montoya-Weiss, M.M. and Calantone, R., 1994. Determinants of New Product Performance: A Review and Meta-Analysis. *Journal of Product Innovation Management*, 11 (5), 397–417.
- Moorman, C. and Miner, A., 1997. The Impact of Organizational Memory on New Product Performance and Creativity. *Journal of Marketing Research*, 34 (1), 91–106.
- Oner, M.A. and Gol, S., 2007. Pitfalls in and success factors of corporate foresight projects. *International Journal of Foresight and Innovation Policy*, 3 (4), 447.
- Ottum, B.D. and Moore, W.L., 1997. The role of market information in new product success/failure. *Journal of Product Innovation Management*, 14, 258–273.
- Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y., and Podsakoff, N.P., 2003. Common method biases in behavioral research: a critical review of the literature and recommended remedies. *The Journal of Applied Psychology*, 88 (5), 879–903.
- Rank, J., Natalie, B., Georg, H., Unger, B.N., and Gemünden, H.G., 2015. Preparedness for the future in project portfolio management: The roles of proactiveness, riskiness and willingness to cannibalize. *Journal of Project Management*, 1–38.
- Reid, S.E. and de Brentani, U., 2010. Market Vision and Market Visioning Competence: Impact on Early Performance for Radically New, High-Tech Products. *Journal of Product Innovation Management*, 27 (4), 500–518.
- Reid, S.E. and De Brentani, U., 2004. The fuzzy front end of new product development for discontinuous innovations: A theoretical model. *Journal of Product Innovation Management*, 21 (3), 170–184.
- Reid, S.E. and De Brentani, U., 2012. Market vision and the front end of NPD for radical innovation: The impact of moderating effects. *Journal of Product Innovation Management*, 29, 124–139.
- Reid, S.E., Roberts, D., and Moore, K., 2015. Technology vision for radical innovation and its impact on early success. *Journal of Product Innovation Management*, 32 (4), 593–609.
- Riel, A. Van, Lemmink, J., and Ouwersloot, H., 2004. High-Technology Service Innovation Success: A Decision-Making Perspective. *Journal of Product Innovation Management*, 21, 348–359.
- Ringle, C.M., Sarstedt, M., and Straub, D., 2012. A Critical Look at the Use of PLS-SEM in MIS Quarterly. *MIS Quarterly*, 36 (1), iii–xiv.
- Ringle, C.M., Wende, S., and Becker, J.-M., 2014. *Smartpls 3*. Hamburg.
- Rohrbeck, R., 2010. Corporate foresight: towards a maturity model for the future orientation of a firm. Berlin: Springer-Verlag.
- Rohrbeck, R., Battistella, C., and Huizingh, E., 2015. Corporate foresight: An emerging field with a rich tradition. *Technological Forecasting and Social Change*, 101, 1–9.
- Rohrbeck, R. and Gemünden, H.G., 2008. Strategic Foresight in Multinational Enterprises: Building a Best-Practice Framework from Case Studies. In: *R&D Management Conference 2008 'Emerging methods in R&D management'*.
- Rohrbeck, R. and Gemünden, H.G., 2011. Corporate foresight: Its three roles in enhancing the innovation capacity of a firm. *Technological Forecasting and Social Change*, 78 (2), 231–243.
- Salomo, S., Talke, K., and Strecker, N., 2008. Innovation Field Orientation and Its Effect on Innovativeness and Firm Performance. *Journal of Product Innovation Management*, 25 (6), 560–576.
- Salomo, S., Weise, J., and Gemünden, H.G., 2007. NPD Planning Activities and Innovation Performance: The Mediating Role of Process Management and the Moderating Effect of Product Innovativeness. *Journal of Product Innovation Management*, 24 (4), 285–302.

- Sarangee, K.R., Woolley, J.L., Schmidt, J.B., and Long, E., 2014. De-escalation mechanisms in high-technology product innovation. *Journal of Product Innovation Management*, 31 (5), 1023–1038.
- Schoemaker, P.J.H. and Day, G.S., 2009. How to make sense of weak signals. *MIT Sloan Management Review*, 50 (3), 81–88.
- Seidl, D., 2004. The Concept of ‘Weak Signals’ Revisited: A Re-description From a Constructivist Perspective. In: H. Tsoukas and J. Shepherd, eds. *Managing the Future: Foresight in the Knowledge Economy*. Oxford: Blackwell, 151–168.
- Shenhar, A.J., Dvir, D., Levy, O., and Maltz, A.C., 2001. Project success: A multidimensional strategic concept. *Long Range Planning*, 34 (6), 699–725.
- Simon, H.A., 1947. *Administrative Behavior: A Study of Decision-making Processes in Administrative Organizations*. 4th ed. New York: The Free Press.
- Simonse, L.W.L., Hultink, E.J., and Buijs, J.A., 2015. Innovation Roadmapping: Building Concepts from Practitioners’ Insights. *Journal of Product Innovation Management*, 32 (6), 904–924.
- Slater, S. and Narver, J.C., 1994. Market Orientation, customer value and superior performance. *Business Horizons*.
- Spanjol, J., Mühlmeier, S., and Tomczak, T., 2012. Strategic Orientation and Product Innovation: Exploring a Decompositional Approach. *Journal of Product Innovation Management*, 29 (6), 967–985.
- Teller, J. and Kock, A., 2013. An empirical investigation on how portfolio risk management influences project portfolio success. *International Journal of Project Management*, 31 (6), 817–829.
- Thomke, S. and Reinertsen, D., 1998. Agile Product Development: Managing development flexibility in uncertain environments. *California Management Review*, 41 (1), 8–30.
- Tripsas, M. and Gavetti, G., 2000. Capabilities, cognition, and inertia: evidence from digital imaging. *Strategic Management Journal*, 21 (10), 1147–1161.
- Tsoukas, H. and Shepherd, J., 2004. *Managing the Future: Foresight in the Knowledge Economy*. Oxford: Blackwell.
- Vecchiato, R., 2015. Creating value through foresight: First mover advantages and strategic agility. *Technological Forecasting and Social Change*, 101, 25–36.
- Vecchiato, R. and Roveda, C., 2010. Foresight in corporate organisations. *Technology Analysis & Strategic Management*, 22 (1), 99–112.
- Verdu, A.J., Tamayo, I., and Ruiz-Moreno, A., 2012. The moderating effect of environmental uncertainty on the relationship between real options and technological innovation in high-tech firms. *Technovation*, 32 (9–10), 579–590.
- Voros, J., 2003. A generic foresight process framework. *Foresight*, 5 (3), 10–21.
- Wack, P., 1985. Scenarios: Shooting the Rapids: How Medium-Term Analysis Illuminated the Power of Scenarios for Shell Management. *Harvard business review*, (November-December), 139–151.
- Winter, S.G., 2012. Purpose and progress in the theory of strategy: comments on Gavetti. *Organization Science*, 23 (1), 288–297.
- Yadav, M., Prabhu, J., and Chandy, R., 2007. Managing the future: CEO attention and innovation outcomes. *Journal of Marketing*, 71 (4), 84–101.
- Zhou, K., Yim, C., and Tse, D., 2005. The effects of strategic orientations on technology-and market-based breakthrough innovations. *Journal of Marketing*, 69 (2), 42–60.

## Appendix 3A. Items and constructs (PLS Estimates)

Constructs	Item loading
<b>New product/service success</b> (CR = .84 AVE = .47) (1 = strongly disagree; 7 = strongly agree)	
<i>Our firm performed very successfully during the last three years, with respect to:</i>	
New product/service introduction rate relative to the largest competitor	.756
New product/service success rate relative to the largest competitor	.736
Degree of new product/service differentiation	.764
First to enter the market with new applications	.758
New product/service cycle time (time-to-market) relative to the largest competitor	.775
Acquiring the image of an innovative supplier relative to the largest competitor	.735
<b>New product/service innovativeness</b> (CR = .83 AVE = .55) (1 = strongly disagree; 7 = strongly agree)	
The majority of our innovations are based on substantially different core technology	.740
The majority of our innovations involve technologies that make old technologies obsolete	.787
The majority of our innovations use new technologies that permits quantum leaps in performance	.891
The majority of our innovations use technologies that have an impact on or cause significant changes in the whole industry	.803
<b>New product/service financial performance</b> (CR = .80 AVE = .51) (1 = strongly disagree; 7 = strongly agree)	
<i>Relative to competing new products/services during the last three years, our firm's new products/services is very successful, with respect to:</i>	
Return on investment	.840
Sales	.853
Market share	.728
Profitability	.838
<b>Environmental unpredictability</b> (CR = .68 AVE = .41) (1 = strongly disagree; 7 = strongly agree)	
Actions of competitors are generally quite easy to predict (R)	.574
Product demand is easy to forecast (R)	.951
Customer requirements / preferences are easy to forecast (R)	.664
<b>Environmental technological sophistication</b> (CR = .73 AVE = .40) (1 = strongly disagree; 7 = strongly agree)	
Heavy investments in R&D are characteristic of our industry.	.788
Having superior technical personnel is a key basis for competitive advantage in our industry.	.661
Patents or proprietary technology are often at the root of competitive advantage in our industry.	.788
The widespread employment of a new or advanced process or product or service technology is characteristic of our industry.	.702

CR = Composite reliability, AVE = Average variance extracted.



# Forward-looking search during innovation project development: Under which conditions does it impact innovativeness?<sup>1</sup>

Tymen Jissink<sup>a</sup>, Fiona Schweitzer<sup>b</sup>, René Rohrbeck<sup>a</sup>

<sup>a</sup> Aarhus University, School of Business and Social Sciences, department of Management, Aarhus, Denmark

<sup>b</sup> Centre of Innovation and Product Management, University of Applied Sciences Upper Austria, Wels, Austria.

## ABSTRACT

Despite a growing research interest in the search and evaluation of information on markets, customers, and technologies with an explicit future-focus, which we refer to forward-looking search, it rarely leaves the discussion from the firm- or innovation portfolio level. Little research has investigated whether forward-looking search practices occur during innovation projects where it may contribute towards a project's novelty. We follow the bounded rationality assumption, which views decision-makers as lacking complete knowledge and anticipation of the consequences that will follow on their decision. Especially in pursuing highly innovative projects, which are fraught with uncertainty and longer development times, decision-makers cannot foresee all uncertainty inducing events that may occur during the project development, and therefore cannot reliably foresee if the project's outcome will be novel and still relevant for the firm. Moreover, project planning and budgeting will be unreliable in such cases.

Therefore, the current study posits that, in pursuing increasingly innovative projects, project teams need to engage in forward-looking search during project development to ensure their project's outcome remains novel and relevant. However, we argue that it is only relevant if there is 1) room in project planning to facilitate forward-looking search, 2) slack resources available to implement such changes, and 3) the external environment demands such a forward-looking external perspective. Data on 159 unique innovation projects from the Danish manufacturing industry shows that forward-looking search significantly impacts innovativeness. More importantly, the effect follows an inverted-U shape curve where forward-looking search has the greatest positive effect on innovativeness in moderately planned projects and significantly lower effects in low- and highly planned projects. Furthermore, slack resources available during project development significantly increases forward-looking search's impact on innovativeness. These findings suggest that forward-looking search greatly contributes to innovativeness under certain conditions of project planning and slack, and future research may reconsider how innovation projects may be managed best in order to develop highly novel innovations.

**Keywords:** *Forward-looking search, innovation projects, project planning, slack resources, industry concentration, innovativeness.*

---

<sup>1</sup> Current paper is submitted for the annual ISPIM conference to be held in Vienna, June 2017, and the annual Academy of Management conference, to be held in Atlanta, August 2017.

## 4.1 Introduction

Scholars argue that the search and identification of new information is highly beneficial for innovation (March 1991, Katila and Ahuja 2002, Li *et al.* 2013, Maggitti *et al.* 2013) and frame search as “the controlled and proactive process of attending to, examining, and evaluating new knowledge and information” (Li *et al.* 2013, p. 893). However, the search and evaluation of such information with a forward-looking focus is rather absent from literature on search (Heuschneider and Herstatt 2016). Forward-looking search would entail acquiring new information (e.g. trends, competitor moves), but also the interpretation in terms of future implications to derive potential alternative courses of action. This form of search is less acknowledged as an ongoing process throughout innovation development. Rather, it is depicted as a search process that is only used in the front-end of innovation. For instance, several scholars argue that a systematic search will allow firms to generate and develop new ideas that are consistent with future market needs or technologies that are relevant for the firm’s future (Salomo *et al.* 2008, Kock *et al.* 2015). Others scholars focus on how a future vision of market-technology applications and can provide the firm with the potential of introducing successful new products (Brown and Eisenhardt 1997, Reid and de Brentani 2010, Reid and De Brentani 2012).

However, these literatures are largely silent as to how individual projects throughout their development remain relevant for the firm’s future. Even if the idea is based on sound insights about markets of the future, and perhaps adequate planning, decision-makers are bounded rationality, which is the lack of “complete knowledge and anticipation of the consequences that will follow on each choice” (Simon 1947, p. 81). Furthermore, the notion that well thought-out ideas will bring future success does not take the ever-changing external environment into account which may make any new idea obsolete or simply a case of ‘throwing good money after bad’. Indeed, Sarangee *et al.* (2014) show such a case and found that even when innovation projects were initiated on an idea that seemed to bring future successes at the time, throughout development they realized that it started to

turn into a 'blind alley'. Only through continuously doing market research, revising the assumptions, and question long-term views (those with which the project was initially started with) the financial prospects became increasingly less attractive. It is therefore worthwhile to investigate further whether project teams engage in to what we refer as forward-looking search after innovation projects have been formally initiated.

Especially to pursue the creation of highly novel innovations, anticipatory mechanisms may potentially be better put to use *within* projects. Typically, highly novel (or radical) projects have longer development times, larger consumption of resources, and higher levels of uncertainty associated with the project's outcome (Holahan *et al.* 2014). Therefore, when pursuing a highly innovative new product, project teams want to reduce that uncertainty (Salomo *et al.* 2007). In pursuing highly novel innovations, uncertainty and indeterminacy can stem both from "not knowing which issues, trends, decisions, and events will make up tomorrow" (Marsh 1998, p. 44) and the "imprecision in estimates of future consequences conditional on present actions" (March 1994, p. 178). Although recent research on individual innovation projects finds certain forward-looking mechanisms being used *during* innovation projects (Akgün *et al.* 2012, Horváth and Enkel 2014, Sarangee *et al.* 2014), it is unclear whether such mechanisms are used to the end of creating a highly innovative project. Only (Kaplan and Orlikowski 2013) indicate in an ex-post analysis that there might be a relation between project teams' engagement as to what they refer as 'temporal work' (i.e. practices that lead to new interpretations of the future) and the project's innovativeness, ranging from radical to incremental or mixed.

Therefore, the current study investigates if forward-looking search occurs in relation to the creation of highly innovative projects. Do project teams search in a forward-looking manner to create a highly novel – shrouded by uncertainty – innovation? Furthermore, not only has the link between forward-looking search and innovativeness not been empirically established within innovation projects; prior research also has not examined the conditions under which forward-looking search

can contribute to a project's innovativeness. In other words; what factors can facilitate or hamper forward-looking search from taking place within a project?

We build on the assumptions that innovativeness is a measure of task uncertainty (Salomo *et al.* 2007) and bounded rationality which states that it is not possible to have complete knowledge and anticipation of the consequences on each choice (i.e. the initiation of an innovation) (Simon 1947). Taken together, these two assumptions lead to the following three situations wherein innovativeness of the project may become threatened. It can lead to 1) deficiencies in planning (i.e. not having been able to foresee all possible uncertainty inducing events and consequences), 2) deficiencies in project budgeting (i.e. not have been able to account for emerging issues or opportunities that require additional costs to counteract), and 3) deficiencies in understanding the external environment and all its constituents at the project start (i.e. not fully able to grasp and understand the complexity and heterogeneity of the environment to ensure that other competitor's novel products are not overlooked). These three situations therefore become factors to take into account under which forward-looking search then can contribute optimally: project planning, budget availabilities (i.e. slack resources), and industry concentration.

Using a sample of 159 individual innovation projects of a sample of Danish manufacturing firms paired with objective performance and industry data, we establish the extent to which forward-looking search is related to differing levels of innovativeness — ranging from incremental to more innovative and radical innovations. Furthermore, the extent to which forward-looking search is able to contribute within a project is dependent on the three factors we identified: project planning, slack resource availability, and industry concentration. Using a newly created multi-dimensional measure of forward-looking search during innovation project development, we present novel insights into search practices employed during innovation projects. As forward-looking is argued to be an antecedent to truly radical innovations (Christensen 1997, Ruvio *et al.* 2013), we use a measure that captures innovativeness from incremental to truly radical projects (Schultz *et al.* 2013), by which we

overcome past critiques of how to measure innovativeness on a range from incremental to radical (Garcia and Calantone 2002, Holahan *et al.* 2014).

## 4.2 Background

### 4.2.1 Forward-looking search

While there is a variety of literature on the use of information in a innovation contexts at the firm-level (Riel *et al.* 2004, Citrin *et al.* 2007, Salomo *et al.* 2007, Droge *et al.* 2008), the interpretation of what this information means for the future is absent. Especially at the team-level, little research is available. Only recently, research documented practices that occur *within* projects aimed at searching for information and interpreting its future implications for the project, and consequently how actors within project settings come to create shared interpretations of the future (e.g. Kaplan and Orlikowski 2013, Sarangee *et al.* 2014). We therefore define forward-looking search as constituting the practices of collecting, examining and evaluating new information to derive alternative future courses of action and anticipate their consequences, to the end of forming shared representations that raise the likelihood of enacting action. In doing so, we identify three pillars upon which we conceptualize forward-looking search during projects, which we frame as information intake, formalized interpretation, and informal interpretation.

First, information intake is concerned with the act of scanning for signals that may indicate or lead to a change in the way the future should be perceived. The assumption is that ‘information is out there’ and that it can be found through searching can subsequently provide input into how the future may be (re)imagined (Day and Schoemaker 2005). Essentially all organizations acquire information in a deliberate or non-deliberate way about trends, events, opportunities, and threats in their market environment through either directed scanning, direct experience, imitation, or problem-solving inquiries (Daft and Weick 1984, Day 1994, p. 44). This is typically facilitated through formal data collecting initiatives within an organization, for instance via established information systems which employees can access at any time and contribute to (Boe-Lillegraven and Monderde 2015), hiring

external market research firms to provide information during the development of an innovation (Sarangee *et al.* 2014), or obtaining data on a variety of trends from industry analysts or personal written sources such as magazines (Kaplan and Orlikowski 2013). Especially the role of individuals and how they search is increasingly emphasized. It is argued that the discovery of novel information and resulting ideas is not so much occurring at the firm-level, but is rather the cumulative result of search conducted by individuals (Li *et al.* 2013, Dahlander *et al.* 2016). Such individuals are often given a key role to perform search activities for the firm to access external information sources (Dahlander *et al.* 2016). Collected information can trigger subsequent interpretation processes when those who perceive the signals as not fitting current perceptions of how the future may develop (Kaplan and Orlikowski 2013, Sarangee *et al.* 2014). This subsequently relates to the two following elements, which are formal and informal interpretation. It follows the assumption that searching and identifying signals from the environment are dependent on one's interpretation of it, rather than assuming that such signals are a direct representation of the world (Seidl 2004).

It is the interpretation and meaning-making of issues or opportunities from obtained (weak) signals that brings value to that information (Dutton and Ottensmeyer 1987). Interpreting any searched information allows decision-makers to anticipate, in approximate terms, the longer-term implications of continuing the current course of action, or the outcomes of alternative courses of action (Gavetti *et al.* 2012). During innovation projects, project management and the team may engage in structured approaches such as revising roadmaps by “identifying, allocating, ordering, and interlinking innovation elements of technology foresight, long-term market encounter, and product line evolution in a future map with a timeline” (Simonse *et al.* 2015, p. 912). Indeed, project teams can undertake continual monitoring of roadmaps against information searched for by the project team on potentially new emerging competitive technologies, and assess a project's benefits over time (Sarangee *et al.* 2014, p. 1031). Such structured approaches towards interpreting information in relation to the project's future also facilitates dialogue by means of “creative group conversation

about the future plans on innovation with the timeline as a focal point for creating a mutual understanding” (Simonse *et al.* 2015, p. 912), which allows the project to move forward in the face of uncertainty (Kaplan and Orlikowski 2013).

However, individuals can also engage in interpretation activities in the absence of structured or formalized interpretation approaches outlined before. Anticipating the future of the current project also lies in the social processes that project members go through. These social processes are related to making sense of markets of the future and are crucial in understanding why certain interpretations of the future catalyse or not and draws on ‘prospective’ sense-making which emphasizes the social processes of constructing an interpretation of the future (Gephart *et al.* 2010, Wiebe 2010). Project management and members can engage into revising the assumptions they may have about the envisioned future market of their innovation or the future benefits of using a certain technology, all based on information obtained (Sarangee *et al.* 2014). When project members articulate, challenge, and engage in sharing their future views and assumptions by means of dialogue, it may lead toward creating a mutual understanding of the project’s future (Simonse *et al.* 2015). Also Kaplan and Orlikowski (2013) found such processes in projects, where individuals settle on a representation of the future by deliberate reflection and negotiation of individuals on how they view the past (e.g. how individuals perceive what the organization stands for, what it has done, what strategy it has pursued), what currently is at stake in the present (e.g. how individuals perceive current environmental threats or opportunities for their project), and how the future might be reimagined (Kaplan and Orlikowski 2013, p. 965). These processes involve open-mindedness and willingness to revise held assumptions of how the future will unfold (Sarangee *et al.* 2014).

Overall, project management and team can engage in cycles of the practices outlined above to validate or invalidate a current project’s envisioned future (Kaplan and Orlikowski 2013). While the intake of new information can lead to seeing the future quite differently than what was envisioned, new information itself does not always necessarily initiate such interpretation processes. Also simply

from ongoing development efforts, team-members can engage in interpretation processes because individuals may see the future quite differently in relation to any current actions undertaken. Any of these cycles may spur cycles of creative ‘temporal work’ whereby novel new insights are created (Kaplan and Orlikowski 2013). Considering the three dimensions outlined before seems therefore important when conceptualizing forward-looking search at the project level.

#### **4.2.2 The three moderators in-depth**

We posited that there are three potential factors that can greatly enhance the potential contribution of forward-looking search towards a project’s innovativeness. Here, we discuss these three factors more in detail and why they are relevant for understanding the role of forward-looking search within innovation project development.

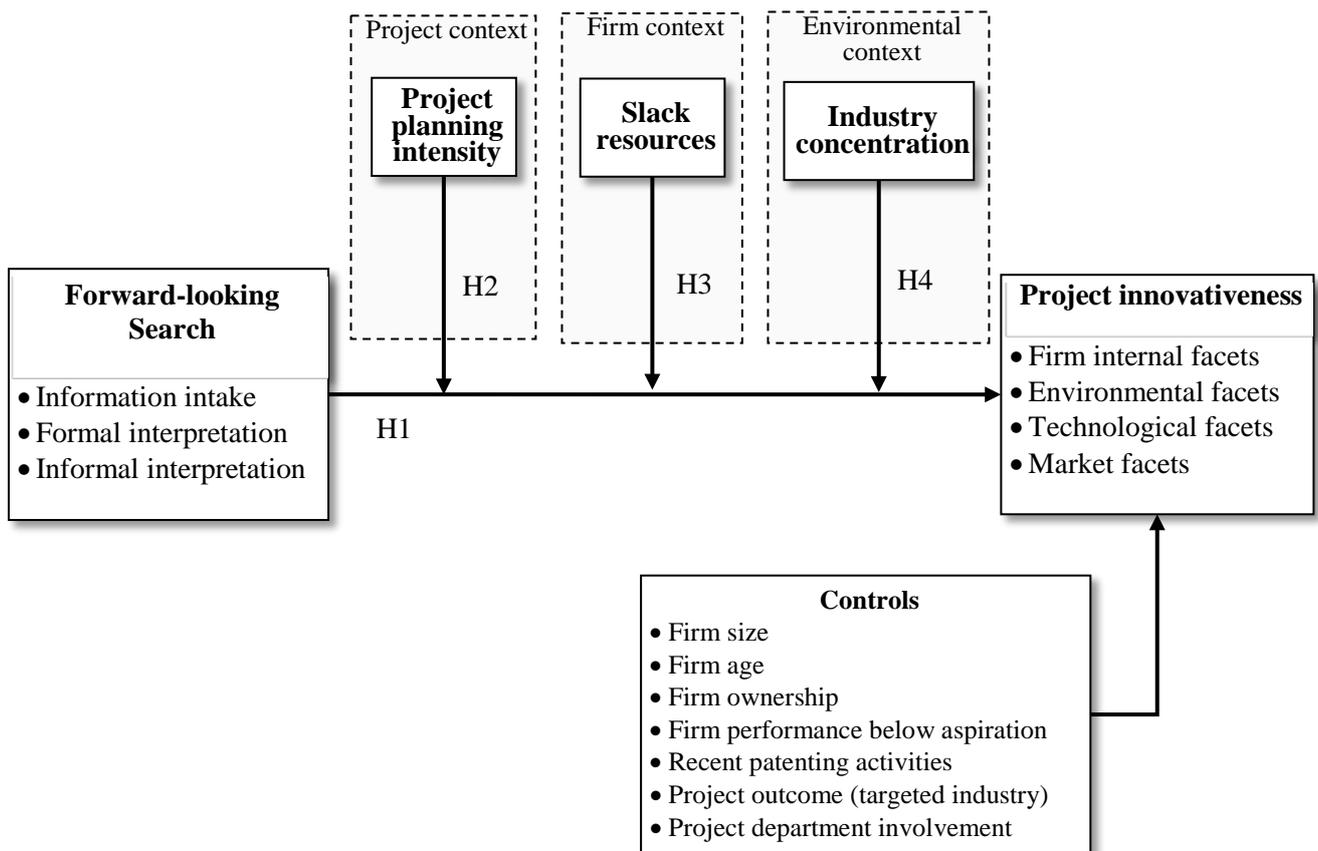
Regarding the first factor, the case of planning, does forward-looking search only occur in poorly and/or flexibly planned projects? The common notion is that highly flexible planned projects are able to produce radical innovations (e.g. Veryzer 1998). It may be the case that these projects see the greatest need to engage in forward-looking search to create highly innovative new products. Indeed, there *must* be room in project planning to facilitate potential changes towards (initially) unforeseen insights via forward-looking search. However, recent research also found evidence that projects aimed at creating highly innovative products are managed far less flexibly than the common notion within innovation management that radical innovation projects should be managed in a flexible manner (Holahan *et al.* 2014). For instance, efforts at sophisticated planning may take away the need to engage in forward-looking search during project development, as planning is in essence “attempts to purposeful, future-oriented decision making” (Hogarth and Makridakis 1981, p. 115). Planning may therefore be sufficiently able to ensure a project’s deliverables are still relevant at the project’s end. Therefore, in order to understand why forward-looking mechanisms are used during project development, we look at potential moderating effects of project planning; under what kind of

project planning circumstances does forward-looking search occur and has the largest effect on a project's outcome?

The second factor relates to the case whether there are budgetary means available to act on unforeseen changes. If a project was initiated based on a defined budget at the time, unforeseen changes were likely not budgeted. Literature on organizational search would posit towards the availability of slack resources (i.e. the resources that are at the present uncommitted to other organisational activities) where firms deploy these resources to avert changes being brought about in the environment (Levinthal 1997). Equally, the notion of slack resources can be transferred to the project level, where past research has pointed out that the lack of slack can hamper the work of new product development teams and lead to project teams not able to implement changes at the project to cope with changes in the external environment (Richtnér *et al.* 2014). Therefore, it raises the question whether forward-looking search is increasingly present during project development if the organisation has the slack resources available to facilitate change at the project level.

The last factor relates to the inability to understand the external environment and all its constituents at the project start. If forward-looking search occurs during project development, it hinges on the assumption that the firm's external environment is complex and dynamic in nature that can only be fully understood over time, as opposed to be fully understood at a single point in time before a project is initiated. Industry concentration refers to the competition in an industry that stems from concentration, or the market share dominance of one or more firms (Dess and Beard 1984). If a firm is present within a highly concentrated industry, it may rely less on forward-looking search during project development to attain innovativeness. There are far less competitors that can bring about changes, technological changes occur less unexpected, and potential changes in the market that can erode envisioned market successes are less common. The question therefore becomes; does forward-looking search then only occur when an innovation project is developed when the firm is

**Figure 4.1: Conceptual model**



positioned within an un-concentrated environment due to the increased number of potential unexpected signals to emerge?

### 4.3 Theory and Hypotheses

In our study, we build on the notion that the degree of innovativeness can be understood as a measure of task uncertainty, because “it describes the difference between a status quo and the actual innovation outcome on several dimensions of the new product (Salomo *et al.* 2007, p. 288). Therefore, the higher degree of innovativeness pursued, the higher the information requirements are to develop an innovative product. Forward-looking search then becomes an antecedent of innovativeness. The premise of this study is therefore that forward-looking search allows project teams to pursue highly innovative products, as set forth by hypothesis H1.

We also posit that the link between forward-looking search and project innovativeness is affected by a number of factors that strongly influence the contribution of forward-looking search to

project innovativeness. First, for forward-looking search to contribute optimally, an innovation project must have a necessary level of planning flexibility to satisfy the assumption that forward-looking search allows one to discover unforeseen changes in the external environment which were not accounted for at the project start. In relation to this, secondly, the role of slack resources plays a dominant role as well, as such resources allows project teams to act upon unforeseen changes within the project that were not accounted for in the project's budget. Third and last, we introduce the notion that the need for information provided for by forward-looking search to pursue an innovative product is reduced by the level of industry concentration; the higher the firm's industry is concentrated, the lesser the complexity and burden of obtaining reliable information. The three factors discussed here are summarised in hypotheses H2 to H4. Figure 4.1 shows our study's conceptual model.

#### **4.3.1 Forward-looking search and innovativeness**

Novel and radical innovations are risky and entails considerable uncertainty. Longer development times and use of a larger variety of resources increases the risks of developing such innovations (Holahan *et al.* 2014). Nevertheless, such radical projects can be beneficial for the focal firm in terms of performance benefits resulting from it (Griffin 1997), but also extremely costly in case of failure due to sunk cost (Sarangee *et al.* 2013). Especially due to the greater amounts of uncertainty associated with radical projects, as well as longer development times, the idea that all facets associated with such a project can be known beforehand goes against the bounded rationality assumption, which is the lack of "complete knowledge and anticipation of the consequences that will follow on each choice" (Simon 1947, p. 81). Paired with overall short product life cycles and the speed and turbulence of technological developments (Cooper *et al.* 2001, Hauser *et al.* 2006), stimuli that frequently inject uncertainty into how the project pans out in the future, attaining innovativeness becomes increasingly difficult. In uncertain situations of developing a radical innovation, ongoing search can lead to perceiving new signals that can have a potential impact on the current

developments taking place. Consequently, it may inform on the future value of a firm's newly developed products (Kaplan and Orlikowski 2013, Sarangee *et al.* 2014). In this way, forward-looking search evaluates whether current developments are still novel in markets of the future. Indeed, change in perception of how the future may unfold, and how future prospects of ongoing development efforts are implicated by new projections of markets of the future (Kaplan and Orlikowski 2013). The main objective of forward-looking search is therefore not to predict the future, but rather to appraise present actions (Dewey 1988, Seidl 2004, Sarangee *et al.* 2014).

However, being keenly aware of a wide variety of trends, competitors, and other relevant information sources, a project team can also facilitate a project's novelty (Im and Workman Jr. 2004). Noting the bounded rationality assumption; a project's initial plans to use certain innovative aspects may turn out to be far less novel than anticipated during development. Indeed, (Sarangee *et al.* 2014) found that continual scanning and benchmarking competitors against the project's roadmaps ensured that projects would pursue other novel avenues that were not yet served by competitors. Forward-looking search therefore can highlight alternative novel paths to pursue in the development of an innovative product for the focal firm (Yadav *et al.* 2007).

Given these arguments, we hypothesize a positive relationship between forward-looking search and innovativeness, either by means of upholding the level of innovativeness pursued or by spotting novel and distant opportunities to pursue with the project:

*H1: Forward-looking search positively impacts project innovativeness.*

#### **4.3.2 The moderating role of project planning intensity**

Project planning can be seen as a form of project abstraction (Gassmann and Zeschky 2008, Horváth and Enkel 2014). Having very structured descriptions and processes in place removes any abstraction of the project; project deliverables are described by concrete features and milestones rather than by only a few essential elements in the case of greater degrees of abstraction (Arora and Gambardella

1994). Having low abstraction removes the need for increased information supply (Hauschildt 1996) and the possibility of generating other novel solutions that could otherwise be imagined due to a more abstract project and problem definition (Horváth and Enkel 2014). It might even be considered inappropriate to engage in forward-looking search under intensely planned projects, as a rigid project plan may already inform the project team they are doing the right thing (Ashford and Cummings 1983). As such, it can be expected that under high planning intensity, managers and project teams may feel less of a need to engage heavily in forward-looking search in order to facilitate or uphold innovativeness.

However, under conditions of loose and flexible project planning, forward-looking search may similarly be able to contribute less towards innovativeness. Prior literature posits that radical innovations can be initiated in unstructured ways, whereby the organization can assign members to innovate, but with an unclear problem definition and unstructured information search (Reid and De Brentani 2004). Therefore, from an abstraction perspective, having very abstract definitions of what the project entails can result in ambiguity as to what to search for, even if the ultimate goal is a highly innovative new product. In such undirected settings, little effort is made at collecting information from a wide variety of sources and interpreting this information with as little equivocality reduction possible (Daft and Weick 1984). Instead, in such situations, members may rely much more on personal contacts to provide information with the aim to reduce equivocality as much as possible (Daft and Weick 1984) and to form coalitions to proceed with the innovation project (O'Connor and Rice 2001, p. 105). One can therefore expect that forward-looking search is used to a much lower degree to attain innovativeness in un-formalized and flexibly planned projects.

However, literature posits that situations of medium levels of project planning intensity are most useful in generating innovative solutions. A medium level of planning provides information on the problem that needs to be solved (i.e. an innovative new product), but also allows for room for assigning how a wide variety of future trends and signals may impact the novelty of the intended

product. As such, a medium level of abstraction allows for a common basis to serve for relatively directed forward-looking search without compromising potential out-of-the-box thinking (Horváth and Enkel 2014). Furthermore, it provides ‘slack time’ (Richtnér *et al.* 2014, p. 1270). Project members need time to be analytical and creative, time to discuss and reflect, and thus to be more innovative (Lawson 2001, pp. 126–127). Therefore, in medium planned projects where there is still some ambiguity about the project and its constituent elements but also slack time available to discuss and reflect, forward-looking search is able to contribute greatly towards the novelty of the project’s outcome.

Taking the above arguments into consideration, we hypothesize that project planning intensity moderates the relationship between forward-looking search and project innovativeness in an inverted-U shape where 1) medium levels of project planning intensity allows for the greatest effect of forward-looking search on project innovativeness and 2) low and high levels of project planning intensity lead to the smaller contributions of forward-looking search toward project innovativeness:

*H2: Project planning intensity moderates the relationship between forward-looking search and project innovativeness in a curvilinear (taking an inverted U-shape) way.*

### **4.3.3 The moderating role of slack resources**

Slack resources – excess inputs such as underutilized capacity, facilities, or labour and financial reserves like working capital or borrowing capacity (Levinthal and March 1981), play a dominant role in the behavioural theory of the firm (Cyert and March 1963). It suggests that slack resources enhance experimentation and risk taking, which influences innovativeness; it provides the capacity to deal with emerging problems (Nohria and Gulati 1996), and allow firms to adapt to complex competitive landscapes (Levinthal 1997). Therefore, firms with greater amounts of slack resource are more likely to have freedom in their responses to newly introduced technologies or competitor strategies, thereby influencing innovativeness. Indeed, Troilo *et al.* (2014) find that slack resources

drive firms to be more engaged in distal search, which in turn affected innovativeness. However, while most research has examined the effects of slack resources on innovation at the firm-level, recent research has transferred these same arguments to the project level. For instance, Richtnér *et al.* (2014) finds slack to be important for project teams to be more innovative, as it allows project teams to act on perceived changes and change elements of the project to increase its novelty. Conversely, if slack is reduced at the project level, project teams are unable to cope with changes in the external environment, such as changing customer needs. What slack resources thus allow for is the ability of project teams to act on forward-looking search. Projects need the (financial) means to implement any foreseen changes to facilitate innovativeness. If a project was initiated based on a defined project plan and budget at the time, changes were likely not foreseen. Especially in the case of pursuing radical innovation, where uncertainty is high and development times are lengthy, the role of slack resources becomes increasingly important to facilitate innovativeness by means of forward-looking search. It allows for any unforeseen reconfiguration of a project's constituent elements which were not accounted for in the project plan or budget, in order to facilitate innovativeness (Nohria and Gulati 1996, Levinthal 1997, Richtnér *et al.* 2014). Conversely, if slack resources are low, forward-looking search's ability to contribute to a project's novelty will be reduced. As such, we hypothesize:

*H3: Higher levels of slack resources positively moderate the relationship between forward-looking search and project innovativeness.*

#### **4.3.4 The moderating role of industry concentration**

The industry in which the firm searches can hamper the ability of forward-looking search to contribute to innovativeness. In highly concentrated industries, firms tend to have a high degree of similarity (Miles *et al.* 1993). These industries feature a lower number of competitors compared to less concentrated industries. Prior research posits that in highly concentrated industries, managers should analyse their environments and analyse the industry structure structure before making

decisions about investing into new product development (Zahra 1993). Indeed, concentrated industries are less complex; they feature more standardized norms of competition, less unpredictability, and therefore an overall lower need for information search (Palmer and Wiseman 1999). Competitors perform actions much less frequently (i.e. new product introductions) that may induce uncertainty within the industry (Derfus *et al.* 2008). Taken the above into account, in concentrated industries, projects may have already been initiated with a rather clear understanding what the project entails and how this is positioned vis-à-vis competitors. Furthermore, there is a lower level of uncertainty that remains relatively constant over the course of a project's development. The need of forward-looking search is thereby diminished as there is a smaller requirement for additional information during the project's development. With that, it is likely that the role of forward-looking search during development is lessened. Therefore, we hypothesize:

*H4: Higher levels of industry concentration negatively moderate the relationship between forward-looking search and project innovativeness.*

## **4.4 Data and measures**

### **4.4.1 Sample and data**

Our main unit of analysis is a single new product or service development project. Our sampling frame is a group of Danish firms from the manufacturing industry (NACE Rev. 2 C-section). The data were collected through a cross-sectional survey, conducted in 2015 and 2016, of the selected firms in Denmark, annual reports of each firm from the Danish Central Business Register for our objective measures, and Bureau van Dijk's ORBIS database for industry and patent information. For our objective data, we gathered data up to three years prior to what we refer to as time  $t=0$ . We set time  $t$  as the year in which the innovation project was under development.

Viable firms were selected by means of two criteria; revenue in the prior financial year of at least 75 million DKK (equivalent to 10 million Euro), or at least 50 employees. Using Bureau van

Dijk's ORBIS database and Danish NN Markeddata, a list was compiled with 1175 firms. Although smaller firms (either in size or revenues) also engage in innovation activities, in the context of this paper, a focus on slightly larger firms is sensible because larger firms in Denmark are arguably disproportionately more engaged in innovation activities and more likely to have adopted organizational practices of search to facilitate innovation.

We did not employ selective sampling based on our study's dependent variable (i.e. by randomly assigning respondents in the survey up-front to select either a radical innovation or incremental innovation). Nor did we mention to the respondents that the research it was about 'innovation' or 'innovativeness' (or any synonyms), but rather about development projects of a new product or service for their company. As such, we are confident we alleviated potential priming biases. Respondents were asked to answer the following questions to assess their suitability for our research:

*“Throughout this survey, you will be asked questions that need to be answered for the specific project that you should select on the basis of the following criteria:*

- 1) It is a project to develop a new product or service for your company,*
- 2) The new product or service of this project is facing market launch, or has been launched within the last 3 years, and*
- 3) You have been involved in this project for the majority of the project running time.*

*Are you involved, or have you been involved in such a project?”*

Potential respondents were presented with these criteria by phone contact first, and were only invited to participate in our study if these criteria were fulfilled by the respondent. Furthermore, the survey had an additional check of these criteria; if the respondent answered 'No' to our final question presented above, the survey would be closed. Using our method, we did not expect respondents to self-select their firm's most innovative projects based on the presented criteria. Overall, we are confident that our method assured that we were not sampling on the dependent variable: all relevant innovation projects were included, whether or not the outcome were innovative.

The research team developed the questionnaire during February to June 2015. To the extent possible, the questions were based on previous studies. In September 2015, the questionnaire was pretested with five industry experts, and resulted in some revised item wording to improve their clarity. Furthermore, as we follow a single response design (albeit with the most knowledgeable respondent per project, being the project manager), we performed a check to assess whether different respondents would rate our measurement items similarly for the same innovation project. Therefore, we recruited two raters for the same innovation project within the same firm, using the same firm selection criteria and project involvement criteria for the respondent outlined before. We had two raters for three innovation projects from three firms, giving us a total of 6 responses. We calculated the intraclass correlation ICC(1) and ICC(2) for the 3 pairs of responses with 108 measurement items representing all the scales of the survey<sup>2</sup>. The ICC(1) was .31, which is well above the recommended cut-off value of .12 (James 1982). This indicates that both individuals for each of the three innovation projects had similar perceptions of each of the measurement items (Bliese 2000). Reliability of the mean values was assessed by computing average of the ICC(2). The value of .62 meets the recommended cut-off value (Bliese 2000), indicating overall consistent rating of the two raters for an innovation project. As such, potential concerns about respondents with different roles within a single innovation project causing for differences in scoring on our items partially alleviated common concerns with single respondent designs.

In September 2015, a private research firm (Wilke AS) administered the questionnaire to the 1175 target firms. Suitable respondents were identified upfront where possible front by means of internet search (e.g. LinkedIn) in order to increase response rate as it allowed to circumvent the switchboard by referring to a specific person on the initial call to the firm. Call outlines were created to make sure the respondent verified that the firm was either larger than 50 employees or had revenues exceeding 75 million DKK, and it met our criteria outlined before regarding involvement in

---

<sup>2</sup> Not all scales from the survey are used in the current study.

**Table 4.1. Sample Characteristics (N=159)**

Firm characteristics	N	Project characteristics	N
<b><i>Firm size (employees)</i></b>		<b><i>Departments involved</i></b>	
Less than 50	4	Single department	14
50-100	38	Multiple departments	145
100-250	54	<b><i>Project phase</i></b>	
250-1000	42	In development	80
1000 or more	21	Market launched (< 3 years)	79
<b><i>Firm revenue (gross profit)</i></b>		<b><i>Project outcome</i></b>	
< 15 million DKK	3	Product	140
15-75 million DKK	9	Service	19
75-375 million DKK	76	<b><i>Project outcome target group</i></b>	
375-750 million DKK	23	Business-to-business	114
750-7500 million DKK	29	Business-to-consumer	45
>7.5 billion DKK	11	<b><i>Project outcome industry target</i></b>	
Does not wish to state	8	Fast-moving consumer goods	25
<b><i>Patents</i></b>		High-tech consumer goods	5
Filed patent(s) in the last 3 years	60	Other consumer goods	27
<b><i>Firm ownership</i></b>		High-tech industrial goods	60
Private	32	Other industrial goods	42
Private equity owned	12		

a new product/service development project. After verification by phone, respondents were given a formal invitation by email during the phone call and, where possible, verified if the email had been received. After two reminders, a total of 214 responses to the survey were recorded, indicating a response rate of 18%. These responses represent 214 unique innovation projects from 214 unique firms. However, because of missing answers, only 159 responses were fully completed.

Respondents were mostly senior project managers, managers responsible for innovation activities, or project members. The 159 unique innovation projects included in the data set are represented by firms that have an average of 217 employees, with wide variation between some very large firms at one end of the spectrum and a number of smaller firms with approximately 50 employees at the other end. Approximately 55% of the firms has at least one patent registered, with 16 patents on average and 37% of the firms having filed patents in the last three years, indicating that they are highly innovation oriented. Table 4.1 shows descriptive characteristics of our sample.

#### 4.4.2 Common method bias

First, we attempted to reduce the potential of common method bias by carefully designing our survey (Podsakoff *et al.* 2003). We refrained from using any wording and sequence of the variables in the questionnaire that may induce item priming effects. Furthermore, because we did not explicitly tell the respondents that the survey was about innovation (or innovativeness), but rather asking what practices were employed during *a project* that resulted in a product or service for their company, we reduced potential context-induced moods as well, as this may have caused a certain tendency to respond to our items in a more desirable way.

As we employ a single-respondent design, the study might still be prone to common method bias. Using statistical tests, we assessed the extent to which respondents explain variance between the study's variables. First, we performed Harman's one-factor test on our self-reported items. We conduct a principal components analysis according to Harman's one-factor test, where all the indicators for our self-reported constructs (*forward-looking search*, *innovativeness*, and *project planning intensity*) are simultaneously entered without rotation. The results of analysis show that the first factor is able to explain 34.3% of the variance, which is well below the 50% threshold. Furthermore, we found multiple factors, and the first factor did not account for the majority of the variance. This finding indicated that common method variance is not a major concern in our study. Second, we find that the smallest correlation between our model's main variables from our survey data is  $r = .19$  (e.g. the correlation between *forward-looking search* and *firm-internal innovativeness*, see Table 4.3), which can be used as a proxy for common method bias. Given the low correlation, this finding does not suggest evidence for common method bias (Lindell and Brandt 2000, Volberda *et al.* 2012).

#### 4.4.3 Measures

The constructs used relied on existing scales taken from the literature when available, or they were adapted from previous conceptual work. All scales were pretested with 8 representatives from

academia and industry to assure the face validity of constructs, improve item wording, and remove ambiguity.

### ***Dependent Variable***

*Project innovativeness.* We adapted the 12-item scale from (Schultz *et al.* 2013) to measure project innovativeness and covers four facets; market, technology, firm-internal, and environment-related facets. The scale represents innovativeness as a continuous construct which is able to measure changes in innovativeness ranging from incremental innovations ,moderate, and radical innovations (Schultz *et al.* 2013, p. 104). Measuring innovativeness on “the entire bandwidth of innovativeness” (Schultz *et al.* 2013, p. 95) is important. By measuring also the firm-internal and external aspects, truly radical products have far-reaching consequences for the future; not only for the focal firm itself, but also for the market structure and potentially even industry level. Because the original scale refers in its items to products or services in its plural form, we slightly altered the item formulation by referring to a single product or service as outcome of the innovation project. The items are measured using a 7-point Likert scale ranging from “strongly disagree” to “strongly agree”. All items are averaged to create a single measure of project innovativeness as it is a latent construct (Schultz *et al.* 2013).

### ***Independent variables***

*Forward-looking search.* We created 18 items to measure forward-looking search. It describes the extent to which activities were employed to 1) proactively scan for potential relevant signals that might endanger the current project or provide a new opportunity to tap into (*information intake*), 2) systematically evaluate and predict the viability of the project outcome in the intended future market (*formal interpretation*), and 3) involve project members to explicitly think about the future of the project’s outcome and its assumptions (*informal interpretation*). All items were formulated to fit a single innovation project and the activities carried out during the innovation project. Information

intake is measured using six items based on conceptual ideas from environmental scanning literature (Jain 1984; Daft 1988; Jennings 1992) and proactivity (Zhou *et al.* 2005, Spanjol *et al.* 2012). This allows to perceive information on potentially new opportunities or threats within and outside of current the current business. Formal interpretation is measured by six items inspired by foresight literature on systematic approaches. These systematic approaches facilitate the creation, articulation, and settlement on 'what might be' (Tsoukas and Shepherd 2004). Lastly, informal interpretation is measured with six items about how project members are open-minded towards potential future signals that could endanger or provide an opportunity for the innovation project. Greater open-mindedness allows to question current and new ideas, assumptions of the current markets and business, or questioning the perceived market boundaries and norms (Spanjol *et al.* 2012, Sarangee *et al.* 2014).

### ***Moderators***

*Slack resources.* Slack resources have been operationalized using a variety of accounting measures. However, in the context of innovation projects, the most easily deployable form of slack by managers is cash. Cash provides managers the greatest degree of freedom in allocating it to virtually any purpose (George 2005, p. 2004, Voss *et al.* 2008). Therefore, we measure slack resources as cash reserves available during the development of the innovation project ( $t=0$ ). We apply a logarithmic transformation to the values. Because some firms had no cash reserves available during project development, we manually imputed a value of 1 for these cases before applying the logarithmic transformation.

*Project planning intensity.* We employ a 5-item scale which reflects the extent to which the innovation project was planned and broken down into work packages, detailed budgets defined, resources assigned to the work packages, and overall allocation of responsibilities to the work packages (Verworn *et al.* 2007). The items are measured using a 7-point Likert scale from 'strongly

disagree' to 'strongly agree'.

*Industry concentration.* Industry complexity has historically been defined as the amount of heterogeneity present within an industry (Aldrich, 1979), which captures the uncertainty that arises as a result of intra-industry competition. We build on Dess and Beard's (1984) model that captures heterogeneity in terms of industry concentration. Two of the most common proxies for industry concentration include the  $k_{th}$  firm concentration ratio ( $CR_k$ ) and Herfindahl index (HHI). Because we focus in our study on the effect of competition and strategic choice availability, we use the  $CR_k$  ratio. More specifically, the  $CR_4$  ratio captures the distinct effect that a few large firms can restrict competition and that a multitude of fringe competitors is unable to engender competition (Bikker and Haaf 2002, p. 2211). Nevertheless, correlations between HHI and  $CR_k$  variables are generally very high ( $>0.90$ ) (Bikker and Haaf 2002).

Because Danish law permits firms to not reveal revenue and sales numbers (when warranted for competitive considerations)<sup>3</sup>, few firms publish this information in their annual reports. Therefore, rather than calculating the  $CR_4$  index of industry concentration using sales, we employ total assets and equity. These values are well reported by Danish firms. We follow prior studies that also use these alternative indicators to measure industry concentration (e.g. Hou and Robinson 2001, Bikker and Haaf 2002). Typical correlations between sales, assets, or equity are  $> 0.95$ , indicating high interrelatedness.

We operationalized industry concentration as the industry four-firm concentration ratio ( $CR_4$ ) (Cohen and Levinthal 1990). First, we defined the focal firm's primary industry based on three-digit NACE Rev. 2 code derived from the Danish DB07 codes from the Danish Central Business Registry<sup>4</sup>. Second, we calculated the total assets (equity) of the industry by summing the assets

---

<sup>3</sup> Section 32, subsection 1 of the Danish Act on Commercial Enterprises' Presentation of Financial Statements, etc. (the Danish Financial Statements Act). Ministry of Business and Industries, act no. 448 of 7 June 2001.

<sup>4</sup> The Danish DB07 code is based on the internationally recognized NACE Rev. 2 codes.

(equity) of all firms in the industry listed in ORBIS<sup>5</sup>. Next, we identified the four largest firms, ranked by assets (equity), in each industry. The four-firm concentration ratio was then calculated as the ratio of the assets (equity) of the four largest firms divided by the total industry assets (equity). Essentially, this ratio is the proportion of assets (equity) in the industry accounted for by the four largest firms. To alleviate any discrepancies between the measures we employ (total assets and equity), we calculated the intra-class correlation between the two measures to assess whether we can group them together into a single indicator. We find ICC(1) to be .97, and ICC(2) to be .99, indicating very high consistency for using either total assets or equity, but also on average taking all the industries into account. We averaged both  $CR_{4(\text{assets})}$  and  $CR_{4(\text{equity})}$  into a single measure of industry concentration. The index can assume a value between 0 and 1, where 0 reflects infinitesimal share of the largest four firms in an industry. A high value indicates disproportionate concentration of firms that limits smaller firms in their strategic choices (Dess and Beard 1984).

### ***Control Variables***<sup>6</sup>.

We control for a wide range of alternative explanations that may affect the innovativeness pursued by an innovation project of a firm.

*Firm ownership.* We controlled for the potential effects of firm ownership on innovativeness, as it may explain a potential tendency to engage in innovative behaviour, most notably for private firms (Acs *et al.* 1997, Shefer and Frenkel 2005). We include a dummy to indicate whether the firm is

---

<sup>5</sup> While we recognize Bureau van Dijk's ORBIS database is not all-inclusive, it is our best proxy to list all firms within a certain 3-digit NACE Rev. 2 industry including both private and public firms. Because we use the  $CR_4$  ratio, the measure is much less affected by the total sample size of firms for each 3-digit industry (as would be the case in using Herfindahl indexes). As such, we are confident our  $CR_4$  measure adequately captures industry concentration.

<sup>6</sup> We did not include a control to indicate the length of the project's development phase as it is endogenous to our dependent variable; the more radical a project, the longer it is usually under development (Holahan *et al.* 2014).

privately owned to control for potential effects of ownership<sup>7</sup>.

*Firm size.* We used the year-end number of full-time employees the firm had employed during the year the innovation project was under development. We applied a logarithmic transformation to quasi-normalize the variable.

*Firm age.* Firm age is included as it can be a determinant of innovativeness (Rhee *et al.* 2010). Firm age is calculated as the time in years between the firm's year of incorporation (obtained from the Danish Central Business Register) and the recorded time of the completed survey.

*Firm performance below aspiration.* We include a measure of performance below aspiration before project start ( $t-1$ ) as it can encourage firms to become more risk-seeking and heighten a firm's engagement R&D (Chen 2008). Consequently, firms may aim to create more innovative products or services which inherently are more risky endeavours to undertake. We used return on assets (ROA) as a performance measure. ROA is preferable as it avoids distortions caused by differences in financial leverage across firms (Greve 2003, Chen 2008). We follow Chen (2008), and model performance aspiration as a weighted average of past performances. As such, firm performance aspiration at time  $t-1$  is a weighted combination of the firm's performance at  $t-2$  with weight 0.6 and at  $t-3$  with weight 0.4. Then, we calculate the difference between firm performance at  $t-1$  and performance aspiration at  $t-1$ . The variable obtains a value of zero if performance is above aspiration levels, whereas in other cases it is performance minus the aspiration.

*Firm recent patenting activity.* We control for any recent successful patenting activity within the last 3 years prior to the development of the innovation project. We use a dummy variable which we

---

<sup>7</sup> We also included dummy's for other ownership structures, such as 1) being part of a collective of firms (e.g. being a subsidiary) (Shefer and Frenkel 2005), 2) being foreign owned (>50% of controlling shares in hands of a foreign entity), 3) being owned by private equity (either national or international private equity owners) (e.g. Lerner *et al.* 2011), and 4) being the head of a group of firms (e.g. having national and/or international subsidiaries). However, these dummy variables did not account for any additional variance. Only the dummy variable for private firms was retained.

coded 1 when the firm had filed (a) patent(s) in three years prior to the development of the innovation project, whereas it was coded 0 when it did not file any patents in that time period. We introduce this variable to control for two potential effects. First, certain firms may differ in their ability to introduce innovative products (or services), which may be due to their ability to patent. Second, it acts as a proxy to account for the potential that our measure of innovativeness of the project is due to firms showing persistence in innovation (Frankort 2016).

*Project outcome targeted industry.* We controlled for industry effects that may affect innovativeness. We included five dummy variables representing the targeted industry for which the innovation project's outcome was meant for: 1) fast-moving consumer goods, 2) high-tech consumer goods (e.g. consumer electronics), 3) other consumer goods, 4) high-tech industrial goods (e.g. IT-solutions, machine automation, and medical equipment), and 5) other industrial goods. For each of the presented options, the survey respondent was additionally asked to fill in an even more specific market segment which they were targeting for. Additional checks were done to make sure each of the innovation projects was put into the right category.

*Project multiple department involvement.* We control for cross-functional collaboration as it can potentially enhance innovativeness. We included a dummy variable which was coded 1 when people from different departments were actively involved in the project, and 0 when there were only people actively involved from a single department (de Visser *et al.* 2014).

#### **4.4.4 Measure validation**

##### *Forward-looking search measure validation*

We employed an exploratory factor analysis with principal component analysis and varimax rotation to investigate the forward-looking search scale. We assessed both the scree plot and initial eigenvalues ( $>1$ ). Three factors emerged as conceptualized. Only items that satisfied the following criteria were included: (1) items should have communality higher than 0.3, (2) dominant loadings

should be greater than 0.5, (3) cross-loadings should be lower than 0.3, and (4) the scree plot criterion should be satisfied (Briggs and Cheek 1988). We deleted three items in total from our 18-item scale that did not satisfy these criteria. One item was removed from systematic evaluation, and two from open-mindedness. The three factors explain 75.3% of the total variance and find very satisfactory item loadings. Furthermore, Cronbach's Alpha values above .90 indicate excellent reliability. Table 2 reports the results of the exploratory factor analysis.

#### *Measurement model assessment*

We assessed the reliabilities of the scales using composite reliability. We find overall acceptable values of composite reliabilities, which range between 0.65 and 0.94. All constructs, except environmental-related facets of innovativeness, meet the general minimum value of 0.7, which indicates adequate reliability of our constructs (Hair et al. 2013). Cronbach's alpha for the environmental-related innovativeness construct is also rather low (0.60; not reported in tables), but does exceed the value of 0.60 as a commonly used threshold (Nunnally 1967). Furthermore, upon closer inspection, the construct has a rather broad conceptual scope facilitated by its three underlying items; reliability for such constructs should generally be above the 0.55 value (Van de Ven and Ferry 1980). Lastly, we were concerned about removing the troublesome item from this construct, as the original measures had undergone rigorous optimization, and in particular the environmental-related facets of innovativeness were able to identify radical innovation projects (Schultz *et al.* 2013). Therefore, we retain the original items and we believe that the reliability for this particular construct should not be of concern.

Each construct contains three to six items and was measured on a seven-point Likert scale. We used confirmatory factor analysis with IBM SPSS Amos 21 to validate the scales resulting from the exploratory factor analysis. Appendix 4A reports the CFA with the item loadings and t-values. A satisfactory fit was achieved with  $\chi^2/d.f. = 1.583$ ; CFI = .922; SRMR = .056; RMSEA = .061  $CI_{0.90} [.052 - .069]$  ( $p_{close} = .02$ ). The CFI of 0.922 is considered an indication of good fit, and the

**Table 4.2. Exploratory Factor Analysis for the Forward-looking Search Measurement Scale**

Constructs	Loading <sup>1</sup>	Item corr. with total
<b>Information intake</b> (Cronbach's Alpha = .91)		
We scanned for potential relevant key trends, opportunities, or threats in the periphery of the target market	.696	.701
We looked out for short-term and long-term changes which could impact the new product	.631	.722
We consulted a large variety of information sources to provide us with issues, such as future threats or future opportunities, relevant to our new product	.677	.379
We continuously scanned for future issues, either threats or opportunities, for our new product	.715	.806
We tracked key trends, policies, and tactics of competitors	.801	.724
We deliberately sought for future issues, such as threats or opportunities, that could come up for our new product	.769	.762
<b>Formal interpretation</b> (Cronbach's Alpha = .93)		
We had formalized evaluations of future issues, such as opportunities or threats, for our new product *		
A structured and deliberate effort was made to predict the future success of our new product	.717	.734
We used systematic approaches to understand the future of markets and/or technologies related to new product	.868	.858
Systematic approaches were used to interpret what the future could bring for the new product	.891	.916
We used systematic approaches to create an understanding of how trends could influence our new product	.806	.812
In order to interpret potential future issues to the new product, we used specific systematic approaches	.826	.802
<b>Informal interpretation</b> (Cronbach's Alpha = .90)		
Project members brought forward issues that could endanger the future success of our product in the marketplace	.788	.765
Information on future issues or opportunities related to the new product were brought forward by project members	.786	.858
Project members frequently challenged whether the assumptions on markets and/or technologies would hold in the future	.778	.789
Project members were encouraged to bring forward any kind of future opportunities or issues that could be relevant for the new product	.755	.719
We relied principally on personal judgment (rather than formalized analysis) when interpreting future threats or opportunities to our new product *		
Determining what the future would hold for the new product was much more affected by personal interpretations than by the results of formal and systematic evaluation *		

<sup>1</sup> Principal component analysis with varimax rotation; \* Item removed due to low factor loading or not loading onto its intended factor.

RMSEA of 0.06 indicates good model fit as it does not exceed (nor does the confidence interval of RMSEA) the critical value of 0.08 (Bentler and Bonett 1980), and the SRMR value is less than .08 which is generally considered a good fit (Hu and Bentler 1999). We verified the discriminant validity of the scales by employing the Fornell-Larcker criterion for the reflective constructs (Fornell and

Larcker 1981). Using this criterion, we find the square root of the reflective constructs' AVE value exceed the value of the highest correlation with other constructs, thus indicating adequate discriminant validity. Table 4.3 reports these findings. In addition, using a bootstrap procedure for Pearson correlations, none of the 95% bias-corrected confidence intervals of the correlation coefficients between any of the constructs included 1.0 (Anderson and Gerbing 1988). Given this collection of supporting indices, we conclude that the measurement model is acceptable.

## 4.5 Results

We tested our hypotheses using ordinary least squares (OLS) regression analysis. For the interaction effects all variables were mean-centered before computing the interaction variables (Aiken and West 1991). While mean-centering the variables reduces multicollinearity (Aiken and West 1991), we additionally checked before running our models whether multicollinearity would be a problem due to our (squared) interaction terms. We tested for multicollinearity by calculating the variance inflation factors (VIFs). We find VIF values for all items well below (largest VIF being 3.4) the common cut-off threshold of 10 (Kleinbaum *et al.* 1998). Furthermore, tolerance values are all well above 0.1 (lowest being 0.3) (Hair *et al.* 2010). Table 4.3 reports descriptive statistics and correlations of our study's variables. Table 4.4 reports on the OLS regression results with six nested models. Model one contains only control variables. Model 2 adds the direct effect of forward-looking search; Model 3 adds the moderating variables (non-hypothesized direct effects). Model 4, 5, and 6 add the two-way interaction terms separately to assess each interaction independently. Lastly, model 7 includes all the prior models.

To test hypothesis 1, which postulates that forward-looking search during project development positively impacts innovativeness. In model 2, we find forward-looking search is positively related to innovativeness ( $b = .330$ ,  $p < .01$ ). This effect remains significant with similar coefficients throughout all the models, and therefore provides strong support for H1.

**Table 4.3. Descriptive Statistics and Matrix of Correlations**

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
1 Information intake	(.80)																					
2 Formal interpretation	.63	(.87)																				
3 Informal interpretation	.74	.59	(.83)																			
4 Firm internal innovativeness	.19	.20	.19	(.71)																		
5 Environmental innovativeness	.27	.19	.26	.36	(.63)																	
6 Technological innovativeness	.26	.28	.20	.32	.42	(.82)																
7 Market innovativeness	.34	.41	.31	.18	.35	.48	(.75)															
8 Slack resources <sup>a</sup>	.01	.04	.04	.06	.21	.15	.00	-														
9 Project planning intensity	.40	.47	.42	.19	.19	.29	.25	.07	(.77)													
10 Firm size <sup>b</sup>	.16	.16	.13	.13	.11	.18	.23	.20	.17	-												
11 Firm age	.07	.09	.01	-.11	-.09	-.08	.02	-.08	-.01	.28	-											
12 Firm private ownership	.10	-.04	-.11	.06	.08	.07	.15	.10	-.06	-.08	.07	-										
13 Firm performance below aspiration	-.02	.00	.12	.13	.17	.06	.12	-.06	.11	-.12	-.10	-.03	-									
14 Firm recent patenting activity	.10	.05	.08	.24	.18	.20	.23	.15	.23	.31	.18	.03	.09	-								
15 Industry: FMCG	.03	.04	-.01	-.15	-.15	-.33	-.25	-.13	-.08	-.06	-.02	.09	-.08	-.19	-							
16 Industry: High-tech consumer goods	.02	.02	.02	-.01	-.07	.11	-.01	.04	.06	.01	-.09	-.09	-.02	.08	-.08	-						
17 Industry: Other consumer goods	-.05	-.03	-.06	-.10	.06	-.08	-.02	.06	-.09	.05	.01	-.06	-.07	-.01	-.20	-.08	-					
18 Industry: High-tech industrial good	.05	-.01	.05	.08	.09	.24	.16	.10	.16	.15	.00	.03	.04	.14	-.34	-.14	-.35	-				
19 Industry: Other industrial goods	-.05	.00	-.01	.13	.00	.04	.05	-.06	-.06	-.16	.05	-.02	.09	-.03	-.26	-.11	-.27	-.47	-			
20 Industry Concentration	-.10	-.20	-.04	-.02	-.05	-.11	-.23	.02	-.11	-.04	.01	-.05	.09	.15	.03	-.07	-.05	-.03	.07	-		
21 Multiple department involvement	.19	.16	.22	.07	-.09	-.05	-.05	-.11	.13	-.01	.02	-.12	-.01	-.03	.07	.06	-.04	-.03	-.02	.06	-	
Mean	4.11	3.52	4.33	2.99	2.47	3.76	3.39	6.91	4.43	4.87	32.94	.20	.03	.38	.16	.03	.17	.38	.26	.54	.91	
SD	1.42	1.46	1.48	1.43	1.22	1.67	1.52	3.38	1.42	1.00	20.82	.40	.08	.49	.37	.18	.38	.49	.44	.25	.28	

Notes: square root of the AVE on the diagonals for latent constructs. Off-diagonal elements are correlations between variables. Correlations of  $|\cdot| \geq .16$  are significant at the .05 level (2-tailed).  $N = 159$ .

<sup>a</sup> Logarithm transformed variable; mean and S.D. for the non-logarithmic transformed variable: Mean = 22441.56; SD = 72388.91.

<sup>b</sup> Logarithm transformed variable; mean and S.D. for the non-logarithmic transformed variable: Mean = 216.77; SD = 338.35.

To test our interaction effects, we assess the incremental increases of the R-squared values for models 4 through 6 and the significance of the interaction coefficients. Incremental R-square increases should be significant for the specific interaction model in order to conclude whether the interaction effect is exhibiting a significant impact, rather than solely relying on the significance of the interaction coefficient (Hair *et al.* 2010). In model 4 we test hypothesis 2, which states that project planning intensity moderates the forward-looking search – innovativeness relationship in a curvilinear way. We find a negative interaction effect between forward-looking search and the squared term of planning intensity ( $b = -.046, p < .05$ ), which indicates that planning intensity exhibits a curvilinear effect in an inverted u-shape. Furthermore, we find a significant increase in our model's predictive ability ( $\Delta R\text{-square} = .021, p < .10$ ) and the coefficient remains significant and of similar size and sign in the full model (Model 7). These findings confirm hypothesis 2.

Hypothesis 3 states that the amount of slack resources positively moderates the relationship between forward-looking search and innovativeness. In model 5, we find strong support for hypothesis 3. We find a positive interaction effect between forward-looking search and slack resources ( $b = .034, p < .05$ ), which indicates that slack resources increases the positive effect of forward-looking search on innovativeness. Furthermore, we find a significant increase in our model's predictive ability ( $\Delta R\text{-square} = .015, p < .05$ ). The positive interaction effect remains significant in the remaining interaction models (5 and 7).

For hypothesis 4, which states that industry concentration negatively moderates the relationship between forward-looking search and innovativeness. In model 6 we find an insignificant interaction effect ( $b = .051, p > .10$ ) and no significant increase in the model's predictive ability ( $\Delta R\text{-square} = .000, p > .10$ ). Therefore, we find no support for hypothesis 4.

To illustrate the impact of our findings, the interactions effects of our three moderators have been plotted in Figure 4.2. We plotted the relationship between forward-looking search and innovativeness at low and high levels of slack resources (represented by two standard deviations

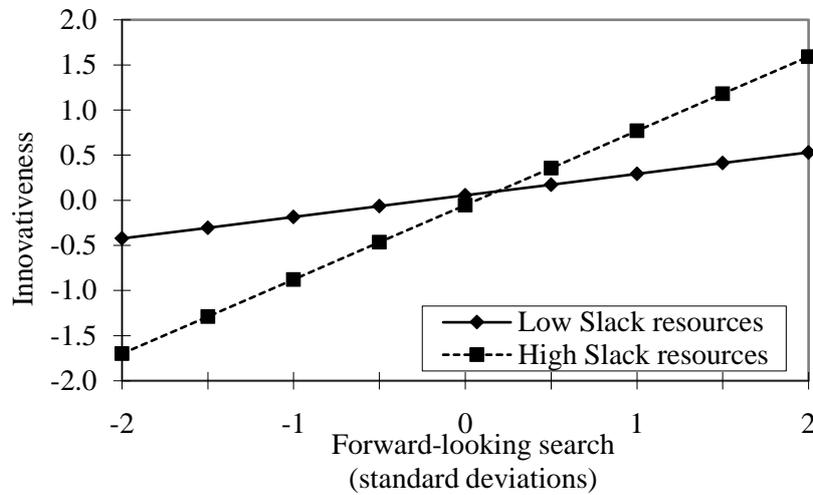
**Table 4.4. Result of Moderated Regression Analysis (Dependent Variable: Innovativeness)**

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	<i>B</i> (SE)	<i>B</i> (SE)	<i>B</i> (SE)	<i>B</i> (SE)	<i>B</i> (SE)	<i>B</i> (SE)	<i>B</i> (SE)
Constant	3.153 (.073)**	3.153 (.066)**	3.115 (.089)**	3.134 (.088)**	3.120 (.088)**	3.114 (.089)**	3.160 (.088)**
<i>Controls</i>							
Firm size	0.266 (.082)**	0.195 (.075)**	0.190 (.076)*	0.173 (.076)*	0.207 (.076)**	0.189 (.077)*	0.188 (.076)*
Firm age	-0.010 (.004)**	-0.010 (.003)**	-0.010 (.003)**	-0.009 (.003)**	-0.010 (.003)**	-0.010 (.003)**	-0.009 (.003)**
Firm private ownership	0.460 (.188)*	0.430 (.169)*	0.419 (.171)*	0.366 (.171)*	0.452 (.170)**	0.421 (.172)*	0.401 (.169)*
Firm performance below aspiration	1.582 (.897) <sup>†</sup>	1.342 (.805) <sup>†</sup>	1.449 (0.818) <sup>†</sup>	1.482 (.811) <sup>†</sup>	1.420 (.811) <sup>†</sup>	1.452 (.821)*	1.469 (.801) <sup>†</sup>
Firm recent patenting activity	0.398 (.166)*	0.367 (.148)*	0.388 (.155)*	0.386 (.155)*	0.446 (.157)**	0.385 (.156)*	0.454 (.157)**
<i>Project industry (reference: FMCG<sup>a</sup>)</i>							
<i>High-tech consumer goods</i>	0.662 (.0464)	0.664 (.416)	0.587 (.420)	0.541 (.417)	0.666 (.419)	0.601 (.427)	0.648 (.418)
<i>Other consumer goods</i>	0.569 (.261)*	0.639 (.234)**	0.585 (.240)*	0.546 (.238)*	0.662 (.241)**	0.590 (.241)*	0.638 (.238)**
<i>High-tech industrial goods</i>	0.845 (.227)**	0.869 (.204)**	0.819 (.207)**	0.824 (.207)**	0.864 (.207)**	0.821 (.208)**	0.875 (.206)**
<i>Other industrial goods</i>	0.880 (.239)**	0.908 (.214)**	0.893 (.215)**	0.849 (.216)**	0.943 (.215)**	0.898 (.217)**	0.903 (.217)**
Project multiple departments involved	0.052 (.263)	-0.270 (.240)	-0.231 (.244)	-0.285 (.243)	-0.325 (.247)	-0.223 (.247)	-0.390 (.247)
<i>Main effects</i>							
<b>H1:</b> Forward-looking search		0.330 (.054)**	0.304 (.062)**	0.416 (.078)**	0.314 (.062)**	0.302 (.063)**	0.443 (.078)**
<i>Moderator variables</i>							
Slack resources			0.001 (.021)	0.004 (.021)	-0.008 (.021)	0.001 (.021)	-0.006 (.021)
Industry concentration			-0.477 (.279)*	-0.525 (.276)*	-0.502 (.276)*	-0.475 (.280)*	-0.561 (.274)*
Project planning intensity			0.040 (.057)	0.067 (.061)	0.035 (.057)	0.042 (.058)	0.063 (.062)
Project planning intensity <sup>2</sup>			0.019 (.030)	0.000 (.039)	0.014 (.029)	0.020 (.030)	-0.002 (.038)
<i>Two-way interaction effects</i>							
Forward-looking search x Planning intensity				-0.042 (.042)			-0.056 (.042) <sup>†</sup>
<b>H2:</b> Forward-looking search x Planning intensity <sup>2</sup>				-0.046 (.021)*			-0.051 (.021)**
<b>H3:</b> Forward-looking search x Slack resources					0.034 (.018)*		0.041 (.018)**
<b>H4:</b> Forward-looking search x Industry concentration						0.051 (.219)	0.081 (.216)
<i>R</i> <sup>2</sup>	0.272	0.419	0.434	0.455	0.449	0.434	0.476
<i>F</i> -Value	5.522**	9.650**	7.313**	6.916**	7.218**	6.814	6.639**
$\Delta R^2$		0.148**	0.015	0.021 <sup>†</sup> <sup>b</sup>	0.015* <sup>b</sup>	0.000 <sup>b</sup>	0.043* <sup>b</sup>

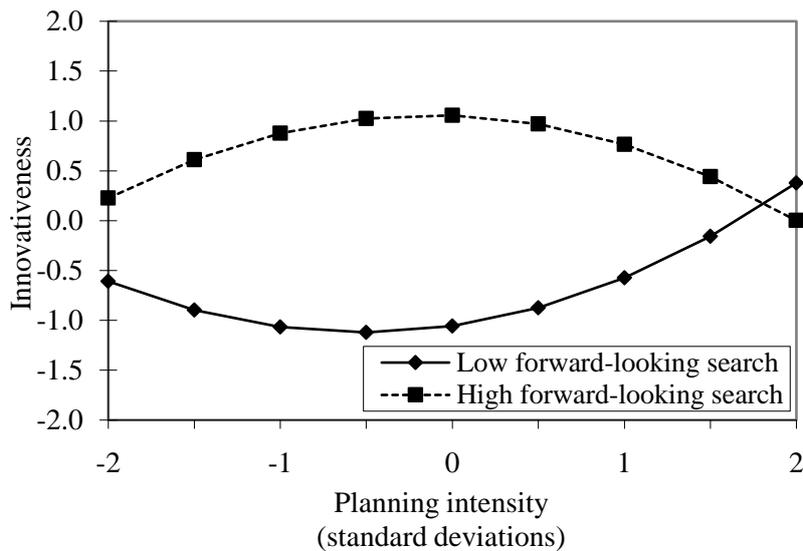
Notes: Unstandardized coefficients (standard error values in parentheses); <sup>†</sup>  $p < .10$ , \*  $p < .05$ , \*\*  $p < .01$  (one-tailed for hypothesized paths, two-tailed for controls). All variables are mean-centered. <sup>a</sup> Fast-moving consumer goods. <sup>b</sup> Compared to model 3.

**Figure 4.2. Plots of significant interaction effects**

**(2a) Effect of forward-looking search and financial slack on innovativeness (plotted at the mean)**



**(2b) Effect of planning intensity and forward-looking search on innovativeness (plotted at the mean)**



below and above the mean) and calculated the slope coefficients (Aiken and West 1991). Supporting hypothesis 2, Figure 4.2(a) shows that the relationship between forward-looking search and innovativeness is strongly positive ( $b = .645, t = 4.574$ ) when financial slack resources are high and marginally positive still ( $b = .187, t = 1.424$ ) when financial slack resources are low. These results suggest that forward-looking search has a positive effect on innovativeness regardless of financial slack resources, however, the effect is enlarged considerably when the firm has high financial slack resources available.

Figure 4.2(b) indicates the relationship between planning intensity squared and innovativeness for high and low levels of forward-looking search. Consistent with our predictions, a high level of forward-looking search is most strongly related to innovativeness at medium levels (i.e. at the mean) of planning intensity. When planning intensity shifts towards the left (i.e. an ill-defined or highly abstract projects), the effect of forward-looking search on innovativeness over diminishes. The same holds true when planning intensity shifts to the right (i.e. very tightly planned and well-defined projects). Here, even tightly planned projects may be more innovative when there is low forward-looking search during the project compared to high forward-looking search.

## **4.6 Discussion**

The purpose of this study was to examine if innovation projects employ forward-looking search in order to attain a higher level of innovativeness. This study aims to close a gap in the literature – a gap that has been given very little attention – on the practices that are employed during innovation projects that explicitly take on a future perspective of the project's outcome. The majority of research contributions where the future has an explicit role is rather scant and is mostly on the level of innovation portfolios (Brown and Eisenhardt 1997, Rohrbeck and Gemünden 2011, Kock *et al.* 2015), or in the case of individual innovation projects only on the front-end (Reid and De Brentani 2012). This study argues that forward-looking mechanisms during innovation projects – specifically when those projects pursue the development of highly innovative outcomes – are important to attain innovativeness. We contribute to the literature in the following ways.

First, we empirically analyse forward-looking mechanisms employed by project teams during the development, and assess its impact on the project's innovativeness as an outcome. Overall, we find a very strong and positive impact of forward-looking search during project development on the innovativeness of its outcome. To our knowledge, we are one of the first studies providing quantitative evidence on forward-looking mechanisms during innovation project's development,

whereas prior research has mostly been built on case studies and anecdotal evidence (Kaplan and Orlikowski 2013, Sarangee *et al.* 2014, Simonse *et al.* 2015). We posit that forward-looking search hinges on the critical assumption – and especially for a radical innovation project – that not all consequences of choices made before development can be foreseen at the start of the project. In other words, decision-makers are boundedly rational and lack “complete knowledge and anticipation of the consequences that will follow on each choice” (Simon 1947, p. 81). Prior research on the innovation portfolio level only focuses on idea selection as a means to tap into the future market needs and technologies that are relevant for the firm’s future (Brown and Eisenhardt 1997, Reid and de Brentani 2010, Reid and De Brentani 2012, 2015, Kock *et al.* 2015). It assumes that when such ‘future-proof’ ideas enter the portfolio as innovation projects they are able to enhance the firm’s future competitive position. This literature does not take into account that a firm’s external environment brings about uncertainty inducing events *during* development that can hamper the future preparedness of projects or require changes in the project for it to remain innovative (Rank *et al.* 2015). We therefore contribute to this literature and posit that not only one can take the future into account at the portfolio level by selecting ideas that may benefit the firm’s future position, but that such ideas (1) are *still* prone to the bounded rationality assumption and uncertainty inducing events during project development, (2) still need to be assessed during development in terms of future outcomes, (3) require active engagement with future issues or opportunities during development by the project team, which is most strongly the case for pursuing highly uncertain radical projects.

Second, the role of forward-looking search during project development also relates closely to mechanisms of project de-escalation (Sarangee *et al.* 2014). Indeed, whereas forward-looking search can contribute to spotting relevant other opportunities that the project can potentially tap into to facilitate innovativeness even further, likewise it can allow project teams to perceive when the current development of the project is deemed unsatisfactory in the project’s future market. It can “lower the odds of throwing good money after bad” (Sarangee *et al.* 2014, p. 1034) by means of

continuous evaluation and assumption correction of the future market, technologies, and competition that surrounds the project's outcome. Our findings therefore add to case study research where such forward-looking mechanisms were found to occur at the organisational level within an NPD context (Sarangee *et al.* 2014), and provide empirical insights into the occurrence of such forward-looking mechanisms taking place at the project level as well. Literature on de-escalation may also benefit from taking a project's innovativeness into account. Innovativeness is a major factor that contributes to the uncertainty surrounding a project (Salomo *et al.* 2007). Therefore, the more novel a project, the more project teams and managers could benefit from engaging in forward-looking search during development to avoid potential escalation of costs and risks.

Third, the investigation of the three interaction effects that may facilitate or hamper the contribution of forward-looking search on project innovativeness has important implications. Our first interaction effect investigates the role of project planning intensity, the most significant and interesting insight of this study. We based this interaction on the assumption that not all consequences of the project can be foreseen at the project start, or the complete knowledge of all uncertainty inducing events that may occur during development. If forward-looking search is to contribute to a project's innovativeness, there must be 'room' in the project planning so that there is additional time available to be more analytical, creative, and allows to discuss and reflect in order to be more innovative (Lawson 2001, pp. 126–127). Therefore, having less intensely planned projects allows for forward-looking search to contribute to the project's innovativeness, as the project schedule and project deliverables allow for 1) changes to be implemented by providing additional time, and 2) changes to be made by not fixing the project's deliverables to a prefixed set of features (Richtnér and Åhlström 2006, 2010, Richtnér *et al.* 2014). However, more importantly, we found that project planning intensity shows an inverted-U interaction with forward-looking search on innovativeness. That is, at medium levels of project planning intensity, forward-looking search is able to contribute most towards a project's innovativeness. Conversely, at low- and high levels of

project planning intensity, forward-looking search's ability to contribute to innovativeness is severely diminished, up to the point where projects showing *low* levels of forward-looking search outperform in terms of innovativeness. This finding can be attributed to the role of *problem abstraction* (Gassmann and Zeschky 2008, Horváth and Enkel 2014). Indeed, as Horváth and Enkel (2014) argue, a medium-level of abstraction seems to be most beneficial; it provides room in the project planning and description to deviate, but still with a fairly defined project outcome in mind. We therefore provide interesting empirical insights into the combined role of project planning and forward-looking search during the project development to attain innovativeness. With this finding we add to Kleinschmidt's (2006) call for revising NPD best practices that explicitly takes into account how such practices should vary across projects with low and high levels of innovativeness and specifically find curvilinear interactions of project planning intensity and forward-looking search on innovativeness.

A related and similarly interesting finding (although not hypothesized in our study) is that at low levels of forward-looking search, even projects that are intensely planned can be innovative (see Figure 4.2(b)). Indeed, recently Holahan *et al.* (2014) find that radical projects are managed much less flexibly than the axiomatic notion in innovation research that radical projects should be managed more flexibly. Holahan and colleagues argue that managing radical projects in a rigid way can be a means for managers to mitigate increased levels of risk associated with radical projects and called for additional empirical research. In our study, we add to this discussion and present evidence that tightly planned projects *can* be highly innovative. As we found the U-shape relationship between project planning intensity and innovativeness under low levels of forward-looking search, it is arguably the role of sophisticated planning that foregoes the need for forward-looking search during development. Sophisticated planning based on clear criteria and developed on the basis of systematic search and development of alternative scenarios can ensure the future potential of projects and more successful project outcomes (Bordley 1998, Osawa and Murakami 2002, Salomo *et al.* 2007).

However, it may also be that forward-looking search has an opportunity cost, which takes attention away from individuals from other activities and may affect innovation outcomes (Dahlander *et al.* 2016), especially under conditions of tight planning. Conditions of tight planning may then also lead to project members searching less for information because they are certain they are already doing the right thing (Ashford and Cummings 1983, Audia *et al.* 2000). The role of management support may be able to play a critical role in the latter, where a lack of management support may lead to project members to not discuss problems or potential failures of the project (Akgün *et al.* 2007). Then, in tightly planned projects, without empowering support from management, team members will be reluctant to discuss potential problems or failures (Akgün *et al.* 2007). Future research may thus need to consider how management is supportive towards team members, and how this may inhibit or facilitate forward-looking search.

With our second interaction effect we introduce slack resources as a necessity to respond to unforeseen changes by means of forward-looking search to facilitate innovativeness. Although slack resources have predominantly been associated with firm-level outcomes (e.g. Nohria and Gulati 1996, Troilo *et al.* 2014), we followed Richtnér *et al.* (2014) and applied it to the project-level. We found a positive interaction effect, where projects with high levels of slack resources and forward-looking search are most innovative. With our findings, we add to recent research (e.g. Richtnér *et al.* 2014) and find slack resources an important resource to consider in project-level research. Slack resources allow project teams to be more innovative and can facilitate a more proactive stance towards search and formulating choices. Although project planning can also create a form of slack such as time and budget availabilities (Lawson 2001, Richtnér *et al.* 2014), which we investigated as part of our interaction with project planning intensity, we still found a distinct effect of financial slack resources at the firm level over and above project planning intensity. Similarly here, rather than looking isolated at the project-level solely, future research may also benefit from incorporating organizational-level factors that can influence the mechanisms employed at the project-level.

Lastly, in our third interaction, we introduced the notion that forward-looking search may be needed less in concentrated industries. In such industries, the need for sophisticated insights and foresights may be less of a burden to achieve, mainly because of the rather homogenous nature of a concentrated industry wherein competition is less complex and dynamic. However, it may also be that concentrated industries undermine a firm's ability to introduce highly novel innovations. In concentrated industries, mutual awareness among competitors is very high and rival firms are more inclined to respond quickly to any novel action "to teach their competitors that breaking the unwritten covenant of tacit collusion will be punished severely" (Derfus *et al.* 2008, p. 66). A firm's willingness to initiate a highly innovative project may then be reduced, thereby in-part explaining our non-significant finding. Indeed, we find that the direct (non-hypothesized) effect of industry concentration on innovativeness is significantly negative (refer to Table 4.4), it may be the case that industry concentration acts as an antecedent rather than a moderator. As Zahra (1993) argues, development projects aimed at being launched in concentrated industries are subject to more up-front planning and evaluation. Future research may therefore consider industry concentration as a potential precursor that foregoes practices such as forward-looking search, but may then potentially increase the role of planning.

#### **4.6.1 Practical implications**

We provide insight into a new practice that can be employed during project development. Managers may consider forward-looking search during innovation projects to enhance innovativeness. Based on our conceptualization of forward-looking search, project teams can incorporate several practices that it puts forward. To enhance innovativeness, project teams can: (1) engage in monitoring of important trends and competitors and searches of information that may provide valuable to the envisioned project outcome, (2) use structured methods and approaches to interpret any newly gathered information in terms of future implications for the project, and (3) facilitate an environment within the project that encourages open-mindedness and frequent challenging of longer-term

assumptions the project is built on. Consequently, project team members can make well informed evaluation of the project novelty and whether it will be attainable still in the future. However, these practices may not be beneficial in tightly or very flexibly planned projects, and therefore should be cautious in encouraging forward-looking practices within such projects.

#### **4.6.2 Limitations and future research**

Of course, the results of this study have several limitations that need to be taken into account when interpreting the results. First, the use of single-informant survey data has its obvious limitations. Because some innovation projects picked by the respondents were already market launched, retrospective bias could be a potential concern. However, as we asked mostly questions about activities performed during the project, we believe this issue is relatively small. Furthermore, using a sample of only Danish firms, the (moderating) effects found in this study may not necessarily replicate to firms from other countries. Future research may improve on these aspects.

This study has also opened up numerous new research opportunities that future research may address. First, future research may investigate the reason why and under which conditions certain projects are seemingly more reliant on less rigid planning and more forward-looking search, as opposed to highly rigid planned projects with very low levels of forward-looking search. It would be interesting to uncover what kind of trade-offs managers make in going for either of these two situations. It is even more interesting that these two scenarios both yield the highest levels of project innovativeness.

Second, although our level of analysis is the project-level, the effects we find can also be partly attributed by the organisational-level phenomena. As the innovativeness of a project increases, the need for sharing information cross-functionally also increases (Holahan *et al.* 2014). The way radical projects are managed can therefore be related to how the organisation is managed and structured. Future research may therefore investigate the influence of higher-level factors (over and above project-level factors that we have explored in this study) that can explain the mechanisms employed

within projects. Two fruitful factors that can be considered are those of organisational structure and leadership support (Droge *et al.* 2008). Regarding the former, given that forward-looking search is partially about information gathering and social interpretation processes, organisational structure can facilitate project teams in obtaining relevant information and cross-functional discussions, and may therefore partially explain a heightened usage of forward-looking mechanisms within projects. Similarly, the role of (project) leadership can explain either the extent to which forward-looking mechanisms are used within projects, but also potential downsides of having strong leadership which may negate the ability of forward-looking search in contributing potentially novel insight – insights which may not be appreciated by leadership (Sarangee *et al.* 2013, 2014).

## References

- Acs, Z.J., Morck, R., Shaver, J.M., and Yeung, B., 1997. The Internationalization of Small and Medium-Sized Enterprises: A Policy Perspective. *Small Business Economics*, 9 (1), 7–20.
- Aiken, L. and West, S., 1991. *Multiple Regression: Testing and Interpreting Interactions*. Newbury Park, CA: Sage.
- Akgün, A.E., Byrne, J.C., Lynn, G.S., and Keskin, H., 2007. Team stressors, management support, and project and process outcomes in new product development projects. *Technovation*, 27 (10), 628–639.
- Akgün, A.E., Keskin, H., Lynn, G., and Dogan, D., 2012. Antecedents and consequences of team sensemaking capability in product development projects. *R and D Management*, 42 (5), 473–493.
- Anderson, J.C. and Gerbing, D.W., 1988. Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*, 103 (3), 411–423.
- Arora, A. and Gambardella, A., 1994. The changing technology of technological change: general and abstract knowledge and the division of innovative labour. *Research Policy*, 23 (5), 523–532.
- Ashford, S.J. and Cummings, L.L., 1983. Feedback as an individual resource: Personal strategies of creating information. *Organizational Behavior and Human Performance*, 32 (3), 370–398.
- Audia, P.G., Locke, E.A., and Smith, K.E.N.G., 2000. The Paradox of Success : An Archival and a Laboratory Study of Strategic Persistence Following Radical Environmental Change. *Academy of Management Journal*, 43 (5), 837–853.
- Bentler, P.M. and Bonett, D.G., 1980. Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin*, 88 (3), 588–606.
- Bikker, J. a and Haaf, K., 2002. Competition, concentration and their relationship: An empirical analysis of the banking industry. *Journal of Banking & Finance*, 26 (11), 2191–2214.
- Bliese, P.D., 2000. Within-group agreement, non-independence, and reliability: Implications for data aggregation and analysis. In: K.J. Klein and S.W. Kozlowski, eds. *Multilevel theory, research, and methods in organizations: Foundations, extensions, and new directions*. San Francisco, CA: Jossey-Bass, 349–381.
- Boe-Lillegraven, S. and Monterde, S., 2015. Exploring the cognitive value of technology foresight:

- The case of the Cisco Technology Radar. *Technological Forecasting and Social Change*, 101, 62–82.
- Bordley, R.F., 1998. R&D project selection versus R&D project generation. *IEEE Transactions on Engineering Management*, 45 (4), 407–413.
- Brown, S.L. and Eisenhardt, K.M., 1997. The Art of Continuous Change: Linking Complexity Theory and Time-Paced Evolution in Relentlessly Shifting Organizations. *Administrative Science Quarterly*, 42 (1), 1–34.
- Chen, W.R., 2008. Determinants of firms' backward-and forward-looking R&D search behavior. *Organization Science*, 19 (4), 609–622.
- Christensen, C.M., 1997. The innovator's dilemma. *Harvard Business School Press, Boston*, 1–179.
- Citrin, A.V., Lee, R.P., and McCullough, J., 2007. Information Use and New Product Outcomes: The Contingent Role of Strategy Type. *Journal of Product Innovation Management*, 24 (3), 259–273.
- Cohen, W. and Levinthal, D., 1990. Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly*, 35 (1), 128–152.
- Cooper, R.G., Edgett, S., and Kleinschmidt, E., 2001. Portfolio management for new product development: results of an industry practices study. *R&D Management*, 31 (4), 361–380.
- Cyert, R. and March, G., 1963. *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice Hall.
- Daft, R. and Weick, K., 1984. Toward a model of organizations as interpretation systems. *Academy of Management Review*, 9 (2), 284–295.
- Dahlander, L., O'Mahony, S., and Gann, D.M., 2016. One foot in, one foot out: how does individuals' external search breadth affect innovation outcomes? *Strategic Management Journal*, 37 (2), 280–302.
- Day, G.S., 1994. The Capabilities of Market-Driven Organizations. *Journal of Marketing*, 58 (4), 37–52.
- Day, G.S. and Schoemaker, P.J.H., 2005. Scanning the periphery. *Harvard Business Review*, 83 (11), 135–148.
- Derfus, P.J., Maggitti, P.G., Grimm, C.M., and Smith, K.G., 2008. The red queen effect: Competitive actions and firm performance. *Academy of Management Journal*, 51 (1), 61–80.
- Dess, G.G. and Beard, D.W., 1984. Dimensions of organizational task environments. *Administrative Science Quarterly*, 29 (1), 52–73.
- Dewey, J., 1988. *Human Nature and Conduct*. Carbondale: Southern Illinois University Press.
- Droge, C., Calantone, R., and Harmancioglu, N., 2008. New product success: Is it really controllable by managers in highly turbulent environments? *Journal of Product Innovation Management*, 25, 272–286.
- Dutton, J.E. and Ottensmeyer, E., 1987. Strategic Issue Management Systems: Forms, Functions, and Contexts. *Academy of Management Review*, 12 (2), 355–365.
- Fornell, C. and Larcker, D., 1981. Structural Equation Models With Unobservable Variables and Measurement Error: Algebra and Statistics. *Journal of Marketing Research*, 18 (3), 328–389.
- Frankort, H.T.W., 2016. When does knowledge acquisition in R&D alliances increase new product development? the moderating roles of technological relatedness and product-market competition. *Research Policy*, 45 (1), 291–302.
- Garcia, R. and Calantone, R., 2002. A critical look at technological innovation typology and innovativeness terminology: A literature review. *Journal of Product Innovation Management*.
- Gassmann, O. and Zeschky, M., 2008. Opening up the Solution Space: The Role of Analogical Thinking for Breakthrough Product Innovation. *Creativity and Innovation Management*, 17 (2), 97–106.
- Gavetti, G., Greve, H.R., Levinthal, D.A., and Ocasio, W., 2012. The Behavioral Theory of the Firm: Assessment and Prospects. *The Academy of Management Annals*, 6 (1), 1–40.
- George, G., 2005. Slack resources and the performance of privately held firms. *Academy of*

- Management Journal*, 48 (4), 661–676.
- Gephart, R.P., Topal, C., and Zhang, Z., 2010. Future-oriented Sensemaking: Temporalities and Institutional Legitimation. In: T. Hernes and S. Maitlis, eds. *Perspectives on Process, Sensemaking, and Organizing*. Oxford: Oxford University Press, 275–311.
- Greve, H.R., 2003. A Behavioral Theory of R&D Expenditures and Innovations: Evidence from Shipbuilding. *Academy of Management Journal*, 46 (6), 685–702.
- Griffin, A., 1997. The effect of project and process characteristics on product development cycle time. *Journal of Marketing Research*, 34 (1), 24–35.
- Hair, J., Black, W., Babin, B., and Anderson, R., 2010. *Multivariate data analysis*.
- Hair, J.F., Ringle, C.M., and Sarstedt, M., 2013. Partial Least Squares Structural Equation Modeling: Rigorous Applications, Better Results and Higher Acceptance. *Long Range Planning*, 46 (1–2), 1–12.
- Hauschildt, J., 1996. Innovation, Creativity and Information Behaviour. *Creativity and Innovation Management*, 5 (3), 169–178.
- Hauser, J., Tellis, G.J., and Griffin, A., 2006. Research on Innovation: A Review and Agenda for Marketing Science. *Marketing Science*, 25 (6), 687–717.
- Heuschneider, S. and Herstatt, C., 2016. *External search for exploration of future discontinuities and trends: Implications from the literature using co-citation and content analysis*. Hamburg, No. 92.
- Hogarth, R.M. and Makridakis, S., 1981. Forecasting and Planning: An Evaluation. *Management Science*, 27 (2), 115–138.
- Holahan, P.J., Sullivan, Z.Z., and Markham, S.K., 2014. Product development as core competence: How formal product development practices differ for radical, more innovative, and incremental product innovations. *Journal of Product Innovation Management*, 31 (2), 329–345.
- Horváth, A. and Enkel, E., 2014. When general recommendations fail: How to search in single innovation project settings. *R and D Management*, 409–426.
- Hou, K. and Robinson, D.T., 2001. Industry Concentration and the Cross-Section of Average Stock Returns, 61 (4), 2001.
- Hu, L. and Bentler, P.M., 1999. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6 (1), 1–55.
- Im, S. and Workman Jr., J., 2004. Market Orientation, Creativity, and New Product Performance in High-Technology Firms. *Journal of Marketing*, 68 (2), 114–132.
- James, L.R., 1982. Aggregation bias in estimates of perceptual agreement. *Journal of Applied Psychology*, 67 (2), 219–229.
- Kaplan, S. and Orlikowski, W.J., 2013. Temporal Work in Strategy Making. *Organization Science*, 24 (4), 965–995.
- Katila, R. and Ahuja, G., 2002. Something Old, Something New: a Longitudinal Study of Search Behavior and New Product Introduction. *Academy of Management Journal*, 45 (6), 1183–1194.
- Kleinbaum, D., Lawrence, K., Muller, K., and Nizam, A., 1998. *Applied Regression Analysis and Other Multivariable Methods*. Pacific Grove, CA: Brooks/Cole.
- Kleinschmidt, E.J., 2006. Rejoinders to ‘Establishing an NPD Best Practices Framework’. *Journal of Product Innovation Management*, 23, 119–121.
- Kock, A., Heising, W., and Gemünden, H.G., 2015. How Ideation Portfolio Management Influences Front-End Success. *Journal of Product Innovation Management*, 32 (4), 539–555.
- Lawson, M.B., 2001. In praise of the of slack: essence Time is. *The Academy of Management Executive*, 15 (3), 125–135.
- Lerner, J., Sørensen, M., and Strömberg, P., 2011. Private Equity and Long-Run Investment: The Case of Innovation. *Journal of Finance*, 66 (2), 445–477.
- Levinthal, D.A., 1997. Adaptation on Rugged Landscapes. *Management Science*, 43 (7), 934–950.

- Levinthal, D. and March, J.G., 1981. A model of adaptive organizational search. *Journal of Economic Behavior & Organization*, 2 (4), 307–333.
- Li, Q., Maggitti, P.G., Smith, K.G., Tesluk, P.E., and Katila, R., 2013. Top management attention to innovation: The role of search selection and intensity in new product introductions. *Academy of Management Journal*, 56 (3), 893–916.
- Lindell, M.K. and Brandt, C.J., 2000. Climate quality and climate consensus as mediators of the relationship between organizational antecedents and outcomes. *Journal of Applied Psychology*, 85 (3), 331–348.
- Maggitti, P.G., Smith, K.G., and Katila, R., 2013. The complex search process of invention. *Research Policy*, 42 (1), 90–100.
- March, J.G., 1991. Exploration and Exploitation in Organizational Learning. *Organization Science*, 2 (1), 71–87.
- March, J.G., 1994. *Primer on decision making: How decisions happen*. New York: Free Press.
- Marsh, B., 1998. Using scenarios to identify, analyze, and manage uncertainty. In: L. Fahey and R. Randall, eds. *Learning from the future*. York: John Wiley, 40–53.
- Miles, G., Snow, C.C., and Sharfman, M.P., 1993. Industry variety and performance. *Strategic Management Journal*, 14 (3), 163–177.
- Nohria, N. and Gulati, R., 1996. Is slack good or bad for innovation? *Academy of Management Journal*, 39 (5), 1245–1264.
- Nunally, J., 1967. *Psychometric Theory*. New York: McGraw-Hill.
- O'Connor, G.C. and Rice, M.P., 2001. Opportunity recognition and breakthrough innovation in large established firms. *California Management Review*, 43 (2), 95–116.
- Osawa, Y. and Murakami, M., 2002. Development and application of a new methodology of evaluating industrial R&D projects. *R & D Management*, 32 (1), 79–85.
- Palmer, T.B. and Wiseman, R.M., 1999. Decoupling Risk Taking from Income Stream Uncertainty: A Holistic Model of Risk. *Strategic Management Journal*, 20 (11), 1037–1062.
- Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y., and Podsakoff, N.P., 2003. Common method biases in behavioral research: a critical review of the literature and recommended remedies. *The Journal of Applied Psychology*, 88 (5), 879–903.
- Rank, J., Natalie, B., Georg, H., Unger, B.N., and Gemünden, H.G., 2015. Preparedness for the future in project portfolio management: The roles of proactiveness, riskiness and willingness to cannibalize. *Journal of Project Management*, 1–38.
- Reid, S.E. and de Brentani, U., 2010. Market Vision and Market Visioning Competence: Impact on Early Performance for Radically New, High-Tech Products. *Journal of Product Innovation Management*, 27 (4), 500–518.
- Reid, S.E. and De Brentani, U., 2004. The fuzzy front end of new product development for discontinuous innovations: A theoretical model. *Journal of Product Innovation Management*, 21 (3), 170–184.
- Reid, S.E. and De Brentani, U., 2012. Market vision and the front end of NPD for radical innovation: The impact of moderating effects. *Journal of Product Innovation Management*, 29, 124–139.
- Reid, S.E. and De Brentani, U., 2015. Building a measurement model for market visioning competence and its proposed antecedents: Organizational encouragement of divergent thinking, divergent thinking attitudes, and ideational behavior. *Journal of Product Innovation Management*, 32 (2), 243–262.
- Rhee, J., Park, T., and Lee, D.H., 2010. Drivers of innovativeness and performance for innovative SMEs in South Korea: Mediation of learning orientation. *Technovation*, 30 (1), 65–75.
- Richtnér, A., Åhlström, P., and Goffin, K., 2014. 'Squeezing R&D': A study of organizational slack and knowledge creation in NPD, using the SECI model. *Journal of Product Innovation Management*, 31 (6), 1268–1290.
- Richtnér, A. and Åhlström, P., 2006. Influences on Organisational Slack in New Product

- Development Projects. *International Journal of Innovation Management*, 10 (4), 375–406.
- Richtnér, A. and Åhlström, P., 2010. Organizational Slack and Knowledge Creation in Product Development Projects: The Role of Project Deliverables. *Creativity and Innovation Management*, 19 (4), 428–437.
- Riel, A. Van, Lemmink, J., and Ouwersloot, H., 2004. High-Technology Service Innovation Success: A Decision-Making Perspective. *Journal of Product Innovation Management*, 21, 348–359.
- Rohrbeck, R. and Gemünden, H.G., 2011. Corporate foresight: Its three roles in enhancing the innovation capacity of a firm. *Technological Forecasting and Social Change*, 78 (2), 231–243.
- Ruvio, A. a., Shoham, A., Vigoda-Gadot, E., and Schwabsky, N., 2013. Organizational Innovativeness: Construct Development and Cross-Cultural Validation. *Journal of Product Innovation Management*, 31 (5), 1004–1022.
- Salomo, S., Talke, K., and Strecker, N., 2008. Innovation Field Orientation and Its Effect on Innovativeness and Firm Performance. *Journal of Product Innovation Management*, 25 (6), 560–576.
- Salomo, S., Weise, J., and Gemünden, H.G., 2007. NPD Planning Activities and Innovation Performance: The Mediating Role of Process Management and the Moderating Effect of Product Innovativeness. *Journal of Product Innovation Management*, 24 (4), 285–302.
- Sarangee, K., Schmidt, J.B., and Wallman, J.P., 2013. Clinging to slim Chances: The dynamics of anticipating regret when developing new products. *Journal of Product Innovation Management*, 30 (5), 980–993.
- Sarangee, K.R., Woolley, J.L., Schmidt, J.B., and Long, E., 2014. De-escalation mechanisms in high-technology product innovation. *Journal of Product Innovation Management*, 31 (5), 1023–1038.
- Schultz, C., Salomo, S., and Talke, K., 2013. Measuring new product portfolio innovativeness: How differences in scale width and evaluator perspectives affect its relationship with performance. *Journal of Product Innovation Management*, 30, 93–109.
- Seidl, D., 2004. The Concept of ‘Weak Signals’ Revisited: A Re-description From a Constructivist Perspective. In: H. Tsoukas and J. Shepherd, eds. *Managing the Future: Foresight in the Knowledge Economy*. Oxford: Blackwell, 151–168.
- Shefer, D. and Frenkel, A., 2005. R&D, firm size and innovation: an empirical analysis. *Technovation*, 25 (1), 25–32.
- Simon, H.A., 1947. *Administrative Behavior: A Study of Decision-making Processes in Administrative Organizations*. 4th ed. New York: The Free Press.
- Simonse, L.W.L., Hultink, E.J., and Buijs, J.A., 2015. Innovation Roadmapping: Building Concepts from Practitioners’ Insights. *Journal of Product Innovation Management*, 32 (6), 904–924.
- Spanjol, J., Mühlmeier, S., and Tomczak, T., 2012. Strategic Orientation and Product Innovation: Exploring a Decompositional Approach. *Journal of Product Innovation Management*, 29 (6), 967–985.
- Troilo, G., De Luca, L.M., and Atuahene-Gima, K., 2014. More innovation with less? A strategic contingency view of slack resources, information search, and radical innovation. *Journal of Product Innovation Management*, 31 (2), 259–277.
- Tsoukas, H. and Shepherd, J., 2004. *Managing the Future: Foresight in the Knowledge Economy*. Oxford: Blackwell.
- Van de Ven, A.H. and Ferry, D., 1980. *Measuring and Assessing Organizations*. New York: John Wiley & Sons.
- Verworn, B., Herstatt, C., and Nagahira, A., 2007. The fuzzy front end of Japanese new product development projects: impact on success and differences between incremental and radical projects. *R&D Management*, 38 (1), 1–19.
- Veryzer, R.W., 1998. Discontinuous Innovation and the New Product Development Process. *Journal of Product Innovation Management*.

- de Visser, M., Faems, D., Visscher, K., and de Weerd-Nederhof, P., 2014. The Impact of Team Cognitive Styles on Performance of Radical and Incremental NPD Projects. *Journal of Product Innovation Management*, 31 (6), 1167–1180.
- Volberda, H.W., van der Weerd, N., Verwaal, E., Stienstra, M., and Verdu, a. J., 2012. Contingency Fit, Institutional Fit, and Firm Performance: A Metafit Approach to Organization-Environment Relationships. *Organization Science*, 23 (4), 1040–1054.
- Voss, G.B., Sirdeshmukh, D., and Voss, Z.G., 2008. The Effects of Slack Resources and Environmental threat on Product Exploration and Exploitation. *Academy of Management Journal*, 51 (1), 147–164.
- Wiebe, E., 2010. Temporal Sensemaking: Managers' Use of Time to Frame Organizational Change. In: T. Hernes and S. Maitlis, eds. *Perspectives on Process, Sensemaking, and Organizing*. Oxford: Oxford University Press, 213–241.
- Yadav, M., Prabhu, J., and Chandy, R., 2007. Managing the future: CEO attention and innovation outcomes. *Journal of Marketing*, 71 (4), 84–101.
- Zahra, S., 1993. New product innovation in established companies: Associations with industry and strategy variables. *Entrepreneurship Theory & Practice*, 18 (2), 47–69.
- Zhou, K., Yim, C., and Tse, D., 2005. The effects of strategic orientations on technology-and market-based breakthrough innovations. *Journal of Marketing*, 69 (2), 42–60.

## Appendix 4A. Results of Confirmatory Factor Analysis

Constructs	Loading <sup>1</sup>	t-value
<b>Forward-looking search</b> (1 = strongly disagree; 7 = strongly agree)		
<b>Information intake</b> (CR = .91, AVE = .63)		
We scanned for potential relevant key trends, opportunities, or threats in the periphery of the target market	.722	
We looked out for short-term and long-term changes which could impact the new product	.763	9.397
We consulted a large variety of information sources to provide us with issues, such as future threats or future opportunities, relevant to our new product	.857	10.583
We continuously scanned for future issues, either threats or opportunities, for our new product	.869	10.729
We tracked key trends, policies, and tactics of competitors	.742	9.130
We deliberately sought for future issues, such as threats or opportunities, that could come up for our new product	.802	9.893
<b>Formal interpretation</b> (CR = .94, AVE = .75)		
A structured and deliberate effort was made to predict the future success of our new product	.776	
We used systematic approaches to understand the future of markets and/or technologies related to new product	.886	12.649
Systematic approaches were used to interpret what the future could bring for the new product	.958	13.990
We used systematic approaches to create an understanding of how trends could influence our new product	.858	12.121
In order to interpret potential future issues to the new product, we used specific systematic approaches	.835	11.697
<b>Informal interpretation</b> (CR = .90, AVE = .69)		
Project members brought forward issues that could endanger the future success of our product in the marketplace	.882	
Information on future issues or opportunities related to the new product were brought forward by project members	.963	18.311
Project members frequently challenged whether the assumptions on markets and/or technologies would hold in the future	.768	12.274
Project members were encouraged to bring forward any kind of future opportunities or issues that could be relevant for the new product	.688	10.299
<b>Project innovativeness</b> (1 = strongly disagree; 7 = strongly agree) (Schultz <i>et al.</i> 2013)		
<b>Firm-internal facets</b> (CR = .74, AVE = .50)		
In order to develop and introduce the new product/service, we had to significantly change our organizational structure	.792	
In order to develop and introduce the new product/service, we had to significantly change our production processes	.516	5.689
In order to develop and introduce the new product/service, we had to significantly change our organizational culture	.775	7.375

Constructs	Loading <sup>1</sup>	t-value
<b>Environment-related facets</b> (CR = .65, AVE = .40)		
In order to introduce the new product, changed industry norms had to be established	.787	
In order to introduce the new product, regulations had to be changed	.605	5.666
In order to introduce the new product, values and norms in the society in general had to be adapted	.440	4.495
<b>Technology facets</b> (CR = .86, AVE = .66)		
Our new product was based on new technological principles	.890	
The technology we used allowed significant performance enhancements.	.733	10.199
Our new product can be characterized as being based on very new technological components	.817	11.540
<b>Market facets</b> (CR = .79, AVE = .56)		
Our new product offered a new customer value not offered before by any other product.	.704	
Our new product created a totally new market	.851	8.291
Our new product changed the way our market functions.	.666	7.303
<b>Intensity of planning</b> (CR = .88, AVE = .60) (1 = strongly disagree; 7 = strongly agree) (Verworn <i>et al.</i> 2007)		
The entire project task (scope) was structured in work packages.	.823	
Every work package was allocated with a specific time allowance.	.868	12.532
Resources (personnel, financial) were assigned to the work packages.	.793	11.158
There was a detailed budget plan for the project.	.696	9.415
Team member responsibilities were defined.	.665	8.885

$\chi^2/d.f. = 1.583$ ; CFI = .922; SRMR = .056; RMSEA = .061 CI<sub>0.90</sub>[.052 - .069] ( $p_{close} = .02$ )

# CHAPTER 5

## Discussion and conclusion

The purpose of this dissertation was to examine the concept of forward-looking search. I did so in three ways. First, I sought to develop an understanding why (or why not) and to what extent firms engage in forward-looking search by positioning the phenomenon within existing (but contrasting on the subject of forward-looking search) literatures of organisational behaviour and strategic foresight. Second, I sought to develop a better understanding how forward-looking search can contribute towards innovation performance at the firm-level. Here I positioned forward-looking search as not directly impacting innovation performance, but rather via innovation portfolio agility. Third, I sought to examine the role of forward-looking search within innovation project development. I positioned forward-looking search as a contributor toward innovativeness and sought to create an understanding to what extent it may impact innovativeness, but also under which conditions this is most strongly the case.

In the next sections, I will discuss the overall contribution of this dissertation, followed by each of the research article's contributions. I will conclude this chapter and dissertation with a brief discussion of its overall limitations and potential opportunities for future research.

### **5.1 Overall contributions**

The overall contribution of this dissertation, next to the more specific contributions of each of the three research articles, is that it introduces the concept of forward-looking search at different organisational levels (firm- and project-level) and provides potential measures for both.

Existing research on search has predominantly focused on the concept of backward-looking search, i.e. the search of alternative courses of action in an evolutionary, learning-based and incremental sense. The concept of forward-looking search provides a departure of that backward-looking sensibility. As I prescribe to the behavioural theory of the firm in my dissertation (most specifically in research article 1), my dissertation contributes to the ongoing quest in the field of organisational behaviour, and most notably search behaviour, to include a fuller picture of also pursuing more distant courses of actions. As Gavetti *et al.* (2012, p. 26) note:

*“A Behavioral Theory of the Firm has given strategy and organization scholars a backward looking, incremental sensibility that gives many useful insights on organizational change. For a fuller view, however, the field also needs to incorporate forward-looking decision making and actions made for distant and uncertain benefits.”*

Most notably, I introduce the concept of forward-looking search as consisting of practices – practices that can be honed, taught, and applied. It is a different view on more recent research on search which can be tracked down to Gavetti and Levinthal’s (2000) article that introduced the notion of ‘cognitive search’ (complementary to the more familiar ‘backward-looking search’). Since then, several studies have emerged that focus on the role of ‘cognition’, ‘mental or cognitive representations’, or ‘mental processes’ in relation to search, and how that allows actors to identify superior alternative courses of action and foresee its consequences (e.g. Chen 2008, Gavetti 2012, Csaszar and Levinthal 2016, Gavetti and Menon 2016). However, while this research has produced very novel and interesting insights, it still remains abstract and does not provide clear prescriptions towards managers. Indeed, as Winter (2012, p. 295) notes:

*“[...] it would be necessary first to develop an operational definition of the superior management of mental processes [...]. That might be quite difficult, considering that important parts of these processes are hidden inside leaders’ heads and may well be subconscious.”*

In contrast, the practice-view I take on forward-looking search partially negates this limitation of prescriptiveness. Not only do I contribute a measure of forward-looking search (consisting of practices) at the firm-level, I do so as well for the project-level where project teams can engage in a range of practices. I clarify what kind of practices may be employed at a more general firm-level that can facilitate and increase the likelihood of seeing more distant and alternative courses of action. I do so similarly at the project-level, where project teams may engage in range of practices that range from acquiring specific information, interpretation of this information with methods, and project-based social practices such as challenging assumptions and allow for open-mindedness during project runtime.

At the firm-level, I show that managers *can* (and do) use a range of methods and practices that may allow them to find a new and distant alternative course of action for their firm *and* find out what sort of consequences this alternative action may have for their firm. I prescribe to the behavioural theory of the firm and acknowledge its assumptions and propositions, I also prescribe to strategic foresight literature, where ‘forward-looking search’ *is* acknowledged as a learnable skill – a skill that can be honed towards explaining, exploring, and interpreting future developments, as well as assessing their consequences for decisions and other actions in the present (Duin, van der 2016). It is not a ‘black box’ as would be mostly the case with the research on cognitive search. Rather, a proper application of selected methods and practices can be used to collect information and build knowledge about the futures (Duin, van der 2016, p. 7). I therefore contribute to the literature on search that it can (or perhaps should) acknowledge the existence of practices that managers may use in order to spot more distant opportunities. Practices that go beyond the “two-by-two frameworks” or other strategy frameworks which seemingly inhibit managers from seeing more distant opportunities (Csaszar and Levinthal 2016, p. 2035). Thereby, search literature can potentially move more towards prescriptive implications. Especially since much of the research on cognitive search has been directed towards strategists (e.g. Gary *et al.* 2012, Csaszar and Levinthal 2016, Gavetti and Menon

2016), relevancy of the research on searching for distant opportunities may need to become much more prescriptive than in its current state. This dissertation provides a step towards this direction.

At the project-level, I show that project teams even so engage in practices that constitute forward-looking search and provides a contribution towards innovation management literatures. First, I provide a validated multi-dimensional measurement scale for forward-looking search during innovation projects. Second, I also confirm previous research that investigated forward-looking search practices at the organisation and portfolio-level (Rohrbeck and Gemünden 2011, Sarangee *et al.* 2014). For instance, Rohrbeck and Gemünden (2011) and Sarangee *et al.* (2014) find using case studies that forward-looking practices are used mostly at the organisational level, rather than at the project-team level. Hence, it views it more as search in a continuous manner; the firm has practices in place at the portfolio or organisational level that facilitate future-oriented guidance to new or ongoing innovation projects. Cited mechanisms are continual research during the project to highlight and contradict fuzzy and dubious long-term views, continually revising assumptions to facilitate more acute appraisal of the project's prospects, and continually creating technical comparisons with the industry through market intelligence and road mapping in order to monitor the current project's prospects against other available solutions in the industry. I transfer these practices to the project-level wherein I find a similarly beneficial role to keep innovation projects novel and relevant for the firm. As literature is relatively scarce on the role of forward-looking search in discontinuous settings (i.e. an innovation project), I contribute insights that forward-looking search not only resides at the higher levels of management (e.g. portfolio managers), but also at the project-team level.

## **5.2 Research article's contributions**

*In the first research article I addressed the question:* To what extent can performance and environmental determinants lead to firms engaging in differing intensities of forward-looking search? Here, I introduce forward-looking search as a set of practices by drawing predominantly on strategic-

foresight literatures, and in turn introduce these practices into the organisational search literatures which have predominantly eluded a practice-view on (distant) search. The latter literatures (e.g. Gavetti and Levinthal 2000, Rivkin and Siggelkow 2007, Gary *et al.* 2012, Gavetti 2012, Csaszar and Levinthal 2016, Gavetti and Menon 2016) acknowledge that somehow actors can identify alternative courses of action and potentially foresee its consequences. However, much of this research is theoretical (mainly driven by NK simulation models) and can receive endless support in academic articles (Winter 2012). Using a practice-view I provide a different way of investigating search behaviours for more distant courses of action and to foresee its consequences. I empirically investigated why firms engage in forward-looking search by positing as a set of practices which, interestingly, also shows why firms may not engage in forward-looking search. The latter is an important contribution, especially since the notion within strategic foresight literatures is that firms should engage in forward-looking search to high degrees. It is argued as essential to firm performance and survival in the face of turbulent and hostile (Brown and Eisenhardt 1997, Gavetti and Levinthal 2000, Tsoukas and Shepherd 2004), but also to spot distant opportunities which can bring superior performance (Hamel and Prahalad 1994, Gavetti and Levinthal 2000, Day and Schoemaker 2005, Schoemaker and Day 2009). I find that under several conditions firms engage in lesser degrees in forward-looking search. First is under conditions of declining performance. While declining performance is a well-established determinant of problemistic backward-looking-search which relies on more short-term problem-solving (Cyert and March 1963), the finding is perhaps not surprising. However, it does provide evidence for the usability of our measure of forward-looking search as it contrasts backward-looking search. Both organisational search and strategic foresight literatures may thus benefit from our measure. Second, firms are engaging much less in forward-looking search under competitive intense situations. It seems that especially under such situations, firms may want to ‘dislodge’ themselves from their current situation to avoid increasing levels of competitive pressures. However, they do not; potentially because they simply do not have the ‘time’

to do so. Indeed, I provide potential empirical insights to more recent notions of more distant search only occurring when firms have *time* to do so (Csaszar and Levinthal 2016). In other words, time to search for more distant courses of action that may yield greater benefits. The lack of time can be attributed to the notion that forward-looking search has an opportunity cost under competitive intense situations, as it takes away attention of the current business that is fiercely being contested (Ocasio 1997, 2011). The same reason can be attributed to the case where higher degrees of technological turbulence do not spur firms to engage in more forward-looking search if there are no slack resources available. Without slack resources, firms are less likely to be able to ‘jump on’ new opportunities identified through forward-looking search in technological turbulent environments (Levinthal 1997, Csaszar and Levinthal 2016). They simply cannot pay attention to the higher degrees of turbulence and search for new alternative courses of action that high levels of turbulence may bring about.

Conversely, the availability of slack resources is found to counteract the two findings above; availability of slack resources spurs firms to engage more in forward-looking search in 1) highly technological turbulent environments, and 2) highly competitive intense situations. Slack resources thus allows a firm to shift attention towards more distant courses of action which may not necessarily pay-off in the short-run. In other words, it provides time to do so. A contribution toward recent research on search is therefore that the factor of time and attention is important to consider in firm’s engagement in forward-looking search (Csaszar and Levinthal 2016), but that also strategic foresight literatures may have to take into account these behavioural aspects more than has done so to date to broaden our understanding that perhaps not every firm *wants* or *can* do forward-looking search.

Lastly, we also find that firm’s performance expectations influence the intensity with which it engages in forward-looking search. We find that a positive performance expectation (i.e. having performed well and likely outperforming one year ahead) to positively affect forward-looking search. A well-established notion from prospect theory is that firms that have been performing well and expect to continue their upward trend are risk averse in their decision-making (Tversky *et al.* 1991).

This suggests that forward-looking search could be a way for firms to decrease potential risks (that may affect their positive performance expectation) by carefully considering alternative futures and the consequences of alternative courses of action or the continuation of current actions (Greve and Taylor 2000). Thereby, it provides potential evidence towards the notion that forward-looking can function as an uncertainty-avoidance mechanism as portrayed predominantly in strategic-foresight literatures (e.g. Ansoff 1980, Schoemaker and Day 2009, Vecchiato and Roveda 2010, Vecchiato 2012).

*In the second article I addressed the question:* To what extent does forward-looking search contribute to innovation performance via innovation portfolio agility? Here, I empirically investigated the role of innovation portfolio agility in translating future insights into innovation performance. I find that the effect of forward-looking search on innovation performance is fully mediated by innovation portfolio agility. In doing so, I provide evidence on also recent notions that strategic foresight can lead to higher performance, but only through exercising agility (Vecchiato 2015). Therefore, I contribute an empirical account on the view that forward-looking search not only functions to potentially identify new innovation ideas (e.g. Brown and Eisenhardt 1997, Reid and De Brentani 2012, Kock *et al.* 2015), but that it can also appraise current projects that may need adjustment or termination in light of new future insights. The portfolio-perspective views firms as having a set of ‘pre-adopted’ opportunities (i.e. innovation projects in a portfolio) that have been initiated at different time periods. Then, forward-looking search can provide novel future insights that may steer portfolio decision-making which can in turn, as I find, influence agility in portfolios and by that ultimately innovation performance. Forward-looking search allows to better align innovation plans with foresights on technology, market, and competitors (Rohrbeck and Gemünden 2011), thereby providing the firm with competitive-timing advantages (Simonse *et al.* 2015). In other words, forward-looking search leads to a different set of criteria to appraise current innovations in a portfolio. Performance then, can be accrued if one can be agile in its portfolio of innovations.

I also contribute towards literature on innovation portfolio management. Innovation portfolio management literatures have lacked, as I would like to call it, a ‘prospective’ stance towards managing portfolios of innovations. More specifically, the role of future insights is seemingly absent in recent frameworks on ‘innovation portfolio decision-making quality’, which in turn enhances agility in the portfolio by providing sufficient information (Kock and Gemünden 2016). Here, it is not recognized that forward-looking search can be regarded as an antecedent by providing novel future insights on which decisions for initiating, (re)prioritization or even termination of projects may be better informed. I therefore contribute to this literature on innovation portfolio management by positing forward-looking search as a set of practices that *can* increase innovation portfolio agility by means of providing novel future insights to the end of facilitating performance and future-preparedness of innovations (Rank *et al.* 2015).

*In the third article I addressed the question:* To what extent and under which conditions can forward-looking search during the development of innovation projects lead to project teams creating more novel innovations? Here, I provide empirical evidence that project teams engage in forward-looking search throughout the entire project development and its positive impact on innovativeness. The findings provide complementary contributions to growing bodies of literature in innovation management that explicitly emphasizes the future as an important element to consider in either the idea selection for innovation (Reid and de Brentani 2010, Reid and De Brentani 2012, Kock *et al.* 2015). Here, I contribute a view that forward-looking search does not merely stop after selecting an idea that may be seen as providing future successes. Rather, forward-looking search is also ongoing *after* initiating an innovation project, thereby significantly positively affecting the innovativeness of a project. I thus also provide evidence of forward-looking mechanisms that have been identified at organisational and portfolio levels that play an ‘opponent’ role to innovation projects. Here, the ‘opponent’s’ role is to ensuring the future viability and novelty of ongoing projects (Rohrbeck and Gemünden 2011, Sarangee *et al.* 2014, Simonse *et al.* 2015). I thus provide evidence that such

practices also occur within individual innovation projects for the duration of their development. Furthermore, because of the empirical setting of individual projects, it allowed me to study forward-looking search practices in more detail as to what extent they occur under a variety of conditions – something that the previously cited studies on the organisational and portfolio level have neglected. I posit that forward-looking search may not always be able to contribute during project development, for instance in the case of excessive planning where planning and work packages take away the ability of also thinking and seeing further ahead in the future; the lack of any external budgets to implement changes (i.e. acquire new technologies) to facilitate the viability of the project in the future; or simply there is little need for forward-looking search because the external environment is homogenous and provides very little fluctuations during development. I find the former two conditions as critical to consider under which forward-looking search contributes most strongly within projects. By that, also the conditions under which it is hampered from contributing. I find that excessive planning, or the lack thereof, does not allow forward-looking search to contribute anything additionally to project innovativeness – only medium planned projects allow for that. Here, I contribute empirical insights into the potential role of abstraction facilitated through project planning intensities, where medium levels of abstraction are most useful (Gassmann and Zeschky 2008). Similarly, slack resources allow project teams to potentially think beyond the project's boundaries and facilitate changes to the ongoing project (Richtnér *et al.* 2014), and can significantly increase the contribution of forward-looking search towards innovativeness. Overall, this study contributes to relatively scarce literature that acknowledges forward-looking search within discontinuous settings, such as projects (e.g. Kaplan and Orlikowski 2013), and provides novel insights into potential new best-practices regarding the management and development of innovations (Kleinschmidt 2006).

### **5.3 Overall limitations and avenues for future research**

While I have addressed more specific limitations in each of the three research articles, the

dissertation in general may be subject to several limitations still. One of the limitations is that forward-looking search can be fraught with difficulties and biases within firms. More specifically, firms consist of a multitude of 'levels that can be seen as constraints. Levels can be the individual, dyad, group, and organizational-level (Lord *et al.* 2014). The multitude of levels can severely inhibit forward-looking search from materializing to fruitful outcomes within organisations; outcomes which I cannot *explicitly* account for. As Lord *et al.* (2014, p. 276) put it: "individuals are nested within much larger systems, which constrain processes, eliminate potentialities, and cause select outcomes to emerge". This limitation is most strongly the case of literature that focuses on cognitive search as identifying alternative courses of action and foresee its consequences (Gavetti and Levinthal 2000, Gavetti 2012, Csaszar and Levinthal 2016). Here, actors (i.e. strategists or decision-makers) are seen as lonely actors which can steer firms toward any direction possible. In other words, the levels of individual and organisation are merged into one; the organisation behaves in the same way actor's behaviour is described. However, while I in this dissertation draw extensively on these insights, even though the firm-level practices I put forward partially negate potential constraints of hierarchical levels<sup>1</sup>, I must still acknowledge the limitation that I cannot account for internal biases or constraints in relation to the actual use of future insights within firms. Hand-over effects of future insights may be present, whether being at the firm-level or project-level, that may hamper (or contribute nonetheless) toward making future insights used in organisational useful ways. While in research article 1 I provide several reasons already for the firm-level that may inhibit future insights from being taken into account, future research may pay additional attention towards 'handover' effects of future insights within the firm (e.g. Hill and Levenhagen 1995), especially within larger organisations where dedicated units may have the mandate to perform forward-looking search (Becker 2002). In doing so, it may uncover the question of what limits decision-makers of

---

<sup>1</sup> Because of the way I measure forward-looking search at the firm-level, it incorporates measures such as support from (top) management, the communication of future insights toward decision-makers, and the establishment of scanning and interpretation practices.

potentially acting on future insights.

One other limitation is that this dissertation follows the notion (albeit well established notion) that forward-looking search is beneficial for overall firm performance, but cannot necessarily establish this causal relationship. While I find in my studies that there are certain firm-level and project-level constraints that may discourage forward-looking search in their respective settings, the overall thinking pattern established in literature is that forward-looking is ultimately beneficial. Indeed, some form of performance will be accrued, as evident in the many propositions noted in foresight-related literatures, either in the form of first-mover advantages or being prepared for potential crises (e.g. Hamel and Prahalad 1994, Gavetti and Levinthal 2000, Tsoukas and Shepherd 2004, Day and Schoemaker 2005, Vecchiato 2015, Gavetti and Menon 2016). However, due to the nature of this dissertation's overall research design based on cross-sectional surveys, it cannot provide causal links between forward-looking search and performance but only hint at such a relationship. An obvious, but necessary, agenda for future research is to adopt longitudinal studies. One way for future research is to track the persistency of forward-looking search processes and how the relationship with performance may change according to changes in persistency (Li *et al.* 2013). While recent research shows causal evidence between long-term incentives on executives (in the form of long-term executive compensations) and longer-term business performance (Flammer and Bansal 2016), it shows that having an overall forward-looking view is beneficial for performance. However, it seems that evidence on the actual link between firms' *search* in a forward-looking manner and performance is still eluding us.

## References

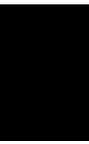
- Ansoff, H.I., 1980. Strategic Issue Management. *Strategic Management Journal*, 1 (2), 131–148.
- Becker, P., 2002. *Corporate foresight in Europe: a first overview*. Brussels: European Commission.
- Brown, S.L. and Eisenhardt, K.M., 1997. The Art of Continuous Change: Linking Complexity Theory and Time-Paced Evolution in Relentlessly Shifting Organizations. *Administrative Science Quarterly*, 42 (1), 1–34.

- Chen, W.R., 2008. Determinants of firms' backward-and forward-looking R&D search behavior. *Organization Science*, 19 (4), 609–622.
- Csaszar, F.A. and Levinthal, D.A., 2016. Mental representation and the discovery of new strategies. *Strategic Management Journal*, 37 (10), 2031–2049.
- Cyert, R. and March, G., 1963. *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice Hall.
- Day, G.S. and Schoemaker, P.J.H., 2005. Scanning the periphery. *Harvard Business Review*, 83 (11), 135–148.
- Duin, van der, P., 2016. *Foresight in Organizations: Methods and Tools*. New York: Routledge.
- Flammer, C. and Bansal, P., 2016. Does a long-term orientation create value? Evidence from a regression discontinuity. *Strategic Management Journal*, 1–58.
- Gary, M., Wood, R., and Pillinger, T., 2012. Enhancing mental models, analogical transfer, and performance in strategic decision making. *Strategic Management Journal*, 33 (7).
- Gassmann, O. and Zeschky, M., 2008. Opening up the Solution Space: The Role of Analogical Thinking for Breakthrough Product Innovation. *Creativity and Innovation Management*, 17 (2), 97–106.
- Gavetti, G., 2012. Toward a Behavioral Theory of Strategy. *Organization Science*, 23 (1), 267–285.
- Gavetti, G., Greve, H.R., Levinthal, D.A., and Ocasio, W., 2012. The Behavioral Theory of the Firm: Assessment and Prospects. *The Academy of Management Annals*, 6 (1), 1–40.
- Gavetti, G. and Levinthal, D., 2000. Looking forward and looking backward: Cognitive and experiential search. *Administrative Science Quarterly*, 45 (1), 113–137.
- Gavetti, G. and Menon, A., 2016. Evolution Cum Agency: Toward a Model of Strategic Foresight. *Strategy Science*, 1 (3), 207–233.
- Greve, H.R. and Taylor, A., 2000. Innovations as Catalysts for Organizational Change: Shifts in Organizational Cognition and Search. *Administrative Science Quarterly*, 45 (1), 54–80.
- Hamel, G. and Prahalad, C., 1994. *Competing for the future*. Harvard business review. Boston: Harvard Business School Press.
- Hill, R.C. and Levenhagen, M., 1995. Metaphors and Mental Models: Sensemaking and Sensegiving in Innovative and Entrepreneurial Activities. *Journal of Management*, 21 (6), 1057–1074.
- Kaplan, S. and Orlikowski, W.J., 2013. Temporal Work in Strategy Making. *Organization Science*, 24 (4), 965–995.
- Kleinschmidt, E.J., 2006. Rejoinders to 'Establishing an NPD Best Practices Framework'. *Journal of Product Innovation Management*, 23, 119–121.
- Kock, A. and Gemünden, H.G., 2016. Antecedents to Decision-Making Quality and Agility in Innovation Portfolio Management. *Journal of Product Innovation Management*, 0 (0), 670–686.
- Kock, A., Heising, W., and Gemünden, H.G., 2015. How Ideation Portfolio Management Influences Front-End Success. *Journal of Product Innovation Management*, 32 (4), 539–555.
- Levinthal, D.A., 1997. Adaptation on Rugged Landscapes. *Management Science*, 43 (7), 934–950.
- Li, Q., Maggitti, P.G., Smith, K.G., Tesluk, P.E., and Katila, R., 2013. Top management attention to innovation: The role of search selection and intensity in new product introductions. *Academy of Management Journal*, 56 (3), 893–916.
- Lord, R.G., Dinh, J.E., and Hoffman, E.L., 2014. A Quantum Approach to Time and Organizational Change. *Academy of Management Review*, 40 (2), 263–290.
- Ocasio, W., 1997. Towards an Attention-Based View of the Firm. *Strategic Management Journal*, 18, 187–206.

- Ocasio, W., 2011. Attention to Attention. *Organization Science*, 22 (5), 1286–1296.
- Rank, J., Natalie, B., Georg, H., Unger, B.N., and Gemünden, H.G., 2015. Preparedness for the future in project portfolio management: The roles of proactiveness, riskiness and willingness to cannibalize. *Journal of Project Management*, 1–38.
- Reid, S.E. and de Brentani, U., 2010. Market Vision and Market Visioning Competence: Impact on Early Performance for Radically New, High-Tech Products. *Journal of Product Innovation Management*, 27 (4), 500–518.
- Reid, S.E. and De Brentani, U., 2012. Market vision and the front end of NPD for radical innovation: The impact of moderating effects. *Journal of Product Innovation Management*, 29, 124–139.
- Richtnér, A., A°hlström, P., and Goffin, K., 2014. ‘Squeezing R&D’: A study of organizational slack and knowledge creation in NPD, using the SECI model. *Journal of Product Innovation Management*, 31 (6), 1268–1290.
- Rivkin, J.W. and Siggelkow, N., 2007. Patterned Interactions in Complex Systems: Implications for Exploration. *Management Science*, 53 (7), 1068–1085.
- Rohrbeck, R. and Gemünden, H.G., 2011. Corporate foresight: Its three roles in enhancing the innovation capacity of a firm. *Technological Forecasting and Social Change*, 78 (2), 231–243.
- Sarangee, K.R., Woolley, J.L., Schmidt, J.B., and Long, E., 2014. De-escalation mechanisms in high-technology product innovation. *Journal of Product Innovation Management*, 31 (5), 1023–1038.
- Schoemaker, P. and Day, G., 2009. How to make sense of weak signals. *MIT Sloan Management Review*, 50 (3), 81–88.
- Simonse, L.W.L., Hultink, E.J., and Buijs, J.A., 2015. Innovation Roadmapping: Building Concepts from Practitioners’ Insights. *Journal of Product Innovation Management*, 32 (6), 904–924.
- Tsoukas, H. and Shepherd, J., 2004. *Managing the Future: Foresight in the Knowledge Economy*. Oxford: Blackwell.
- Tversky, A., Kahneman, D., Krantz, D., and Rahin, M., 1991. Loss Aversion in Riskless Choice: A Reference-Dependent Model. *Quarterly Journal of Economics*, 106 (4), 1039–1061.
- Vecchiato, R., 2012. Environmental uncertainty, foresight and strategic decision making: An integrated study. *Technological Forecasting and Social Change*, 79 (3), 436–447.
- Vecchiato, R., 2015. Creating value through foresight: First mover advantages and strategic agility. *Technological Forecasting and Social Change*, 101, 25–36.
- Vecchiato, R. and Roveda, C., 2010. Strategic foresight in corporate organizations: Handling the effect and response uncertainty of technology and social drivers of change. *Technological Forecasting and Social Change*, 77 (9), 1527–1539.
- Winter, S.G., 2012. Purpose and progress in the theory of strategy: comments on Gavetti. *Organization Science*, 23 (1), 288–297.



# APPENDIX A



## Survey 1

Dear participant,

The University of Groningen and Aarhus University invite you to participate in a study to better understand how firms deal with future-oriented research in innovation.

Completing the survey will take 20-25 minutes. Your answers to the survey will be treated as confidential.

Thank you very much for your participation!

All data gathered through this survey will be used in a form that will make it impossible to determine the identity of the individual respondents or their organizations. Confidentiality of all survey responses is guaranteed. Names of respondents or organizations will only be used for administrative purposes for this study.

**Name of your firm**

\_\_\_\_\_

**Your position in the firm**

\_\_\_\_\_

**Has your firm introduced 3 or more new products/services in the last 5 years?**

Yes  No

**In our firm, future-related research activities mostly take place...**

- in a specialized future research department (i.e. technology centers)
- in an existing department which is not specialized in future research (i.e. R&D, Market Research)
- in temporary project groups / task forces
- with an individual person
- other (please specify)

**For how many years has your firm performed future-related research in a structured way?**

\_\_\_\_\_ years

**Please indicate the extent to which you agree or disagree with each statement as it applies to your organization (the whole firm).**

	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
In our organization, building and maintaining external networks (outside the organization) is encouraged.	<input type="checkbox"/>						
In our organization, future-related research activities are triggered top-down (e.g. by top management).	<input type="checkbox"/>						
People in our organization that engage in future-related research activities are good communicators.	<input type="checkbox"/>						
Our organization performs environmental scanning proactively in both time horizons, long and short term.	<input type="checkbox"/>						
In our organization, future-related research is formally implemented.	<input type="checkbox"/>						
People in our organization that engage in future-related research activities have a broad knowledge reaching beyond their own domain.	<input type="checkbox"/>						
In our organization, future-related information is shared freely across functions and hierarchical levels.	<input type="checkbox"/>						
Our organization performs environmental scanning by using a large variety of information sources.	<input type="checkbox"/>						
People in our organization that engage in future-related research activities have a strong internal network.	<input type="checkbox"/>						
In our organization, future-related information is rapidly diffused through formal channels.	<input type="checkbox"/>						
People in our organization that engage in future-related research activities are well respected inside the organization.	<input type="checkbox"/>						
In our organization, future-related information is rapidly diffused through informal networks.	<input type="checkbox"/>						
For processing future-related information our organization uses structured ways that fit a specific objective or business issue.	<input type="checkbox"/>						
In our organization, future-related research activities are triggered bottom-up.	<input type="checkbox"/>						

**Please indicate the extent to which you agree or disagree with each statement as it applies to your organization (the whole firm).**

	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
In our organization, every employee is encouraged to detect weak signals (i.e. signals that announce a possible external change early).	<input type="checkbox"/>						
In our organization, future-related research activities are performed continuously (e.g. permanent scanning for emerging technologies with disruptive potential).	<input type="checkbox"/>						
For processing future-related information our organization uses structured ways that fit the specific context of our firm (e.g. volatility of the environment).	<input type="checkbox"/>						
In our organization, future-related research activities are issue driven (i.e. directed by a specific question).	<input type="checkbox"/>						
Our organization performs environmental scanning also outside our current business.	<input type="checkbox"/>						
In our organization, most employees are receptive to signals from the external environment (outside the organization).	<input type="checkbox"/>						
In our organization, top management strongly supports future-related research.	<input type="checkbox"/>						
Our organization performs environmental scanning by using also restricted or exclusive sources (such as personal contacts and specialized databases).	<input type="checkbox"/>						
In our organization, every employee is encouraged to transmit weak signals (i.e. signals that announce a possible external change early).	<input type="checkbox"/>						
Our organization uses structured ways to integrate future-related information from different time horizons.	<input type="checkbox"/>						
In our organization, basic assumptions are challenged explicitly and frequently.	<input type="checkbox"/>						
People in our organization that engage in future-related research activities have a strong external (outside the organization) network.	<input type="checkbox"/>						
Our organization uses structured ways to integrate future-related market and technology information.	<input type="checkbox"/>						

**Please indicate the extent to which you agree or disagree with each statement as it applies to your organization (the whole firm).**

	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
In our organization, we detect changes in our environment at different stages of their development.	<input type="checkbox"/>						
In our organization, we ensure that decision-makers are committed to act upon future-related insights.	<input type="checkbox"/>						
In our organization, we acquire information on future themes, future opportunities, and future threats.	<input type="checkbox"/>						
In our organization, we create outlooks on multiple possible futures.	<input type="checkbox"/>						
In our organization, we diffuse future-related insights from research to a wider audience throughout the organization.	<input type="checkbox"/>						
In our organization, we communicate the results of our future-related research in a way that is easy to understand.	<input type="checkbox"/>						
In our organization, we interpret future-related information to determine its implications for our business.	<input type="checkbox"/>						
In our organization, we filter future-related information for its relevancy to the organization.	<input type="checkbox"/>						
In our organization, we search for future-related information in current, adjacent and unrelated business areas.	<input type="checkbox"/>						
In our organization, we select relevant environmental fields from which to acquire future-related information (e.g. politics, regulation, technology, and customers).	<input type="checkbox"/>						
In our organization, we involve people with different backgrounds in future-related research.	<input type="checkbox"/>						
In our organization, we ensure that results from future-related research reach relevant decision-makers.	<input type="checkbox"/>						
In our organization, we present the results from our future-related research to trigger organizational responses.	<input type="checkbox"/>						
In our organization, we seek information from many different sources.	<input type="checkbox"/>						
In our organization, we design potential organizational responses to address possible futures.	<input type="checkbox"/>						

**Please choose one item that best describes your organization (the whole firm).**

**Our organization...**

- typically operates within a broad product/service-market domain that undergoes periodic redefinition
- values being “first in” in new product/service and market areas even if not all of these efforts prove to be highly profitable
- responds rapidly to early signals concerning areas of opportunity, and these responses often lead to a new round of competitive actions
- may not maintain market strength in all of the areas it enters

**Our organization...**

- attempts to maintain a stable, limited line of products or services
- is at the same time moving out quickly to follow a carefully selected set of the more promising new developments in the industry
- is seldom “first in” with new products or services
- carefully monitors the actions of major competitors in areas compatible with its stable product/service-market base
- can frequently be “second in” with a more cost-efficient product or service

**Our organization...**

- attempts to locate and maintain a secure niche in a relatively stable product or service area
- tends to offer a more limited range of products or services than its competitors
- tries to protect its domain by offering higher quality, superior service, lower prices, and so forth
- is often not at the forefront of developments in the industry
- tends to ignore industry changes that have no direct influence on current areas of operation
- concentrates on doing the best job possible in a limited area

**Our organization...**

- does not appear to have a consistent product/service-market orientation
- is usually not as aggressive in maintaining established products/services and markets as some of its competitors
- is not willing to take as many risks as other competitors
- responds in those areas where it is forced to do so by environmental pressures.

**Please indicate the extent to which you agree or disagree with each statement as it applies to your organization (the whole firm).**

	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
Customer requirements / preferences are easy to forecast.	<input type="checkbox"/>						
Our industry is stable with very little change resulting from major economic, technological, social or political forces.	<input type="checkbox"/>						
Most people in our organization basically agree that our organization's ability to learn is the key to our competitive advantage.	<input type="checkbox"/>						

We actively prepare for the changes brought by the government's policies.	<input type="checkbox"/>						
When one department finds out something important about competitors, it is slow to alert other departments.	<input type="checkbox"/>						
We actively build our capacity to react effectively to market changes.	<input type="checkbox"/>						
It is difficult to capture sufficient information on our external environment (outside the organization) before making a major decision.	<input type="checkbox"/>						
We use sophisticated technologies in our new product/service development.	<input type="checkbox"/>						
The set of competitors in our industry has remained relatively constant over the last 3 years.	<input type="checkbox"/>						
We are slow to detect changes in our customers' product/service preferences.	<input type="checkbox"/>						
The basic values of this organization include learning as key to improvement.	<input type="checkbox"/>						
We ensure that our advantages can withstand changes in the industry.	<input type="checkbox"/>						
Technological innovation based on research results is readily accepted in our organization.	<input type="checkbox"/>						
It is difficult to predict with good confidence the trends and events in our external environment (outside the organization).	<input type="checkbox"/>						

**Please indicate the extent to which you agree or disagree with each statement as it applies to your organization (the whole firm).**

	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
It is difficult to identify the reason for the occurrence of an event in our external environment (outside the organization).	<input type="checkbox"/>						
Actions of competitors are generally quite easy to predict.	<input type="checkbox"/>						
The sense around here is that employee learning is an investment, not an expense.	<input type="checkbox"/>						
It is difficult to have adequate information on our external environment (outside the organization) to assist us in decision-making.	<input type="checkbox"/>						
Learning in our organization is seen as a key commodity necessary to guarantee organizational survival.	<input type="checkbox"/>						
It is difficult to understand the cause and effect of the trends and events in our external (outside the organization) environment.	<input type="checkbox"/>						

We frequently review the likely effect of changes in our business environment on customers.	<input type="checkbox"/>						
Our new products/services always use state-of-the-art technology.	<input type="checkbox"/>						
Technological innovation is readily accepted in our program/project management.	<input type="checkbox"/>						
When something important happens to a major customer or market, the whole organization is informed about it within a short period.	<input type="checkbox"/>						
Product/service demand is easy to forecast.	<input type="checkbox"/>						
For one reason or another, we tend to react slowly to changes in our customers' product or service needs.	<input type="checkbox"/>						

**Please indicate the extent to which you agree or disagree with each statement as it applies to your organization (the whole firm).**

	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
Usually, we are able to identify the key drivers of change.	<input type="checkbox"/>						
We regularly challenge the state-of-the-art of our innovation projects.	<input type="checkbox"/>						
Usually, we are able to identify opportunities and threats in our environment.	<input type="checkbox"/>						
We have a clear view on emerging innovations introduced by competitors.	<input type="checkbox"/>						
The majority of our innovations use technologies that have an impact on or cause significant changes in the whole industry.	<input type="checkbox"/>						
We are often faster than our competitors in assessing the feasibility of innovation projects.	<input type="checkbox"/>						
We regularly challenge the assumptions of our innovation projects.	<input type="checkbox"/>						
We regularly redefine our innovation projects in response to external change (outside the organization).	<input type="checkbox"/>						
We regularly review our innovation portfolio.	<input type="checkbox"/>						
We regularly terminate potentially unsuccessful innovation projects before the target date.	<input type="checkbox"/>						
The majority of our innovations are based on a substantially different core technology.	<input type="checkbox"/>						
We have a good track record of identifying new business fields.	<input type="checkbox"/>						
We have a good track record of spotting threats to our innovation projects early	<input type="checkbox"/>						

**Please indicate the extent to which you agree or disagree with each statement as it applies to your organization (the whole firm).**

	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
Usually, we are able to identify alternative development trajectories for our innovation projects.	<input type="checkbox"/>						
We are often faster than our competitors in generating promising innovative ideas.	<input type="checkbox"/>						
We have a clear view on emerging customer needs.	<input type="checkbox"/>						
We are often faster than our competitors in adjusting our innovation projects to external changes (outside the organization).	<input type="checkbox"/>						
We have a clear view on emerging technologies.	<input type="checkbox"/>						
Usually, we are able to reduce uncertainty related to innovation project decisions.	<input type="checkbox"/>						
We regularly update our innovation projects when external change (outside the organization) demands it.	<input type="checkbox"/>						
The majority of our innovations involve technologies that make old technologies obsolete.	<input type="checkbox"/>						
We have a clear view on emerging market opportunities.	<input type="checkbox"/>						
The majority of our innovations use new technologies that permit quantum leaps in performance.	<input type="checkbox"/>						
We regularly have strategic discussions about innovation projects.	<input type="checkbox"/>						
We regularly identify disruptions that could endanger the success of our innovation projects.	<input type="checkbox"/>						

**Please indicate the extent to which you agree or disagree with each statement as it applies to your organization (the whole firm).**

**Our firm has performed very successfully during the last three years, with respect to:**

	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
New product/service introduction rate relative to the largest competitor.	<input type="checkbox"/>						
New product/service success rate relative to the largest competitor.	<input type="checkbox"/>						
Degree of new product/service differentiation.	<input type="checkbox"/>						
First to enter the market with new applications.	<input type="checkbox"/>						
New product/service cycle time (time-to-market) relative to the largest competitor.	<input type="checkbox"/>						

Acquiring the image of an innovative supplier relative to the largest competitor.

**Relative to competing new products/services during the last three years, our firm's new products/services are very successful, with respect to:**

	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
Return on investment	<input type="checkbox"/>						
Sales	<input type="checkbox"/>						
Market share	<input type="checkbox"/>						
Profitability	<input type="checkbox"/>						

**Please indicate the extent to which you agree or disagree with each statement as it applies to your organization (the whole firm).**

	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
Technological changes provide big opportunities in our industry.	<input type="checkbox"/>						
The widespread employment of a new or advanced process or product or service technology is characteristic of our industry.	<input type="checkbox"/>						
The frequency of changes in customer preferences is high.	<input type="checkbox"/>						
Patents or proprietary technology are often at the root of competitive advantage in our industry.	<input type="checkbox"/>						
Our ability to respond to market opportunities is high.	<input type="checkbox"/>						
This market is too competitive; price wars often occur.	<input type="checkbox"/>						
Having superior technical personnel is a key basis for competitive advantage in our industry.	<input type="checkbox"/>						
Anything that one competitor can offer, others can match easily.	<input type="checkbox"/>						
A large number of new product/service ideas have been made possible through technological breakthroughs in our industry.	<input type="checkbox"/>						
Our ability to reduce market uncertainty is high.	<input type="checkbox"/>						
The extent of turbulence in the market is high.	<input type="checkbox"/>						
There are too many similar products/services in the market, therefore it is very difficult to differentiate our brand.	<input type="checkbox"/>						
The technology in our industry is changing rapidly.	<input type="checkbox"/>						

Heavy investments in R&D are characteristic of our industry.

Our competitors are relatively weak.

**Please indicate the size of your firm (in full-time employees):**

<100  100-249  250-499  500-999  1000-1499  1500-2999  >3000

**Please indicate the age of your firm (in years):**

0-1  2-5  6-10  11-20  21-50  More than 50

**Please indicate the industry type of your firm:**

Banking, Investment, Insurance  Construction  Consumer Services  Manufacturing  
Consumer Goods  Engineering, Research & Development  Information Technology  Mining,  
Extraction, Oil  Management Consulting & Business Services  Retail or Wholesale Trade  
 Transportation or Public Utilities  Other (please specify)

**Please indicate your firm's annual sales in the last financial year (in Euros):**

Less than 10 million Euros  10-99 million Euros  100-999 million Euros  1-9.9 billion  
Euros  More than 10 billion Euros

**Please indicate the average annual growth in sales within the last three years:**

Less than 5%  5-9%  10-19%  20-34%  35-50%  More than 50%

**Please indicate the percentage of sales that comes from business to business markets (the remainder comes from consumer markets):**

%

**Please indicate the average annual return on sales in the last three year:**

Less than 0%  0-4%  5-9%  10-19%  20-35%  More than 35%

**Please indicate your firm's principal area in which its business activities take place:**

Regional  National  Continental  Global

**Please indicate the typical development time for new products or services (the elapsed time from ideation to market launch of a new product/service) in years:**

Less than 1  1-3  4-9  10-14  15-20  More than 20

**Thank you very much for participating in our study!**

**By ending this survey, you will be guided to our website where you can download our latest research reports.**

**If you are interested in participating in our workshop, please enter your email-address. We will contact you concerning further information.**

# APPENDIX B

## Survey 2

Dear participant,

Thank you for showing an interest in a study facilitated by Aarhus University and FH OÖ – University of Applied Sciences Upper Austria to better understand how firms deal with their new product/service development projects on various aspects.

Completing the survey will take approximately 15 minutes. Your answers to the survey will be treated as confidential.

Thank you very much for your participation!

*All data gathered through this survey will be used in a form that will make it impossible to determine the identity of the individual respondents or their organizations. Confidentiality of all survey responses is guaranteed.*

Throughout this survey, you will be asked questions that need to be answered for the specific project that matches the following criteria:

- It is a project to develop a new product or service for your company
- The new product or service of this project is facing market launch, or has been launched within the last 3 years
- You have been involved in this project for the majority of the project running time

1. Are you involved, or have you been involved in such a project?

- Yes
- No → exclude → end of survey

- *If you have been actively involved in multiple projects that fit the criteria, please select the project you are most involved with and keep this project in mind while answering the questions of this survey.*

In case, we contact you again at a later stage regarding the project, please provide us with a short abbreviation that helps you identify the project or product/service and please provide an email address for contacting you in this regard:

- Email: \_\_\_\_\_
- Project or product/service: \_\_\_\_\_

# **1. The following questions relate to your project, its status, activities performed, and resulting product or service.**

Questions may contain the wording 'new product', but this may refer to either a new product or a new service, depending on the project you chose.

<b>The outcome of the project is a:</b>
<input type="checkbox"/> Product <input type="checkbox"/> Service

<b>The new product/service from your project is a:</b>
<input type="checkbox"/> Business-to-business (B2B) solution <input type="checkbox"/> business-to-consumer (B2C) solution

<b>The new product/service that results from your project belongs in the following industry:</b>
<input type="checkbox"/> Fast-moving consumer goods <input type="checkbox"/> High-tech consumer goods (e.g. consumer electronics) <input type="checkbox"/> Other consumer goods <input type="checkbox"/> High tech industrial goods (e.g. electronics, IT-solutions, machine automation, vehicle components, medical equipment, machinery) <input type="checkbox"/> Other industrial goods
<i>*For any option selected, add a textbox indicating the respondent to fill out what industry exactly</i>

<b>Please indicate what best describes your project:</b>
<input type="checkbox"/> People from different departments were actively involved in the project <input type="checkbox"/> Only people from a single department were actively involved in the project

<b>Please indicate the current status of your project:</b>
<input type="checkbox"/> Investigation / pre-development phase <input type="checkbox"/> Development phase <input type="checkbox"/> Testing / validation phase <input type="checkbox"/> Market launch, or less than 1 year on the market <input type="checkbox"/> More than 1 year after market launch

Going by the current status of the project...	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
... it can be regarded as successful.	<input type="radio"/>						
... all project goals have been achieved.	<input type="radio"/>						
... the output of the project is of high quality.	<input type="radio"/>						
... the team, which is responsible for this project, is satisfied with its performance.	<input type="radio"/>						
... our top management can be fully satisfied with the progress of this project.	<input type="radio"/>						

**Please indicate the extent to which you agree or disagree with each statement as it applies to...**

***The product or service resulting from your project:***

	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
In order to develop and introduce the new product/service, we had to significantly change our organizational structure	<input type="radio"/>						
In order to develop and introduce the new product/service, we had to significantly change our production processes	<input type="radio"/>						
In order to develop and introduce the new product/service, we had to significantly change our organizational culture	<input type="radio"/>						
In our organization, future-related research activities are issue driven (i.e. directed by a specific question).	<input type="radio"/>						
In order to introduce the new product, changed industry norms had to be established	<input type="radio"/>						
In order to introduce the new product, regulations had to be changed	<input type="radio"/>						
In order to introduce the new product, values and norms in the society in general had to be adapted	<input type="radio"/>						
Our new product was based on new technological principles	<input type="radio"/>						
The technology we used allowed significant performance enhancements.	<input type="radio"/>						
Our new product can be characterized as being based on very new technological components	<input type="radio"/>						
Our new product offered a new customer value not offered before by any other product.	<input type="radio"/>						
Our new product created a totally new market	<input type="radio"/>						
Our new product changed the way our market functions.	<input type="radio"/>						

**Please indicate the extent to which you agree or disagree with each statement as it applies to...**

***Your project:***

	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
We scanned for potential relevant key trends, opportunities, or threats in the periphery of the target market	<input type="radio"/>						
We looked out for short-term and long-term changes which could impact the new product	<input type="radio"/>						
We consulted a large variety of information sources to provide us with issues, such as future threats or future opportunities, relevant to our new product	<input type="radio"/>						
We continuously scanned for future issues, either threats or opportunities, for our new product	<input type="radio"/>						
We tracked key trends, policies, and tactics of competitors	<input type="radio"/>						
We deliberately sought for future issues, such as threats or opportunities, that could come up for our new product	<input type="radio"/>						
We had formalized evaluations of future issues, such as opportunities or threats, for our new product	<input type="radio"/>						
A structured and deliberate effort was made to predict the future success of our new product	<input type="radio"/>						
We used systematic approaches to understand the future of markets and/or technologies related to new product	<input type="radio"/>						
Systematic approaches were used to interpret what the future could bring for the new product	<input type="radio"/>						
We used systematic approaches to create an understanding of how trends could influence our new product	<input type="radio"/>						
In order to interpret potential future issues to the new product, we used specific systematic approaches	<input type="radio"/>						
Project members brought forward issues that could endanger the future success of our product in the marketplace	<input type="radio"/>						
Information on future issues related to the new product, such as threats or opportunities, were brought forward by project members	<input type="radio"/>						
Project members frequently challenged whether the assumptions on markets and/or technologies would hold in the future	<input type="radio"/>						
Project members were encouraged to bring forward any kind of future issues, such as opportunities or threats, that could be relevant for the new product	<input type="radio"/>						
We relied principally on personal judgment (rather than formalized analysis) when interpreting future threats or opportunities to our new product	<input type="radio"/>						
Determining what the future would hold for the new product was much more affected by personal interpretations than by the results of formal and systematic evaluation	<input type="radio"/>						

	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
The entire project task (scope) was structured in work packages.	<input type="radio"/>						
Every work package was allocated with a specific time allowance.	<input type="radio"/>						
Resources (personnel, financial) were assigned to the work packages.	<input type="radio"/>						
There was a detailed budget plan for the project.	<input type="radio"/>						
Team member responsibilities were defined.	<input type="radio"/>						

	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
Overall, most senior company executives supported the vision of this project	<input type="radio"/>						
Overall, senior company management helped surmount rather than create obstacles for this project	<input type="radio"/>						
During team meetings, senior company management, if present, frequently made encouraging versus discouraging remarks	<input type="radio"/>						
When the team members asked for help from senior company management, they received it	<input type="radio"/>						

	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
<b>In this project team...</b>							
...members generally like the other members.	<input type="radio"/>						
...members like to stay in this team.	<input type="radio"/>						
...there is a high team spirit.	<input type="radio"/>						
...members appreciate each other personally.	<input type="radio"/>						
...members enjoy being a member of this project.	<input type="radio"/>						

## **2. The following questions relate to the involvement of external stakeholders in your project.**

*External stakeholders* are individuals or groups who are external to your firm and can affect or are affected by the achievement of your firm’s objectives.

**Please indicate the extent to which you agree or disagree with each statement as it applies your project:**

	Not at all	To a very small extent	To a small extent	Somewhat	To some extent	To a fairly great extent	To a great extent
<b>We <i>involved</i> the following stakeholders in our project:</b>							
Trade Agents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Suppliers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Providers of complementary products	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Competitors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Owners, Shareholders	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Banks, Insurance Companies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Current Customers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Potential customers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Political administration officers, politicians, and legislators	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
NGOs, pressure groups (e.g. environmental organizations, Human rights organizations, Consumer organizations)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Press/Journalists/Media	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
General Public/Society	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Local Communities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Think Tanks, Research Institutions, Consultancies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bloggers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Not at all	To a very small extent	To a small extent	Somewhat	To some extent	To a fairly great extent	To a great extent
<b>We <i>perceived pressure</i> from the following external stakeholders in our project:</b>							
Trade Agents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Suppliers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Providers of complementary products	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Competitors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Owners, Shareholders	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Banks, Insurance Companies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Current Customers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Potential customers	<input type="radio"/>							
Political administration officers, politicians, and legislators	<input type="radio"/>							
NGOs, pressure groups (e.g. environmental organizations, Human rights organizations, Consumer organizations)	<input type="radio"/>							
Press/Journalists/Media	<input type="radio"/>							
General Public/Society	<input type="radio"/>							
Local Communities	<input type="radio"/>							
Think Tanks, Research Institutions, Consultancies	<input type="radio"/>							
Bloggers	<input type="radio"/>							

	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
The different external stakeholders had contradictory objectives.	<input type="radio"/>						
Tensions existed between issues that external stakeholders raised.	<input type="radio"/>						
The different external stakeholders had needs and requirements that were difficult to bring together	<input type="radio"/>						
Concessions toward specific external stakeholders negatively impacted other external stakeholders' interests.	<input type="radio"/>						
Balancing the demands from different external stakeholder groups was challenging for us.	<input type="radio"/>						

	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
<b>In our project, we involved external stakeholders ...</b>							
...for meetings to facilitate dialogue about possible consequences, either positive or negative, of the new product on external stakeholders.	<input type="radio"/>						
...for consultations to recognize positive and negative consequences of the new product on external stakeholders	<input type="radio"/>						
...to join future-oriented activities as team members (e.g. in scenario analysis workshops) to consolidate on possible consequences, either positive or negative, of the new product on external stakeholders	<input type="radio"/>						
...to allow for open communication among our project team members and external stakeholders during the project	<input type="radio"/>						
...to facilitate a high degree of information sharing among our project team members and external stakeholders for the project	<input type="radio"/>						
...to jointly work out problems or issues external stakeholders may have with our project	<input type="radio"/>						

	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
<b>In our project...</b>							
... we developed knowledge about a very diverse set of external stakeholders.	<input type="radio"/>						
... we developed strategies for dealing with very diverse external stakeholder groups.	<input type="radio"/>						
... we established relationships with very diverse external stakeholder groups.	<input type="radio"/>						
... we successfully dealt with very different issues raised by diverse external stakeholder groups.	<input type="radio"/>						

	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
<b>In our project...</b>							
... we developed deep knowledge about the profiles and behavior patterns of our most important stakeholders.	<input type="radio"/>						
... we developed strategies for dealing with our most important external stakeholders.	<input type="radio"/>						
... we established strong relationships with our most important external stakeholders.	<input type="radio"/>						
... we successfully dealt with the issues raised by our most important external stakeholders.	<input type="radio"/>						

	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
<b>The new product/new service of our project...</b>							
... achieved high levels of external stakeholder satisfaction	<input type="radio"/>						
... delivered value to our external stakeholders	<input type="radio"/>						
... delivered what our external stakeholders want	<input type="radio"/>						
... fostered harmony with our external stakeholders	<input type="radio"/>						

### **3. The following questions relate to your own firm in general.**

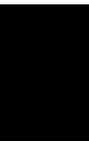
<b>Overall, the top management of our company...</b>	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
...is very oriented towards external stakeholders.	<input type="radio"/>						
...always has the external stakeholders' best interest in mind.	<input type="radio"/>						
...enjoys interacting with external stakeholders.	<input type="radio"/>						

<b>In general, the operating management philosophy in my firm favors...</b>	Strongly Disagree	Disagree	Somewhat Disagree	Undecided	Somewhat Agree	Agree	Strongly Agree
Highly structured channels of communication and a highly restricted access to important financial and operating information.	<input type="radio"/>						
A strong insistence on uniform managerial style throughout the firm	<input type="radio"/>						
A strong emphasis on always getting personnel to follow the formally laid procedures.	<input type="radio"/>						

<b>Please indicate your firm's annual sales in the last financial year (in Euros)</b>
<input type="checkbox"/> Less than 2 million € <input type="checkbox"/> 2-9 million € <input type="checkbox"/> 10-49 million € <input type="checkbox"/> 50-99 million € <input type="checkbox"/> 100-999 million € <input type="checkbox"/> 1 billion € and more
<b>Please indicate the size of your firm (in full-time employees):</b>
<input type="checkbox"/> Less than 100 <input type="checkbox"/> 100-249 <input type="checkbox"/> 250-499 <input type="checkbox"/> 500-999 <input type="checkbox"/> 1000-1499 <input type="checkbox"/> 1500-2999 <input type="checkbox"/> More than 3000
<b>Please indicate the age of your firm (in years):</b>
<input type="checkbox"/> 0-1 <input type="checkbox"/> 2-5 <input type="checkbox"/> 6-10 <input type="checkbox"/> 11-20 <input type="checkbox"/> 21-50 <input type="checkbox"/> More than 50



# Appendix C



## Co-author statements

1. Why do firms engage in forward-looking search? Internal and external determinants
  - Tymen Jissink, Eelko K.R.E. Huizingh, René Rohrbeck
2. Forward-looking search and innovation performance: The role of innovation portfolio agility
  - Tymen Jissink, Eelko K.R.E. Huizingh, René Rohrbeck
3. Forward-looking search during innovation project development: Under which conditions does it impact innovativeness?
  - Tymen Jissink, Fiona Schweitzer, René Rohrbeck

### Declaration of co-authorship\*

Full name of the PhD student: Tymen Jissink

This declaration concerns the following article/manuscript:

Title:	Why do firms engage in forward-looking search? Internal and external determinants
Authors:	Tymen Jissink, Eelko K.R.E. Huizingh, René Rohrbeck

The article/manuscript is: Published  Accepted  Submitted  In preparation

If published, state full reference:

If accepted or submitted, state journal:

Has the article/manuscript previously been used in other PhD or doctoral dissertations?

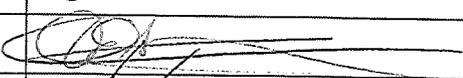
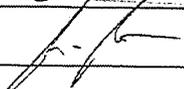
No  Yes  If yes, give details:

The PhD student has contributed to the elements of this article/manuscript as follows:

- A. Has essentially done all the work
- B. Major contribution
- C. Equal contribution
- D. Minor contribution
- E. Not relevant

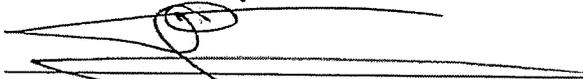
Element	Extent (A-E)
1. Formulation/identification of the scientific problem	A
2. Planning of the experiments/methodology design and development	C
3. Involvement in the experimental work/clinical studies/data collection	C
4. Interpretation of the results	A
5. Writing of the first draft of the manuscript	A
6. Finalization of the manuscript and submission	B

#### Signatures of the co-authors

Date	Name	Signature
26/1/2017	Eelko K.R.E. Huizingh	
24/01/2017	René Rohrbeck	

Date: 24/01/2017

In case of further co-authors please attach appendix

  
Signature of the PhD student



### Declaration of co-authorship\*

Full name of the PhD student: Tymen Jissink

This declaration concerns the following article/manuscript:

Title:	Forward-looking search and innovation performance: The role of innovation portfolio agility
Authors:	Tymen Jissink, Eelko K.R.E. Huizingh, René Rohrbeck

The article/manuscript is: Published  Accepted  Submitted  In preparation

If published, state full reference:

If accepted or submitted, state journal:

Has the article/manuscript previously been used in other PhD or doctoral dissertations?

No  Yes  If yes, give details:

The PhD student has contributed to the elements of this article/manuscript as follows:

- A. Has essentially done all the work
- B. Major contribution
- C. Equal contribution
- D. Minor contribution
- E. Not relevant

Element	Extent (A-E)
1. Formulation/identification of the scientific problem	B
2. Planning of the experiments/methodology design and development	C
3. Involvement in the experimental work/clinical studies/data collection	C
4. Interpretation of the results	A
5. Writing of the first draft of the manuscript	A
6. Finalization of the manuscript and submission	A

#### Signatures of the co-authors

Date	Name	Signature
26/1/2017	Eelko K.R.E. Huizingh	
24/01/2017	René Rohrbeck	

Date: 24/01/2017

In case of further co-authors please attach appendix

Signature of the PhD student

\*As per policy the co-author statement will be published with the dissertation.



**Declaration of co-authorship\***

Full name of the PhD student: Tymen Jissink

This declaration concerns the following article/manuscript:

Title:	Forward-looking search during innovation project development: Under which conditions does it impact innovativeness?
Authors:	Tymen Jissink, Fiona Schweitzer, René Rohrbeck

The article/manuscript is: Published  Accepted  Submitted  In preparation

If published, state full reference:

If accepted or submitted, state journal:

Has the article/manuscript previously been used in other PhD or doctoral dissertations?

No  Yes  If yes, give details:

The PhD student has contributed to the elements of this article/manuscript as follows:

- A. Has essentially done all the work
- B. Major contribution
- C. Equal contribution
- D. Minor contribution
- E. Not relevant

Element	Extent (A-E)
1. Formulation/identification of the scientific problem	B
2. Planning of the experiments/methodology design and development	C
3. Involvement in the experimental work/clinical studies/data collection	B
4. Interpretation of the results	A
5. Writing of the first draft of the manuscript	A
6. Finalization of the manuscript and submission	A

**Signatures of the co-authors**

Date	Name	Signature
25/01/2017	Fiona Schweitzer	
24/01/2017	René Rohrbeck	

Date: 24/01/2017

In case of further co-authors please attach appendix

Signature of the PhD student

\*As per policy the co-author statement will be published with the dissertation.