Managing the Innovation Paradox of Exploitation and Exploration in R&D

Is measurement of innovation the key to promote exploration?

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Master of Science Thesis TRITA-ITM-EX 2018:181
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It is not the strongest of the species that survive, nor the most intelligent, but the one most responsive to change.

- Charles Darwin
Abstract

Managing the paradox of exploitation and exploration symbolises the simultaneous pursuit devoting enough resources to exploitation to ensure short-term profits and, at the same time, enough resources to exploration to ensure future organisational viability. Previous research advocates that sustained organisational performance and success highly depends on the interaction of exploitation and exploration or in other words, the balancing act between change and continuity. To strategically balance these contradictory requirements is a challenging task for most organisations since exploitation and exploration require fundamentally different organisational structures, processes, strategies and capabilities. Organisations that possess the ability to balance these contradictory requirements are referred to as ambidextrous organisations, what is evident is however that different ambidextrous strategies bring several distinctive challenges that organisations explicitly must deal with. Past literature advocates that management constitute an important part in creating organisational ambidexterity, but has nevertheless due to differentiations in organisational contexts resulted in ambiguous guidance in how to practically solve the tensions between exploitation and exploration.

Scania the initiator of this thesis project, one of the world´s leading manufacturers within trucks and buses for heavy transport applications is sensing uncertainty in what undoubtedly used to be a relatively stable environment. Continues improvements has been a fundamental strategy in R&D for decades but in the face of a potentially disruptive technological shift, Scania senses urgency to leverage the innovation capability they possess, to reclaim the exploration space in order to act and seize upon these uncertainties.
The purpose of this thesis is to explore how management can support and sustain the exploration space in a mature R&D department.

This study builds upon a qualitative case study limited to a specific R&D department, Truck Chassis Development. To draw parallels and provide a deepened understanding of how the specific context of the organisation affect section managers at Truck Chassis Development in supporting and enabling exploration, interview data from several departments at R&D and sales & marketing is analysed.

Results from this research show that there is an overall pressure for exploitation in R&D in general, and that section management encounter several challenges in supporting and sustaining the exploration space. An overall pressure for delivery precision crowds out time for exploration and present performance measurements are found to further add to this challenge since they are, to a large extent designed to measure and follow-up the relatively more certain and superior benefits from exploitation, implying that they tend to induce and support exploitative activities. The research findings provide managerial implications in terms of directing attention towards exploration through measurements of exploration.

Key-words: innovation, exploitation, exploration, organisational ambidexterity, ambidextrous leadership, performance measurement, process management.
Sammanfattning

Att balansera innovationsparadoxen syftar till den organisatoriska förmågan att tillägna tillräckliga resurser för exekvering för att säkerställa kortsiktigt vinst, och samtidigt, tillräckliga resurser till utforskande för att säkra ett strategiskt framtida läge. Tidigare forskning visar att organisationers långsiktiga överlevnad är beroende av dessa avvägningar, att leverera produkter med högt kundvärde är viktigt för dagens affär men får inte göras på bekostnad av att utforska möjligheter som kan resultera i framtida innovationer. Att strategiskt balansera dessa två perspektiv utgör en stor utmaning för alla organisationer eftersom att exekvering och utforskande aktiviteter kräver helt olika förutsättningar när det kommer till strukturer, processer och strategier. Företag som besitter förmågan att balansera dessa två helt olika perspektiv brukar refereras som tvehänta. Tvehänta organisationer har visat sig balansera dessa två perspektiv på olika sätt, vilka alla medför utmaningar, dock av olika slag. Tidigare forskning har betonat ledarskap och chefskap som viktiga faktorer i skapandet av tvehänta organisationer men har på grund av organisatoriska differentieringar och olikheter resulterat i vaga riktlinjer angående hur man praktiskt löser de utmaningar som uppstår mellan exekverande och utforskande aktiviteter.


Syftet med detta examensarbete är att undersöka hur management kan möjliggöra och främja utforskande aktiviteter i en mogen FoU-avdelning.
Den utförda forskningen grundar sig i en kvalitativ fallstudie som är avgränsad till en specifik FoU-
avdelning, chassiuutveckling för lastbil. För att få en djupare förståelse för ledarskap och det
ledarskapsansvar som finns i att främja och stödja utforskningsaktiviteter kräver vissa
organisationsiska förutsättningar har ett flertal avdelningar inom FoU-organisationen samt sälj &
marknad inkluderats i studien.

Den utförda forskningen visar att chefer på den undersökta avdelningen möter av ett flertal
utmaningar när de försöker möjliggöra och främja utforskningsaktiviteter. Det grundar sig främst
i ett högt focus på leveransprecision som begränsar chefer i sin roll att stödja och främja
utforskningsaktiviteter, följden av detta resulterar i begränsat med tid för utforskningseftersom
dessa aktiviteter inte prioriteras. Nuvarande prestationsmätning visar indikationer på att ytterligare
bidra till dessa utmaningar eftersom de avser att mäta till den största grad, leveransprecision, kvalité
och kostnad och där utforskningsaktiviteter saknar prestationsmätning. Resultatet av denna studie
bidrar med praktiska implikationer för den studerade avdelningen. Eftersom att uppmärksamhet
är den mest begränsade resursen har mätvärden för utforskningsaktiviteter föreslagits då mätning
och styrning av utforskningsaktiviteter kan bidra till att dessa aktiviteter uppmärksammas samtidigt
som de kan utgöra ett stöd för sektionscheferna i deras roll att främja och stödja utforsknings
aktiviteter.
Acknowledgements

This thesis concludes our Master of Science degree in Industrial Engineering and Management at Royal Institute of Technology, KTH. Conducting this research has been a truly remarkable journey, while it has allowed us to explore interesting and very important areas, it has at the same time been a research filled with intellectual challenges and uncertainties allowing for insights we never could have imagined a master thesis would bring. With that being said, it would have been impossible without the help and support of many people.

First and foremost, we want to express our very gratefulness to our supervisor at Scania, Kent Johansson, who have provided us with immense personal support, challenged our ideas and allowing us to actively take part of the organisation. Thank you for the exciting opportunity to explore the innovation paradox at Scania's R&D department, Truck Chassis Development.

A special acknowledgement goes to our supervisor at Royal Institute of Technology, Lars Uppvall. Your profound academic support, guidance and recognition of our thoughts, as well as thoroughly reading and commenting our work have been invaluable sources of support.

Lastly a special thanks to all employees working at Truck Chassis Development, and informants at Scania that we have come across, for providing us with invaluable sources of information. Without your unreserved devotion of time and dedication this research would simply not have been possible!

We hope that all readers of this master thesis find it interesting. In particular, we hope that Truck Chassis Development, Scania, and its individuals, find valuable insights into the innovation paradox, and through those insights find embracement in how exploration and employee creativity can be absorbed and attained in their organisation.

Thank you all for making this happen!

Sincerely,

Michelle Karlsson
Charlotte Vesterlund

Stockholm, June 2018
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Chapter 1

INTRODUCTION
1 Introduction

This chapter introduces the paradox of exploitation and exploration, or in other words, the challenge many organisations face, to simultaneously engage in sufficient exploitation to serve current markets, and at the same time, in sufficient exploration in order to prosper in future markets. The background presents why organisations struggle to balance these contradictory requirements and why it is a necessity for organisations to incorporate and support strategic initiatives to manage the tensions between exploitation and exploration. Tensions that becomes especially evident in the face of a potentially disruptive technological shift, and that management pose a significant responsibility in balancing these contradictory requirements emerging form the simultaneous engagement in exploitation and exploration. Further is problematisation and the thesis purpose with its belonging research questions posed along with corresponding delimitations. This is followed by contributions and a brief description of the thesis theoretical positioning. Lastly, is a disposition of the thesis presented which allows for an overview of its subsequent chapters.

1.1 Background

The dual perspectives of attaining exploitation and exploration within the same business unit is something that has kept researches occupied for decades. Since March (1991) published his pioneering article the innovation terms, exploitation and exploration have come to constitute a central part of organisational analysis in relation to technological innovation, competitive advantage, adaptation, and thus organisational survival. While exploitation is associated with efficiency, refinement, production, and incremental innovation, exploration characterises firm behaviours of search, risk-taking, experimentation, flexibility, variation and the strive towards radical innovation (March, 1991). The paradoxical relationship between exploitation and exploration and the challenge organisations face to balance these conflicting necessities simultaneously has emerged into a research stream referred to as organisational ambidexterity (Tushman & O’Reilly III, 1996). Tensions between exploitation and exploration is the heart of organisational ambidexterity theory, which underlines the need for organisations to simultaneously exploit and explore in order to possess the ability to compete in existent and emerging markets (Tushman & O’Reilly III, 1996). Several researchers advocate that sustained organisational performance and success highly depends on the interaction of exploitation and exploration or in other words, the balancing act between change and continuity (Brown & Eisenhardt, 1997; Raisch, Birkinshaw, Probst, & Tushman, 2009; Tushman & O’Reilly III, 1996).

Research and development (R&D) departments must explicitly deal with the tensions between exploitation and exploration as R&D departments are responsible for product development which entails to a certain extent the exploitation of existing capabilities to provide existing customers with high quality products within a shortened time-span. At the same time, R&D departments are responsible for exploring and researching areas that possibly will result in the generation of products suitable for tomorrows customers’ needs.
While exploiting existing capabilities to a certain degree might foster structural inertia\(^1\) and thus reduce an organisation's ability to adapt to future changes. Exploration on the other hand might reduce the speed of incremental innovation due to disruption of current successful routines and hence loss in existing business (Tushman & O'Reilly III, 1996). As summarised by Levinthal and March (1993):

"The basic problem confronting an organisation is to engage in sufficient exploitation to ensure its current viability and, at the same time, to devote enough energy to exploration to ensure its future viability."

- Levinthal and March (1993) p. 105

What is rather evident is that in times where efficiency and speed become critical and competitive factors as in the case for industries operating in mature markets, increased routinisation and coordination evolves as strategies to foster exploitation and incremental innovation (Levinthal & March, 1993). Throughout history there are numerous examples of mature organisations that have shown the inability to respond appropriately to changes in their external environment. Kodak is such an example, Kodak were first to invent the technology behind digital cameras but failed to seize the window of opportunity when digital cameras became the new business (Birkinshaw, Zimmermann, & Raisch, 2016). Incumbent firms possess great positions to seize disruptive opportunities but still sometimes fail to embrace them, Leonard-Barton (1992) advocates the possible explanation, that core capabilities in mature organisations over time turns into core rigidities.

Theoretically the ambidexterity theory, to simultaneously achieve both exploitation and exploration within the same business unit is conceptually rather straightforward to apprehend, but in practice it is not an easy capability to achieve (McCarthy & Gordon, 2011). Several researchers emphasise that the dynamic capability to both exploit and explore require a management that adapts, integrates and reconfigures organisations skills and resources in order to face environmental change (O’Reilly III & Tushman, 2011; Jansen, George, Van den Bosch, & Volberda, 2008; Smith & Tushman, 2005; Andriopoulos & Lewis, 2009). The managerial challenge lies not only in justifying exploitation and exploration as the strategic intent and vision of an organisation, more importantly it is the managing act between the tensions that arise from exploitation and exploration and their conflicting relationships with existing organisational architectures (O’Reilly III & Tushman, 2011).

1.1.1 Case Company

Scania, the initiator of this thesis project is one of the world's leading manufacturers within trucks and buses for heavy transport applications. Approximately 3500 employees work at the R&D department in Södertälje with the development of heavy trucks, buses and industrial engines. Scania separates its product development process into three different processes; (1) the yellow arrow process,

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\(^1\) As organisations increase in size they tend to develop processes and structures to cope with the complexity of executing work efficiently and effectively. When these processes and structures further becomes imbedded in organisational routines, changes becomes difficult and costly to implement which results in structural inertia, an underlying organisational resistance. "A resistance to change rooted in the size, complexity and interdependence in the organisation’s structures, systems, procedures and processes." (Tushman & O’Reilly III, 1996)
which is inclusive of research, advanced engineering and concept development, (2) the *green arrow process* which is industrialisation, here concepts are specified, verified, and further validated, and (3) the *red arrow process* constitute projects which deals with maintenance of the current product range in an efficient and effective manner.

Scania’s entire production system builds upon modularisation which allows for as few components as possible to create almost infinite product combinations. This implies, meeting the needs of customisation without interfering on product volume. The introduction of the modularisation strategy has generated unrivalled profit margins compared to other actors within their industry, and thus considered as one of Scania’s core capabilities.

### 1.2 Problematisation

The internal combustion engine has been dominating the heavy vehicles industry in which Scania operates for several decades and thus allowed for incremental advancements of this dominant design. Implementation of process management approaches such as lean and six sigma in R&D has further allowed Scania to strive for efficiency, quality targets and a product development work based on routinisation. To exploit existing capabilities alongside with constantly nurturing an environment of continuous improvement has allowed Scania to prosper during the current technological paradigm. However, actors in this industry are now sensing uncertainty in what undoubtedly used to be a relatively stable environment. New technologies such as electrification and automation are emerging which marks a complexity for an organisation where current processes and structures are deeply rooted in continuous improvements and incremental innovation.

To problematise the tensions between exploitation and exploration even further in R&D, a feature of managing and controlling R&D has been the search for effective control systems that enables and directs R&D behaviours and outcomes. The focal point within control systems have been on performance measurements systems which tend to stimulate measurable innovation or exploitation (Mccarthy & Gordon, 2011). The managerial challenge is inevitable and must more explicitly deal with the strategic initiative to simultaneously pursue exploitation for the success of current businesses and at the same time emphasise the exploration of emerging technologies for sustained success and adaptation (O’Reilly & Tushman, 2008). Researchers within adaptive systems² have extensively studied the innovation strategies, exploitation and exploration, and claimed their respective significance to the short-term profit and long-term sustained performance for organisations (Raisch, Birkinshaw, Probst, & Tushman, 2009; He & Wong, 2004). This has however due to organisational context complexities left clear managerial implications insufficiently represented.

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² Adaptive systems in this context refers to the co-evolution between an organisation and its environment, and thus organisations ability to adapt to changes in their environment. “The interplay between a system and its environment and the co-evolution of both the system and the environment” (Choi, Dooley, & Rungrusanatham, 2001, p. 352).
1.3 Purpose and Research Questions

The purpose of this thesis is to explore how management can support and sustain the exploration space in a mature R&D department. To operationalise the purpose, one main research question, derived into two sub-questions will be answered:

**Main Question:** How can management support and sustain the exploration space in a mature R&D department?

**SQ 1:** What challenges are encountered by management in their role as providers and enablers for exploration?

**SQ 2:** How can the design and use of performance measurements support management of exploration?

1.4 Delimitations and Limitations

This thesis is delimited to explore how management can support and sustain the exploration space in a mature R&D department. More explicitly, this also implies exploring managerial challenges and management behaviours required to deal with the tensions between exploration and exploitation. This denotes that the study is delimited to the individual level within the system perspective. How this choice of delimitation may affect other levels is further evaluated and critically discussed in implications for practice, Chapter 6.

The scope of this project is further delimited to concept development within the yellow arrow process of Scania’s product development process. This part of product development naturally imposes the need for activities to be explorative. Separating the yellow arrow process from the green arrow process is an effort for exploration to thrive in product development. The green arrow process which makes up industrialisation and the red arrow process which constitute projects dealing with errors and quality issues is purposely left out as these processes to a certain extent by default require routinisation.

Lastly, this research is limited to truck chassis development, RT, a sub-department of Scania’s R&D department. Scania’s R&D consists of 4 sectors in total, each sector is divided into several departments and each department is further divided into different sections, an overview of the entire R&D department structure is presented below, see Figure 1. This limitation implies that the study is limited to a single case, namely the case of truck chassis development which also denotes that managerial implications are limited to this specific department. However, empirical data has been obtained from various R&D departments and sales & marketing to analyse and provide a deepened understanding of how the current organisational architecture affect management, coordinating time and resources between exploitation and exploration.

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3 The system perspective implies three levels of analysis, the individual and organisational level which is the focus of this report, the functional level and the industrial level. Implications of an encountered problem might come to cause effects on other levels than the investigated and these levels should therefore be addressed accordingly. The functional level emphasises a process and production perspective and the possible effects on organisational structure. And the industrial level emphasises the impact changes may have on a larger scale, inter-business related within the industry (Blomkvist & Hallin, 2015).
1.5 Contribution

Previous literature has extensively studied the innovation paradox between exploitation and exploration in ambidextrous organisations (March, 1991; He & Wong, 2004; O’Reilly III & Tushman, 2011), stretching from individual (Lund Stetler, 2015), managerial (Lubatkin, Simsek, Ling, & Veiga, 2006) and organisational perspectives (Raisch, Birkinshaw, Probst, & Tushman, 2009). Several researchers have also advocated that management constitute a central role in managing the conflicting tensions that arises in ambidextrous organisations (O’Reilly III & Tushman, 2011; Jansen, George, Van den Bosch, & Volberda, 2008; Smith & Tushman, 2005; Andriopoulos & Lewis, 2009). Managerial implications have however remained insufficiently represented due to differentiations in organisational contexts. By exploring how management can support and sustain the exploration space in a mature R&D department, we contribute practically to the case company by analysing why current processes and strategies does not favour exploration or support management in balancing these conflicting needs. We further contribute to the case company by presenting a different viewpoint on performance measurements and its relation to exploitation and exploration. By describing why current performance measurements support and foster exploitative activities and by presenting performance measurements of exploration which possess the ability to provide management with support to justify exploration.

This research also contributes with empirical insights to theory as its provides thorough explanations of the managerial challenge that resides in supporting exploration within a specific context. Prominent in this research is the context of modularisation and the potentiality of a disruptive technological shift in the heavy vehicles industry. This research emphasises the managerial challenge in a specific organisational context where processes and strategies currently favours exploitation, and thus why the managerial behaviour of favouring exploitative activities in front of more explorative ones occur.

1.6 Theoretical Positioning

This research positions itself within the field of organisational ambidexterity and more explicitly, within tensions between exploitation and exploration, see Figure 2. The research stream of organisational ambidexterity emerged as a response to how organisations survive in the face of change (Tushman & O’Reilly III, 1996). It is a complex area of research as it spans over several research fields. Ambidextrous organisations possess the capability to simultaneously pursue the exploitation of existing capabilities and the exploration of new opportunities (Raisch, Birkinshaw,
Probst, & Tushman, 2009) albeit in different ways depending on different strategic organisational configurations. Different strategies pose different organisational and managerial challenges in balancing contradictory requirements from exploitation and exploration. It is our aim to problematise the tensions between exploitation and exploration, and to provide understandings for why and how organisations desire to balance the paradox in different ways with the support of ambidexterity theory. Process management was intentionally supposed to coordinate and improve production related work, however, it has gotten increased attention in R&D in order to enhance process efficiency (Benner & Tushman, 2003) and therefore pose significant implications for exploration to thrive. Other relevant areas that might have practical implications on ambidexterity is organisational strategies and innovation measurements as strategy and measurement can direct and control R&D outcome as well as support exploitative and explorative activities. Lastly, as managerial behaviours are advocated to possess a significant mean towards balancing the paradox (Andriopoulos & Lewis, 2009) the linkage between ambidextrous leadership and organisational ambidexterity constitute a central aspect in our research to provide understanding for how management can contribute to balance the paradox, as well as analyse if management is provided with the organisational support that is needed.

Figure 2: Areas of relevance to explore managerial challenges that resides in enabling and supporting exploration lies at the very heart of ambidexterity theory. Organisational strategy, ambidextrous leadership and process management approaches are further areas that supposedly possess an influential impact on ambidexterity. The dashed arrow highlight remarks from this thesis, that innovation measurements if designed appropriately could support management in their work coordinating resources and time to balance the paradox.

1.7 Disposition of the Thesis

The introduction chapter introduces the paradox many organisations find problematic to master, to engage simultaneously in sufficient exploitation and exploration. It highlights the challenge Scania faces, to reclaim the exploration space in the face of a potential disruptive technology shift. The following chapter presents pervious research within specific and closely relating areas which allows the reader to get familiarised with areas of organisational ambidexterity, organisational
strategy and ambidextrous leadership, and how these areas are linked together. This is followed by the methodology used in this thesis, how the research has been conducted and the approach towards answering the posed research questions. Thereafter, the results from the data collection are presented, which serves as a foundation for a more thorough analytical discussion. Lastly, the concluding aspects from this research with regards to the research questions and the thesis purpose are presented. A disposition overview is illustrated below in Table 1.

Table 1 Disposition of the report, inclusive of main sections in each of the chapters.

1. Introduction

- Background
- Problematisation
- Purpose & Research Questions
- Delimitations
- Contributions
- Theoretical Positioning

2. Managing the Paradox of Exploitation and Exploration

- The Interplay between Exploit and Explore
- Strategies to Balance the Paradox
- Practical Implications on Ambidexterity
- Ambidextrous Leadership

3. Methodology

- Research Approach
- Data Collection
- Data Analysis
- Research Quality
- Research Process

4. Results

- Product Development in R&D
- Strategies to Manage R&D
- The Managerial Challenge

5. Discussion

- Pressure for Exploitation
- The Managerial Challenge at Truck Chassis Development
- “Attention” focus through Performance Measurements
- Theoretical Implications
- Revisiting the Research Process

6. Managerial Implications

- Managing Exploitation and Exploration in R&D
- Measurements of Exploration
- Sustainability Implications

7. Conclusion

- Revisiting the Research Questions
- Future Research
Chapter Summary

This chapter introduces the challenge confronting R&D departments, to exploit existing capabilities for short-term profits and to explore new possibilities for long-term sustained success. Due to the many differences and dependencies of exploitation and exploration, organisations tend to favour exploitation at the expense of exploration or the inverse. The background highlights the tensions that arise between exploitation and exploration in times where uncertainty replaces the relatively stable ones. Scania, the case company, a world leading manufacturer within trucks and buses for heavy vehicle transportations has during decades provided customers with products of prominent qualities due to organisational processes and strategies in place for incremental advancements of the combustion engine that has been dominating their industry. Facing a potential disruptive technology shift, Scania is sensing the urgency to reclaim the exploration space in order to adapt and seize opportunities appearing in their surroundings. The purpose of this thesis is to explore how management can support and sustain the exploration space in a mature R&D department.
Chapter 2

LITERATURE REVIEW
This chapter builds upon theory in the field of organisational ambidexterity, a research stream that has evolved as a response to how organisations balance the tensions between exploitation and exploration. Different viewpoints on exploitation and exploration are presented to provide understandings for challenges that lies in attaining both of these contradictory requirements in the same organisation. Exploitation and exploration are defined differently in past literature and this research builds on March (1991) view on how exploitation and exploration should be defined, namely, as different types of learning. This viewpoint allows for the realisation and explanation that there are different dimensions of exploitation and exploration, and that these different dimensions contribute differently to organisational targets; short-term profits and long-term sustained success. Further are different ambidexterity strategies presented, which all allow organisations to balance tensions between exploitation and exploration, albeit in different ways. Different ambidexterity strategies bring different advantages and challenges and thus pose significantly different impacts for management, enabling and supporting exploration. In this research is the contextual ambidextrous approach especially emphasised since Scania’s R&D department attempts to simultaneously balance exploitation and exploration within this specific department. In contextually ambidextrous organisations the tensions between exploitation and exploration are dealt with at the individual level which require an organisational structure that integrates support, trust and discipline.

Previous literature has found process management approaches and performance measurements to have practical implications on ambidexterity in R&D departments. How such approaches might affect organisations ability to balance the paradox is described and discussed as it brings relevant dimensions into the challenges encountered in mature R&D departments. Lastly in this chapter are theories on ambidextrous leadership presented, as previously mentioned, management and their moderating role has been emphasised by several researchers, that management possess the ability to influence, enable and support organisational learning and innovation, and thus, exploitative and explorative activities. Research in ambidextrous leadership advocates that different behaviours is an important mechanism in supporting exploitation and exploration. While some behaviours support exploitation, these precise behaviours also impedes exploration.

2.1 The Interplay between Exploitation and Exploration

Several decades ago, Abernathy (1978) advocated that sustained organisational performance depends on an organisation’s ability to simultaneously be innovative and increase efficiency. He named this tension, to emphasise two fundamentally different logics the productivity dilemma (Abernathy, 1978), which today can be viewed as analogous with the paradoxical relationship between exploitation and exploration described by March (1991). Tushman and O’Reilly III (1996) argue that these tensions becomes especially evident when periods of revolutionary change precedes periods of relatively stability. To realise the need to abandon or destroy the very strategies that paved the path to success in the first place is crucial for organisational survival in the pace of revolutionary change (Tushman & O’Reilly III, 1996).

March (1991) defines the innovation paradox in such a way that organisations makes implicit and explicit choices of how to best allocate resources exploitation and exploration. Consequently, exploitation and exploration compete for the same scarce resources as they are mutually exclusive (March, 1991). The challenge lies in assigning enough resources to both exploitation and exploration as favouring one of them at the expense of the other threatens organisational long-term survival and prosperity. The challenge in making these choices originates from that the returns from exploration and exploitation vary. Not only do they vary with respect to their expected value...
but also in terms of variability and their timing. Effectiveness, certainty and proximity are driving exploitation. While the search for new ideas naturally results in a less certain outcome with diffuse effects as in the case for exploration. Due to these differences, mature organisations operating in periods of relatively stability tend to make the explicit choice of allocating more resources to exploitation at the expense of exploration (March, 1991).

Latter research has instead of viewing exploration and exploitation as two ends of a continuum or a competing phenomenon advocated that they should be viewed and interpreted as “two different and orthogonal aspects of organisational behaviour” (Gupta, Shalley, & Smith, 2006, p. 693). Are exploration and exploitation complementary or competing qualities of organisational actions? Scholars indicate two ends of a continuum if exploitation and exploration compete for attention and scarce resources (March, 1991) or complementary if exploitation and exploration thrives and builds upon each other (Gupta, Shalley, & Smith, 2006). To view them as complementary implies realising that exploiting existing capabilities nurtures the exploration of new possibilities, and exploring these new opportunities further increases an organisation adaptive capabilities (Gibson & Birkinshaw, 2004). The unspoken business, whether this paradoxical relationship should be viewed as two ends of a continuum or if exploitation and exploration are mutually exclusive puts pressure on organisations and how it should be managed in practice. Several researchers argues that organisations needs to balance these contradictory logics (Benner & Tushman, 2003; Gupta, Shalley, & Smith, 2006; Eisenhardt & Martin, 2000) and in order for exploitation or exploration to thrive, fundamentally different organisational structures, processes, strategies and contexts are required (Raisch & Birkinshaw, 2008).

2.1.1 Defining Exploitation and Exploration

Following March’s (1991) definitions, exploration could be exemplified with search, experimentation, risk-taking and variation in technologies, processes and routines. While exploitation associates with refinement, efficiency, selection and execution. Organisations that engage in exploration at the expense of exploitation usually find themselves suffering the costs of variation and experimentation since engaging to much in exploration poses the risk of overly investing in these activities without gaining many of its benefits. Contrariwise, organisations that engage in exploitation at the expense of exploration will supposedly find themselves trapped in a stable state of equilibria and my not be able to respond fast enough to changes in their environment (March, 1991).

Previous literature emphasises the innovation paradox of exploitation and exploration defines these innovation concepts in rather one of two ways, either that exploitation and exploration can be defined through different types of learning or through the absence versus presence of learning (Gupta, Shalley, & Smith, 2006). He and Wong (2004) view and define exploitation and exploration as differences in type of learning, exploitative innovation aims at improving products in existing markets, and explorative innovation aims to create entirely new markets. Following on this definition that exploitation and exploration should be defined according to differences in learning, disagreements exist whether exploration entirely refers to learning along the new or old technological trajectory (Gupta, Shalley, & Smith, 2006). The second viewpoint, defining exploitation and exploration through the absence versus presence of learning requires the view of referring to exploitation as the merely reuse of existing knowledge and that all learning activities relates to exploration (Rosenkopf & Nerkar, 2001).
2.1.2 Why Favour Exploitation at the Expense of Exploration or Vice Versa?

Conflicting pressures could possibly explain the challenge of balancing exploration and exploitation, and why exploitation sometimes is favoured at the expense of exploration or the inverse. Pressures for exploitation sometimes emerges as a response from organisational inertia as organisational inertia allows mature organisations to continue its current trajectory. In the perspective of organisational learning, inertia impels routine-based experiential learning and thus facilitates exploitation. Whereas inertia pressures exploitation and drives organisations to exploit, absorptive capacity pressures exploration (Lavie & Rosenkopf, 2006). Absorptive capacity is an organisations ability to acknowledge the value of new information, identify emerging opportunities, embrace these opportunities and apply it to commercial ends (Cohen & Levinthal, 1990). As absorptive capacity motivates the acquiring of new information and knowledge it drives organisations to explore. Being proactive in exploring new opportunities sheds light on changes in the external environment and thus enhances adaptation and organisational responsiveness. The tendency of emphasising exploitation over exploration or the reverse can partially be explained by path dependencies, whereby decisions one’s made in the past constraints its future. Exploitation path dependency emerges because inertia impels routine-based activities which in turn are most likely to produce desired and favourable outcomes. Exploitation and routinised work increases efficiency and thus, investing in exploitation is likely to result in more exploitation. Path dependency in exploration on the other side emerges as absorptive capacity builds on past experience within its knowledge domains. Exploration strives for flexibility with a highly uncertain outcome and thus past investments in exploration will most likely require future investments in exploration to attain the desired outcome (Lavie & Rosenkopf, 2006).

2.1.3 Learning and Innovation

Corso and Pellegrini (2007) expands the different ways to define exploitation and exploration by combining learning focus with innovation focus in a bi-dimensional matrix, see Figure 3. They argue that in order to fully balance the paradox, organisations must excel at managing both exploitation and exploration, and incremental and radical innovation. Also to fully understand that exploitation, exploration, incremental innovation and radical innovation require different approaches and understandings about their differences.
Incremental Exploitation

Incremental exploitation refers to activities where exploitation of existing capabilities results in incremental innovation. Striving for efficiency and improved firm performance through continuous improvement (CI). This process builds upon long-term learning and evolves around routinisation, systematic improvement of behaviour within existing routines or the reinforcement of additional routines. CI is also compatible with systematic processes for problem-solving and different measuring processes. From a knowledge transfer perspective, CI allows for the possibility of knowledge transfer across barriers, from tacit knowledge to explicit knowledge, as tacit knowledge can be articulated in organisational routines (Corso & Pellegrini, 2007).

Incremental Exploration

Incremental exploration refers to explorative activities paving the path to an incremental output. The concept of design engineering is highly associated with incremental exploration as it strives towards performance improvement, however, in contrast to CI in the shape of non-linearity (Corso & Pellegrini, 2007). Concurrent engineering is a widespread concept within new product development and highly associated with incremental exploration (Corso, Martini, Paolucci, & Pellegrini, 2001). Concurrent engineering replaces the more traditional stage-gate approach with agility and joint participation, this also implies separating concept development from product development. The focus shifts towards quick and intense knowledge socialisation in cross-functional teams. These rapid learning loops improve the overall time-to-market within the product development process, however, success depends highly on sharing knowledge and the reuse of design solutions (Corso & Pellegrini, 2007).
Equilibrium between Exploitation and Exploration

Binary or dual organisations refers to organisations that tend to mutually master incremental exploitation and exploration, whereby dual organisations balance exploit and explore synergistically while binary organisations do so orthogonally. Binary organisations master the balance of exploration and exploitation by separating them either in time or space. While dual organisations approach the dilemma synergistically, allowing innovation of exploitative and explorative character to emerge simultaneously. Either through a top-down approach through integrating processes, technology and organisational mechanisms in accordance with strategic alignment. Or through a bottom-up approach where employees are encouraged to act outside formal job descriptions and hence are able to conduct explorative tasks still aligned with the overall business strategy (Corso & Pellegrini, 2007).

Radical Exploration

Radical exploration refers to exploring capabilities that paves the path towards radical innovations. Radical innovation is naturally associated with discontinuity-theory, where unpredictability and instability constitute core elements. Discontinuities poses a major threat to incumbents as it reframes space and boundary conditions. A specific trade-off exists between small to medium organisations, generally new players and incumbents when facing discontinuity. The former poses an advantage of agility, adaptation and the ability to learn fast as they are not encumbered with past experiences. While incumbents possess the competencies, financial assets and the ability to “mix the technologies they master”, they usually show signs of inertia in not seizing opportunities fast enough, and thus falter (Corso & Pellegrini, 2007). To survive a discontinuous shift entails sensing the atmosphere, discovering weak signals pointing towards discontinuity in unchartered territories, understanding the needs of a market that that has not yet paved the path to its existence, strategic decision making in time of uncertainty, promoting project which lies outside of the organisations ordinary scope, and perhaps most importantly, learning to unlearn (Corso & Pellegrini, 2007).

Equilibrium between radical and incremental innovation

This specific state of equilibrium deals with the balancing act between steady state and discontinuous innovation. Corso and Pellegrini (2007) states that this could be managed in an orthogonal way by setting up a new organisational unit, having their own resources operating under entirely new conditions as this prevents the disruption of stealing resources serving current market needs. Setting up separate units in order to manage both radical and incremental innovation solves the tensions between exploitation and exploration in terms of resources, but creates challenges in terms of knowledge transfer. Dealing with the pressure of discontinuity by isolation implies executing projects without its essential sources of learning, resources and competences (Corso & Pellegrini, 2007).

Radical Exploitation

Radical exploitation refers to the leveraging of existing capabilities that paves the path to a radical output. Research in this stream of literature is difficult to find, it should thus be noted that many incumbent firms should be credited for radical innovation while levering their existing knowledge (Corso & Pellegrini, 2007).
2.1.4 Why Definitions Matter

Innovation, usually defined as the realisation of novel ideas that creates and capture value (Shapiro, 2006) is a rather ambiguous definition, since novelty is paradoxical and value is highly subjective. To provide clarity in this research, we aim to build on March’s (1991) definition, that activities, exploitative and explorative are defined as learning, albeit in different types. Defining exploitation and exploration as different degrees of learning further allows us to elaborate upon different dimensions of exploitation and exploration presented by Corso and Pellegrini (2007). Since this research seeks to explore managerial challenges that resides in supporting and enabling exploration in a mature R&D department we find it relevant to explore exploration in terms of both incremental exploration and radical exploration. Firstly, incremental exploration associates with design engineering and concurrent engineering (Corso & Pellegrini, 2007) and thus pose significant similarities to concept development. Secondly, to enable and promote radical exploration might be particularly important as Scania’s relatively stable environment is challenged by emerging, possibly disruptive technologies. Figure 4 presents an overview of exploitation and exploration in relation to their dichotomies and builds upon our definition viewing them as complementary.

![Figure 4: Exploitation and exploration in relation to their dichotomies](image)

2.2 Strategies to Balance the Paradox of Exploitation and Exploration

Theory on organisational ambidexterity has emerged as a response to how organisations tend to balance tensions between exploitation and exploration. And the four most prominent ambidexterity strategies to be found in the ambidexterity theory are structural ambidexterity, sequential ambidexterity, contextual ambidexterity or ambidexterity through internal vs. external sourcing of competencies, they all pose different implications on organisations and management, albeit in different ways. The following sections presents these different strategies and the challenges they bring. It should however be noted existing research indicate that organisation also use combinations of different strategies to deal with emerging tensions from exploitation and exploration (Kauppila, 2010).
**Structural Ambidexterity**

Structural ambidexterity, sometimes referred to as organisational separation (Lavie, Stettner, & Tushman, 2010) is the simultaneous pursuit of exploitation and exploration by using separated business units (O’Reilly III & Tushman, 2013). Separating exploit and explore in different business units also entails the separation of organisational culture, competencies, processes, and incentives (O’Reilly & Tushman, 2008). In structurally ambidextrous organisations’ exploitative units tend to be centralised and focused on efficiency while explorative units are much smaller in size, decentralised and focused on experimentation (Lavie, Stettner, & Tushman, 2010). Balancing conflicting demands by separating exploitation and exploration in space require coordination by top management, to strategically align (O’Reilly III & Tushman, 2013) and integrate exploratory and exploitative units is a necessity as exploratory projects are transferred to exploitative units (Lavie, Stettner, & Tushman, 2010).

**Sequential Ambidexterity**

Balancing the paradox of exploitation and exploration through sequential ambidexterity requires organisations to temporally shift between the merely focus on exploitation or exploration (Lavie, Stettner, & Tushman, 2010). The sequential ambidexterity strategy springs originally from the theory behind punctuated equilibrium, that long periods of stability and continuous change are punctuated by brief periods of radical breakthroughs and therefore require efficient organisational processes and procedures in order to manage the transition phase (O’Reilly III & Tushman, 2013). Challenges that sequential ambidexterity pose are linked to managing the transition phase but also in identifying the need for change. The sequential ambidexterity strategy evades conflicting pressures and enable organisations to both exploit and explore, albeit not simultaneously. For example, Brown and Eisenhardt (1997) describes how small firms in the high-velocity computer industry temporally switches between exploit and explore and manage the transition phase through so called “semi-structures” and that they by doing so form a core capability for creating persistent and frequent change. Other researchers are however advocators of that this strategy might not be the most suitable for organisations operating in long periods of stability as focusing solely on one type of activity for a long period of time might reduce the preparedness for change (Lavie, Stettner, & Tushman, 2010; O’Reilly III & Tushman, 2013).

**Contextual Ambidexterity**

Both structural and sequential ambidexterity attempt to solve the paradox by separating exploitation and exploration either in time or space. A contextual ambidextrous approach is rather different as it aims to balance these tensions internally at the individual level thorough a supportive context (O’Reilly III & Tushman, 2013). Gibson and Birkinshaw (2004) describes a supportive organisational context as “characterised by an interaction of stretch, discipline and trust (p.214)” which should encourage individuals to divide their attention between exploitation and exploration by themselves. This approach is somewhat similar to structural ambidexterity, however differ to the extent that contextual ambidexterity allows for exploration and exploitation to endure in all business units. While a contextual ambidextrous approach might work under stable conditions, O’Reilly III and Tushman (2013) find it difficult to see how such an approach would allow an organisation to adjust and adapt in order to face disruptive change. Through a quantitative study on contextual ambidexterity, Gibson and Birkinshaw (2004) argues that contextual ambidexterity
is a desirable capability at business unit level which can be supported and shaped through management and leadership behaviour. Contextual ambidexterity is important and suitable in R&D according to Mccarthy and Gordon (2011) especially since R&D already is separated from other organisational activities such as sales & marketing, and manufacturing. Since controlling R&D usually occurs with formal processes and structures which enables employees to individually divide their time between the conflicting pressures of exploitation and exploration, or between alignment and adaptability. What is inevitable in the contextual ambidextrous approach is the continuous trade-off between exploitation and exploration in terms of resource allocation (Gibson & Birkinshaw, 2004).

**Internal vs. External**

Achieving ambidexterity through internal or external sourcing of competencies refers to externalising exploitation or exploration either by establishing alliances or through outsourcing (Raisch, Birkinshaw, Probst, & Tushman, 2009). This comes with similar challenges as in structurally separating exploitation and exploration, namely with strategic integration challenges. While Rosenkopf and Nektar (2001) found empirical evidence pointing towards a greater impact of exploration when acquired externally than within organisational boundaries, Benner and Tushman (2003) advocates that processes for exploitation and exploration when externalised might be harmed by the strategic integration between independent firms.

**2.3 Practical Implications on Ambidexterity**

Process management approaches in R&D and its influence on innovation has contracted increased attention in previous literature (MackAldener & Stetler, 2015; Benner & Tushman, 2003). While process management techniques initially strived for efficiency in manufacturing domains, the potential benefits process management techniques bring such as variation reduction and efficiency improvements has spread to other processes, inclusive those underlying product development (Benner & Tushman, 2003). While process management approaches tend to induce organisational effectiveness during periods of stability, they can be argued to further add to organisational exploitation bias, as they over time build resistance towards change (Benner & Tushman, 2003). A second factor which possess the possibility to pose conflicting implications on ambidexterity, or exploitation and exploration are performance measurements. Controlling and managing R&D behaviours and outcomes through performance measurements is challenging, knowing what to measure and how to measure is rather difficult in general, and for innovation in particular.

**2.3.1 The Love for Process Management**

Process management is defined as a system of processes linked together which transform input into output and where value is added during the transformation (Benner & Tushman, 2003; MackAldener & Stetler, 2015). The output may be aimed for an external customer, but the output may as well be aimed as an input for an internal receiver within upstream processes. The focal point of process management is to increase efficiency and reduce variance. Process management is based on three main practices: identify processes, refine process and finally standardise refined process (Benner & Tushman, 2003). The two most common process management methods are lean and six sigma. The aim with lean management, developed by Toyota, is to decrease and eliminate waste which are argued to be non-value adding activities in the processes. Six sigma, developed by
Motorola, is used in order to improve quality during processes. This is achieved by decreasing deviation and variation among products in the processes (Arnheiter & Maleyeff, 2005).

Since process management aims to decrease variance and improve the efficiency within an organisation, it allows for work based on continuous improvements. Therefore, researchers claim that process management promotes innovation of an incremental character and exploitation. Meanwhile, innovation of an exploratory innovation character and radical innovation will not be promoted. As a result, process management will support organisations to continue in the short run. But it will be difficult to succeed in the long-run since exploration is required then, and exploration is not encouraged by process management. Therefore, researchers argue that process management is preferable for organisations in stable circumstances, where customers are known, and the product encourages a work based on continuous improvements (Benner & Tushman, 2003). In organisations where exploration is necessary process management activities has to be separated from these exploratory activities, in order to generate the space which exploration, require (MackAldener & Stetler, 2015).

2.3.2 Performance Measurements

Performance measurements in its simplicity allows to measure organisational actions in terms of effectiveness and efficiency (Nilsson, et al., 2012). The use of measurements is argued to constitute an essential part in the management of any business function (Mansoorchehri, 2010). For innovation management in R&D, the measurement of innovation can support managers to control and evaluate R&D behaviours and outcomes (Mccarthy & Gordon, 2011) and help managers to provide goal and process clarity (Nilsson, et al., 2012). Despite the potential measurements bring, knowing what to measure and how to measure it is a challenge. Measuring innovation is especially difficult as innovation is rather ambiguous, unpredictable and complex (Adams, Bessant, & Phelps, 2006). Mccarthy and Gordon (2011) argue that management of R&D has had a tendency to focus too much on just one type of measurement system, namely the diagnostic control system which one out of four types of control systems in the framework “Simons our levers of control” by Simons (1994). As diagnostic control systems focus on evaluation, correcting deviations and monitoring results this type of control system tend to induce exploitation and incremental innovation (Mccarthy & Gordon, 2011). Shapiro (2006) advocates along the lines of Mccarthy and Gordon (2011) that organisations using a single type of measurement for innovation risk being biased towards what they actually measure, and that fixed measurements should be combined with variable measurements if organisations want to pursue both exploitation and exploration.

The most common measurement of innovation is the percentage of revenue acquired from new products. While this measurement might be appealing, using this measurement as a fixed stand-alone measurement will result in a bias towards product innovation (Shapiro, 2006). If innovation, defined as the realisation of novel ideas that creates and capture value should be measured in terms of the percentage of revenue acquired from new products, terms such as newness and the timeframe for how long something is new must be defined (Shapiro, 2006). Nilson et al. (2012) explored challenges related to innovation measurements encountered in three high technological organisations all aiming to realise both radical and incremental innovation. Concluding remarks from their research is present in Table 2 and points towards that the presence of contradictory requirements emerging from incremental and radical innovation have implications on how and what to measure. That contradictory requirements in terms of uncertainty, time, flexibility and
control pose significant differences in the design and use of measurements for incremental and radical innovation (Nilsson, et al., 2012).

Table 2: The implications on innovation performance measurements in relation to dichotomies in innovation management, adapted form (Nilsson, et al., 2012)

<table>
<thead>
<tr>
<th>Dimensions in dichotomies</th>
<th>Issue in Measurement</th>
</tr>
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<tbody>
<tr>
<td><strong>Uncertainty</strong></td>
<td></td>
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<tr>
<td>Technical</td>
<td>Radical Innovation:</td>
</tr>
<tr>
<td></td>
<td>- requires a higher number of market and external</td>
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<tr>
<td></td>
<td>environmental measures than incremental</td>
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<tr>
<td>Market</td>
<td>- need to be measured on sales growth rather than profitability</td>
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<tr>
<td>Project scope</td>
<td>in the commercialisation stage in contrast to incremental innovation</td>
</tr>
<tr>
<td>Resource</td>
<td></td>
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<tr>
<td>Strategic alignment</td>
<td>- requires a high amount of data from different sources compared to incremental innovation</td>
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<td></td>
<td>- need not to be measured using strategic, operational and business model fit as requirement why the opposite is needed for incremental</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td>Valuation and selection of idea and projects require different measures: ex. ROI, net present value (for incremental) vs. opportunity cost (for radical)</td>
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<tr>
<td>Long and short</td>
<td></td>
</tr>
<tr>
<td>Discontinuous and continuous</td>
<td>Radical innovation need to be supported by measures that trace rapid and unexpected events and incremental measures that traces alignment to a predefined path.</td>
</tr>
<tr>
<td>Rapid and slow</td>
<td></td>
</tr>
<tr>
<td><strong>Flexibility (vs. stability)</strong></td>
<td>Incremental innovation benefit from using the same measures for a long period of time.</td>
</tr>
<tr>
<td>Process</td>
<td>More measures for external communication and for measuring relations needed for radical innovation</td>
</tr>
<tr>
<td>Structure</td>
<td></td>
</tr>
<tr>
<td><strong>Control (Vs. freedom)</strong></td>
<td>Measure identification and implementation for radical innovation require both audit (bottom up) and need driven procedures (top down) why incremental innovation is supported by a need driven procedure alone.</td>
</tr>
<tr>
<td>Roles</td>
<td></td>
</tr>
<tr>
<td>Leadership</td>
<td>Measurements need to be aligned to and support both radical and incremental recognition and reward system.</td>
</tr>
</tbody>
</table>
While findings from the research presented by Nilsson, et al. (2012) informs about the complexity innovation measurements brings in companies aiming to pursue both radical and incremental innovation, Richtnér, Brattström, Frishammar, Björk and Magnusson (2017) implies that the challenge lies not in identifying innovation metrics, nor in identifying the right ones but rather to truly understand why measurement on innovation is needed in their organisation.

What is especially evident in the design and use of performance measurements is that they need to be derived from an organisations corporate strategy, since they aim to support and direct organisational behaviour towards a strategic intent (Nilsson, et al., 2012).

2.4 The Utilising Role of Ambidextrous Leadership

To succeed with ambidexterity, an effective innovation process is necessary in order to handle exploitation and exploration simultaneously. An effective innovation process requires a leadership which can handle both exploitation and exploration, which is the ambidextrous leadership (Andriopoulos & Lewis, 2009). Implementation and creativity do not proceed linear and as a result, the innovation process is complex and difficult, which increases the importance of a well-functioning ambidextrous leadership (Slater, Mohr, & Sengupta, 2014; Rosing, Frese, & Bausch, 2011).

Further, research has shown that employees that are highly innovative have a high degree of both exploitation and exploration. If employees do not have a high degree of exploitation or exploration, employees do not take full advantage of their innovative capacity. Therefore, an ambidextrous leadership is necessary in order to foster a high degree of innovation among the employees (Zacher, Robinson, & Rosing, 2016).

This results in that leadership is crucial for innovation (Zacher, Robinson, & Rosing, 2016; Slater, Mohr, & Sengupta, 2014). According to Rosing et al. (2011), exploitation and exploration require different management and support, which is also described by Slater et. Al (2014) and Yukl (2012). Leadership is important and necessary for an organisation in order to succeed with ambidexterity, but since there is a lack of empirical research of how leadership should handle innovation, the interest for the relationship between innovation and leadership has lately gotten an increased attention within the literature (Rosing, Frese, & Bausch, 2011; Zacher, Robinson, & Rosing, 2016).

2.4.1 Transactional and Transformational Leadership

According to previous research, a leadership style which is frequently associated with innovation and ambidextrous leadership is transactional and transformational leadership (Rosing, Frese, & Bausch, 2011; Yukl, 2012). In the following chapter transactional and transformational leadership will be presented, followed by how transactional and transformational leadership is related to innovation.

**Transactional Leadership**

Transactional leadership is described as a transaction of work towards reward between the leader and the employee. The transaction allows an exchange between the leader and the employees of promises and rewards for good work, or disciplines and threats for poor work. As a result, the leader gets the work done by creating and rewarding promises of pay increases, promotions and gratitude (Hartog, Muijen, & Koopman, 1990; Bass, 1990). According to Yukl (2012), transactional
leadership, might result in that the employee will agree with the requests from the leader, but at the same time the employee will not likely feel committed nor enthusiastic to the tasks set by the leader.

According to Bass (1990), transactional leadership is characterised by three leadership behaviours; the first behaviour is contingent reinforcement or contingent reward. The manager clarifies the expectation from the employee, as well as what the employee will receive in return. As a result, the relationship between the employee and the leader consists of a series of exchanges. When the employee act according to their leader’s wishes and satisfies what is expected from the leader, the employee receives the reward. The second and third behaviours are two different types of management-by-exception, meaning that a leader only takes action when standards are not met, and things go wrong. There is a mind-set of “if it is not broken, do not fix it”, which results in that transactional leadership is a formula for mediocrity. If performance goals are met, leaders encourage employees to do the work as they used to, the leader does not encourage employees to work proactively since the performance goals are met. Further, Bass and Bass (2009) mention that management-by-exception can either be passive or active. A characteristic of a passive leader is that the leader only takes action when errors and indiscretions occur. Meanwhile, an active leader constantly and actively seeks for differences from standard procedures, and when deviations occur the leader takes action.

**Transformational Leadership**

Researchers define transformational leadership as a leadership that typically inspire employees to do more than expected. Transformational leadership promotes their employees interest, encourage employees to look beyond their own self-interest for the good of the group and create awareness of the groups’ purpose and mission (Bass, 1990; Hartog, Muijen, & Koopman, 1997; Yukl, 2012). Transformational leadership consists of four leadership behaviours. The first behaviour is charisma. A charismatic leader possesses great authority and power, and as a result the employees will be inspired and want to identify themselves with the leader. The charismatic leader gains trust and respect from the employees and increase the enthusiasm amongst the group. A charismatic leader inspires the employee with the idea that the employee might be able to achieve great things with certain additional work (Bass, 1990; Slater, Mohr, & Sengupta, 2014).

The second behaviour of transformational leadership is inspiration. Den Hartog et al. (1997) describe it as leaders that embrace this behaviour have an ability to use symbols to focus the efforts, essential purposes are clarified in a simple way and high expectations are communicated. Hartog et al. (1997) further describe individual consideration, which is the third behaviour in transformational leadership. An individual considerate leader pays close attention to each employee, identifies differences among employees, and for those employees who want to develop and grow will be supported by the leader, the leader will act as a mentor. As a result, the employee will reach his/her full potential by coaching from the leader. The fourth behaviour is intellectually stimulating. An intellectually stimulating leader provide employees with new ideas that will encourage employees to re-think the old way the work has been done. Also, an intellectually stimulating leader will stimulate creativity and new thinking and awareness of problems amongst employees (Bass, 1990).

Transformational leadership is critical for exploration (Rosing, Frese, & Bausch, 2011; S. Kraft & Bausch, 2016). According to Bass (1990), transformational leadership should be encouraged among organisations leaders since it can affect an organisation performance at all levels.
A transformational leadership generates a closer relationship between leaders and employees, which results in an increased contribution to the organisation, compared to transactional leadership. Further, the performance and motivation among employees will increase by transformational leadership in a greater extent than transactional leadership. However, those transactions of rewards which take place between leader and employee within transactional leadership, are valuable for the employee, as long as the leader can provide the reward. Therefore, according to the literature within this subject, a combination between transformational and transactional leadership will generate the most effective leadership (Yukl, 2012). An effective leader will combine behaviours from both transactional and transformational, and adjust these behaviours depending on the situation.

Meanwhile, according to Rosing et al. (2011), transformational leadership has a strong correlation to exploration, but in some situations the correlation to exploration is limited. Rosing et al. (2011) explain the reason for this, and argue that transformational leadership is too broad and therefore it both encourage and hinder innovation. For example, if a transformational leader inspires the employee with a vision, it might encourage the employee to experiment with different ideas which might result in exploration. If the employee is too fascinated by the vision, the vision might prevent the employee from experimenting with different ideas, since the employee is locked to the vision. To solely focus on transformational and transactional leadership is not enough (Rosing, Frese, & Bausch, 2011; Zacher, Robinson, & Rosing, 2016), and complementary leadership behaviours have been discussed in the literature. By combining behaviours from transactional and transformational leadership in a new way, and switch between exploit and explore, increases the likelihood of generating an effective innovation process. These leadership behaviours are called opening and closing leadership behaviours, pursuant to Rosing et al. (2011).

2.4.2 Opening and Closing Leadership Behaviours

As mentioned above, opening and closing leadership behaviours are a complement to transformational and transactional leadership. It is based on the same behaviours as transformational and transactional leadership, but it combines the behaviours differently in order to encourage exploitation and exploration and switch between these two activities (Rosing, Frese, & Bausch, 2011; Zacher, Robinson, & Rosing, 2016).

Increased variance is the core of exploration. Thus, when exploration is encouraged, the variance of employee’s behaviour should increase. Rosing et al. (2011) mean that this can be achieved by using opening leadership behaviours, and as a result, it encourages employees to think in new dimensions and break routines.

The opposite of opening leadership behaviours is closing leadership behaviours. The purpose with exploitation is to reduce the amount of variance. Therefore, when exploitation is desired, closed leader behaviours will decrease the amount of variance of the employee’s behaviours. For that reason, Rosing et al. (2011) mean that when an exploitative innovation is desired, the leader has to show closing leadership behaviours. In Table 3 different characteristic behaviours for opening leader and closing leadership are presented.
Table 3: Different characteristic behaviours for opening leadership and closing leadership (Rosing, Frese, & Bausch, 2011).

<table>
<thead>
<tr>
<th>Opening Leadership Behaviours</th>
<th>Closing Leadership Behaviours</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Permitting errors</td>
<td>- Routines are established</td>
</tr>
<tr>
<td>- Giving space for own idea</td>
<td>- Corrective action is taken</td>
</tr>
<tr>
<td>- Encourage to experiment with different ideas</td>
<td>- Following plans</td>
</tr>
<tr>
<td>- Different ways for complete task is allowed and risks is encouraged</td>
<td>- Achieved goal is controlled and monitored</td>
</tr>
<tr>
<td>- Independent acting and thinking is allowed</td>
<td>- Control observation with rules</td>
</tr>
<tr>
<td>- Error learning is encouraged</td>
<td>- Determining errors</td>
</tr>
<tr>
<td></td>
<td>- Focus on achievement of uniform task</td>
</tr>
</tbody>
</table>

The relationship between transformational and transactional leadership and opening and closing leadership behaviour is presented in Table 4. Opening and closing leadership behaviours are, as mentioned before, based on behaviours from transformational and transactional leadership (Rosing, Frese, & Bausch, 2011).

Table 4: The relationship between opening and closing leadership behaviour and transformational and transactional leadership (Rosing, Frese, & Bausch, 2011).

<table>
<thead>
<tr>
<th>Opening Leadership Behaviour</th>
<th>Closing Leadership Behaviour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transformational Leadership</td>
<td></td>
</tr>
<tr>
<td>- A vision which encourage exploratory behaviour</td>
<td>- A vision which encourage agreeing behaviour</td>
</tr>
<tr>
<td>- Thoughts within new direction are stimulated</td>
<td>- Small improvements and increase efficiency are encourage</td>
</tr>
<tr>
<td>- The value of tolerance and openness is communicated</td>
<td>- The value of rules is communicated</td>
</tr>
<tr>
<td>Transactional Leadership</td>
<td></td>
</tr>
<tr>
<td>- Experimentations is rewarding</td>
<td>- Efficiency is rewarding</td>
</tr>
<tr>
<td>- Focus on failure in order to learn from them</td>
<td>- Focus on failure in order to avoid them</td>
</tr>
<tr>
<td>- Explorative goals are set and monitored</td>
<td>- Exploitative goals are set and monitored</td>
</tr>
</tbody>
</table>

Different situations in an innovation process require different behaviours from the leader. When explorative innovation is desired, a leader within opening leadership behaviours will combine behaviours from both transformational and transactional in an effective way (Zacher, Robinson, & Rosing, 2016). In other words, opening leadership behaviour is constituted of behaviours which
are related to exploration but also exploitation. The same for closing leadership behaviour. However, behaviours within transformational leadership are only related to exploration. And behaviours within transactional leadership are only related to exploitation (Rosing, Frese, & Bausch, 2011). According to Rosing et al. (2011), this is the reason why opening and closing leadership behaviour is more efficient than only applying transformational and transactional leadership. Opening and closing leadership behaviour combine exploitation behaviours with exploration behaviours, and effectively switch these different behaviours according to the situation (Rosing, Frese, & Bausch, 2011).

The theory of Yukl (2012) is similar as the theory of Rosing et al. (2011). According to Yukl (2012), an effective leader will identify possibilities with combining exploitation and exploration. For instance, methods used for exploration, for an example brain storming, can be used in processes of an exploitative character, where the focus is to improve established processes. Further, methods that are used in exploitation can be used within exploration in order to reduce costs.

By combining transformational and transactional leadership with opening and closing leadership behaviours within the innovation process, it might generate innovation in a more effective way since the leader will have the opportunity to change behaviour based on the situation in the innovation process. However, as mentioned before, it is stated by several researchers that there is a lack of empirical research within the area of managerial implementation within ambidextrous leadership and how it is supposed to work in practice (Rosing, Frese, & Bausch, 2011; Slater, Mohr, & Sengupta, 2014). Further, to understand when to switch method is difficult. It all depends on the situation when the leader should switch from opening to closing and vice versa. This constitutes a dilemma for the leader, the leader has to encourage employees to think outside the box and explore, but at the same time the leader has to maintain standardisation, to ensure high productivity and efficiency (Rosing, Frese, & Bausch, 2011; Zacher, Robinson, & Rosing, 2016).

This dilemma is also confirmed by Yukl (2012). It is stated that successful organisations have the possibility to handle both exploitation and exploration. In order to generate new variance from existing products, exploitation, and at the same time investigate within new areas and market, exploration. However, it is difficult for leaders to handle the balance between exploration and exploitation. Too much focus on exploitation might result in hesitation for new products and processes and decreased flexibility. Meanwhile, too much focus on exploration might generate exaggerative costs in order to increase new knowledge. Further, introducing new products too early on the market might result in decreased profitability of current products, which stands for the costs for the development process. However, waiting too long with introducing new products might result in decreased competitiveness. A successful leader within ambidextrous leadership needs to balance exploitation and exploration depending on the situation (Yukl, 2012). Therefore, when an organisation selects a leader for ambidextrous leadership, it is important that the leader possesses the ability to show both leadership behaviours, due to the complexity (Zacher, Robinson, & Rosing, 2016).

It is important to understand that there are several different factors which affect if an organisation will succeed with innovation and exploration; other than leadership. Examples of factors are an organisations architecture and the process for developing radical product innovations. Therefore, it is difficult to draw the conclusion that only transformational and transactional leadership and opening and closing leadership behaviours will generate innovation and exploration, other factors
have to exist as well (Slater, Mohr, & Sengupta, 2014; Rosing, Frese, & Bausch, 2011). Further, according to Zacher et al. (2016), employees within an organisation need to understand the concept of ambidexterity, for the ambidextrous leadership to succeed. If employees do not understand the importance of exploitation and exploration, it will be difficult for the leader to encourage exploitation and exploration.
Chapter Summary

The starting point for this chapter describes differences and dependencies from exploitation and exploration in order to provide understandings for why they require different organisational structures and support. Exploitation and exploration differ roughly in terms of goal, risk, knowledge and priority, and is by some researches viewed as competing qualities of organisational actions, ad by some as complementary. Exploitation and exploration also differ in terms their definitions, scholar defines these innovation concepts through different types of learning or through the presence versus absence of learning. Since the purpose of this research is to explore how management can support and sustain the exploration space, it has been our intentions to provide clarity in how we have chosen to define exploration, namely as different degrees of learning and that exploration comes in different dimensions, incremental exploration and radical exploration.

Ambidexterity, defined as the organisational ability to balance the paradox, or balancing the contradictory requirements emerging from exploitation and exploration can be done in several ways. The four most prominent ones are structural separation, contextual ambidexterity, sequential ambidexterity and internal vs. external ambidexterity. However, different strategies to balance the paradox comes with different advantages and challenges, challenges that organisation explicitly must deal with. Ambidexterity theory aims to provide understandings for why we see the results we see in our research, how a certain strategy to balance the paradox is linked to the challenges encountered by management.

Further presented in this chapter is process management and performance measurements which we claim creates practical implications on ambidexterity. Firstly, the adoption of process management approaches has allowed Scania to reduce variation and improve efficiency within the product development process, this has proven to be successful under the current technological paradigm. While a routine based product development process impels exploitation it pose barriers for exploration to thrive. Secondly, measurements of innovation can direct R&D behaviours and outcomes, and thus support management of innovation, if the organisations strategic intent is to pursue both radical and incremental innovation measurements for both exploitation and exploration should be designed and implemented. Measuring innovation comes with its own challenges, exploitation is much easier to measure since we know beforehand what should be achieved, and what seems sensible and easy to measure is usually measured. Resulting in that many organisations possess an overall bias towards exploitation, since they have to many measurement for exploitation, and to poorly designed and too few measurements for exploration. In Chapter 6, implication for practice we argue with the use of previous research within performance measurements that attention can be directed towards exploration by designing and implementing measurements for exploration.

Lastly, in order to succeed with ambidexterity an organisation need a leadership style which can handle and encourage both exploitation and exploration. This leadership style is according to the literature referred as ambidextrous leadership. Researchers claim that leadership is crucial for innovation and exploitation and exploration require different management and support. Transactional and transformational leadership is frequently associated with ambidextrous leadership in the literature. Transactional leadership encourages efficiency and a work based on routines and researcher relate transactional leadership with exploitation. Transformational leadership on the other hand encourage the employee to re-think old way the work has been done and inspire the employee with visions. Transformational leadership is according to the literature related to exploration. Researchers considers that a combination between transformational and transactional leadership will generate the most effective leadership where an effective leader can combine behaviours from both transactional and transformational, and adjust these behaviours depending on the situation. Some research however states that transactional and transformational is a too broad leadership style and therefore complementary leadership behaviours have been discussed in the literature, which is called opening and closing leadership behaviours. These behaviours are based on behaviours from transactional and
transformational leadership but are combined in a new way. Researchers mean that by combining behaviours in this way, a narrower leadership style will be created. Opening and closing leadership behaviours should be combined and adjusted depending on the situation, like transformational and transactional leadership. Leadership is crucial for innovation but if an organisation will succeed with ambidextrous leadership, the right conditions from the organisation must be ensured. For example the organisational architecture has to be suitable so both exploitation and exploration get the space they need.
Chapter 3

METHODOLOGY
3 Methodology

This chapter provides a descriptive overview of the chosen methods used to gather the empirical material necessary to operationalise the thesis purpose, to explore how management can support and sustain the exploration space in a mature R&D department. Methodological choices are thoroughly described, evaluated upon their appropriateness and then critically discussed in accordance with their strengths and weaknesses. Further outlined in this chapter is a discussion of reliability, validity and source criticism. Lastly, is a reflection of the research process presented.

3.1 Research approach

Research paradigms or philosophical worldviews in social science represent particular ways of determining what constitutes truth and what constitutes knowledge and thus, how we interpret social reality. Paradigms guide researches depending on their views and beliefs about reality towards the assumption of how reality should be understood and studied (Creswell, 2009). The social constructivist worldview spans this research as it seeks to explore how management can support and sustain the exploration space in a mature R&D department. As opposed to positivists viewing reality as objective, constructivists believe that there are multiple realities, reality is highly subjective and constructivists therefore aim to understand the world as others experience it (Creswell, 2009).

Challenges associated with the phenomenon of attaining enough resources to both exploitation and exploration within the same business unit or shifting between exploitation and exploration has extensively been studied (O’Reilly & Tushman, 2008; March, 1991). However, due to organisational complexity and differentiations in organisational contexts, clear managerial implications have remained insufficiently represented. Previous researchers within this area emphasise the managerial responsibility as an important factor influencing organisations paths towards resolving the dilemma between exploitation and exploration (Probst, Raisch, & Tushman, 2011; Andriopoulos & Lewis, 2009; Jansen, George, Van den Bosch, & Volberda, 2008). We therefore argue that this constitutes a research where in-depth knowledge of the case company needs to be gathered to firstly understand how current processes and organisational strategies facilitates or inhibits exploitation and exploration. And secondly, how these processes and strategies relate to challenges encountered by management in their role as providers and enablers for exploration. Also, a research requiring the view of participants to understand their meaning of this phenomenon which makes a qualitative research approach suitable (Creswell, 2009). Creswell (2009) further advocates that qualitative approaches allow researchers to discover unknown variables and relations, to disclose and to further problematise the complexity of processes, and to illustrate organisational behaviour in relation to its social context. While a quantitative research approach may yield a broad overview of a phenomenon and findings that can likely be generalisable into wider contexts, it risks reducing the complexity of the phenomenon being studied. The research in this thesis has further been conducted inductively, which entails conducting the empirical material based on the identified problem while subsequently utilising theory (Blomkvist & Hallin, 2015).

3.1.1 Case study approach

A single exploratory case study approach was chosen for this investigation due to its possibility of disclosing important factors needed to achieve a deepened understanding of the investigated phenomenon (Blomkvist & Hallin, 2015). Case studies permits researchers to be exposed to a phenomenon within its natural settings and thus allow for boundaries which are not clearly evident
to emerge. Case studies possess a distinctive advantage when “how” questions are asked within a specific context where researchers have little or no control (Yin, 2003). The case study was limited to truck chassis development department (RT) at Scania, a sub-department of Scania’s R&D department which implies that managerial implications are limited to this specific business unit, previously outlined in section 1.4. Truck chassis development is a development department interesting to investigate for this study since chassis constitute a central part of the truck and is interlinked with many different sub-components. Secondly in the face of disruptive technologies such as electrification would require chassis to radically transform.

A case study approach where one single case is analysed as in this report limits the generalisability of the study (Blomkvist & Hallin, 2015) and analytical benefits might be difficult to endorse compared with having two or more cases. However, as the analysis expands the entire R&D by emphasising how current processes and strategies impedes or supports exploitation and exploration and their respective influence on the managerial challenge, we argue that other subdivisions within Scania’s R&D department will benefit from the research findings.

3.1.2 Insider research

The research presented in this thesis project was conducted during a 20 weeks full-time employment at Scania. Being employed at Scania during our thesis project has allowed us to conduct our research while simultaneously working side by side with managers, business developers and advisors which has enabled access to company specific primary information that otherwise would have been difficult to get hold of. To hear about the challenges of attaining both exploitation and exploration within the same business unit from different perspectives in the organisation has allowed us to get a sense of the whole and provided understandings for why we see certain results in our research. While insider research yields important in-depth knowledge about organisations which other approaches may not be able to disclose, it also comes with the disadvantage of researcher bias (Brannick & Coghlan, 2007). We are aware of this challenge and the possible effects it might have on our research. However, we do argue for impartiality towards the results that we see in our research as we present findings that can be interpreted as disadvantageous for Scania. How we have encountered researcher bias is further discussed in research quality, section 3.4.

3.2 Data collection

The empirical data has been collected through semi-structured interviews, a supplementing questionnaire and through document gathering. Interviews have been conducted internally at Scania with employees working in the R&D department but also externally, outside of Scania, due to the interviewees’ expertise within specific areas that were deemed necessary for the scope of this research. The case study builds upon interviews with managers working at RT:s sub-units and interviews with employees working at different departments within RT. However, as previously mentioned, primary sources have also been gathered from interviews with employees working at different departments within Scania’s R&D, inclusive of sales & marketing to understand the boundaries certain processes and organisational strategies pose with regards to exploration. The questionnaire comprised six questions and targeted a specific group, the managers from RT:s sub-departments.
3.2.1 Semi-structured interviews

Interviews of semi-structured character were considered appropriate for this research, partly due to the explorative nature of this thesis as well as its ability to capture a wide range of considerations and meanings about the investigated phenomenon (Collis & Hussey, 2013). Open-ended questions as an interview strategy allowed us to capture facts as well as respondents own opinions necessary for this research. According to Yin (2003) open-ended questions permits the interviewee to elaborate and propose insights into specific incidences and that putting forward such propositions for further analysis is critical to the case study success. When such propositions emerged that deemed necessary to understand, follow-up “how” questions were asked to understand underlying assumptions behind those propositions.

Information about the interview, such as topic, pre-determined questions, interview purpose and how the empirical data would be used in the report was sent to the interviewee in advance. This to achieve a mutual agreement between the interviewee and the interviewer. The selection of informants were at an initial state influenced by our supervisor at Scania who directed us towards participants which he thought would be relevant for our research. This could be argued to impede validity, however these first initial interviews allowed us to establish a network which sanctioned us to select informants through a snowball strategy. This implies that contacts with informants are based on previously established contacts (Blomkvist & Hallin, 2015). The snowball sampling strategy constitute the informant selection aiming at conducting the empirical data necessary to generate a holistic understanding of how different processes and organisational strategies facilitates or impedes exploration, for a more detailed about these informants see Table 5. Further were section managers of the investigated sub-unit selected with the specific focus to explore managerial challenges that resides in balancing the contradictory requirements of exploitation and exploration. Table 6 provides an overview of the interviews conducted with these managers. The primary purpose of external interviews were to access a bit more objective information and knowledge within specific areas that we thought needed a more thorough investigation, and to gain guidance in literature within the areas of sales & marketing and performance measurements. See Table 7 for an overview of conducted external interviews.

Notes were taken during all interviews, and in addition to this, were all interviews recorded through a mobile device and later transcribed to provide an overview of the knowledge gained. Further, all interviews were conducted in Swedish, meaning that quotations used in the report have been translated to English and this in a manner to be as similar as the source material as possible. All interviews except two were conducted as face-to-face interviews in order to eliminate important factors such as the loss of non-verbal data (Opdenakker, 2006). The two interviewees that were not conducted as face-to-face interviews was held and recorded through Skype due to the interviewee being situated in a different part of Sweden.

Table 5: Conducted interviews at Scania with the aim to generate a holistic understanding of how different processes and organisational strategies facilitates or impedes exploitation and exploration.

<table>
<thead>
<tr>
<th>Title</th>
<th>Description of Expertise and Relevance</th>
<th>Interview Date</th>
<th>Duration [min]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predevelopment Manager</td>
<td>Works at the investigated business unit, possess knowledge and expertise within the yellow arrow process.</td>
<td>2018-01-30</td>
<td>60</td>
</tr>
<tr>
<td>Role</td>
<td>Role Description</td>
<td>Date</td>
<td>Duration</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td>Business Developer</td>
<td>Works at the investigated business unit, possess a holistic perspective of the product development process and how projects are interlinked.</td>
<td>2018-02-01</td>
<td>60</td>
</tr>
<tr>
<td>Project Coordinator</td>
<td>Works at the investigated business unit, possess knowledge and expertise within the green arrow process</td>
<td>2018-02-01</td>
<td>60</td>
</tr>
<tr>
<td>Interviewee X</td>
<td>Works with building innovation capability by leveraging intrapreneurial skills of employees, projects are of an explorative nature and are carried out in an incubator setting.</td>
<td>2018-02-12</td>
<td>60</td>
</tr>
<tr>
<td>Senior Project Manager</td>
<td>Responsible for configuring the X-order process, a process which aims to allow the development of new products with a shortened time-to-market to meet and learn from emerging technologies, both from an engineer and customer perspective.</td>
<td>2018-02-13</td>
<td>60</td>
</tr>
<tr>
<td>Senior Technical Advisor</td>
<td>Recommended by a previous interviewee, possess experience and knowledge about concept development, both from a practical and theoretical perspective.</td>
<td>2018-02-14</td>
<td>60</td>
</tr>
<tr>
<td>Senior Research Manager</td>
<td>Works at the research and advanced engineering business unit with future urban mobility, new business models, business eco-systems and external co-operations. This business unit conducts explorative projects.</td>
<td>2018-02-27</td>
<td>60</td>
</tr>
<tr>
<td>Product Planning Manager</td>
<td>Recommended by a previous interviewee, responsible for product roadmaps of the fast moving and innovative area of eMobility trucks. Knowledge about the customer perspective of the X-order process and the impact sales and marketing creates on exploit and explore.</td>
<td>2018-03-07</td>
<td>60</td>
</tr>
<tr>
<td>Senior Advisor</td>
<td>Responsible for project decisions made in research and advanced engineering.</td>
<td>2018-03-09</td>
<td>60</td>
</tr>
<tr>
<td>Project Manager</td>
<td>Recommended by a previous interviewee, responsible for configuring the X-order process, a process which aims to allow the development of new products with a shortened time-to-market, to meet and learn from emerging technologies, both from an engineer and customer perspective.</td>
<td>2018-03-09</td>
<td>60</td>
</tr>
<tr>
<td>Technical Project Manager</td>
<td>Group leader at the investigated business unit, works with concept development, responsible for an electrification platform project.</td>
<td>2018-03-12</td>
<td>90</td>
</tr>
</tbody>
</table>
Research Director: Works at the research and advanced engineering business unit with future technology trends, scenario planning and portfolio management. This business unit conducts explorative projects.

Vehicle Application Manager Refuse: Recommended by a previous interviewee, works at a business unit which links sales & marketing with R&D, possess knowledge and expertise within property driven product development.

<table>
<thead>
<tr>
<th>Title</th>
<th>Description of Expertise and Relevance</th>
<th>Interview Date</th>
<th>Duration [min]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior Manager Head of Business Development</td>
<td>Responsible for the strategic business development within the investigated BU, strategy and business goal formulation, project deliveries and to provide support to the line organisation.</td>
<td>2018-04-04</td>
<td>60</td>
</tr>
<tr>
<td>Section Manager 1</td>
<td>The focus of the interview was to explore the managerial challenge that resides in supporting exploration and to understand how this challenge is perceived by line-management</td>
<td>2018-04-17</td>
<td>60</td>
</tr>
<tr>
<td>Section Manager 2</td>
<td>The focus of the interview was to explore the managerial challenge that resides in supporting exploration and to understand how this challenge is perceived by line-management</td>
<td>2018-04-18</td>
<td>60</td>
</tr>
<tr>
<td>Section Manager 3</td>
<td>The focus of the interview was to explore the managerial challenge that resides in supporting exploration and to understand how this challenge is perceived by line-management</td>
<td>2018-04-19</td>
<td>60</td>
</tr>
<tr>
<td>Section Manager 4</td>
<td>The focus of the interview was to explore the managerial challenge that resides in supporting exploration and to understand how this challenge is perceived by line-management</td>
<td>2018-04-23</td>
<td>60</td>
</tr>
<tr>
<td>Section Manager 5</td>
<td>The focus of the interview was to explore the managerial challenge that resides in supporting exploration and to understand how this challenge is perceived by line-management</td>
<td>2018-04-23</td>
<td>30</td>
</tr>
</tbody>
</table>
Conducted interviews with external actors of relevance for the scope of this research project.

<table>
<thead>
<tr>
<th>Interviewee</th>
<th>Notification</th>
<th>Title</th>
<th>Date of Interview</th>
<th>Duration [min]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per Lindstedt</td>
<td>Possess expertise within the interlinked areas, product development and customer value</td>
<td>Founder of The Value Model</td>
<td>2018-02-27</td>
<td>60*</td>
</tr>
<tr>
<td>Katarina Lund Stetler</td>
<td>Previously industrial researcher and coach at Scania, R&amp;D</td>
<td>Director of Innovation, Kairos Future</td>
<td>2018-03-27</td>
<td>60*</td>
</tr>
<tr>
<td>Mats Magnusson</td>
<td>Professor in product innovation engineering, possess knowledge and expertise within performance measurements</td>
<td>Professor at KTH, The Royal Institute of Technology</td>
<td>2018-04-27</td>
<td>60</td>
</tr>
</tbody>
</table>

*Skype interview*

3.2.2 Questionnaire

A second method used to gather empirical material was through a questionnaire. Before interviewing the section managers they were asked to answer six questions which comprised the questionnaire. The primary purpose of the questionnaire was to gain managerial perceptions about certain hypotheses that had emerged through previous interviews, to capture neutral thoughts and their perceptions about these hypotheses. The purpose with the questionnaire was furthermore to evaluate and support the empirical material gained from the latter conducted interviews with these managers. Using the questionnaire as a data collection method should not be confused with this research having a mixed-method approach, nor to increase generalisability, but to strengthen the validity and reliability of its results. For the specific questions that comprised the questionnaire, see appendix 1.

3.2.3 Document gathering

Document gathering has been used as third data gathering method. These documents have been obtained from Scania and cover organisational strategies, Scania’s strategic intent and vision, definitions and courses of the product development process, the modularisation strategy and information about different units within the R&D department at Scania. This data was analysed in relation to the previously mentioned empirical material and aimed at strengthening the holistic understanding of Scania’s organisational context and the challenges it creates to attain both exploitation and exploration within the same organisational unit. Table 8 provides an overview of extracted documents.
Table 8: Overview of extracted documents collected at Scania.

<table>
<thead>
<tr>
<th>Document Name</th>
<th>Retrieved From</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scania Corporate Presentation</td>
<td><a href="https://inline.scania.com/">https://inline.scania.com/</a></td>
<td>PowerPoint presentation</td>
</tr>
<tr>
<td>Definition of the S-order Normal Situation</td>
<td><a href="https://inline.scania.com/">https://inline.scania.com/</a></td>
<td>PowerPoint presentation</td>
</tr>
<tr>
<td>Technical Product Planning</td>
<td><a href="https://inline.scania.com/">https://inline.scania.com/</a></td>
<td>Internal information retrieved from Scania InLine</td>
</tr>
<tr>
<td>Scania Innovation Factory</td>
<td><a href="https://inline.scania.com/">https://inline.scania.com/</a></td>
<td>Internal information retrieved from Scania InLine</td>
</tr>
</tbody>
</table>

3.2.4 Ethical considerations

A nondisclosure agreement was signed by the researchers conducting this investigation and it was agreed upon not disclosing company sensitive information, as for specific designations or names of employee participants. By linking titles or roles of the interviewee participants to specific answers or quotes, complete anonymity has been assured while maintaining a certain degree of transparency. Third parties are thus not able to track answers back to a specific interviewee participant. Further has The Swedish Research Council’s principles of ethical research for the humanities and social research framework presented by Blomkvist and Hallin (2015) worked as a backbone when conducting the interviews in this research. The four principal requirements constitute the information requirement, the consent requirement, the confidentiality requirements and the good use requirement. These requirements have been assessed accordingly:

The information requirement: Interviewees have been informed in advance about the purpose of the research.

The consent requirement: All interviewee participants have agreed upon being studied after receiving information about the purpose of the study and how the empirical material gained will be assessed.
The confidentiality requirement: The empirical material gained throughout this study has been treated with respect to the interviewee participants and towards Scania. Thus, informants will remain anonymous throughout the report.

The good use requirement: The empirical material gained has been used accordingly to definite intentions. No deviations have been made regarding the information the interviewees received beforehand.

3.3 Data analysis
In qualitative research the process of analysing data is to make sense of the empirical material that has been obtained (Creswell, 2009). Analysing case study evidence is the least developed analytic strategy but all analytical strategies should define what and why should be analysed (Yin, 2003). The centre of this research has been to explore how management can support and sustain the exploration space in a mature R&D department. To answer this we have found it a necessity to provide understandings for challenges encountered by management in their role as providers and enablers for exploration, and why exploitation is favoured at the expense of more explorative activates in a mature R&D department. We have analysed our empirical material according to the framework presented by Creswell (2009). This framework follows the lines of organising and preparing data for analysis which implies transcribing interview recordings, reviewing extracted documents and results from the questionnaire. Transcribing interviews have been done alongside conducting them in order to get a sense of the empirical material, it also enabled to continuously follow up if something was unclear or in the need of supplementing questions. This was followed by reading through all the data independently, writing notes about general thoughts to obtain a sense of the whole. Emerging codes were labelled and similar labels were formed into clusters representing a specific topic. The topics were reviewed in order to see if new categories would emerge. All data that reflected each category were gathered and thematically analysed in accordance with existing literature.

3.4 Research quality
The quality of qualitative research can be described in terms of construct validity, external validity and reliability (Yin, 2003) which is further discussed in the sections below, along with a critique towards the source material used in this report.

3.4.1 Construct validity
Construct validity refers to whether the research representations of reality are captured accurately, or in other words how well the research content adds up with the purpose of the study (Yin, 2003). Qualitative studies naturally tend to generate high validity as the empirical data constitutes rich and detailed explanations of the investigated phenomenon, as opposed to quantitative or survey-based research where it is sometimes hard to determine if respondents have understood the questions in an accurate way (Creswell, 2009). In order to strengthen the construct validity concerning interviewees’ understanding of questions posed in the questionnaire an “everyday language” was used and complex concepts such as exploitation and exploration were defined and stated in advance in order to avoid misconceptions. The questionnaire was also tested by a Scania employee not relevant for the scope of this research. This test was followed by a discussion concerning difficulties in understanding the statements or questions. To further avoid misconceptions about complex concepts a framework based on our definitions of innovation, exploitation and
exploration were brought to the interviews to ensure that the interviewee based his or hers answers on the same definitions of these innovation concepts when questions referring to these concepts were asked, see Appendix 3 for this framework.

Qualitative research is all about subjectivity and interpretations which potentially bring researcher bias. However, when conducting a case study the problem of making interpretations cannot be avoided. When events cannot directly be observed, interpretations are made based upon the empirical data collected in the study, that a specific event is the result from an earlier occurrence (Yin, 2003). To deal with this validity issue in our research, different alternatives and explanations has been considered when making interpretations. To determine the accuracy of interpretations different methods have been used to a large extent as possible to triangulate the empirical material from where these interpretations emerged from. Triangulation in qualitative research allow researchers to control bias and increase propositions trustfulness of the investigated phenomenon (Golafshani, 2003). To further emphasise the accuracy of researcher interpretations informants have been asked to look over quotes used in this report, to correct and confirm that these quotes reflects their view of reality.

3.4.2 External validity
External validity measures if the results can be generalised into broader contexts (Yin, 2003). The chosen case study approach delimits external validity since it is arguably the case company itself that will benefit the findings from a single case. However, the intentions of qualitative generalisation are never to generalise findings into broader contexts as the value of qualitative research lies in the justified themes developed from the empirical material within its context. Due to in-depth knowledge gained in this research, exploring how management can support and sustain the exploration space in a mature R&D department, we argue that other organisations similar to Scania possibly would benefit from the research findings. Other organisations with a similar approach to product development and with contextual similarities would possibly reach similar results.

3.4.3 Reliability
Reliability measures the extent to which the results of the study will yield the same result if repeated, meaning, this study would credit high reliability if the same case study would be repeated and arrive at the same conclusions (Yin, 2003). If it is possible to replicate the findings from this research is difficult to answer. As qualitative approaches often result in complex investigations, reliability rather becomes a matter of structure and transparency (Flynn, Sakakibara, Schroeder, Bates, & Flynn, 1990). We have strived for such a transparency by giving a thorough description of how we have conducted our research. While defining complex concepts in order for the interviewees to be able to answers questions and maintaining a mutual consensus of these concepts, interviewers may present different answers depending on mood and how well the person is involved in the subject. To strengthen reliability in this research, procedures has been specified in a case study protocol containing aspects such as the case study plan, questions, evaluations, where interviews took place, contact persons etcetera. Documenting a case study is extremely important, especially if conducting multiple case studies and if they should possess the possibility of being repeated and yield the same results (Yin, 2003). To approach the challenge of researcher bias in insider research we have taken advantage of the benefits multiple researchers brings to an investigation (Eisenhardt, 1989). When
conducting interviews we divided the interview work into the lead interview role and the lead data collecting role. This increases the probability of approaching all interviews in a similar way and supports the research reliability (Voss, Tsikriktsis, & Frohlich, 2002). We have put high value in transcribing our interview material accordingly and latter reviewed it independently of each other in order to see if we both would arrive at the same emerging themes.

### 3.4.4 Source criticism

Secondary sources used in this report such as journals, articles and books have been carefully selected. Journals and articles have been chosen from established journals primary in the field of product innovation management and industrial management and evaluated through the framework presented by Blomkvist and Hallin (2015). This framework emphasises authenticity, proximity and dependence, tendency and representability (Blomkvist & Hallin, 2015). According to this framework, to the largest possible extent, authors have been evaluated upon their knowledge and expertise within the field, if the published information is current, if the presented work is peer-reviewed, and if so by whom, and if the presented work represents and is relevant for this research present in this thesis.
Chapter summary

This chapter has presented the methods chosen to gather the empirical material for this research. A qualitative case study was considered to be an appropriate method to explore how management can support and sustain the exploration space in a mature R&D department. The empirical material has been gathered through semi-structured interviews with employees working at Scania and with external actors, through a smaller questionnaire and through extracted documents. The first round of interviews targeted employees working at different departments within Scania’s R&D department and the second round consisted of semi-structured interviews with six managers working at truck chassis development, the specific department which constitute a limitation in this research. The semi-structured interviews with the section managers was complemented and further validated through the questionnaire, which comprised six questions. While the external validity and reliability in this study arguably is limited, it contributes with high construct validity as it provides deep insights of the emerging tensions between exploitation and exploration in a specific R&D context. Reliability is strived for through documentation and transparency while external validity or transferability as we would like to phrase it is strived for through the gathering of in-depth knowledge of the investigated phenomenon and its contributing result which arguably other similar organisations might find beneficial.
Chapter 4

RESULTS
4 Results

In order to explore managerial challenges that resides in supporting and enabling exploration in a mature R&D department, a series of semi-structured interviews were conducted, interviews with employees working at various R&D departments and sales & marketing, section managers working at the truck chassis development department and three external interviews. In addition, to complement and support the interview-data, various documents have been gathered and a smaller questionnaire was distributed and targeted section management at truck chassis development. This chapter presents the results from the empirical material obtained through these different data collection methods. It starts by giving a brief introduction of the product development process followed by a more thorough presentation of the yellow arrow process within the product development process since this research as previously outlined in Chapter 1 is delimited to this specific process. Further are different methods to order Scania products presented which aims to provide understandings for how product development vary depending on customer orders and that they target customer value differently. Relevant to analyse in this research is the newly introduced X-order, an order process that emerged as a response to face potentially disruptive technologies. This is followed by different strategies to manage R&D, modularisation, sales & marketing, property driven product development and strategic buckets to provide insights into how different strategies facilitates or impedes management in supporting and enabling exploration. Thereafter are challenges encountered by section management to support and enable exploration described according to their own perceptions, followed by a description of existing performance measurement and their relation to exploration. Lastly is a presentation of initiatives taken by Scania in order to encourage exploration.

4.1 The Product Development Process

Scania separates its product development process into three different processes see Figure 5, (1) the yellow arrow process, which include research & advanced engineering and concept development, (2) the green arrow process which is industrialization, here concepts are specified, verified, and further validated, and (3) the red arrow process constitute projects dealing with maintenance of the current product range in an efficient and effective manner. The product development process (PD-process) aims to generate products of the right quality, at the right time, with short time-to-market and within a pre-defined budget.

![Figure 5: The process for product development with three different sub-processes: the yellow arrow with research and advance engineering and concept development, green arrow with product development and finally the red arrow product follow up.](image-url)
4.1.1 The Yellow Arrow Process

The yellow arrow process is in turn separated into research & advanced engineering and concept development. Research & advanced engineering constitutes a business unit with focus on research, explorative projects and emerging technologies. This business unit was introduced and implemented seven years ago and is responsible for the development and evaluation of Scania’s technology roadmaps (TRM). Research & advanced engineering receives a small part of the budget allocated to the R&D. A decision meeting occurs in the beginning of every project and in the end of the project. These meetings decide which project that are allowed to start and which projects that should not. Results from projects conducted by this business unit will not necessarily result into a product, the main purpose with this process is to learn and increase new knowledge. Therefore, modularisation is not an important part within projects carried out in this business unit since the goal is not to produce a significant number of vehicles, the goal is to increase, create and capture new knowledge. Modularisation is an important strategy for Scania, but it should not constrain the process of research & advanced engineering. The teams within research & advanced engineering consist of experts and it is not unusual that team members also have continual contact with researcher from the academy.

There is no clear or precise strategy for projects within research & advanced engineering to continue to the next phase in the PD-process, the transition differs depending on the project maturity. Some projects are transferred directly into the green arrow process, industrialisation, while some projects require further concept development.

The existing process within research & advanced engineering affects exploration in several ways. According to a Predevelopment Manager (2018) at Scania, there are explorative projects in this process since it encourages learning and that promotes exploration. However, according to a Senior Project Manager (2018) who works with research projects, there is a challenge of transferring knowledge within Scania. Since there is no clear strategy when and how projects within research & advanced engineering should be transferred into the PD-process, knowledge transfer does not take place in a structured way. Also, the Senior Project Manager (2018) mentions that project today within research & advanced engineering often includes collaboration with actors operating in other markets. Previously, the mission was to develop new parts for trucks and busses. But now, for example when hybrid trucks are developed, collaboration with external partners are needed in order to solve the problem of charging the vehicle. Current process within research & advanced engineering at Scania does not support these new types of projects, and according to the Senior Project Manager (2018), this partly inhibits exploration.

“I find it sometimes difficult to get attention for projects that are not in line with what we do today, but which will be needed for our future business.”

- Senior Research Manager (2018)

Since the existing process only supports research that is driven by what Scania does today, there is a risk for negligence and falling behind competitors, according to the Project Manager (2018). The project manager also believes that resources that are assigned for projects within research & advanced engineering are often moved to green arrow projects when these projects pose a risk for not meeting deadlines. When a project of exploitative character with a clear deadline is delayed, experts are moved from research & advanced engineering in order to solve problems.
Since projects within research & advanced engineering do not have the same time constraint, these resources are transferred in order to deal with more urgent projects.

“The experts are used to solve urgent issues, “extinguish fires” in the CD- and PD-process. The managers are aware that the experts should not only be used for this, but they do it to solve the most urgent issues in major projects, and thus the experts have little or no time for exploratory work.”

- Predevelopment Manager (2018)

According to an engineering director at Scania, research & advanced engineering receives an insignificant part of the total resources at R&D, but it is difficult to retain this minimal amount of resources.

“At managerial level they want to do explorative projects, but at group managerial level they have to prioritize between the resources they have. When project deliverables are what counts, green arrow projects will be prioritized. Then I have no chance of attention for explorative projects compared to green arrow projects.”

- Research Director (2018)

The concept development process, hereinafter the CD-process, is compared to research & advanced engineering a structurally managed process with several clear stage gates. The CD-process focus is on investigation of technical solutions, business potentials and design engineering. The idea with this process is to minimise risks in green arrow projects and thus deal with these risks in concept development. Small demarcated teams work with concept development, different concepts are set against each other in order to find the most suitable concept. In order to select a concept, there are several factors that affects concept-selection: cost, weight, investment, service traceability and customer value. When a concept has been evaluated and determined as risk-free, the concept moves into the green arrow process in order to complete product development.

The department vehicle definition has the main responsibility for the CD-process, they manage routines, meetings and protocols. Between every stage gate there is clear instructions on what to do before the next gate, in order to continue with the project. The stage gates also decide when a project in the CD-process is ready to continue into the green arrow process. There is a clear deadline from the beginning since the production has to prepare for the new product and for an example, buy new machines. This deadline is called start of production, SOP. Further, a business case is required where expected customer, potential profit and how much market share it is expected to take. It is important that the concept that is to be developed during the CD-process fits with existing interfaces, since Scanias product range is based on modularisation. The small teams that works in the CD-process should work by themselves in order to carry out work in an effective and efficient manner.

There are several factors that affect exploration within the CD-process. According to a Technical Project Manager (2018), the CD-process is extremely structured, which inhibits the possibility to carry out work in a more explorative way. In the beginning of concept development, it is decided when the project should be ready for production, SOP. The strategy with sharp deadlines and SOP fits for work based on exploitation. For an example when an attachment has to be adjusted, a sharp deadline is not a problem since there are few risks and uncertainties associated with the adjustment. Therefore, there is a low risk for delay, since the project will proceed seamlessly.
But when there is a need for exploration which included several risks and uncertainty, it is difficult with sharp deadlines in form of SOP.

“95% of all yellow projects have a deadline, which makes the explorative work that is needed difficult. “Here it should be finished” is already predetermined and this affects creativity in a negative way. Time is prioritized.”

- Project Coordinator (2018)

According to the Technical Project Manager (2018), this is not the right way to conduct concept development. When developing concepts, the team do not know what to do and sometimes the team do not understand the technology. Therefore, it is difficult to decide when the project is ready for production, it is not always possible to determine a start of production within concept development, but this is always required. The challenge with sharp deadlines is also confirmed by a Senior Project Manager (2018) and a Predevelopment Manager (2018).

“If a sharp deadline is given, we take what we have, make some smaller adjustments and hope it is good enough.”

- Predevelopment Manager (2018)

The technical project manager believes that sharp deadlines is the reason why not several different concepts are evaluated in the concept development phase. Since there is a clear deadline, project teams do not dare to being late with the project and as a result the team will select a concept that the team know is working, and therefore they will not evaluate several different concepts. This is also confirmed by the Predevelopment Manager (2018), a Business Developer (2018) and a Senior Technical Advisor (2018). The consequence according to the interviewees is that since different concepts are not set against each other, it is difficult to ensure that the most suitable concept has been chosen, and as a result exploration is down prioritised, since there is no time to explore.

“There is not much innovation within the CD-process, many projects are more of an adjustment of existing components.”

- Predevelopment Manager (2018)

Project teams within concept development used to have the opportunity to think outside the box, but there is no possibility for that today due to time constraints. According to a Project Manager (2018), the cross functional work during projects is inadequate. In the beginning of a project, there is too little cross functional work, but in the end of the project, there are several different departments and teams that want to decide and have opinions. The Project Manager (2018) means that these decisions and opinions should be made earlier in the project when the complexity is lower, and not in the end. According to the Project Manager (2018) it could be solved due to continuous meetings and reconciliation. If the cross functional work increase, the exchange of ideas and knowledge would increase and as a result, it could generate a greater and more explorative product, according to the Project Manager (2018).

4.2 Different Methods to Order Scania Products

Today there is a possibility to order Scania products in three different ways, through A-, S- and L-orders. A-order is the method where customers orders from the current product range, it is possible
to order different variants of components and there is a clear price of the product. A-orders builds on present modules and this order focuses on a short and stable lead time. When customers want unique product, it is handled by S-order. In order to produce a unique product, factors such as modularity, cost or lead time are not prioritised in the same way as in A-orders. As a result, Scania is able to meet customers demand which is not possible to meet otherwise through the marketed product range. When a S-order has been ordered several times, but the special composition is not included within the marketed product range, it is called L-order. Scania know how to produce the unique product, but it is not part of the standardized assortment.

A fourth order, X-order has during the last year been developed which aims to meet customer demands in new emerging markets. This order is described more in detail below as it fosters exploration.

### 4.2.1 X-order

Customers today demand new technologies and Scania needs to learn about these new technologies. Therefore, X-order makes it possible for Scania to learn and develop new technologies together with their customers. The fact that the customer is involved during the whole project to a greater extent than other projects is a characteristic for X-order. Collaboration with subcontractors and authorities occurs within X-order projects.

"X-order has a clear purpose: in a faster way reach the market with immature products so we can learn by the new products. The development of technology goes fast, and R&D is far too slow."

- Product Planning Manager (2018)

X-order should be used as a side-track and it should not take more than one year to develop a product with a new technology, compared to the existing PD-process where it takes several years to develop products. X-order allow Scania to get immature products out on the market quickly, to reach the market with new technology and to learn from new technology. In order to decrease time-to-market, a lot of quality assurance is cut, and modularisation is not a restraining factor. Since quality assurance and modularisation are overridden, X-order projects do not suit ordinary product development projects. Also important in X-order projects is that decisions and approvals have to be made within the team in order to avoid inertness and keep time-to-market at minimum.

Due to the limited timeframe for X-order projects, these products do not meet the same quality requirements as the products of the current range. It is more important that the product reaches the market fast and since it is a new product with a new technology, the customer has lenience with the product quality. However, it is important that the quality increase as development takes place. Further in “normal” projects there is a project leader with sub-groups with sub-project leaders which are responsible to make decisions. In X-order, the project leader only has small teams, which decrease the lead time. By the usage of X-order, Scania makes it possible to absorb knowledge and learn about new emerging technologies.
“Today Scania has a core process which include quality, premium products etc. But the market is changing, and it is more important to get the product to the market, time-to-market must be short. If you do not get that, you are not in the game anymore. It is OK if it breaks down sometimes, it is a new product with a new technology, thus the customer has forgiveness with the quality, since the quality will get better meanwhile”

- Senior Project Manager (2018)

X-order starts with an initiative, a customer wants a product with a new technology and that constitute the base in X-orders. Then when the customer has received the product, engineers are responsible for maintenance, instead of service facilities that is normally used. During the entire project, engineers are able to learn about the new technology in reality and must then transfer this knowledge to R&D. When the leasing contract is over, Scania takes back the product for evaluation. If the customer then wants a new product, Scania should deliver it with higher quality and performance. Due to this knowledge-loop during the X-order projects, the loop provides constant knowledge transfer to the rest of R&D. This should in theory allow Scania to stay competitive in the current and emerging markets.

X-orders are highly explorative and foster exploratory activities. Several interviewees appreciate the new process, as it enables to learn about new technologies and creates the possibility to introduce products with new technologies on the market.

“How do we test new technologies directly on the market? The CD-process is limited and not very explorative. This has resulted in the search for new ways to explore within new areas.”

- Senior Research Manager (2018)

Further, since X-orders should be used in order to increase knowledge and encourage to take risks, it allows for managers to encourage exploration among employees, since there is a process which is adjusted for just exploration. However, one challenge for managers regarding X-order is the allocation of recourses. Today, managers have problems to secure resources within explorative projects as resources are being transferred to green arrow projects. Therefore, a Senior Project Manager (2018) suggest that X-order should be handled within an external organisation, in order to minimise the risk for recourses transferring.

“Resources within X-order have to be all-time-recourse, they cannot be prioritised for other projects.”

- Senior Project Manager (2018)

4.3 Strategies to Manage R&D at Scania

Scanias core values, customer first, respect for the individual, elimination of waste, determination, team spirit and integrity constitute the building blocks of the Scania house and the strategy towards a leading position in sustainable transports. In 2017 Scania intensified its focus on resources for electrification, automation and connectivity to drive the shift towards sustainable transports.

“Scania’s aim is to drive the shift towards a sustainable transport system, creating a world of mobility that is better for business, society and the environment.”

- The Scania Report 2017
4.3.1 Modularisation Strategy

What is argued to be one of Scania’s most important success factors is modularisation. This strategy has been developed during decades, generated unrivalled profit margins and constitutes the core of Scania’s business model. Modularisation creates the possibility for few components to create almost infinite product combinations which allow Scania to offer tailor-made solutions without interfering on product volume. The modular system builds upon three principles, standardised interfaces, equal needs should generate identical solutions and well-balanced performance steps to match specific customer needs. Meeting the needs of the customers is achieved through the design of interfaces between different components. Each interface is carefully defined to allow for maximum flexibility when combining components to the right performance level of the vehicle. Achieving economies of scale and efficient resource utilization through modularisation is utilised in production as well as in R&D. The modular system applies to the entire product portfolio, trucks, buses and engines. The ability to offer tailor-made solutions enables Scania to meet specific requirements from a variety of industries, ranging from mining, the forest industry, bus systems and distribution for retail and waste disposal.

Work conducted at the research & advanced engineering department is highly experimental and explorative and these projects in their early stages depart from modularisation as it allows to test new technology without constraints. However, as projects progress it needs to be adaptable to the modular system.

“Scania is a mature company and has during decades been very profitable, so you want to minimize risks and thus avoid exploration. We are used to think modularity, continuous steps and to keep risks at a minimum.”

- Research Director (2018)

Both the Technical Project Manager (2018) and the Project Manager (2018) mentions challenges for modularisation in relation to emerging technologies as for electrification and autonomous vehicles and how these technologies set entirely different requirements on ingoing components. The combustion engine has for an example specific cooling requirement while the electric motor has completely different cooling requirements, cooling requirements that relates to the batteries which creates a challenge for the current modular system since it is adjusted according to the combustion engine.

“Modularisation has been a successful tool for Scania and it works well as long as the vehicle looks like today. But when the vehicle does not look like the vehicle today, it will be difficult for Scania to work based on modularisation. If you remove the powertrain, how will the production then look like?”

- Technical Project Manager (2018)

4.3.2 Sales & Marketing Strategy

Sales & marketing covers sales of trucks, busses, engines, spare parts, services and accessories. Scania wants to offer optimal solutions for specific customer needs and put emphasis on “if our customers are profitable, we are profitable”. For sales & marketing it is important to ask the right questions in order to understand customers unspoken needs, to understand what they actually want. When sales & marketing has identified which product or service the customer wants, this information needs to be transferred to R&D, which is done by the business unit vehicle definition.
Sales & marketing possess the possibility to influence both exploitation and exploration, depending on the marketing strategy. Since sales & marketing have direct contact with customers, they have the possibility to understand customers’ unspoken needs, which might generate an input to R&D of an exploratory character. Exploratory projects at R&D are facilitated by an exploratory input. However, according to Product Planning Manager (2018), Scania is highly controlled by R&D and sales & marketing has little influence. Therefore, according to the manager there is a risk that R&D miss valuable insights from the marketing side and as a result, possibly miss out on customers unspoken needs and thus, exploration.

“It used to be R&D that develops and marketing that sells. Today marketing has increased their influence, but it is still R&D that is in control.”

- Product Planning Manager (2018)

Further according to the Product Planning Manager (2018), since sales & marketing has limited influence over R&D, it poses a huge risk that in the end, the wrong product has been developed. Further, the product planning manager reasons that since the influence is minimal, it makes it difficult for sales & market to mediate customers unspoken needs to R&D. As a result, the focus for sales & marketing is on existing products, since it is easier to bring forward continuous improvements rather than exploration.

“I do not think sales & marketing take its fully responsibility and looks forward, they look at today’s business. But when they do, they do not have the opportunity, since R&D is the one who decide.”

- Product Manager (2018)

4.3.3 Property Driven Product Development

Vehicle Definition is a business unit responsible for the truck’s modular structure at the main component level, the performance development among trucks, competitor comparison and legal requirements. As a result, vehicle definition match future customer demands with decided projects and planned technical roadmaps. As mentioned previously, vehicle definition owns the concept development process and the project portfolio in concept development will help R&D to accomplish technical roadmaps.

Vehicle definition works with property driven product development and mediates information brought from sales & marketing to R&D. Vehicle definition translates customer demands from sales & marketing into technical specifications to R&D. Property driven product development starts and ends with the customer. Therefore, it is important to understand customer’s current as well as future needs, in order to constantly push product development forward. In order to reach desired property levels, the whole R&D organisation has to work according to these property targets, which are specifically set in each development project.

Vehicle definition influences exploration in several different ways. Since vehicle definition is responsible for the translation between sales & marketing and R&D, it is important that the translation functions correctly. Otherwise, it is difficult for R&D to understand and obtain a sense of the whole.
Unfortunately, the transition to R&D does not work very well. Customer needs from sales & marketing shall be transferred to vehicle definition, but vehicle definition does not have the ability to fully understand these needs. It is difficult to convey a property to vehicle definition since they want to hear component, and not property.”

- Product Planning Manager (2018)

According to Per Lindstedt, an expert within the interlinked areas of product development and customer value, sales & marketing has the possibility to identify customers unspoken needs, which is a prerequisite for exploration.

“You need to understand what it looks like, you cannot deliver only a report, and you have to have some self-experience. In other companies we include as many people as we can in the exploratory phase. There is a problem with development processes, the market department discovers what the customer wants and put it together into a document for someone who does his part and so on. Each part can be good, but no one has the overall view. If you miss it, then it falls, and it can be totally wrong.”

- Per Lindstedt (2018)

Further, according to Per Lindstedt, there is a challenge when sales & marketing must inform R&D about customer needs through third parties. When customer value has to go through several different units, it creates the risk of losing important aspects of this customer value, and as a result, the wrong product might be developed.

4.3.4 Strategic Buckets

Scania uses strategic buckets in order to distribute resources strategically to particular areas in accordance with the R&D strategy. Examples of buckets are electrification, autonomous and future powertrain. Strategic buckets create the possibility to balance resources in the project portfolio and to follow up on the resource distribution to ensure that it is in line with the overall R&D strategy. It is also easier to prioritise between projects within each bucket. Strategic buckets enable control, to estimate resources and to follow up. The bucket strategy was introduced at Scania a couple of years ago. Strategic buckets create challenges for innovation projects in several ways. According to a Technical Project Manager (2018), these buckets has caused a shift in focus, from technology to money and this affects exploration in a negative way.

“At technology meetings, people used to talk about technology. Today the discussion is about money, money and time.”

- Technical Project Manager (2018)
A Business Development Manager (2018) advocates another challenge, which is that projects are shut down every month due to the lack of resources.

“Since Scania has a variety of different buckets, and the entire R&D budget needs to be divided between all these buckets which implies that each bucket receives a little bit of whole. As a consequence, if there are no resources left within a specific bucket, projects within this bucket has to be shut down. However, these projects might be of strategic importance for Scania, but if there are no resources left, these projects are shut down. Meanwhile, other projects within other buckets can proceed, since these buckets still are not out of resources. But these projects might not be the most strategically important ones.”

- Senior Manager Head of Business Development (2018)

Another challenge with the buckets is the complexity they bring. It is unclear who determines how much resources each bucket should comprise of and there is an overall dissatisfaction with the bucket strategy.

“Nobody understands the buckets, you understand the idea but not how it should work in practice.”

- Section Manager 1 (2018)

4.4 Management of Exploration at Truck Chassis Development

R&D is a complex organisation and to succeed with an efficient product development, the product development process has to be structured. Scania want assurance, take small steps, think modularisation in everything they do in order to minimise risks. This results in a daily work with continuous improvements and adjustments of existing processes. Therefore, there is a challenge for managers to encourage explorative project, since exploration by nature involves high uncertainty and risks.

Section Manager 3 (2018) advocates that if projects are in-line with the overall responsibility of the business unit, the manager believes he has the mandate to start projects. However, projects that are not in line with what the business unit does today, are more challenging and difficult to justify.

“If a project is not in-line with the group´s area and it supposedly would require one or two resources and it has a specific cost, then it has to be anchored at a higher managerial level”

- Section Manager 3 (2018)

Since Scania main focus is on continuous improvements within known areas and techniques, it is difficult for managers to justify projects of an explorative character, since exploration is associated with investigation of an unexplored area, risks and uncertainties. Section Manager 2 (2018) and Section Manager 3 (2018) think that they have the mandate to encourage explorative projects, but they also mention that there is a risk that the project get stuck in budget issues and priority issues. Managers suppose that they would be questioned when money and individuals are tied up for exploration and not prioritised for green arrow projects. This uncertainty about encouraging explorative projects is also shown from the questionnaire which was answered by section managers, which can be seen in Appendix 4. Four section managers responded “strongly agree” to the question about if they have the authority to encourage exploitative projects, and one section manager responded “agree” on this question. Further, the next question in Appendix 4 was if the
manager has the authority to encourage explorative projects. Three section managers responded “agree” and two section managers responded, “do not know”.

Since section managers are not evidently encouraged to start projects that are associated with high risks, it is difficult to get approval of more explorative projects. The uncertainty regarding encourage risk-taking is also shown in the questionnaire, Appendix 4. Three section managers responded “agree” on the question that they encourage risk-taking, meanwhile one section manager responded, “do not know”, and one section manager responded, “strongly agree”. Scania has difficulties making long-term and risky decisions, which affect the speed of the decision-making process in a negative way for more explorative projects, since explorative projects need to be anchored at a higher managerial level.

“It took a year and a half to get permission to start a project of an exploratory character. Now, a year and a half later, the project has been approved; meanwhile competitors have come further with such a development. This is due to the fact that managers do not dare not make decisions about explorative projects since those projects comes with high risks and uncertainty.”

- Technical Project Manager (2018)

It is also mentioned that everyone that is affected by the explorative project should be informed, in order to be able to put a veto. This makes the decision-making process even more slow. Section Manager 3 (2018) believes that several decisions could be made on section level or on group level. However, for some reason many decisions have to be anchored on a higher level, and this results further into a slow decision-making process.

It is also mentioned in the interviews that there is no clear innovation strategy at Scania today. From the questionnaire there was one question about if they had a clear understanding of Scania’s innovation strategy. The results are presented in Figure 6. There is only one section manager who responded “agree”, meanwhile three section managers responded “do not know” regarding Scania innovation strategy. Finally, one section manager responded “disagree”. Meanwhile, there is a greater understanding about Scania’s future destination. One question in the questionnaire was about understanding the future destination of Scania, which can be seen in Appendix 4. The results from this question was that four section managers responded “agree” and one section manager responded, “strongly agree”. Section Manager 2 (2018), Section Manager 3 (2018) and Section Manager 4 (2018) believe that if there was a clear innovation strategy, it would be easier for them to encourage exploration among their employees if they know how and in what direction Scania is focusing regarding innovation and exploration.
There is a high emphasis and focus on green arrow projects at R&D. It is mentioned previously in this report that when there are problems within green arrow projects, one steals resources from explorative projects since employees with certain expertise usually works with these explorative projects. This results in challenging task for managers, because when managers try to prioritise explorative projects in urgent times, resources are transferred to green arrow projects. Further, if a manager tries to prioritise explorative projects and ensures that resources are reserved for this project, the manager is then instead questioned why these reserved resources are not allocated in green arrow projects.

“There is no strategy for innovation, there exist a mind-set but a specific strategy is missing. You do not defend great ideas, when there are problems in green arrow projects, resources are instantly transferred to deal with these errors. It might be a strategy, but it is not a strategy supportive for innovation.”

- Section Manager 3 (2018)

All section managers believe that Scania is putting too much time and resources on green arrow projects. The green arrow projects are important as they are the reason behind Scania’s profitability, but managers believe that there has to be a balance in order to stay competitive in the future.

“I think we have too little focus on exploration. There is a huge focus on green arrow projects, which are a necessity for us, but I think we need to increase exploration in order to reach a balance.”

- Section Manager 3 (2018)

Another challenge for managers related to green arrow projects is the date for start of production, SOP, which is determined in the beginning of a project. A green arrow projects cannot be late, and this encourages to a work based on continuous improvements, in order to minimise risks, risks which might cause a delayed SOP. It is expected of managers to move resources when there are problems within green arrow projects, since there are large amounts of money involved in these
projects, and as they have a specific customer need. Section Manager 2 (2018) claims that clear directives must come from higher up in the organisation, to prioritise exploration and innovation. Since there is a huge focus on continuous improvements and green arrow projects, all section managers believe that they do not have the time to encourage exploration. According to the managers, long-term thinking requires more thoughts and strategic thinking. One has to twist and turn many times before one understands the long term. You do not understand it in half-days, you have to spend time to understand. Therefore, exploration require time, but this time is prioritised to green arrow projects.

In order to understand which factors that have the highest impact on projects, managers on sectional level were given the opportunity to rank the impact of different factors on projects. These factors were time, budget, customer value, knowledge creation and risk minimisation. The result is presented in Figure 7. What that can be seen is that beyond customer value, time has the largest impact on projects. This further confirm the fact that time is highly valued within projects at Scania. The results also show that knowledge creating has the lowest impact on projects, meanwhile risk minimisation and budget neither have the largest or lowest impact on projects.

![Figure 7](image)

**Figure 7** Manager at sectional level had the opportunity to rank five different factor and their impact on projects at Scania

There is one sub-department at the investigated department which faces other challenges when encouraging exploration compared to other section managers. When the new truck at Scania was developed, Scania had to make their capacity more flexible. Therefore, a sub-department allocated outside Södertälje head-counter mostly based on consultants was created. This was because consultants can easily be moved, and consultant missions are temporal. This made it possible for Scania to handle different amounts of projects by increasing and decreasing the number of consultants. This resulted in a collaboration among consultant firms with 140 000 consultants, and a large network was created. According to the sectional manager who is in charge for this sub-department, this makes it possible for the sub-department to solve any kind of problems, due to the large network. It is also an opportunity for Scania to learn about new technologies since this group does not have any limitations based on competence. If the group needs an expert within a certain area, they can just hire a consultant within this area. This results in challenges for this sub-
department which other section managers at Scania do not experience. Since the sub-department is based on consultants, knowledge is created among these consultants and not within Scania, which make it difficult for Scania to learn about new technologies.

“We are able to do everything at this department. By explorative project new knowledge will be created, but this new knowledge can be hard to be saved within Scania because of consultant use, that is a problem for Scania. This results in that Scania will not allocate explorative projects at the department. Instead, we get projects of exploitative character, and as a result we do not use the department fully capacity.”

- Section Manager 4 (2018)

Another challenge according to Section Manager 4 (2018) is the risk for “not invented here”, which is a huge challenge for this sub-department. If it is not developed within Scania, you do not take care of it and this is a huge challenge for the sub-department. It is difficult for them to implement results from projects within Scania, since it is not invented in Södertälje.

4.5 Present Performance Measurements

Truck Chassis Development designs performance measurements based on four areas within a balanced scorecard and based on overall strategic R&D directives and key performance indicators. While truck chassis development measures more than required, Senior Manager Head of Business Development (2018) acknowledges that R&D in general has had a tendency to review few key performance indicators at a time, and when one of them provides indications of not realising targets, actionable modifications are directed towards that target.

“When the interest for key performance indicators is missing, you tend to choose easier measurements which is easier to draw conclusions from, which is what R&D has had a tendency to do.”

- Senior Manager Head of Business Development (2018)

Senior Manager Head of Business Development (2018) further acknowledge that while truck chassis development intends to measure more than what is required, it is of outmost importance that these measurements are visible for sections and section management since what you measure is usually what controls behaviour and attention.

There is no clear key performance indicator for innovation or exploration, which makes it difficult to encourage exploration. If you cannot measure innovation and exploration, it is difficult to ensure that enough with resources have been prioritized for explorative activities.

“There is no focus on learning and competence. We look at the overall perspective and each group at Scania is responsible to ensure that everyone have the right competence, but we do not prioritise to measure it”

- Senior Manager Head of Business Development (2018)
Section Manager 1 (2018) mentions that his/her manager does not request innovation and exploration. This combined with the absence of clear key performance indicators for innovation and exploration, makes it difficult for R&D to ensure that innovation and exploration targets are met.

"All my managers want to see is budget, technical, work satisfaction and process development. They want to see a lot, but do they want to see exploration?"

- Section Manager 1 (2018)

It is further mentioned from several informants that delivery and green arrow projects are highly prioritised. Since there are clear key performance indicators for delivery precision in green arrow projects, these projects are prioritised to a larger extent in front of exploration.

4.6 Safe-guard the Exploration Space

From the interviews it has been concluded that there is an overall understanding to increase exploration at Scania. Some initiative has been taken in order to increase the encouragement for exploration. One initiative is innovation factory (IF). It has been found out from the interviews that when a project is to start, a business case has to be developed. This is rather difficult for engineers, since they often have technical expertise, but they have challenges in understanding how the product will be accepted on the market and which profit it will generate. IF on the other hand can support the engineer on this part, to avoid that the project will be shut down due to inductive business case. IF should be used as a support for the engineer with an idea of explorative character. This initiative was started two years ago.

“Employees at Scania are very positive to Innovation Factory. They believe that there are limitations in time for creativity and therefore, their ideas cannot take place. But now employees have a separate channel for their ideas. The majority of applicants who wants to test Innovation Factory are employees that have been working less than five years at Scania.”

- Interviewee X (2018)

Further, at the investigated department, truck and chassis development, an initiative called dragon’s den was started in March 2018. The idea with dragon’s den is similar to IF, to support and coach the engineer with the explorative idea. But dragon’s den is mainly focused on ideas within the departments area. If the idea is not within the departments area, it is recommended to use IF instead.

According to interviewees, IF and dragon’s den are facing similar challenges. Scania has a complex organisational structure, and this makes it difficult for initiatives which are different and not in line with the business of today, to take place. As a result, decisions have to reach the higher level within Scania to get through provisions within the initiative.

However, several interviewees reasoned that these initiatives are not enough to meet the demand for new technology. Interviewees believes that Scania has to take responsibility and increase the encourage for exploration. As mentioned previously in this report, exploration takes place if an employee has an explorative idea, but interviewees mention that Scania has to encourage exploration as well, in order to increase exploration in the daily work.
Chapter summary

This chapter has presented the result from interviews collected at Scania. First, a description about the product development process, PD-process, was explained. Focus in this thesis is the yellow arrow process since this process has the greatest opportunity to encourage exploration. There are several factors in the yellow arrow process which affect exploration. Within research & advanced engineering there are possibilities for exploration, since the focus with research & advanced engineering is to increase knowledge. But there is no clear strategy when and how projects should be transferred into the PD-process and knowledge transfer does not take place in a structured way, and this affects exploration in a negative way. Further, there are challenges for exploration within the concept development process, the CD-process. The purpose with the CD-process is to explore different concepts, evaluate and select the concept which suits the best, and this work encourages exploration. But, time limitation decreases the possibility to explore different concepts and employees have to select a concept early, and as a result, the part with exploration do not exist.

Thereafter, a description of different processes to order Scania's products was presented in order to generate an understanding for how product development vary depending on customer orders and that they target customer value differently. Further, the newly introduced order process, X-order, is presented which is an order process that emerged as a response to face potentially disruptive technologies. The purpose with X-order is to reach the market with immature products and with a collaboration with the customer learn about the new technology and improve it. But X-order is facing the challenge about resource allocation and interviewees consider that resources within X-order should be handled within an external organisation, in order to minimise the risk for resources transferring.

Further, several strategies in order to manage Scania were presented and how these strategies affect exploration. Modularisation is the heart of Scania which is a great tool as long as the components looks like today. But when they do not it will be rather difficult with existing modularisation, and as a result it might affect exploration in a negative way. Sales & marketing has a great opportunity to understand customers unspoken needs which is the base for an exploratory input to the PD-process. However, it has been shown that sales & marketing has limited influence on R&D. Strategic buckets distribute resources at R&D and according to interviewees, these buckets have contributed to a shift in focus, from technology to money, and this counteract exploration. Further, due to buckets, the priority is based on how much money there is left in each bucket, not how important the project itself is.

Then challenges when encouraging exploration according to section managers was presented. What can be conducted is that there is a huge demand for exploitation and continuous improvements and this results in no time for exploration. Section managers further believe that risk-taking is not encouraged to a greater extent at Scania, and this contribute to challenges for managers when they try to encourage risks. There is no innovation strategy at Scania and section managers believes that it would be easier to encourage exploration if they knew about an innovation strategy. Decisions has to be anchored within Scania and some section manager believe that there are difficulties regarding explorative decisions, since these decisions often means uncertainty and risks, and there is a general resistance to risks and uncertainty.

Thereafter a presentation of existing performance measurement was presented and how they contribute further to challenges for exploration, since existing performance measurement is designed for exploitation. This results in that exploitation is prioritised before exploration due to the fact that section managers are measured on exploitation. Therefore, it is difficult to follow up and demand exploration, since performance measurement is not designed for this type of work. Lastly, some initiatives which have been taken at Scania in order encourage exploration was presented. These initiatives are innovation factory and dragon’s den, which aims to support and encourage employees with explorative ideas. But, some interviewees mention that these initiatives are not enough, and Scania has to take some responsibility and demand exploration, and not only rely on that employees will ensure that exploration is completed.
Chapter 5

DISCUSSION
5 Discussion

This chapter provides an analytical discussion based on the empirical material outlined in Chapter 4 in relation to the literature review presented in Chapter 2. It starts by analysing R&D in general in order to provide understandings for why there is an overall pressure for exploitation, and how certain strategies and organisational structures could facilitate exploration. This is followed by the managerial challenge at truck chassis development, two prominent interlinked themes emerged from our empirics which describe why management encounter challenges in supporting and sustaining the exploration space at their respective departments, focus on delivery precision crowds out time for exploration. This is further something that can be explained with performance measurements or measurements of innovation. Lastly, this chapter presents a discussion of theoretical implications and the research process.

5.1 Pressure for Exploitation in R&D

It has fallen naturally for Scania to direct product development attention towards exploitation and incremental advancements of the internal combustion engine since this core component has been dominating the heavy vehicles industry for decades. To deliver products of prominent qualities with high customer satisfaction has been the focal point in product development. High emphasis has therefore been dedicated to improve processes, this to minimise errors, defects and variations in order to achieve and improve efficiency within product development.

Modularisation has further allowed Scania to meet the needs of customisation without interfering on product volume. In modularisation, standardised interfaces allow for different components to be combined and compatible with each other. Keeping these standardised interfaces as compatible requirements makes it possible to manage innovation and product development within specific units, for example, engine development can be done without interfering with cab or gearbox development. This simplifies product development and underlines the continuous improvement strategy that has enabled Scania to produce trucks and buses with prominent qualities (Sköld, 2016). The modularisation strategy has generated unrivalled profit margins compared to other actors within their industry, and thus considered as one of Scania's core capabilities. Well defined processes for product development and core capabilities has enabled Scania to prosper during the current technological paradigm and we argue in accordance with Lavie and Rosenkopf (2006) that inertness has allowed Scania to continue its current technological trajectory and the focal reason why there is a pressure for exploitation.

What is evident is that emerging technologies possibly will disrupt the heavy vehicles industry and informants across the organisation have raised concerns about the current way of working, and if it will be enough for future organisational viability.

While previous research has emphasised that management has an important role in emphasising and creating right conditions for exploitation and exploration (Rosing, Frese, & Bausch, 2011; O’Reilly III & Tushman, 2011), it has been our aim to provide understandings for that other factors provide implications for managing exploitation and exploration simultaneously. This part of the analysis provides a deeper view of how different organisational processes and structures both can facilitate and encumber management in their role to enable and support exploration and exploratory activities.

5.1.1 Integration between Sales & Marketing and R&D – A Missing Link?

Sales & marketing possess an important responsibility for innovation, to transfer customers’ needs to R&D, preferably in dual forms, in the forms of both exploitation and exploration. This however
would require a marketing strategy that explicitly divide attention between the search for exploitative and explorative customer needs (Lindstedt, 2018). Transferring exploitative and explorative needs could possibly facilitate and direct R&D towards both exploitation and exploration and thus support management of innovation. However, R&D show signs of being in control of this process, resulting in that sales & marketing possess limited influence over R&D activities, and cover the sales of products, rather than directing R&D behaviours and outcomes (Product Planning Manager, 2018).

Contextually ambidextrous organisations should through a supportive organisational architecture encourage individuals to themselves divide their attention between exploitation and exploration. What precisely a supportive organisational architecture means is rather ambiguous in previous literature. We argue in accordance with Gibson and Birkinshaw (2004) that the interaction of stretch discipline and trust are important factors to account for, however this integration should permeate the entire R&D organisation. Indications from our empirical material provide insights in that R&D has an overall contextually ambidextrous approach with elements of structural separation (Lavie & Rosenkopf, 2006). What indicates this more precisely is the notion that all employees working in R&D should work in all stages through the product development process while research and advanced engineering is separated from this process, and that truck chassis development has a specific section with mainly consultants. While this specific section could work with explorative activities they are strictly assigned to work with exploitative activities since there otherwise would be consultants who learn and not R&D. This provides indications that R&D in general avoids challenges that comes with structural separation, namely to integrate knowledge from these separate units (Lavie, Stettner, & Tushman, 2010). Further, there are supportive functions that fosters creativity such as RT Dragons Den and Innovation Factory, these functions has been somewhat separated from the rest of the organisation as a mean to nurture employee creativity and thus domain separation. This rather proves that separate functions is required since the ambidextrous organisational architecture alone does not permit individuals themselves to foster tensions between exploitation and exploration and that actions has been taken to manage tensions between exploitation and exploration. Several informants have raised concerns about the difficulty in getting attention for projects not strictly in line with the core business (Senior Research Manager, 2018; Senior Project Manager, 2018; Head of Vehicle Acoustics, Performance and Reliability, 2018), and that a reason for this is the high uncertainty that comes with projects of an explorative character (Technical Project Manager, 2018). While scholar like Gibson and Birkinshaw (2004) argue that contextual ambidexterity can be shaped and supported through management, we argue that section management at truck chassis development has a great responsibility for shaping and supporting this architecture that is required for contextual ambidexterity. However, if this is not something that permeate the entire organisation from top management and down, it will be challenging, if even possible, for managers at a lower level to balance contradictory requirements from exploitation and exploration.

5.1.2 How to play and win? Dare to Try, Manage the Risk!
It has been acknowledged through several interviews that one possible explanation for the crowding out of exploration is the uncertainty and high risks that comes with such activities (Product Planning Manager (2018); Project Manager 2018; Research Director 2018; Section Manager 1, 2018). The focal point of product development is to introduce premium products on
the market, faster and with superior quality. Results in this thesis point towards several factors that underlines the fear of taking risks and why novelty in risk-taking is deprioritised. The most prominent one is, that decades of being profitable has resulted in a somewhat look-in effect in profit margins. If a novel idea cannot prove its value according to a business case with a specific profit margin it will be neglected (Research Director, 2018). Exploration and explorative activities naturally associates with high risks as it aims to explore something unknown.

Emerging, potentially disruptive technologies pose a significant challenge for R&D existing processes, partially due to long lead times in product development. To face disruptiveness and learn about new technologies, R&D in cooperation with sales & marketing developed and released the new X-order process with the specific intentions to introduce new technologies on the market in cooperation with their customers. While product development through X-order arguably creates the substantial benefits to pursue radical exploration, introduce new products on an immature market, facilitate learning of new technologies, no actual X-order project has yet been initiated (Product Planning Manager, 2018). While X-order does not directly relate to section management of exploration it provides an understanding of organisational inertia and how incumbent R&D organisations, pressured to exploit existing capabilities for decades are constrained by investments made in exploitation in the past and thus show signs of resistance towards change (Lavie & Rosenkopf, 2006). Informants are further concerned about X-order and how such a process could result in non-homogeneity among employees, that key individuals would be assigned to work with X-orders and that it would be harmful to Scania just culture. Since X-orders separates itself from modularisation, a possible explanation for the fear of introducing these projects could be the fearfulness that X-order will be a separate side-track, and that it will not be profitable as it does not take industrialisation into account at first. A second possible explanation for not initiating X-order projects is releasing immature products on the market (Project Manager, 2018), product of prominent qualities is significantly important for today’s customers and the reason why todays customers choose Scania products and thus introducing product variants with lower quality could be harmful to Scania’s image.

While X-order first and foremost aims to facilitate learning of new technologies, capture early adopters and learn about a market that has not yet paved its path towards its full existence, X-order evidently creates the possibility to pursue radical exploration, the exploration of capabilities that possibly could result in radical innovation (Corso & Pellegrini, 2007). We argue along the lines of Corso and Pellegrini (2007), since radical exploration associates with discontinuity theory, radical innovation pose a specific pressure for Scania to pursue in the face of a potentially disruptive technological shift. To survive a discontinuous shift entails sensing the atmosphere, discovering weak signals pointing towards discontinuity in unchartered territories, understanding the needs of a market that has not yet paved the path to its existence, strategic decision making, promoting project which lies outside of the organisations ordinary scope, and perhaps most importantly, learning to unlearn (Corso & Pellegrini, 2007). Since X-order projects, if initiated would require the work of small decremented teams executed by key employees, section management would explicitly have to deal with resource allocation challenges, if these key players currently are situated in their respective department. The role of risk-taking in projects that lie outside of the core business is further argued to be a factor why exploration is down prioritised by several informants (Senior Project Manager, 2018; Research Director, 2018; Product Planning Manager, 2018). The initial idea with X-order projects was to release products on the market faster without prioritising quality, to
learn about new technologies together with customers, also a way for sales & marketing to learn about new business model. However, as these X-order projects comes with high risks, and at first they won’t be very profitable they are somewhat neglected as you are afraid of taking the risk (Senior Project Manager, 2018). Product Planning Manager (2018) especially emphasise that these projects are aimed for learning about new technologies, that you need to invest money in learning for long-term sustained success.

5.1.3 Realising the Need to Change – Exploration through Support Structures
RT Dragons Den and Innovation Factory are initiatives aiming to support and enable employee creativity, ideation and more explorative activities in R&D, activities that lies outside the scope of today’s core business activities. These business units evidently show completely different structures for support, stretch and discipline compared to how work “normally” is executed at R&D. Creating separate business units and allowing these units to work under completely different conditions allows to solve the tensions of resource constraints in contextually ambidextrous R&D organisations. However, while these two initiatives might foster employee creativity and ideation, solving tensions between resource constraints becomes a managerial challenge in terms of discharging these specific individuals from their ordinary assigned tasks, which becomes an even more evident challenge if these employees are somewhat key players within the organisation. To structurally separate explorative activities is might a necessity to solve tensions in contextually ambidextrous organisations (O'Reilly III & Tushman, 2013), but structural separation comes with its own challenges, more specifically to integrate learning and knowledge from these separate units into the rest of the organisation (Lavie, Stettner, & Tushman, 2010).

5.2 The Managerial Challenge at Truck Chassis Development
While there are several factors that explain the overall pressure for exploitation in R&D, these factors lie outside of what section managers are able to influence. However, we argue that these factors provide understandings for the more evident and specific challenge encountered by section management in sustaining the exploration space. Evident in our empirical material is that high focus on delivery precision pressures section management and crowds out time for exploration.

5.2.1 Delivery Precision over Innovativeness
Section managers at truck chassis development provide somewhat different definitions of what their role as section manager entails. While their most prominent responsibility is to deliver against the projects undertaken by their section, some explicitly express that they have the responsibility to support employee creativity (Section Manager 3, 2018), to provide visionary guidance and provide their section with the support needed to strive towards strategically long-term decisions (Section Manager 3, 2018; Section Manager 4, 2018). While results from the questionnaire indicates that section managers encourage employees to take risks, which is a behavioural presumption for exploration (Rosing, Frese, & Bausch, 2011), they also indicate that there is an overall focus on delivery precision that permeates the entire R&D. To deliver in pre-determined projects is a necessity, however, delivery precision in green arrow projects pose significant pressures for exploitation. It is a necessity to minimise risks in projects with a pre-determined SOP in order to ensure that targets within these projects are met. Several section managers clearly express that time for exploration is not prioritised since to deliver in projects that their respective section are
accountable for is what first and foremost is requested (Section Manager 1, 2018; Section Manager 2, 2018).

5.2.2 Time for Exploration

Evident, is that all managers see a challenge in finding time for exploration, time to provide the support needed for employees to work with explorative activities. Green arrow projects which make up industrialisation are critical projects in terms of project deliverables since they have a predetermined “start of production” date, and time for exploration is crowded out in front of exploitation, to a large extent due to green arrow projects. When green arrow projects run in to unexpected deviations, resources are usually transferred from concept development to these projects in order to deal with these errors. Stealing resources from originally planned exploration in order to deal with green arrow deviations indicates according to Benner and Tushman (2003) that exploration is less prioritised than exploitation. The high focus on project deliverables and delivery precision is a necessity for R&D since it is the reason behind Scania’s unrivalled profit margins, to deliver what the customer wants, at the right time with the highest quality. So when deviations occur in green arrow projects, stealing resources from originally planned exploration, whether it is from concept develop or other explorative activates, can be argued to be the right decision to make.

It is emphasised from Section Manager 3 (2018) that exploration is rather something that finds its way through the organisation by driven employees, and not something that is required from top management. It is also argued that is then a managerial responsibility to allow employees to get hearing for their ideas, while section management can support and promote employee creativity it has its organisational constraints since business cases always are required. In order for employees to take ideation one step further, they must outside of actual work dedicate time to evaluate their ideas and with a business case demonstrate potential market share, profit and expected customer value. To encourage employees to experiment with ideas and give space for ideas is a necessary presumption of opening leadership behaviours supportive for exploration (Rosing, Frese, & Bausch, 2011). According to several section managers, this creates frustration, both among employees and managers, since managers tries to encourage and be supportive towards exploration while business cases constrains the creation of novel ideation into projects. While a business case provides clarity, and is suitable for the for the more certain and superior benefits of exploitation, it constrains exploration and the potential value in learning. The novelty in exploration does not lie in financial benefits, but rather in acquiring new knowledge and in the exploration of new possibilities rather than in the exploitation of old certainties (March, 1991). Figure 8 provides a visualisation of what should constitute as driving forces for exploitation and exploration.
The questionnaire which was distributed to section management provides somewhat diverse answers regarding factors influence on projects in the present project portfolio, however, it still indicate that knowledge creation is one of the least important factors. Customer value and time are the premier influencing factors on their overall project portfolio. What should also be noted from the questionnaire is that all section managers clearly have the authority to promote projects of an exploitative character, while the authority to promote projects of an explorative character is not just as straight forward. Section Manager 1 (2018) and Section Manager 2 (2018) clearly express that they are not encouraged to enable and support exploration in the same way as they are for exploitation, or in other words, project deliverables. Signs of this organisational internal priority is found in sentences like, “All my managers want to see budget, technology improvements and process development, they want to see a lot, but do they want to see exploration?”. Project Manager (2018) express concerns that the most prominent and inhibiting factor for exploration is the lack of incitements for these types of activities, sharing novel ideas it is not something that generally is rewarded (Project Manager, 2018).

5.2.2 Incremental exploration in concept development
Incremental exploration, according to Corso and Pellegrini (2007), refers to explorative activities paving the path towards incremental innovation and highly associates with the notion of design engineering. Incremental exploration is arguably in line with the initial idea behind concept development within the yellow arrow process in R&D. Intentionally, concept development aims to explore technical solutions and business potentials, it should involve evaluation of different concepts and the most suitable concept should be chosen in relation to cost, weight, investment, service traceability and customer value. However, mentioned by several interviewees, Predevelopment Manager (2018), Business Developer (2018), Project Coordinator (2018) and Technical Project Manager (2018) is that pre-determined project deadlines constrains the explorative work that is needed within concept development and that this also affect creativity in a negative way. Predevelopment Manager (2018) further elaborates and explains that due to time constraints “adjustments” are made within concept development rather than innovation.
5.3 “Attention” focus through performance measurements

The RTA department is responsible for the design and use of performance measurements at truck chassis development, measurements which is derived from R&D Strategy 2018+. Senior Manager Head of Business Development (2018) implies that truck chassis development measure more than what is required in order to do better analysis. However while finding right measurements is desirable, high workload result in that easier measurements that provide somewhat straight indications are designed. Even if innovation and the acquiring of new knowledge are factors that should be measure, those are not getting any direct attention. What is evident from interviews with section managers is that measurements on delivery precision and deviations are the most articulated and shared measurements. Even if measurement on delivery precision and deviations are not intentionally designed to measure innovation, they follow the lines of diagnostic control systems and can thus be argued to induce and support exploitation and incremental innovation (Mccarthy & Gordon, 2011). We further argue in the lines of Shapiro (2006) that Scania pose an overall tendency to measure the more certain and superior benefits from exploitation and therefore possess an bias towards exploitation and incremental innovation.

While the use of measurements constitute an essential part in the management of any business function, previous scholars such as Nilsson, et al. (2012) and MacCarthy and Gordon (2011) advocate that the measurement of innovation becomes an especially challenging task, when organisations are contextually ambidextrous or when aiming to pursue both radical and incremental innovation simultaneously.

Further, according to results from the questionnaire, consensus prevails about Scania’s vision and future destination, to become a leader in sustainable transports through increased attention and focus within areas such as electrification, automation and connectivity. Previous ambidexterity research presented by O’Reilly III and Tushman (2009) advocates that one necessary condition for management to successfully manage ambidexterity is the articulation of a shared vision that provide the organisation with a common identity throughout exploratory and exploitative units. While all section managers clearly expressed to strongly agree upon having a clear understanding of Scania’s future destination, Section Manager 4 (2018) and Senior Manager Head of Business Development (2018) express the ambiguousness and unclarity in how this articulated vision should be achieved, that there is no clear strategy behind the achievement of such a vision. Section Manager 1 (2018) expresses concerns about a two folded message, while electrification is supposed to be given increased attention, a large extent of R&D resources are assigned to work with future powertrain projects i.e. advancements of the internal combustion engine. Measurements should be derived from a strategy in order to support and enable the organisations strategic intent, and without such a strategy, designing right measurement will supposedly become a challenge (Nilsson, et al., 2012).

5.4 Scientific implications

This research provides thorough explanations for why a mature R&D department find difficulties in balancing the contradictory requirements from exploitation and exploration. The challenge for section management to find time for exploration follow the lines of previous research within contextual ambidexterity, that efficient resource allocation is especially difficult in this structure of ambidexterity (Gibson & Birkinshaw, 2004). That measurements of exploitation create an overall bias towards exploitation (Mccarthy & Gordon, 2011) further support our results as R&D in general tend to measure the more certain and superior benefits of exploitation such as delivery
precision. However our results also point towards organisational resistance for radical exploration, that is especially difficult to get attention for projects outside of today’s core, and we argue that this resistance could be linked with the well-defined modularisation system currently created for the internal combustion engine. Emerging technologies such as electrification require adaptation of several present modular components, and regarding the limitation of this research, limited to truck chassis development, this pressures chassis development as chassis needs to be redesigned for batteries and drivetrain exchange in particular. What evidently is lacking in previous research is how modularisation more specifically and possibly ads to the challenge in pursuing both exploitation and exploration.

5.5 Revisiting the research process

In the methodology chapter, Chapter 3, we have argued in accordance with scholars such as Yin (2003) and Creswell (2009) for the appropriateness of our chosen methodology. We believe that it was a right choice to conduct a qualitative approach for this thesis. A qualitative approach made it possible for us to achieve a deeper understanding within the specific phenomenon we aimed to explore. Semi-structure interviews was chosen, which allowed us to discuss the answers to the questions which were given during the interviews. As a result, a deeper understanding was giving, and it made it possible for the interviewee to open up and elaborate upon the answers. However, it is important to keep in mind that due to our discussions and complementary questions, there is a risk that we affect objectivity in a negative way. We may have raised questions that make the interviewees respond in a certain way, and this will affect our results. Meanwhile, a structured interviews with closed questions and limited discussion, could be an alternative to increase the objectivity. With structured interviews there is a risk that we would not get the same results as we did with semi-structured interviews, since much of the valuable information and knowledge came through discussions. In order to increase objectivity in our thesis, a small questionnaire was performed during interviews with manager at sectional level. This due to that these interviews were similar to each other and therefore these interviews were suitable for a questionnaire. The questionnaire was given in the beginning of the interview in order to avoid our impact on the interviewees answers.

If we had selected a quantitative approach instead, we believe it would be rather difficult to collect data in this context. It is difficult for us to get a deeper understanding about the phenomenon since Scania is highly complex and has deeply rooted core values, which takes time to truly understand. If we had made a data collection based on limited knowledge and understanding, it would be a major risk that the quality of the data would be of a poor quality. But, if there was more time, a complementary questionnaire could be accomplished, and the data collection could then be done iteratively for improvements of the results. A major advantage with such a method is the incensement of the objectivity in our thesis.

Concerning time, this thesis was performed during a limited time frame and this has of course affected our research and results. If more time was given, further deepening within managerial challenges could have been done. As a result, the study might be even more in detailed with more in-depth knowledge.

Further, different data sources were used within the same subject in order to increase the validity. By interviewing managers on sectional level, an understanding for challenges when they encourage
exploration was given. Then, interviews with experts within existing process and strategies at Scania were hold, in order to understand managerial challenges when encouraging exploration from an organisational perspective. In that way, we conducted data from two different perspectives within the same subject. However, it is rather difficult to validate our results. If we propose that managers should encourage employees to take risks, it will probably result into an explorative work, and this can be verified by different data recourses. To conclude that managers should encourage employees to take risks and this will result into that Scania become innovative, is rather difficult to validate, since there are several factors which affects if Scania will increase their innovativeness or not.
Chapter 6

IMPLICATIONS
FOR PRACTICE
6 Implications for Practice

This chapter provides our recommendations in terms of implications for practice and starts by clarifying why performance measurements for exploration should be designed and implemented at R&D. While designing measurements of innovation is challenging, measurements for exploration constitute an even larger challenge and it is our aim to describe why and how they at a starting point for truck chassis development should be designed in order to direct attention towards exploration. Several factors necessary to consider when it comes to conducting explorative projects is highlighted and discussed since we believe they should be taken into consideration, especially in an organisational environment permeated by continuous improvements. Lastly is sustainability implications discussed since it brings relevant dimensions into our research, reclaiming the exploration space.

6.1 Managing Exploitation and Exploration in R&D

A profound coordinated development work has allowed Scania to thrive under the current technological paradigm. Processes for product development are well suitable for the development of products with prominent qualities and where outcome is known beforehand. While this research evidently shows that exploration is difficult to handle and promote in R&D at Scania, it should be acknowledged that Scania’s present way of working is the reason behind decades of unrivalled profit margins and being successful over time. This research provide understandings for several factors that are likely to be the result of an overall organisational bias towards exploitation. That management of exploration explicitly encounter several challenges in the facilitation and establishment of contextual ambidexterity. We, however, aim to emphasise that attention can be directed towards exploration through the design and use of performance measurements in order to create a demand for exploration and follow up that explorative activities are performed. Regarding our delimitation and this proposition, delimiting this research to explore how management can support and sustain the exploration space, we argue that this will come to have effects on other levels, such as the individual level and the organisational level. We have found that individuals at Scania are somewhat concerned, as well as frustrated for the crowding out of exploratory activities. Both in terms of diminishing employee creativity and in terms of if the right things are done and the right decisions are being made in the face of disruptiveness. To pressure exploration with measurements is therefore argued to create the possibility to foster employee ideation and an overall organisational environment which supports and facilitates explorative activities to a larger extent. It can also allow to overcome barriers for exploration in the present organisational structure. Further, from an organisational point of view, to pressure exploration when facing potentially disruptive technologies might be a first step towards to seize and act upon uncertainties appearing in their surroundings.

In this research we have found different factors which affect and possibly could be considered as barriers for exploration. Firstly, an inadequate transition between sales & marketing to R&D. If sales & marketing’s influence on R&D would increase and a marketing strategy that actively seeks and search for exploration in terms of customer value, R&D might be in a different position regarding their overall project portfolio. Secondly, it was acknowledged by several interviewees that while Scania’s vision is straightforward and clear, how this vision should be achieved is somewhat ambiguous, and that Scania lacks an innovation strategy. Performance measurements should support an organisations corporate strategy and measurements of innovation should support an innovation strategy preferably aligned to the corporate strategy. Without incorporating innovation
at a strategic level, designing measurements of innovation becomes somewhat problematic, which is why we below provide the following recommendations and assessment framework regarding measurements for exploration.

6.2 Attention for Exploration through Performance Measurements

While the social construction of leadership behaviours has been researched in previous literature as an enabling factor for ambidexterity (Zacher, Robinson, & Rosing, 2016, Rosing, Frese, & Bausch, 2011), this research points towards several organisational constraints that somewhat prevents section management in enabling and supporting exploration and employee ideation in their respective sections. To support management of exploration, referring back to our posed sub-question 2, we argue in accordance with Nilson et al. (2012), that the design and use of performance measurements for exploration can support section management at truck chassis development in enabling and justifying exploration and explorative activities. Implications of such a strategic direction and considerations regarding what such an implementation require is presented and discussed below.

6.2.1 A deeper Understanding of the Innovation Paradox

While routines, systematic process improvement and efficiency targets are driving forces for exploitation (Corso & Pellegrini, 2007), exploration require substantially different structurers for support. What was rather evident in this research is that exploration is neglected to a substantial part due to the more superior and certain benefits exploitation generates, that you target and emphasise the rate of innovation rather than innovation impact. Driving forces for exploration should be the acquiring of new knowledge capabilities, knowledge creation though experimentation rather than through routinisation. We want to emphasise the importance of the following two factors in particular:

1. Project of an explorative character should be defined in terms of non-resulting experiments and not in terms of project failure. Find acceptability for that innovation projects of an explorative character naturally comes with high risks and that they in many cases will not result in any direct profits.
2. Realise that there is a potential value in learning! Projects of an explorative character incorporates learning and must therefore be evaluated accordingly.

6.2.2 Secure Resources for Exploration

The “stealing of resources” from originally planned exploration whether it is from originally planned incremental exploration or radical exploration was emphasised by several informants. This is partly found to be the reason due to unrealistic project time plans and in accordance with Benner and Tushman (2003) that exploration is put at lower priority, and possibly the most inhibiting factor for exploration. Initiatives taken, such as RT Dragon’s Den at truck chassis development aims to nurture employee creativity and ideation and thus creates an arena for exploration to thrive. However, if resources cannot be secured for this initiatives it stands at risk of partly missing out on acknowledgeable ideas and support initiatives for exploration but more importantly the risk of losing employee trust which is a necessary condition in contextually ambidextrous organisations (Gibson & Birkinshaw, 2004). To secure resources for exploration must be a priority from top management and preferable strategically aligned with Scania’s corporate strategy.
6.2.3 Exploitation Bias

Previous scholars are advocators of the organisational tendency to pose an overall bias towards exploitation since performance measurements usually are designed for these type of activities (Nilsson, et al., 2012; McCarthy & Gordon, 2011). Since exploitation refers to optimising something and output is known beforehand makes it very grateful to use measurements for these types of activities and to follow-up. To measure exploitation is easy, and it is easier to measure in correct ways, and what is easy to measure and seems sensible to measure is most certainly measured as it allows follow up, as well as control and direct R&D behaviour and outcomes, which most certainly will pose a bias towards exploitation.

We argue that the overall delivery precision focus that permeates R&D and that present performance measurements contributes to exploitation bias and pressures management to first and foremost pursue exploitation, ensuring that these exploitation targets are met. We therefore argue that designing and implementing performance measurements for exploration can pressure and justify exploration and explorative activities. Since measurements constitute an essential part of any business function (Manoochehri, 2010), introducing measurements of exploration can provide goal and process clarity and more importantly support section management in nurturing employee creativity since these activities also would allow for follow up and ensuring that targets are met within the exploration space.

6.2.4 Measurements of Exploration

While it is relatively easy to measure exploitation, measurements of exploration come with ambiguity. When we usually measure something, we want to achieve a certain result, a causal relationship between what we achieve and what we measure. This implies that measurement of exploration needs to be designed completely differently from measurements of exploitation. Assessing the framework in Figure 9, a first step towards designing measurements for exploration is to understand what problem measurements of exploration should solve for the organisation. Secondly, to assess good measurements in general, measurements should be deduced from a strategy in order to be aligned with the organisations strategic intent. Referring back to the organisational tendency to pose an overall bias towards exploitation, usually the result of measuring exploitation to a larger extent than measuring exploration. This allow for the realisation that measurement of exploration rather becomes a matter of fact that we need to measure exploration in terms of assuring that activities are performed within these areas, and not in the achievement of a specific goal. Thus, exploration cannot be measured in terms of output, but rather through input and activities, sometimes referred to as fruitput. Exploration needs to be measured in terms of leading indicators, if we do “this” it creates the possibility for “this” to happen. The following examples of possible measurements provide indications for of how exploration can be measured and thus ensuring that explorative activities actually takes place:

- Amount of experiments: How many experiments should we perform?
- Non-resulting projects: How many projects within the overall project portfolio should result in non-resulting projects?
- “Input” in terms of resources: How much resources should we spend on explorative activities?
- Market growth instead of profitability for radical exploration
- Amount of tests
To consider the following: how much resources do we spend on exploration? Do we perform explorative activities? How many experiments do we do? How many tests do we perform? These measurements provide the possibility to control that actual explorative activities are performed. Then what the actual results from these activities are, will have to remain unknown. Measurement of exploration in terms of activities and to some extent input can provide assurance that overall exploration targets are met.

![Assessment framework for measurements of innovation](image)

6.3 Sustainability Implications

Sustainability consists of three different pillars; social-, economic- and environment sustainability (Epstein & Rejc Buhovac, 2014). If Scania designs performance measurement for exploration it will facilitate for managers to encourage exploration among employees compared to today. This will result into that employees at Scania will easier get hearing for their explorative ideas if managers are asked for exploration in a greater extent than today. As a result, this will affect social sustainability in a positive way, since employees will feel encouraged and motivated if they get attention for their explorative ideas.

Further, designing and implementing performance measurements for exploration, as mention before, creates the possibility to increase exploration and this will positively affect both the environment – and economic sustainability. Scania’s vision, to be a leader in sustainable transports, this through cooperation and integrating sustainability completely into their business. In this way, Scania believes that they can create long-term value, tackle impacts and transform the industry. We strongly believe that reclaiming the exploration space could support Scania in realising their vision, to become a leading provider of sustainable transports, since exploration might result into new sustainable products which will create long-term value, tackle impacts and transform the industry. However, if one compares electrified vehicles with sustainability, one must take into consideration the development of batteries and its relation to the internal combustion engine, this argumentation however lies outside the scope of this research.
Also, by increasing exploration at Scania, it makes it possible to develop new products which do not affect the environment to the same extent as today. It can either be a radical improved combustion engine with a dramatic reduction of emissions. Or it could be new batteries with a new structure for future electric motors, which is not based on limited elements as today. Governments are demanding environmental requirements of a greater extent, for an example CO2 emission from the transport sector in Sweden should decrease by 70% by 2030 compared to 2010. Scania has to meet these environmental requirements and therefore, exploration can make it possible for Scania to develop technology and products in order to meet these requirements and as a result it will affect the environmental sustainability in a positive way.

Further by increasing exploration at Scania some of the resources will be moved from exploitative work to explorative work. In short-term, this will decrease the profit from exploitation, since there is a reduction of exploitative projects, in order to generate resources for exploration. However, new technology and products will be developed as a result from exploration, and it could enable Scania to be more adaptable to change when disruptive technologies arise.
Chapter 7

CONCLUSION
7 Conclusion

To balance the paradox of exploitation and exploration in organisations is challenging, and this research illustrates several tensions that resides in the management of organisational ambidexterity. Throughout this research, actions have been directed towards the thesis purpose previously presented in Chapter 1:

The purpose of this thesis is to explore how management can support and sustain the exploration space in a mature R&D department.

One main question divided into two sub-questions were designed to operationalise the purpose. The first sub-question aims to provide understandings for challenges encountered by management in their role to support and enable exploration.

**SQ 1: What challenges are encountered by management in their role as providers and enablers for exploration?**

Several challenges were identified to prevent management from supporting and enabling exploration whereby the most prominent factors was time. Why time prevents managers from supporting and enabling exploration is argued to in turn be the result of following factors:

- Naive project planning: “Stealing of resources” from originally planned exploration in order to deal with deviations in green arrow projects. While this is a necessary decision to make when these deviations occurs it can be argued to be the result of moving through the concept development phase too fast to begin with, in order not to jeopardise the pre-set “start of production” date.
- High focus on delivery precision: While delivering products with the highest quality, at the right time noticeably is a reason behind Scania’s unrivalled profit margins, time to explore the potential value in acquiring new learning is put at lower priority.

**SQ 2: How can the design and use of performance measurements support management of exploration?**

It is found that present performance measurements measure the relatively certain and superior benefits from exploitation. These performance measurements however have little or no control over radical or incremental exploration. Controlling and directing R&D behaviours and outcomes with the design and use of exploitative measurements creates an overall bias towards exploitation and project deliverables of an exploitative character. If everything else but exploration is measured, attention will naturally be focused towards the those activities. Designing, implementing and using performance measurements for exploration can therefore first and foremost safeguard the exploration space in terms of ensuring that activities are performed within these areas and that attention is focused towards exploration. We argue that performance measurements with the intent to measure exploration can provide management with the support needed to justify exploration and foster creativity. As presented in the previous chapter, implications for practice, to measure exploration is challenging, and it should focus to measure that activities within the boundaries of exploration are performed. Implying that number of experiments, number of non-resulting projects, tests and to some extent input can be used as measurements for exploration. Turning to this thesis sub-title, “Is measurement of innovation the key to promote exploration?”, while we argue that measurements can provide some clarity and support for management, the key to promote exploration or managing the innovation paradox is probably a bigger puzzle to solve.
**Main Question:** How can management support and sustain the exploration space in a mature R&D department?

To balance the paradox of exploitation and exploration in organisations is challenging, and this research illustrates several tensions that resides in the management of organisational ambidexterity and challenges encountered by management when aiming to enable and support exploration. In answering this question we turn towards one major challenge which is time for exploration, which is the result of following two challenges: naive project planning and high focus on delivery precision. To support and sustain the exploration space would require an effort first and foremost in securing these resources for explorative activities. Secondly to divide attention between delivery precision and exploration, to begin with performance measurements for exploration, this would allow to follow up exploration, both in terms of resources and activities in order to ensure that activities which lies in the boundaries of exploration actually is performed.

To further provide understandings for partly the managerial challenge but also organisational constraints, our results points to that several organisational strategies contributes to the managerial challenge in supporting exploratory activities. Firstly, strategic buckets as they are designed today controls projects in their respective bucket based on resource availability and not on what is of outmost strategic importance. Secondly, sales & marketing possess the possibility to direct R&D output and behaviour towards exploration. This would however require sales & marketing to strategically search for customer value outside existing markets. While Scania’s vision is clearly expressed, there is little consensus how this vision should be realised. An innovation strategy incorporating both short term and long term strategic directions could possibly bridge this gap and thus support management in their decisions and reflect the choices made for exploitative and explorative activities.

**7.1 Further Recommendations**

While this research provide a glimpse of challenges encountered in managing the contradictory requirements of exploitation and exploration in a mature R&D department in general, and by section management in particular, several of our findings serves as a foundation for further recommendations.

**7.1.1 Innovation Strategy**

Previous literature emphasise the importance to link performance measurements accordingly with an organisations corporate strategy in order to provide business value (Kaplan & Norton, 1996) in order to direct attention towards the achievement of the corporate strategy. What became evident in our research is that a specific strategy for innovation at R&D is missing, this implies that designing particularly useful measurements becomes a little more problematic. It should however be noted according to Nilson et al. (2012) that when the strategic intent of an organisation is to pursue both incremental and radical innovation, measurements for radical exploration need not to be measured using strategic, operational and business model fit as requirement why the opposite is needed for incremental innovation. We however argue that an innovation strategy incorporating both short- and long-term perspectives could provide clarity when designing measurements for exploration.
Secondly, it was acknowledged that the balanced scorecard is used as a foundation for present performance measurements, following the lines of Macarthy and Gordon (2011). The balance scorecard allows to focus on solely one type of control system, the diagnostic control system which tend to stimulate and facilitate the more certain benefits from exploitation. To further stimulate measurements of exploration we believe that reviewing how different type of control systems within Simons four levers of control arguably could provide more depth into measurements of exploration and management of exploration. Simon’s four levers of control incorporate belief systems, boundary systems, diagnostic control systems and interactive control systems which create opposing forces of effective strategy implementation (Simons, 1994). A balanced structure of these four level of control systems is argued to support organisational ambidexterity (Kruis, Speklé, & Widener, 2016). Figure 10 provide a visualisation of which control systems that tend to stimulate exploration.

![Figure 10: Four levers of control incorporating exploration and exploitation, originally adapted from (Simons, 1994).](image)

**7.1.2 Factors that could solve tensions between Exploitation and Exploration**

Sales & marketing possess a great possibility to discover customers’ needs which might results in an explorative input to R&D. Therefore, we believe that Scania should investigate the lacking transition between sales & marketing and R&D in order to take advantage of the explorative input which sales & marketing have the opportunity to discover. If sales & marketing increase their influence on R&D, it would allow for a developed strategy in order to discover customers’ needs in a greater extent than today. Further, we also believe that Scania should investigate their strategic buckets and their impact on exploration. According to the literature, strategic buckets are based on an organisations strategy and aims to defends resources for radical R&D projects (Chao & Stylianos, 2008). Researcher further claims that most business are using four or fewer buckets (Cooper & Scott, 2005). Therefore, we believe that strategic buckets have potential to encourage exploration. What we can see is that strategic buckets do not support exploration to any greater extent today, and this is also supported by several interviewees. One reason might be the number...
of buckets. It is recommended to use four or fewer, but Scania has four times as many. Therefore, we believe that Scania should investigate their strategic buckets since this is an area which can contribute to exploration in a greater extent compared to today.

7.1.3 Organisational Support Structures for Exploration
While RT Dragons Den is a newly started support structure for exploration, it aims to facilitate exploration and employee creativity at truck chassis development and truck chassis development is just one of many development departments at R&D. We hope that this initiative will facilitate exploration as it intends to do since our research proves that structures as these are needed. To some extent we argue that the product development process alone create boundaries where radical exploration and ideation simply cannot thrive. A necessity for these initiatives is to secure resources and to find a processes where employees can be freed from their ordinary assigned tasks. What also is necessary to consider is how to evaluate employees working with explorative activities, as projects in RT Dragons Den most certainly will be recognised as a project failure in terms of product delivers. Projects of an explorative character will many times result in nothing else than learning. Thus, realise that there is potential value in learning. Since exploration is all about learning and projects initiated by employees through RT Dragons Den most certainly will result in learning, a processes for how to transfer learning generated from these projects is necessary if learning gained should be absorbed within the rest of the organisation.
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Interviews


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Appendix 1. Questionnaire

Questionnaire

The purpose of this questionnaire is to examine different factors that relates to leadership and its influence on innovation. Six statements are listed below. Evaluate how applicable you find each statement.

1. I have a clear understanding of the future destination of my company

2. I have a clear understanding of my company’s innovation strategy

Exploitation and Exploration are two innovation concepts critically discussed and emphasised by researchers and practitioners. **Exploitation** is closely related with things such as production, efficiency, continuous improvement, refinement and incremental innovation. Innovation of an exploitative character is characterised by continuous improvements of an existing product or process and the strategic intent is to improve competitiveness within existing markets or industries.

**Exploration** characterises firm behaviours of search, risk-taking, experimentation, flexibility, variation and the strive towards radical innovations. Explorative activities are broadly defined and the strategic goal of exploration is to transform existing markets/industries or to create new ones.

3. As a manager, I have the authority to promote innovation projects of an exploitative character
4. As a manager, I have the authority to promote innovation projects of an explorative character

5. As a manager, I encourage employees to take risks

6. Rank the following factors in accordance with their respective influence on a project. Rank between 1-5 where 1 is the most important factor and 5 is the least important factor.

- Time
- Budget
- Risk minimisation
- Customer value
- Knowledge creation
Appendix 2. Interview guide in Swedish, section management


**Introduktion**

- Hur länge har du arbetat som sektionschef på Rxx?
  - Hur länge har du arbetat på Scania?
  - Vilka tidigare tjänster har du haft på Scania?
- Vad anser du att din nuvarande tjänst som sektionschef på Rxx innebär?
- Hur och i vilken utsträckning anser du att ditt arbete relaterar till innovation?

**Innovation, exploitation and exploration**

- Hur arbetar sektionen som du ansvarar över med exploit (kortsiktig/inkrementell innovation) och explore (långsiktig/radikal innovation)?
  - Vad fungerar bra/minde bra i projekt som är av explorativ karakter?
  - Vad fungerar bra/minde bra i projekt som är av karaktären exploit?
- Anser du att man tillägnar tillräckligt med resurser till exploitation och exploration idag?
- Finns det specifika processer/strukturer på Scania som du anser främjar exploit?
  - Om ja, vilka/varför?
- Finns det specifika processer/strukturer på Scania som du anser främjar explore?
  - Om ja, vilka/varför?

**Management of innovation**

- Vilka utmaningar i din roll som sektionschef ser du i att leda två skilda typer av innovationsarbeten (Exploit/Explore)?
- I vilken utsträckning anser du att ditt ledarskap påverkar din sektions förmåga att arbeta med innovation?
- Vilka faktorer påverkar dig i ditt ledarskap?
  - Vilken typ av beslutsmandat har du som sektionschef?
  - Är det någon skillnad på chefskap och ledarskap?
- Hur skulle du beskriva styrning och ledarskap på Scania?
- Hur upplever du att den beslutsfattande processen fungerar på Scania?
  - Hur påverkar den beslutsfattande processen dig i ditt arbete som sektionschef?
- Har du som sektionschef mandat att ta risker i form av explorativa projekt?
Appendix 3. Framework of Exploitation and Exploration

**Exploitation** (Utnyttja)
- Kortsiktigt
- Undvik risker
- Befintlig kunskap
- Effektivitet

**Exploration** (Utforska)
- Långsiktigt
- Uppmuntra risker
- Skapa ny kunskap
- Experimentera

Diagram showing the relationship between exploitation and exploration with terms such as possibilities, goals, risks, knowledge, and priorities.
Appendix 4. Results from the questionnaire

I have a clear understanding of the future destination of my company

- Strongly Disagree: 1
- Disagree: 4

I have a clear understanding of my company’s innovation strategy

- Strongly Disagree: 1
- Disagree: 3

As a manager, I have the authority to promote innovation projects of an exploitative character

- Strongly Disagree: 1
- Disagree: 4
As a manager, I have the authority to promote innovation projects of an explorative character

As a manager, I encourage employees to take risks

Rank of factors’ influence on projects