Leadership in Open Innovation

An exploratory study on the nature of R&D projects and predominant leadership characteristics in industry-academia collaborations

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Abstract

This study looks at Open Innovation in Research and Development projects and explores the nature of collaboration and leadership characteristics. Thereby perspectives of both industrial and academic partners are considered, focusing primarily on the project level of the collaboration. It is based on the understanding that leadership plays a crucial role in bringing the partners successfully together, based on the prior understanding that academia and industry are potentially different in the nature, objectives and working dynamics of research and development.

This thesis begins with examining the existing literature on the concept of Open Innovation, including benefits and drawbacks of such projects. This leads to uncovering the managerial challenges that such projects encounter which can be mitigated by effective leadership. For this reason, relevant theories on leadership are explored, especially focusing on leadership in R&D contexts, as these kind of projects have special requirements from leaders that differ from traditional projects.

This research is qualitative in nature and takes an abductive approach to theory. 18 semi-structured interviews were conducted, consulting with heads of R&D departments from industrial companies, professors in charge of research labs at universities and representatives from intermediary organisations. The study is exploratory and cross-sectional in nature, as open innovation collaborations in Sweden, the UK and the Netherlands were in the centre of attention. The process of analysis implied the use of a template analysis, which provided the researchers with enough flexibility to code, categorize, and interpret necessary findings.

The results show that the nature of Open Innovation collaborations differs from case to case, from mere contractual relationships to collaborative partnerships with a high level of interaction on a daily basis. The key motive for both partners is finance-based, as the universities gain access to funding and the company can save on research expenses. Additionally, companies benefit from access to academic expertise and from potential governmental funding.

Further, there is not a single leader in an industry-university collaboration, rather each entity has a leader of their own and collaborative working is fostered by them. It is deduced that no single leadership theory fits best in the operational level of R&D open innovation functioning, rather it is a mixture of a few popular theories which were predominant in collaborative relationships. The characteristics of leaders in open innovation were deduced and autonomy, communication and joint problem-solving have a prominent role in furthering the R&D collaborative relationship. As a result, a connection between leadership and Open Innovation collaborations was explored.

**Keywords:** Open Innovation, Open Innovation projects, project management, leadership, leadership characteristics, transformational leadership, research and development, innovation management, Open Innovation between universities and industry, academia-industry collaboration
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Aakriti Singh
Jana Wenzlaff

Umeå, January 6, 2015
### Abbreviations

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<th>Description</th>
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<tbody>
<tr>
<td>CAQDAS</td>
<td>Computer-assisted qualitative data analysis software</td>
</tr>
<tr>
<td>EC</td>
<td>European Commission</td>
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<td>EU</td>
<td>European Union</td>
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<tr>
<td>IMF</td>
<td>International Monetary Fund</td>
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<tr>
<td>IP</td>
<td>Intellectual Property</td>
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<tr>
<td>LM</td>
<td>Leader Member</td>
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<td>LMX</td>
<td>Leader Member Exchange</td>
</tr>
<tr>
<td>LTU</td>
<td>Luleå tekniska universitet (Luleå University of Technology)</td>
</tr>
<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
</tr>
<tr>
<td>OI</td>
<td>Open Innovation</td>
</tr>
<tr>
<td>PhD</td>
<td>Philosophiae Doctor (Lat., Doctor of Philosophy) – advanced university degree</td>
</tr>
<tr>
<td>P&amp;G</td>
<td>Procter&amp;Gamble Co.</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
</tr>
<tr>
<td>SCM</td>
<td>Supply Chain Management</td>
</tr>
<tr>
<td>SLU</td>
<td>Sveriges Lantbruksuniversitet (Swedish University of Agricultural Sciences)</td>
</tr>
<tr>
<td>SME</td>
<td>Small and medium-sized enterprise</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>UMU</td>
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1. INTRODUCTION

This preliminary chapter aims at familiarising the reader with the practical and theoretical background of Open Innovation (hereafter “OI”) collaborations and leadership of R&D projects in an OI context. It aims to present the gaps in understanding the connection of leadership and OI projects, which are the focus of this thesis. The background of the thesis’ topic and its relevance for business studies are explained, the current status of research in OI and leadership in a R&D projects are discussed, which leads to the research question and research objective of this study.

An OI example

P&G has been working with Leeds University since 2013 and has entered into a strategic partnership where the university is helping P&G in their long term strategic targets, which will give them a higher competitive edge. The university is gaining by getting more industrial and commercial exposure. An example of such a collaborative project is being carried out by a PhD student from Leeds University who is utilising his expertise in modelling how materials behave under stress, for the design of new razor blades by P&G (University of Leeds 2014).

Through this thesis we would like to unearth the answers relating to similar cases about the nature of such collaborative projects, governance involved, benefits for the two collaborating organisations, leadership involved at the project level and the characteristics of such leaders in fostering and furthering such a collaborations.

1.1. Background of the study

Open innovation is a popular topic in current innovation management literature. Scholars in the field argue that companies should make a conscious change from a traditional, internal R&D approach to an ‘Open Innovation’ model, collaborating with external partners such as suppliers, competitors, customers or academic institutions, in order to gain a competitive advantage. OI is promoted to benefit the companies from the combination of the internally existing knowledge of the firm and external expertise of the collaborating partner (Chesbrough 2003, p. 36). Besides, advocates of OI argue that it allows the companies to better adapt to dynamic market needs, lower their innovation costs, share risks among partners, and as a result, gain higher commercial returns (Giannopoulou et al. 2011, p. 520, Du et al. 2014, p. 145). Therefore, OI is treated as an imperative for innovative firms, and an increasing number of companies have embraced OI strategies in the innovation process (Chesbrough and Brunswicker 2014, p. 16). For these reasons, OI is a recent and relevant topic for business studies with a high potential for further research (Huizingh 2011, p. 7).

Open innovation is a broad term for a range of innovation activities to create new products and services in very diverse industries. It ranges from innovation contests on online platforms, like a recent OI contest from Starbucks to reduce paper cup consumption, to user co-creation in the consumable products, like cosmetics or food, to collaborations with companies from different industries, such as Volvo’s collaboration with a telecommunication operator in order to foster the innovation of vehicle services. The focus of this study will be on Open Innovation in terms of collaboration in R&D projects in the high-technology industry. Thereby, collaborations with
academic institutions will be in the centre of attention, leaving OI collaborations with other private companies, suppliers, customers, or users out of scope. We think that this form of OI is of special interest, as the collaborating parties come from the academic and business worlds that are considered to be very different regarding their focus, objectives, values, and organisational culture. Hence, bringing researchers from these different backgrounds together, is a challenge for project managers and leaders, which will be revealed in this study.

OI literature is typically taking the companies’ perspective and discovering OI at a strategic level, focusing on organisational aspects and emphasizing the opportunities that lie in such collaborations for the industry. In this study, we focus on collaborations at the project level, where innovation activities actually happen. Further, we broaden the viewpoint from the mere business perspective of the company to explore the position of the collaborating partner, the academic institution, in order to get a holistic picture of an OI collaboration.

It has been articulated occasionally in innovation management literature that organisational culture and leadership skills are important aspects for success of an R&D project (Vanhaverbeke et al. 2014, p.117). Few articles on leadership in R&D projects exist, but merely in a closed innovation context (e.g. Eisenbeiß and Boerner 2010, Keller 2006, Gumusluoglu et al. 2013). To the best of our knowledge, no explicit research has focused on predominant leadership styles in an OI context. A remaining question is how R&D teams in a collaboration of industry and academia work together, which leadership style the leader predominantly takes and what factors of leadership characterise and promote an OI environment. Leadership in an OI context is especially interesting, because the leader of the R&D project team has to manage team members from different organisations with different perceptions of what to aim for and how to get there, in addition to their own other work priorities. Also, the leader often lacks formal authority about external team members, and has to direct work from distance. The leader needs to create an environment, where collaborating partners trust each other and dare to share information. Furthermore, it is of interest to note in an OI context, to identify the leader, since it can be a person from the industry, academia or even the government.

1.2. Practical and theoretical motivations for the study

From a practical perspective, it is relevant for managers, leaders and decision-makers both in industry and academia to understand how OI collaborations work, what benefits lie for each of the partners, which challenges are perceived by the collaborating partners and how to deal with them. Further, it is of major interest to understand the nature of leadership and the characteristics involved which are required in this specific context of R&D in an open environment, where issues such as sharing of knowledge and leading project team members belonging to different organisations is of practical significance.

From a theoretical point of view, the field of OI is a relatively new research area in innovation management which has a high potential of contributing to existing knowledge on the subject. Our study delivers various significant findings; first about the nature and perceived challenges of OI at the project level. Second, literature on the topic of leadership in unconventional settings like R&D, is scarce. In addition to this, as far as we know, there is no study on leadership in the OI field. Third, this study answers the question, whether leadership dimensions are likely to affect the OI process, and if so, which characteristics would be required in the leaders to further the collaboration. As a result, in this study various literature streams are combined: leadership
theories, Open Innovation theory, R&D, innovation management and literature on university-industry relationships.

To sum up, this paper aims at contributing to the theory of Open Innovation by, first, providing several examples of OI collaboration in the terms of industry-academia collaborations in a cross-sectional study. Secondly, we analyse how leadership aspects may affect openness and play a role in bringing together the different partners in order to establish a successful research project. This leads to the research question and objective of the study.

1.3. Research questions

This thesis tries to find the answers to some of the research questions which have not been covered in previous works in OI. The aim is to focus on managerial aspects of OI, especially on management and nature of such collaborations, the role of leaders, the leadership characteristics involved, as well as the identification of a dominant role played by one of the partners driving the research. On the basis of the aforementioned practical and theoretical motivations for the study, we define the central research question of our research:

*What is the nature of open innovation R&D projects and leadership involved in industry-academia collaborations?*

In order to answer this question, we split the analysis into two complementary blocks, the first dealing with OI and the second with leadership. First, supporting research questions in order to explore the nature of research in this specific context nature of open innovation R&D projects are the following:

- What characterises the nature of OI collaborations between academia and industry?
- What are the benefits and drawbacks of an OI collaboration between academia and industry? Which partner is benefiting more from this collaboration?
- How OI projects are managed and what are the challenges involved?

Second, in order to explore the predominant leadership characteristics involved in industry-academia collaboration, we aim at answering the following research questions:

- Who is the leader in an OI collaboration – industry or academia?
- What is the role of a leader in OI? How does (s)he further the collaboration?
- What specific characteristics are required in leaders in OI?
- Do the traditional theories of leadership apply in OI?

The research context for our study is OI and the unit of analysis would be the collaboration practices and leadership characteristics which are primary in an R&D context, and which we expect to be held true in an OI context also.

1.4. Research objective

This thesis aims at answering the research questions posed in the previous section. Since, the focus of our research is at the operational level rather than at the strategic level, as we are looking at leaders of research groups in universities as well as in the industries in the R&D technology sector. A comparison is made between the two, and the aim is to uncover if one is taking a more dominant role than the other.
We assume that one partner, generally the one providing monetary benefits, has a stronger and a more dominant role in the collaboration. This question would be uncovered by looking at how the collaboration occurs between the two partners by using a variety of questions geared towards deciphering the relationship between the two partners. There is existing literature on OI which states that usually a mutually beneficial partnership exists and we would uncover, if indeed such a relationship is driving the research and the alliance. The aim is to ask specific questions during the data collection stage to interpret the relationship between the partners.

We expect the leader (either of the academic partner or industrial partner) to play a dominant role within the collaborative group and be responsible for majority of the decisions; although we do expect to find the leader engaging in some form of consultative behaviour with established members of the team. We intend on uncovering this by looking at intellectual property rights, and if the leader has control over them majority of the times. We will also ask specific questions to the leaders on their behaviour with their subordinates and how often they engage in meetings and take suggestions from group members.

To unearth the leadership characteristics required in an OI collaboration, we expect to find a close relationship with the existing theories of leadership applicable in R&D management, namely transformational, LMX theory and collective leadership. These theories will not be analysed in the OI context, rather specific characteristics will also be extracted from these theories and tested and analysed in the OI setting. This is done as we do not believe that one single theory can justify the leadership style in this unique environment of OI. We aim to uncover the characteristics by which the leaders further the collaboration as well as support their teams in opening up to the partner and work collaboratively in an open environment.

To sum up, to the best of our knowledge, there are no studies on leadership characteristics in Open Innovation projects in an R&D setting. In this thesis, we aim to fill that research gap.

1.5. Relevant concepts

In the following, relevant concepts that are repeatedly referred to in this thesis are defined in order to clarify how the terms are understood in this study’s context. It is considered relevant, because we believe that the reader needs this information in order to better understand the following chapters and concepts presented. A more thorough description of the key concepts will follow in the third chapter, when setting the theoretical frame of reference.

**Leadership** - Leadership is defined by various authors which reflects a common concept of influencing other people or members of groups or organisations to “guide, structure and facilitate activities and relationships” (Yukl 2010, p. 18). A leader does not necessarily have to be the head of the organisation or the group, but (s)he can show behaviour which is characteristic of leaders. It is the ability of an individual to “influence, motivate and enable others to contribute to the effectiveness and success of the organisation”(House and Aditya 1997, p. 409).

**Open innovation** - Open Innovation is “the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively” (Chesbrough 2006, p. 1).
**Project** - “A project is a temporary endeavour undertaken to create a unique product, service or result.” Among others, a project can create a result, such as an outcome or document (e.g., a research project that develops knowledge) (Project Management Institute 2013, p. 3).

**Project management** - “Project management is the application of knowledge, skills, tools and techniques to project activities to meet project requirements.” Managing a project typically includes identifying requirements, addressing the various needs, concerns, and expectations of the stakeholders, managing stakeholders towards meeting project requirements and creating project deliverables, and balancing the competing project constraints, such as scope, schedule, budget, resources, and risks (Project Management Institute 2013, p. 5-6).

**Research and development (R&D)** - R&D involves unstructured problem-solving (Scott and Bruce 1994, p. 581). The nature of R&D is considered to be ambiguous, unique and uncertain. Long-term benefits are accrued over a period of time, and are dependent on the quality of research for it to be “economically and technologically attractive” to the market (Elkins and Keller 2003, p. 588).

### 1.6. Delimitation of the study

The scope of this study is limited, as we are investigating OI collaborations between university research groups and research departments at industrial companies. Thereby, we explore collaborations in Western and Northern Europe, more precisely Sweden, the UK and the Netherlands. We assume that the findings are generalizable to a certain degree across national borders, as the cultural differences are not large and not as relevant for the nature of collaboration and leadership as the R&D environment itself. However, we cannot transfer the results of this study completely to other regions.

The research is cross-sectional, as data is collected at a single point in time and research relies on the perceptions of respondents that are based on their experiences. Answers can be rather subjective and results can differ in a long-term study. Also, results on leadership aspects are not applicable to other types of OI collaborations, such as innovation projects with suppliers, competitors or customers.

The focus lies on practices and leadership aspects on the project level of OI. Hence, the findings of this study are not applicable for discussing managerial implications at the strategic firm level. Further, the focus is on large multinational companies in the high-tech and chemistry industry. So, we do not consider a potential impact of firm size or industry/research discipline on OI practices and leadership. Thus, findings might not be applicable to other industries. And lastly, we are not looking at the change process from ‘closed’ to ‘open’ R&D, as that requires a longitudinal study.

To conclude, even though the findings may be relevant to other actors, the study and its results will by no means represent all organisations that are engaging in OI. Generalisations can just be made to a certain extent. The limitations of this study are discussed more in detail in chapter 7.3 following the data presentation and analysis of the findings.
1.7. **Outline of the research disposition**

In order to allow the reader to better follow the content, an outline of the disposition of the thesis is given in the following section. This introductory chapter aims at familiarizing the reader with the topic of OI and the significance of exploring leadership structures within OI projects. The research questions and objective are stated.

The second chapter addresses the academic starting point, including the research philosophy and approach. Ontological and epistemological considerations are discussed, in order to clarify the authors’ assumptions about the nature of social reality and how to build knowledge. As a consequence of the research subject, ontological and epistemological considerations, as well as the authors’ values are explained. As another impact on the academic starting point, the preconceptions of the authors that might influence the way the research is done and results are interpreted, and the process how literature is selected, are included.

In the third chapter the theoretical frame of reference is established. First, the concept of OI is explored, as well as an insight into how OI undertakings are connected to project management. Reasons and motivations for collaboration between industry and academia are discovered. Second, light is shed on the general concept of leadership. Literature in innovative contexts is reviewed, such as leadership styles in R&D projects. Thereby, the key concepts of OI and leadership are connected in our theoretical framework as a basis for our research setting.

In the fourth chapter, the research methodology and the chosen research strategy are explained, as well as the type of qualitative research method and the process of data collection. Furthermore, the thesis’ values regarding truth and objectivity criteria are discussed, as well as ethical issues involved in key methodological choices are considered. This aims at facilitating an assessment of the results and the applicability of the study.

In the fifth section, the data analysis chapter, the empirical findings on the nature of OI and leadership in OI projects are presented and analysed, using a template analysis.

In the sixth chapter the results of the study are discussed. The main findings are summarised and the research questions are discussed and answered.

The purpose of the last chapter is to draw a conclusion. The study’s theoretical and practical significance and contributions will be discussed, the limitations are drawn out and recommendations for future research directions are presented.
2. ACADEMIC STARTING POINT

Taking the ‘Research Onion Model’ of Saunders et al. (2012, p. 126-129), the issues underlying the choice of data collection as well as analysis procedures are depicted as the core of the research. The various layers of the research ‘onion’ support and aid us in arriving to the central theme as well as give causality to our research. Hence, it is of utmost importance to show the coherence of research philosophy, research approach, methodological choice, strategies followed, research design and time horizon. As layers are “peeled away” and we move towards the core, it shall become clear to the readers why the selected topic was chosen to study. Furthermore, it is suggested by Manen (1997, p. 2), that the research choices made should hold a deep seated meaning to the researchers. In the following study, a constructivist approach to ontology and an interpretivist approach to epistemology is taken. Furthermore, due to the nature of our research, we are testing existing theories of leadership on a new concept of OI (deduction). It is possible that we might find some interesting patterns which can be fed into the theories (induction). Hence, an abductive approach is taken in this study. An exploratory method is taken in this study to explore new insights about OI and leadership and to discover the relationship between the two. Qualitative research strategy was considered for the thesis to further understand the point of view of the participants and their interpretation of the topic of interest. Moreover, a cross-sectional design was undertaken as we compared different organisations in different countries and the data was collected simultaneously over a short period of time. Finally, the data was analysed using interview transcripts and inferences were drawn. The research onion for this thesis is displayed in Figure 1.

![Figure 1: The “research onion” adapted for the purpose of this study](image_url)

2.1. Research philosophy

The basic aim of any research is to develop the existing knowledge and contribute effectively to it, so as to gain a more profound understanding of the field. Researchers in social sciences, however, need to reflect upon themselves and existing assumptions that they might inevitably have which make their world view, including values, morals and aesthetics (Morgan 2007, p. 50). It is these assumptions that imprint on the research philosophy and are demonstrated through the research strategy and the methods used (Saunders et al. 2012, p. 128). Furthermore, the research philosophies adopted also have a direct influence on the research design and the data collection approach.
However, it has been noted by various authors such as Reed (1985) and Buchanan and Bryman (2007, cited in Bryman and Bell 2011, p. 26) that one cannot be a purist when selecting research philosophies as this would lead to reduction in creative theoretical development. On the contrary they articulate that the research should be considered as multi-faceted and multi-dimensional which will give a holistic picture of the research done (Bryman and Bell 2011, p. 126, Long et al. 2000, p. 127).

2.1.1. Ontological considerations

Ontological considerations are concerned with the nature of social entities (Bryman and Bell 2011, p. 20). Two types of ontology are predominantly recognised in literature: objectivism and subjectivism/constructivism (Bryman and Bell 2011, p. 20, Saunders et al. 2012, p. 131). Objectivism hypothesises that the social phenomena and their meaning have an existence independent from and external to the social actors. It views reality as a “concrete structure”; as opposed to constructivism which takes the phenomena of constant change as the underlying assumption of social order and views reality as “cognitively constructed” and as a projection of human imagination (Bryman and Bell 2011, p. 21, Long et al. 2000, p. 190, Morgan and Smircich 1980, p. 492, Saunders et al. 2012, p. 132). It theorises that social phenomena are produced through social interaction and are in a “constant state of revision” by the social actors (Bryman and Bell 2011, p. 22). Hence, it is important to understand and appreciate the reality behind the occurrences of social phenomena in order to grasp the comprehensive picture of the research undertaken.

In an organisational environment, it is believed that the leader has a crucial role to play and a direct impact on the relationship between the participating organisations, teams and the goal achievement activities of the organisation (Stogdill 1950, p. 4). Leaders are studied in this thesis, and hence their subjective interpretations of the OI relationship, its nature and the leadership characteristics are observed. Moreover, the relationship between the company and the participating organisation (university) in an OI setting will give profoundness to the study. Hence, to understand the reality of such a complex situation, a constructivist approach needs to be adopted.

2.1.2. Epistemological considerations

Epistemology refers to what is and what constitutes as acceptable knowledge in a particular discipline (Long et al. 2000, p. 190). It is dependent on the point of view of the researcher and what is considered relevant to him. Two main epistemological stances have been assertively identified by various authors such as Bryman and Bell (2011, p. 16) and Saunders et al. (2012, p. 136): Positivism and Interpretivism. An interpretivist approach supports the humanness of social science research and argues against the positivistic stance of application of scientific techniques as a true testament of the social phenomenon being studied (Bryman and Bell 2011, p. 16, Ghoshal 2005, p.76, Long et al. 2000, p. 191). Morgan and Smirich (1980, p. 493) quote Skinner (1957) asserting that objective knowledge views social phenomena as a factual description with laws and regularities. Advocates of interpretivism assert that the complexity of human nature and social reality is lost when the collected data is viewed as unprejudiced and value-free (Ghoshal 2005, p.76, Long et al. 2000, p. 191, Saunders et al. 2012, p. 137). It is suggested by Bryman and Bell (2011, p. 16) that social scientists should adopt a method which expresses the distinctive nature of humans and treats each ‘subject’ in a subjective way. It is
this involvement of the researchers with the subjects which impresses on the subjective reality of social science research and influences the path and strategy of research, taking into account the world view of the researchers. It must, nonetheless be noted that there can exist opposing views to the interpretation of reality. Therefore, an interpretivist approach has been adopted for the current thesis, as it is believed that it captures the true essence of the nature of OI between universities and industries as well as the leadership involved in an OI environment. It allows us to see beyond the rhetoric, and into the personal experiences of each individual and aid in the analysis of the interactions and relationships that exist between the leaders of the participating organisations. Moreover, it will allow the research to be conducted in an idiosyncratic and close relationship with each of the subjects, and help us to study how they define their relationships with their social environment and create an understanding of, the social world (Long et al. 2000, p. 191, Morgan and Smircich 1980, p. 493). Therefore, an interpretivist approach will allow us to capture the nuances and complexities in OI relationship and leadership behaviour in this unique environment, which a positivistic-objective stance will not.

2.2. Research approach

With the ground work laid down for this thesis’ research, and the research philosophies understood, it is important to elaborate on the research approach adopted. It serves as one of the important building blocks of the research, and drives the understanding of the theory and the deduction, induction or abduction that can be made through it. (Mason 2002, p.180, Saunders et al. 2012, p. 143). However, Bryman and Bell (2011, p. 13) do not recognise abduction as a research approach, but they do acknowledge that an iterative approach is becoming a popular approach and is particularly evident in grounded theory.

Deduction can be concisely defined as the process of theory generation via data or “generalising from general to specific” (Bryman and Bell 2011, p. 11, Mason 2002, p.180, Saunders et al. 2012, p. 144). The logic underlying deductive line of thinking and inference is dependent on the validity of the premises (Saunders et al. 2012, p. 144). It employs data collection as the means to evaluate existing hypotheses for a theory. Induction, on the other hand, opposes deduction, where theory is generated from the commonality perceived in the collected data (Bryman and Bell 2011, p. 11, Mason 2002, p.180, Saunders et al. 2012, p. 144). It involves the submergence of the researcher in the experimental setting so as to better understand the research problem. The purpose of data collection is to “identify themes and patterns and create a conceptual framework” (Saunders et al. 2012, p. 144). And lastly, an abductive approach is one in which an iterative process of data generation and analysis is undertaken (Mason 2002, p.180). The generalisation is made from “the interactions between specific and general”. An abductive line of reasoning oscillates between induction and deduction – first adapting observations to existing theories and then evaluating the theories through action (Morgan 2007, p. 71).

The starting point of theory in our research is going to be existing literature on OI, the general nature of how this collaboration is conducted and maintained. Then the nature of R&D would be explored with predominant leadership theories in R&D. Data will be collected to explore the nature of OI between industrial and academia partners, the benefits and drawbacks would be explored, and some existing frameworks would be tested, if our data fits into them. Then the nature of leadership in R&D OI projects would be explored and tested if the existing theories of leadership in R&D and their characteristics are valid in an OI environment (deduction). Patterns and themes will be identified via qualitative data collection, and placed in the existing
theories to test if they are valid. Although the purpose is not to generate theory, but the nature of findings might be such that upon reflection a “surprising finding” is uncovered, which will lead to theory formulation or modification (induction) (Saunders et al. 2012, p. 147). Hence, abduction possess both inductive and deductive elements and is the most appropriate choice for our research. A key point to note here is that an abductive approach displays inter-subjectivity and transferability of data; as opposed to the theory-driven deduction approach and data-driven induction approach (Morgan 2007, p. 71), which falls in line with the underpinnings of our research aims in this thesis. Furthermore, we are aware that an abductive approach might be time-bound and may take extensive data collection and analysis to reach conclusive evidence. There is also the risk of finding no patterns or theory emerging from the collected data (Saunders et al. 2012, p. 148).

2.3. Preconceptions

Despite our aim of striving for the utmost objectivity in our research, one has to be aware that research is never value-free, as it is influenced by the preconceptions of the authors, based on our prior knowledge and experience, as well as attitudes and personal values (Bryman and Bell 2007, p. 29 f.). These preconceptions might influence various issues in the process of this research, such as our choice of research area, design and method and formulation of research question. The interpretation of data and the conclusions drawn are especially subjective and influenced by our preconceptions. This applies particularly to the chosen data collection technique of interviews, which is often criticised as being highly subjective and biased (Eisenhardt and Graebner 2007, p. 28).

At the moment of undertaking this study, both researchers have been studying towards a Masters in Strategic Project Management, which has given us insights into the basic as well as relevant concepts of this study, such as leadership, change management, and project management. Apart from this graduate study in project management, both researchers come from very diverse academic and social backgrounds. One of us has studied Nanotechnology in India and done her final thesis in a research lab of a major diversified technology company in the Netherlands which has a number of collaborations with various universities and companies. Therefore, she has experienced the R&D process first hand and has some working knowledge of the group dynamics and leadership involved in such an open R&D context. The other researcher has a background of Business Administration on an undergraduate level and has worked as a commercial project manager in an engineering and electronics conglomerate in Germany. She has experienced the importance of R&D and innovation for a competitive edge in an integrated technology company, as enormous budgets were spent on R&D activities each year. In her vocational training, she has experienced the process of budget approvals for R&D projects, however, she has never experienced a R&D environment herself on-site.

Due to our backgrounds as well as our current study, we have complementary knowledge of some of the basic concepts involved in this thesis. We are, however, not familiar with innovation management, or of all the intricacies that are involved in a collaboration driven by OI. Furthermore, we have not encountered product development and acquirement which forms the basis for the strategic intent of an organisation involved in OI. To sum up, we are aware of potential preconceptions that we have due to our backgrounds, but expect them to not lead to a strong bias in the research.
2.4. Researchers’ motivation

We came across the topic of Open Innovation as a rather new and interesting alternative to traditional R&D being adopted by companies, who are opening up to external partners (universities, research institutions, small and medium sized companies, and customers) to be at the forefront of R&D and the market, with the central aim to gain competitive advantage. With the concept being just about ten years old, extensive research has not been done on all the aspects of OI, with many related concepts still in their infancy and open to interpretation. Furthermore, we want to explore how the collaboration is initiated, fostered and managed as well as what benefits lie for the partners in such a collaborative environment.

Complementary to this, we found the topic of leadership interesting as it increases our understanding and awareness of different workplace behaviour and which leadership style encourages creativity and innovation (which in turn are important factors for OI), ultimately leading to higher performance in a research project team. It will also help us in exploring the specific qualities in leaders in OI, where two collaborating partners come together, and the role that a leader plays in facilitating such an environment. We are also interested in discovering through our exploratory study which theory of leadership, out of the big pool of leadership theories, fits the OI setting best. Moreover, we want to understand the dynamics of who the real leader is in an OI setting: the project leader of the industrial partner or the project leader/principal researcher of the research group at university. This study will elucidate on this relationship more, and will lead us to better understand the interaction and power play in such a setting.

Additionally, we found that research endeavours in universities and companies are also seen as projects, with a definitive start point, a semi-defined scope (due to nature of R&D) and an end point. It appealed to our interest to investigate how management of R&D projects work. It is our assumption that the operation of such projects significantly differs from the classic commercial/customer projects like construction projects. However, we feel that a number of project management processes that are in the focus of our master programme, can be (partly) applied to the R&D project context, such as the consideration of all stakeholders involved, the importance of transparent project management and communication.

We feel that the knowledge gained through this research study will also help us as future practitioners in understanding the breadth and diversity of roles, a leader plays in a non-traditional setting, as well as how a complex relationship between a profit-driven organisation (industry) and a research-driven organisation (universities) is maintained. It is our assumption that this study will also expose us to the complex group dynamics involved in such a setting. Due to the above mentioned reasons and some ‘Ah-ha moments’ that we hope to come across, it was a natural choice to decide in favour of this research topic.

2.5. Literature selection approach

When selecting relevant literature about open innovation and leadership, the intention was to review the existing literature in a structured way. We used the search engines of the online library of Umeå University, which consults the electronic EBSCO/Host database, thereby focusing on peer-reviewed journals. Besides academic journals, few well-established textbooks were used, mainly for the purpose of defining our research methodology.
In order to identify relevant publications, the keywords “Open Innovation”, and “Innovation management” were searched for in the topic field (including the title, key words, and abstract in the database). For the leadership aspects of our research, we searched for the terms “leadership” independently, and “leadership” paired with “open innovation” or “R&D”. We set guidelines for the papers, journals and authors that we included in the thesis. Naturally, there are publications closely related to OI and leadership without using these terms, but we decided not to focus on them. Mainly those social sciences publications, journal articles and peer-reviewed books were included which were exclusively talking about the keywords in our thesis: leadership, open innovation and R&D. A mix of these factors was preferred as the content was richer and more focussed and closer to our research topic. We excluded material like book reviews, pure interviews, or industry reports.

When reviewing articles that seemed significant and reliable to us, we used the bibliographies provided, taking a snowball approach of scrutinising the references of various articles to get the source of knowledge and not merely someone’s interpretation of it. Additionally, there are several literature reviews published on the current state of OI research (e.g. Huizingh 2011, West et al. 2014), and on leadership (e.g. Elkins and Keller 2003, Keller 1992, 2001, 2006), which were decent starting points to identify relevant articles.

Even though OI research has impacted the direction of innovation management studies, it has had limited influence on the broader disciplines of management and economics. Most of the OI articles were published in research journals, such as the International Journal of Innovation Management or Research Policy, just few exceptions were found in general management journals, such as the MIT Sloan Management Review. When selecting journals for OI, the focus was mainly on articles published in 2003 and ahead, as this was the year of publication of the book “Open Innovation” by Chesbrough (2003a) which is generally treated as a milestone book in the OI field (Huizingh 2011, p. 2). When focusing on collaborations between academia and industry, it was realised that OI literature typically concentrates on the company perspective. In order to explore the view of other stakeholders, such as academic institutions, another stream of literature was involved about industry-university collaborations and knowledge transfer.

In leadership, the state of theory development is significantly more established and much richer. We focused on publications from about the 1980s, when Burns (1978) revolutionised the practitioner view on leadership and first introduced transformational leadership (Spector 2014). The search for literature for the concept of Leadership resulted primarily in leadership journals, such as Leadership: Theory and Practice or Leadership Quarterly, but also in journals for organisational studies like Organization Science or Organizational Dynamics, and psychology journals, such as the Journal of Applied Psychology. Contemporary theories like transformational leadership, LMX theory and collective leadership were explored, which have a more modern business application than the older theories of leadership like Trait Theory, Behavioural Theory and Style Theory. Literature which touched aspects of gender-based leadership and cultural aspect of leadership were excluded, as they are out of scope of our thesis. Our rationale for not considering these topics was because the topic of our research is very refined and focussed and going down the paths of gender and culture will be shifting from the main aim of our thesis and the problem setting.
3. THEORETICAL FRAME OF REFERENCE

3.1. Introduction

The literature review is the basis for formulating our research questions and building the research design. By using the existing literature, we aim to show the relevance of this study and where research in the field is leading. We present what is already known about OI and leadership in an R&D setting, and which concepts and theories are relevant in these fields. Controversial findings are discussed as well as potential research gaps identified.

In order to investigate the nature of OI collaborations and how leadership encourages innovation in open research and development contexts, a theoretical frame of reference is developed as a basis for the empirical investigation and the following discussion. Therefore, theories related to OI and leadership, especially leadership in R&D contexts, will be in focus.

First, the concept of Open Innovation is introduced and contrasted to the traditional closed model of innovation. Frameworks to categorize OI activities are briefly presented, and some attention is given to the criticism that the OI concept receives in the innovation management field. Potential benefits and threats of implementing an OI model from a firm’s perspective are discussed, as well as challenges for management for adopting an OI approach. The role of governmental and intermediary institutions will be discussed briefly, as well as a potential impact of firm size and the industry for the suitability of an OI approach.

Second, this literature review will focus on OI in the context of industry-academia collaborations, reflecting the benefits of a collaboration also from the perspective of academia. Then, the nature of R&D projects and the concept of leadership is discussed, especially in an R&D context. Thereby the focus will lie on the theories of transformational and collective leadership, and leader-member-exchange. Eventually, the main findings from the literature review will be summarised, and potential research gaps identified. As a result, a conceptual framework is presented, combining both the streams of OI and leadership.

3.2. Open Innovation

Open Innovation (OI) was presented by Chesbrough (2003a) as a notion of the need to open up the innovation process outside the traditional boundaries of a firm. In the last decade, OI has become “one of the hottest topics in innovation management” (Giannopoulou et al. 2011, p. 505, Huizingh 2011, p. 2). Recently several reviews of the state of research in OI have been published (e.g. Huizingh 2011, Lichtenthaler 2011, West and Bogers 2014), however, managerial implications of OI are scarce and still in the developmental stage (Giannopoulou et al. 2011, p. 505). The following sections aim to explain the concept of OI and its importance, present OI frameworks, reveal criticism on the concept, discuss potential advantages, challenges and managerial implications of an OI approach. The central focus of this section is the collaboration between universities and industry, around which the role of governments and intermediaries on adopting an OI approach are discussed.

3.2.1. The OI concept – From innovation to open innovation

The concept of OI was introduced by Chesbrough (2003a) in the book “Open Innovation: The New Imperative for Creating and Profiting from Technology”, which is generally treated as a
milestone book in the open innovation field (Huizingh 2011, p.2). Chesbrough (2003a, p. XXIV) claims that “firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as firms look to advance their technology”. It is argued that companies need to change from a closed innovation model, where it internally develops and commercializes its own ideas under tight control (see Figure 2), towards a more open innovation approach, permeating the external boundaries of the firm and collaborating with external organisations (Chesbrough 2003b, p. 36, Giannopoulou et al. 2010, p. 163, Westergren and Holmström 2012, p. 210). Chesbrough defined OI as “the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively” (Chesbrough 2006, p. 1). This concept is seen as a new way for companies to profit from inter-organizational collaboration (Westergren and Holmström 2012, p. 209).

Why is there a need for an OI model?

The rationale behind the new model for R&D activities is that large industrial firms, which had been independent leading innovators in the past, nowadays face fierce competition by start-ups and a globalised market (Chesbrough 2003b, p. 35, Westergren and Holmström 2012, p. 209).
First, the increasingly and rapidly changing environment and international competition at the end of the 20\textsuperscript{th} century have led to a tougher business. This goes along with an increased time pressure to innovate in order to stay competitive, as knowledge quickly gets obsolete (Vanhaverbeke 2006, p. 205, Yström 2013, p. 2). Second, there have been social changes in working patterns, as professionals do not seek a job-for-life with a single employer (Dahlander and Gann 2010, p. 610). Due to this mobility of knowledge and skilled labour, it is impossible for companies to keep the best talents and relevant knowledge within the organisation (West et al. 2006, p. 285). Third, market institutions for trading ideas have improved, such as intellectual property (IP) rights, venture capital, and technology standards, which facilitate a knowledge exchange between organisations (Dahlander and Gann 2010, p. 610). Fourth, the rise of new technologies such as the internet allows to collaborate across geographical distances (ibid.). The aforementioned factors have led to an increased permeability of organisational boundaries and the need for companies to interact with other organisations to develop new technologies, commercialise new products, or just to keep track of the latest technological developments (Vanhaverbeke 2006, p. 205).

\textit{Differences between a closed and an open innovation approach}

Often in literature, the underlying principles of the closed and open approaches to innovation are contrasted (see Table 1). A traditional “closed” approach to innovation follows the philosophy that successful innovation requires control, i.e. that companies need to generate ideas, develop, and finance them on their own (Chesbrough 2003a, p. 20).

<table>
<thead>
<tr>
<th>Closed innovation principles</th>
<th>Open innovation principles</th>
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<tbody>
<tr>
<td>The smart people in the field work for us.</td>
<td>Not all of the smart people work for us, so we must find and tap into the knowledge and expertise of bright individuals outside our company.</td>
</tr>
<tr>
<td>To profit from R&amp;D, we must discover, develop, produce and ship it ourselves.</td>
<td>External R&amp;D can create significant value; internal R&amp;D is needed to claim some portion of that value.</td>
</tr>
<tr>
<td>If we discover it ourselves, we will get it to market first.</td>
<td>We do not have to originate the research in order to profit from it.</td>
</tr>
<tr>
<td>If we are the first to commercialize an innovation, we will win.</td>
<td>Building a better business model is better than getting to market first.</td>
</tr>
<tr>
<td>If we create the most and best ideas in the industry, we will win.</td>
<td>If we make the best use of internal \textit{and} external ideas, we will win.</td>
</tr>
<tr>
<td>We should control our intellectual property (IP) so that our competitors do not profit from our ideas.</td>
<td>We should profit from others’ use of our IP, and we should buy others’ IP, whenever it advances our own business model.</td>
</tr>
</tbody>
</table>

\textit{Table 1: Contrasting Principles of closed and open innovation (Chesbrough 2003c, p. 38)}

However, the concepts of closed and open innovation are not mutually exclusive, because in reality, not many firms follow a fully closed innovation approach (Huizingh 2011, p. 2). Innovation activities are situated on a continuum from closed to open innovation (Lichtenthaler 2011, p. 76, Huizingh 2011, p. 3). It is questionable whether external ideas can fully substitute internal R&D (Dahlander and Gann 2010, p. 701). Maintaining an internal “closed” process of R&D is still a necessary complement to openness for external ideas, keeping an appropriate balance between both approaches (Boscherini et al. 2010, p. 1068).
Inbound and outbound strategies

In the OI model, a company commercialises not only its own ideas, but also innovations from other firms, as well as academic institutions. The process of exploring external knowledge and ideas and bringing them into a company's own innovation process, is referred to as inbound strategy or outside-in process (Chesbrough and Brunswicker 2014, p.16, Lichtenthaler 2011, p.76). In addition, OI seeks ways to bring its unused in-house ideas to market by deploying pathways outside its current businesses, using an outbound strategy (Chesbrough 2003b, p.37). This is an inside-out process aiming at an exploitation of knowledge through the commercialization of technological knowledge. As Lichtenthaler (2011, p.76) points out, Philips Electronics gains high revenues annually in licensing. However, empirical studies have found that companies perform more inbound than outbound activities (Bianchi et al. 2011, p.22). The reason for under exploitation of ideas, e.g. by licensing, is connected to IP, as companies are afraid to diffuse relevant knowledge (Huizingh 2011, p.4). However, recent research shows that there is an increasing trend of out-licensing of technologies, but it still needs to be proven whether this trend continues or whether companies might have a decent reason for not exploiting their knowledge externally (ibid.).

The link of OI to theory and strategy of the firm

As it had been criticised, Chesbrough did not link the OI concept directly to established theories in the field. Nevertheless, researchers since then have linked OI with the resource-based view of the firm, along with the associated dynamic capabilities perspective (West et al. 2014, p.808). OI challenges the traditional resource-based view of the firm according to which the competitive advantage of a firm lies primarily in its internal capabilities (Giannopoulou et al. 2010, p.169, Dodgson et al. 2006, p.334). Vanhaverbeke (2006, p.260) is of the opinion that OI is a new approach to a resource-based view, since organisations have to combine their internal resources with those of their partners in order to generate value.

Some authors refer to OI not just as an ad-hoc activity, but as a new business strategy. It is a strategic choice to use external ideas and knowledge in value creation (Giannopoulou et al. 2011, p.508). OI can be a result of an explicit top down strategy (Gassmann 2006, p.226). Dodgson et al. (2006) examined how Procter & Gamble changed its R&D strategy to a ‘Connect and Develop’ strategy and developed products and technology with new external partners. It was considered as highly successful in terms of business growth. It shows how a company can facilitate to move towards an OI model (Gassmann 2006, p.226).

Process of OI implementation – From a closed to an open innovation model

Scarcce literature focuses on the process of leading a company from a “closed” to a more open innovation approach, which is seen as a radical change in a company’s organisation (Boscherini et al. 2010, p.1069). Boscherini et al. (2010, p.1071) apply the process of opening up the innovation process to Lewin’s (1947) model of organisational change, which is well-established in change management theory. They suggest that the change from closed to open innovation follows Lewin’s (1947) three stage model of “unfreezing, moving, refreezing” in order to overcome potential resistance to change by organisational members, by means of a pilot project (Boscherini et al. 2010, p.1069). Chiaroni et al. (2010, p.225) analysed the “journey” through which firms open up the boundaries of their business models towards an OI model by studying four Italian companies. It was found that a company needs to manage and stimulate the change from a closed to an open system involving four main dimension of the firm’s organisation:
inter-organisational networks, organisational structures, evaluation processes and knowledge management systems.

As Huizingh (2011, p. 6) points out, most literature in this research field centres on exploratory case studies, which implies a need for more systematic research with larger samples to better understand how organisations manage the transition towards open innovation. However, in this thesis, the focus will not be on the process of how an organisation opens up to OI initially, but rather on the everyday processes, practices and challenges of managing OI projects, including leadership as a key factor. This will be discussed in section 7.2 on managerial implications.

OI has become the umbrella that integrates a range of already existing activities in innovation management, which enables both academics and practitioners to rethink the design of innovation strategies in a networked world (Huizingh 2011, p. 3). Despite the increased scholarly work, literature reviews on OI present a disintegrated research field, where the meaning of the concept is still debated, which will be explored more in the next section (Elmquist et al. 2009, p. 327, Huizingh 2011, p. 7).

### 3.2.2. OI frameworks

Several authors conceptually further developed Chesbrough’s definition of OI, developing frameworks about how to categorize OI activities. Most frameworks are focused on detailing the inbound and outbound dimensions of OI (Giannopoulou et al. 2011, p. 507), which can be more or less open (Huizingh 2011, p. 3). In the following, three conceptual frameworks will be presented in order to show that OI instruments are diverse and can be categorized along multiple dimensions (Rass et al., p. 183).

Dahlander and Gann (2010, p. 701) base their framework on the degree of openness, using the dimensions of inbound and outbound OI and distinguish between pecuniary versus non-pecuniary interactions. The authors provide an analytical framework of four different forms of OI activities, which was further elaborated by Rass et al.(2013, p. 182). There are two inbound activities: acquiring and sourcing. *Acquiring* refers to activities where companies acquire input to innovation processes in exchange for market prices (Dahlander and Gann 2010, p.705), such as innovation marketplaces or intermediaries. Innovation intermediaries are often described as middlemen between searchers and solvers of innovation-related problems (Rass et al. 2013, p. 182). *Sourcing* is the integration of external resources without paying market prices in exchange (Dahlander and Gann 2010, p. 704). Innovation contests are typical examples of this category, as the winners of such contests receive a monetary or non-monetary prize (Rass et al. 2013, p. 182 f.). Furthermore, there are two outbound processes: revealing and selling. *Selling* refers to the commercialisation of internally developed knowledge for market prices (Dahlander and Gann 2010, p. 704). For example, licensing activities fall into this category as a means to create additional value from organisational knowledge and capabilities, even though licensing is not the core business of the company (Rass et al. 2013, p. 184). *Revealing* includes activities when companies reveal internal resources without direct financial rewards, but aim at indirect benefits (Dahlander and Gann 2010, p. 703), like the use of open source software in the IT sector (Rass et al. 2013, p. 184).

In this study, the focus lies on inbound activities, where companies are typically collaborating with universities in order to explore knowledge. We expect that the observed activities of collaborating with universities can have either an acquiring character, when the organisation that is hired for R&D purposes is paid a market price in exchange, or having a sourcing
character, when the university receives non-pecuniary benefits, such as a free use of material for research purposes.

In their conceptual paper, Felin and Zenger (2014) link OI choices to established theories of governance in economics. They extend Chesbrough’s differentiation between closed and open innovation, as they distinguish between six governance forms: two types of internal/closed innovation (authority-based hierarchy and consensus-based hierarchy), and four forms of external/open innovation: market/contract, partnership/alliance, contest/platform, and user innovation (Felin and Zenger 2014, p. 915). In contrast to Chesbrough (2003b), who argued that open innovation per se is the desirable approach nowadays, Felin and Zenger (2014, p. 914f.) discuss that different sorts of innovation problems need different ways of governance. They take a context-specific approach, as they argue that the choice of governance depends on the kind of knowledge that shall be acquired and the nature of the problem that has to be solved (Felin and Zenger 2014, p. 924).

In this thesis, a collaboration with university can have a market or contractual governance form, when a company identifies a problem and invites academic institutions to provide a solution as exchange for a market price (Felin and Zenger 2014, p. 919f.). However, this governance structure is seen as suitable for rather simple, well-structured problems. Due to the complexity of innovation problems, we expect to rather find the governance form of partnerships in this study. A partnership is a more socially complex governance arrangement and supports solving problems of intermediate to high complexity. Partnerships require a more open, collaborative governance form and encourage external partners to an open exchange of knowledge, often including rich communication channels (Felin and Zenger 2014, p. 920 f.).

Following Huizingh (2011), OI practices can also be grouped by differentiating between innovation process and outcome which can each either be closed or open (see Table 2). First, in Closed Innovation both the innovation process and the outcome are “closed”. Second, when the innovation outcome is closed, i.e. it is a proprietary innovation, but the innovation process is open, it falls into the category of Private Open Innovation (Huizingh 2011, p. 3). Less frequent are Public Innovations, where internal resources are spent for an open innovation outcome. This is often done for the purpose of establishing one’s own technology as a standard, e.g. the introduction of VHS videotape in 1976. Fourth, when both the innovation process and the outcome are open, such as in open source software, it is termed Open Source Innovation (Huizingh 2011, p.4). These two strategies are also covered by the aforementioned revealing strategy in the framework by Dahlander and Gann (2010, p. 703). This study will exclusively deal with the category of Private Open Innovations, where the innovation process is opened up to universities, but the outcome is usually a proprietary innovation for the company involved.

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<tr>
<th>Innovation Process</th>
<th>Innovation Outcome</th>
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<td>Closed</td>
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<tr>
<td>Closed</td>
<td>1. Closed Innovation</td>
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<td>Open</td>
<td>2. Private Open Innovation</td>
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Table 2: Various ways of innovation based on the openness of both the process and the outcome of innovation (from Huizingh 2011, p.3)
3.2.3. Criticism on the OI concept

Some researchers doubt that the OI concept adds any significant value to existing theories, and claim that it is simply “old wine in new bottles”, i.e. a mere collection of old ideas (Trott and Hartmann 2009, p. 715). They argue that OI is not a new phenomenon, because companies have always collaborated with external parties. For example, licensing of IP rights had already been an established way of doing business in the chemical industry in the 1970’s, when the detergent competitors P&G and Unilever were trading patents (Trott and Hartmann 2009, p. 727). Therefore, the critics argue that Chesbrough’s (2003b, p. 36) assumption that companies have worked so far following a closed innovation model, is simply wrong. Moreover, Trott and Hartmann (2009, p. 731) accuse the OI community to not consider sufficiently earlier work of scholars, who had already described and analysed most characteristics of the OI model, long before the term OI was coined. Chesbrough and Brunswicker (2014, p. 16) admit that firms have used inputs from external parties for decades, like accessing research projects of universities, however, firms then were still predominantly relying on internal competencies.

Groen and Linton (2010, p. 554) question whether the term OI should be modified or abandoned. They argue it has a lot of similarities with supply chain management (SCM), as it focuses on the creation of value by crossing the traditional boarders of an organisation including external parties such as suppliers or customers. From their point of view, the artificial separation of OI and SCM concepts creates communication barriers between these research fields which constrains the process of significant theory development. Von Hippel (2010, p. 555) agrees with that opinion, arguing that Chesbrough’s usage of the term OI indeed has some similarity to SCM.

However, van de Vrande and de Man (2011, p. 185) object that view, as OI takes a broader perspective than SCM, including stakeholders such as universities and competitors that are not part of the value chain in SCM. The core focus of OI is access and exploitation of knowledge, whereas SCM concentrates on the sequence of processes involved in the production and distribution of a commodity. OI uses broader techniques than SCM, such as knowledge intermediaries and IP licensing. Besides, OI involves major organisational changes, affecting internal structures, governance, paradigms, norms and values. The authors agree that despite the differences, the research streams of OI and SCM have some relevant overlaps and should be more integrated (Van De Vrande and De Man 2011, p. 186).

Another point of criticism is that Chesbrough developed his OI concept on the basis of industrial case studies (Trott and Hartmann 2009, p. 716). Also, other scholars often refer to case studies of large multinational companies such as Procter and Gamble (Dodgson et al. 2006, Huston and Sakkab 2007) and Philips (Vanhaverbeke et al. 2014, Lichtenthaler 2011), which have incorporated the principles of OI and facilitated conferences and publications on the subject (Trott and Hartmann 2009, p. 731). As case studies deliver a rich in-depth description of a particular situation, but are often questioned in terms of generalizability (West et al. 2014, p. 807), there is a demand for a larger sample in an empirical study which can deliver higher generalizability (Huizingh 2011, p. 6).

To sum up, critics mainly claim that the OI model is missing academic credibility and does not significantly contribute to existing theories. In contrast, Huizingh (2011, p. 7) argues that OI research indeed adds value to the literature, mainly because it is based on observation of practice and aims to solve real management problems. Van de Vrande and de Man (2011, p. 186) conclude the discussion by admitting that the OI concept is more grounded in practice than in established theories, hence the value of its theoretical contribution still needs to be proven.
3.2.4. Benefits and threats of an OI model

Most scholars in the OI field have highlighted the potential advantages of opening up the innovation activities, especially from the firm’s perspective (Dahlander and Gann 2010, p. 700). Companies may achieve direct monetary benefits, such as licensing revenues (Lichtenthaler 2011, p. 75), higher sales, and reduced innovation costs, due to shared R&D expenses and shared risks (Yström 2013, p. 2). Non-monetary benefits of OI can be a more diverse set of ideas and knowledge, access to expertise outside the organisation, improved product quality and accelerated time to market for new products (Wallin and Von Krogh 2010, p. 2), access to new markets and improving the organisation’s technological position (Huizingh 2011, p.4). According to Rass et al. (2013, p. 177) implementation of OI instruments strengthens a company’s social capital, i.e. employees’ engagement and social relations, which in turn increases firm performance. The authors argue that open innovation instruments stimulate idea generation for concepts, products or services, and create a valuable social resource that companies can use in diverse ways (Rass et al. 2013, p. 176).

Recently, few empirical studies aimed to explore a potential relationship between OI activities and innovation performance (e.g. Christensen et al. 2005, Bogers and West 2012), with mixed results. A positive relationship has been found between the breadth and the depth of collaborating with external partners and innovation outcomes (Laursen and Salter 2006, p. 134). Similarly, Fey and Birkinshaw (2005, p. 616) find that partnerships with universities lead to higher R&D performance. However, other studies have found no significant relationship or a negative effect (e.g. Un et al. 2010). Du et al. (2014) identify as a possible reason for contradicting research findings, that most studies are conducted at the firm level, comparing performance of firms that differ regarding their overall openness (Du et al., p. 828). The authors identify that OI practices with both market-based partners (customers and suppliers) and science-based partners (universities and knowledge institutes) are linked to a higher financial performance at the project level (Du et al. 2014, p. 833). However, findings of these different studies are not easily comparable, as the means of measuring performance and the level of analysis vary. It can be argued that OI effectiveness exceeds the obvious financial benefits (Huizingh 2011, p.4), and could also be measured as number of project outcomes (new developed products), innovation speed of the project, or the number of patents generated (Du et al. 2014, p. 833). Though, due to its ambiguity, measuring the performance of innovation is out of scope of this thesis.

Despite the promoted opportunities, OI also bears potential threats, as companies risk the outflow of internal core competences and knowledge which could lead to higher vulnerability to competitors (Westergren and Holmström 2012, p. 210). In practice, there is often the fear that OI collaborations are difficult to manage. It is claimed that there is a danger to lose control and flexibility, as well as the glory associated with an invention, or to spend resources in an unthoughtful way (Yström 2013, p. 3). The collaboration has to be managed carefully, in order to take full advantage of prospective value and minimise potential risks (Giannopoulou et al. 2011, p. 505). However, literature on managerial implications is still scarce.

3.2.5. Managerial challenges of OI

Adapting and living an OI approach implies some challenges for the organisation, therefore effective OI management is important. A company planning to open up for R&D collaboration has to face critical questions, such as how to include new types of partners in the innovation
process, how much information should be shared, who is having the rights for the research outcomes, and how to actually manage such a collaboration (Wallin and Von Krogh 2010, p. 145, Yström 2013, p. 3). As pointed out before, it was claimed that Chesbrough’s (2003a) concept is mainly a business model, but missing practical implications (Giannopoulou et al. 2011, p. 520). However, there is a need for guidance on managerial practices, as companies question how they can adapt the OI concept and manage the collaboration with external partners effectively (Brunswicker and Hutschek 2010, p. 683, Yström 2013, p. 1). In the following some of those managerial aspects, leadership for diversity and intellectual property (IP) management, are discussed.

**Leadership in OI**

It is stressed that the human factor in OI, culture and leadership is very important, as it is people who push the innovation process. This aspect is relevant for all organisational levels, from top management, to middle managers, the project managers and the researchers, as they determine the firm’s degree of openness and the organisational culture (Herzog 2008, cited in Giannopoulou 2010, p. 170). Commonly scholars agree that shifting from closed to a more open innovation approach requires a cultural change within the organisation, which should be facilitated by management, requiring certain leadership skills. It is seen as the leader’s responsibility to identify and fight a potential resistance to change (Giannopoulou et al. 2011, p. 515). These observations are connected to the theoretical fields of change management and leadership. It is stressed that leaders need to motivate employees that are involved in the OI process, and build an effective relationship with partners inside and outside the firm (Giannopoulou et al. 2011, p. 516). Management has the responsibility to facilitate the shift to OI, bringing in cultural change, innovative thinking and clear objectives (Giannopoulou et al. 2011, p. 509). It is a challenging question, how employees who belong to different organisations can be set a clear direction when collaborating partners have different perceptions of what to aim for and how to get there (Yström 2013, p. 4). A leader needs to create an environment, where people from different organisations trust each other and share information (ibid.). Despite the awareness that leadership is important for success in OI collaborations, previous research has only scratched the surface, which presents an essential knowledge gap that requires researchers’ attention (Wallin and Von Krogh 2010, p. 145, Yström 2013, p. 4). Leadership, specifically in R&D would be detailed further in section 3.4.

**Intellectual property (IP) management**

Since in an OI collaboration ideas on technology are exchanged and commercialised within the emerging technology market places, management of IP rights is a critical issue. Therefore, property rights over solutions or new knowledge generated have to be established in the very beginning of the collaboration, in order to avoid problems of appropriation of IP (Felin and Zenger 2014, p. 920, Giannopoulou et al. 2011, p. 517). Even though, it might seem to be controversial to what the term “open” implies, collaboration should not start before detailed agreements on IP are made. It is recommended to avoid having IP ownership dependent on inventorship (Munsch 2009, p. 50). Giannopoulou et al. (2011, p. 517) warn that in an OI partnership with universities one has to consider different mentalities about publishing and sharing intellectual assets. Typically, nowadays employment contracts for employees in R&D departments stipulate that IP generated from their work is assigned to the firm (Felin & Zenger 2014, p. 918).
To sum up, IP issues are perceived by many managers as one of the key barriers to OI (Giannopoulou et al. 2011, p. 519). Implementing and living a business model that favours OI, can be hindered by strong IP protection, organisational structures and politics. It is beneficial for companies, to use their intellectual assets proactively and engage in OI practices (ibid.). For successful OI, an open culture is needed, which can mean a significant change in the mentality of the organisation. In this study, it will be explored if IP is perceived by collaborating partners as a hindrance to OI and how it is objectively managed, however, contract management and IP management are not a central focus of this thesis.

3.2.6. Role of government and intermediaries

Since innovation is critical to a country’s competitiveness, policy-makers have recognized the importance of encouraging innovation activities and increasingly of OI activities. Occasionally this alliance is referred to as “triple helix” of industry, academia and government policy (Giannopoulou et al. 2010, p. 172).

Publicly funded R&D centres are established as innovation intermediaries to stimulate innovation spill overs between industry and academia (Young et al. 2008, p. 473, Huizingh 2011, p. 6). An intermediary mainly organises the network and builds trust between its members, acting as a “bridger” (Lee et al. 2010, p. 290). It can provide information about potential collaborators or facilitate a transaction between different parties (Howells 2006, p. 720). Moreover, intermediaries can take a more active role, which can be described as an architect, designing preconditions and offering leadership in the innovation process (Agogué et al. 2013, p. 5). Such intermediaries can provide an innovation arena, a platform to help companies which have a need for innovation, and inventors to find a market for their ideas (Giannopoulou et al. 2010, p. 172). Thus, intermediaries increase the connectivity and can impact the network of actors involved in the innovation process (Agogué et al. 2013, p. 6).

In this study, it is recognised that governmental policies have an impact on OI activities and intermediaries can play a significant role as facilitators for collaborations. However, the focus lies on the OI project level, where researchers from industry and academia come together. Therefore, these two actors are the main objects of our study. The role of governments is just mentioned where it has a significant influence on the nature of the observed OI collaborations.

3.2.7. Context of OI – influence of company size and industry

Several scholars argue that OI is not necessarily an imperative for all kinds of organisations, rather there is a need for a contingency approach (Gassmann 2006, p. 223). Internal context characteristics, such as company size, age, or location, and external context characteristics, such as industry, market turbulence or competitive intensity, influence the effectiveness and appropriateness of adopting an OI approach.

Firm size is the most frequently studied internal context characteristic (Huizingh 2011, p. 5). Research has shown that there is a size effect, as most OI adopters are larger firms, due to more resources, scale effects, a wider market reach and more technological assets to bargain with (Bianchi et al. 2011, p. 22, Wincent et al. 2009, p. 55). However, also SMEs are increasingly adopting OI practices (Van de Vrande et al., 2009, p. 435, Lee et al. 2010, p. 290). Small firms, that are geographically close to each other and operate in the same industry, join strategic networks and cooperatively conduct R&D (Wincent et al. 2009, p. 55). Since SMEs have less
resources to build and maintain collaborative networks and to create and enforce intellectual property rights, small size is often perceived as a barrier in OI (Spithoven et al. 2013, p. 537, Huizingh 2011, p. 5). However, this pitfall can also be motivating for SMEs to search for external collaboration (Spithoven et al. 2013, p. 537, Lee et al. 2010, p.299). Interestingly, large established companies and small start-ups manage OI differently, reflecting their differential position within the innovation system (Christensen et al. 2005, p. 1545), as SMEs have less formalised R&D procedures and different networks (Spithoven et al. 2013, p. 555).

A relevant external context characteristic for OI collaborations is industry. OI research often focuses on specific industries, such as the biopharmaceutical industry (Bianchi et al. 2011), consumer electronics (Christensen et al. 2005), or the food industry (Sarkar and Costa 2008). However, in some industries, an OI model does not seem adequate. Nuclear and military industries are typical examples of closed innovation in which non-proliferation of technology and protection remain important (Gassmann 2006, p. 224). In a study on the current state of OI, Chesbrough and Brunswicker (2014, p.18) find out that OI is indeed practiced in different industries; still the dominant sector is the high-tech industry, such as information and communication technology. Nevertheless, it is suggested that adopting OI is more a matter of business strategy than a matter of industry, i.e. internal context characteristics of companies are more important than the external environment (Huizingh 2011, p. 5).

Despite the awareness that firm size and industry might have an effect on OI activities, these context characteristics will not be considered in the data collection and analysis of this study. The focus here lies on large firms in the high-tech industry, following the prevailing approach in OI research, and increasing the availability of relevant data. Attention is paid to leadership dynamics inside the OI project team, leaving context factors of the collaboration largely out of scope.

3.3. Joint R&D projects of academia and industry

3.3.1. OI between academic institutions and industrial partners

Technological innovation is critical to organisational productivity, competition, and survival (Howell and Higgins 1990, p. 339, Judge et al. 1997, p. 72), which is at the core of R&D. A symbiotic relationship exists between innovation and R&D, where one is incomplete without the other, and is a result of efforts of individuals, team and the organisation, working towards a new common initiative (Denti and Hemlin 2012, p. 1, Olsson et al. 2012, p. 606). In this thesis, we focus on a particular form of OI: collaborations between the industry and academia. In the context of OI, universities play a crucial role since they “co-operate and share knowledge with other organisations in knowledge transfer exchange processes” (Padilla-Meléndez and Garrido-Moreno 2012, p. 417). Universities contribute significantly to a firm’s innovation process by offering creative ways of solving problems, and giving insights into emerging technologies (Giannopoulou 2011, p. 515). Researchers at universities are seen as key agents in the whole process, emphasizing the role of individuals in OI (Padilla-Meléndez and Garrido-Moreno 2012, p. 417).

The nature of collaboration between university and industry is multifaceted. As Perkmann and Walsh (2007, p. 262) point out, research can be organised in a very collaborative way as inter-organisational partnerships. In contrast, R&D activities can also be perceived as research services that are commissioned by industrial clients, including contract research and consulting.
This reflects the different governance forms of partnerships and markets/contracts as described by Felin and Zenger (2014) and discussed in the Section 3.2.2 on OI frameworks. Relationships often occur in combination with human mobility, e.g. when companies sponsor PhD studentships within the context of specific collaborative projects (Perkmann and Walsh 2007, p. 263). Companies increasingly engage in more strategic long-term relationships with universities rather than changing the partners frequently (Perkmann and Walsh 2007, p. 274). We expect to discover which party plays the leadership role in such a collaboration, or whether there is not even a leadership role, as it is argued by some authors that the need of a leader in R&D is redundant (Dionne et al. 2002, p. 461, Graen and Uhl-Bien 1995, p. 224).

**Benefits for industrial partners**

After having indicated general benefits of OI collaborations, there are explicit advantages of joint R&D activities with universities. The major benefit for industrial partners from an economic perspective lies in the higher cost-effectiveness than similar in-house research would have (Ankrah et al. 2013, p. 60). From an institutional point of view, the access to new knowledge and leading-edge technologies is seen as most beneficial, as well as keeping up to date with technological developments in universities, solving specific technical problems and the opportunity to access a wider network of research expertise (ibid.). By the inbound knowledge-flow from the university, the existing knowledge assets of the company are enhanced, which furthers the elaboration of new ideas and can lead to superior R&D performance (Fey and Birkinshaw 2005, p. 616).

It is argued that a partnership with a university, as opposed to contracting with another industrial partner, has two main benefits. First, universities are more likely to share knowledge freely in a partnership than private partners, because the norms of academic research favour the sharing knowledge rather than hoarding (Fey and Birkinshaw 2005, p. 603). Second, any outflow of knowledge is less risky when collaborating with academic partners, as universities are generally not potential direct competitors (Fey and Birkinshaw 2005, p. 616). As a result, in order to maximise R&D effectiveness it is advised by Fey and Birkinshaw (2005, p. 617) to partner with universities and limit collaborations with industrial partners.

**Benefits for the academic institutions**

Academic institutions also reap benefits from collaborations with industry. The driving reasons for collaborating with the industry are the access to funding for research, i.e. for equipment, materials and researchers’ salaries, and a creation of business opportunities (Tartari and Breschi 2012, p. 118, Ankrah et al. 2013, p. 58). Furthermore, collaboration for both university and industrial actors is often partly driven by government policies in order to get access to public grants (Ankrah et al. 2013, p. 58).

From an institutional perspective, OI exposes students and the faculty to practical problems and to state-of-the-art technology, which enhances the business relevance of their research. It is important for universities that research is at a cutting edge and stimulates technological advancement (Ankrah et al. 2013, p. 59). Researchers can also be driven to participate in collaborative projects by career-related motives. OI projects can provide career opportunities especially for students and post-doctoral researchers, and offer alternative career paths in the industry (Lam 2007, p. 1009). Interestingly, secrecy concerns, i.e. the possibility that the companies claim IP rights and limit the distribution of research results, are not perceived as highly significant by researchers (Tartari and Breschi 2012, p. 1118).
**Does (formal) project management matter?**

Du et al. (2014) follow the question whether formal project management approaches (which are rather designed for closed innovation projects) still work for managing OI projects. Their findings suggest that R&D projects with both market-based and science-based partnerships are related to a better financial performance, given that they are managed in the right way. Market-based partnerships are associated with higher project performance if a formal project management process is applied, whereas science-based partnerships are positively correlated with higher project revenues when loosely managed (Du et al. 2014, p. 837).

Du et al. (2014, p. 831) explain the finding that science-based partnerships require a less formal project management approach to be effective than market-based partners by the following reasons: First, the expertise and objectives of academic researchers may be different from the company’s R&D team, who are used to an environment of regular monitoring and control. Scientific researchers follow an institutionalized way of doing research at their own academic clock-speed and are used to an environment of autonomy and academic freedom (Du et al. 2014, p. 831). Collaboration with industry is often perceived as a threat to a researcher’s academic autonomy (Tartari and Breschi 2012, p. 1117, Ankrah et al. 2013, p. 60). Scientists are often even willing to accept lower wages to maintain their academic freedom and retain decision rights over their R&D projects, pursue their own research agendas and publish research findings (Stern 2004, p. 835). They might therefore feel uncomfortable in an R&D project that is managed in a formal way, with an emphasis on meetings and reporting (Du et al. 2014, p. 831). Second, since the firm’s risk of knowledge loss in collaborations with academic partners is less, as they do not act as direct competitors, there is less need of formal monitoring and scope control. Third, as R&D is a process of uncertainty and experimentation, strict monitoring might suppress creativity and hinder success (Du et al. 2014, p. 832). The study shows that companies need to adapt their project management approach in regard to the collaborating partner. The finding that loose, less formalised management is more beneficial for R&D projects with science-based partners is of relevance for leadership in an OI context.

**Who is taking the lead in an industry-academia collaboration?**

The study of leadership in such a complex environment is interesting to study with various interplaying factors. Who exactly is the leader and who motivates the individuals - the team leader, organisational influence (environment) or self-motivation? Moreover, it is advanced by various authors (Bass 1997, p. 133, Elkins and Keller 2003, p. 587, Keller 1992, p. 489) that leadership is a crucial aspect in the innovation process, while others say that professionalism and other context factors might substitute for the effects of leadership (Dionne et al. 2002, p. 461, Graen and Uhl-Bien 1995, p. 224). Due to extensive prior experience and training, internal motivation, scientists, engineers, researchers working in R&D teams represent a key context in which substitutes for leadership can be especially relevant (Keller 2006, p. 204, Yukl 2009, p. 52). Some authors discuss the independence of R&D departments, and whether there is indeed a need to lead them (Scott and Bruce 1998, p. 3). Therefore, the next section will detail on our research context of R&D and explore a few leadership theories and characteristics of leadership involved in such a setting.

**3.3.2. Illustration of OI between industry and academia**

The illustration shows the “triple helix” of industry, academia and governmental institutions (Giannopoulou et al. 2010, p. 172). As detailed in the text previously, a significant portion of
the financial resources are obtained from the government in support of collaborative projects between universities and industry. The intermediaries can also act as bridgers, brokers or third parties initiatives (Agogué et al. 2013, p. 4). The main role of an intermediary is to organise the network between industry and academia and build trust amongst them (Lee et al. 2010, p. 290). These are important to mention in the conceptual framework due to their significant impact on the collaboration between industry and universities, however, their role is not detailed in this study as it lies outside the scope of our thesis.

We hypothesise that the triple helix of industry, academia and intermediaries is enclosed in a porous frame of open innovation. We assume that some level of leadership abilities are required throughout the open innovation process from initiation to delivery. Hence, it is imperative that leadership is studied in such a unique environment and analyse the leadership characteristics which play an important role in furthering and fostering such a collaboration. It is assumed that there is free flow of ideas and knowledge between the two collaborating partners which can be moderated by the government sometimes. It is hence important to include government in this preliminary framework. However it is essential to stress on the point that the role of intermediaries is not the focus of our study. These two partners (academia and industry) jointly put in the collaboration their time, monetary resources, human resources and knowledge and ideas to produce some tangible and intangible benefits and results. The outcome of such a collaboration can be intellectual property (patents and publications), technology, products and some intangible knowledge which can be gained during the operation of the project, that can be used for future ventures. This has been illustrated in Figure 4.

![Figure 4: Open Innovation and Leadership Framework](image-url)
3.3.3. Research context: R&D projects

For the scope of this thesis, R&D was specifically chosen because of multiple aspects involved - the autonomous operation of teams with outcomes dependent on collective effort, role of leaders and differences in performance and working culture (Keller 2006, p. 202). Furthermore, much of the literature on management of R&D has focussed on budgeting and resource allocation (Liberatore and Titus 1983, p. 962). Through the means of the first section of this theory chapter, we have set the basis of our study with a detailed discussion on OI and the collaborations between universities and industry, the benefits for each and the interplaying factors. In this section, we would like to broaden the scope of the existing literature on R&D and explore the leadership roles in an R&D setting, which can be applied to an OI setting.

R&D involves unstructured problem-solving (Scott and Bruce 1994, p. 581). The nature of R&D is considered to be ambiguous, unique and uncertain. Long-term benefits are accrued over a period of time, and are dependent on the quality of research for it to be “economically and technologically attractive” to the market (Elkins and Keller 2003, p. 588). Immediate benefits might not be seen, which can influence the resistance of some organisations to be directly involved in R&D activities (Olsson et al. 2012, p. 608). Spencer (2001, p. 433) proposed that commercial research on one hand is on a time budget, academic research, on the other hand, is more flexible and has a higher time horizon.

The central task of R&D management is to blend powerful leadership with an empowered workforce, clear goals with an open and participative culture, and a focus on the task at hand (Judge et al. 1997, p. 83). Howell and Higgins (1990, p. 338) posit the organic nature of R&D organisations, where much of the power rests with the individuals which is in contrast to traditional mechanistic organisations, that have a strong centralised power. Generally, in innovative companies, the boundaries are defined by the strategic objectives, but the R&D department is given enough independence to “operate freely in the defined context” (Judge et al. 1997, p. 75). It can be noted that too much management control can stunt innovation and creativity; and therefore research. Hence, a balance needs to be struck between operational and strategic autonomy, which would promote innovation by encouraging researchers to be creative in organisationally beneficial ways (Judge et al. 1997, p. 75 ff).

Types of research

There are mainly three types of research done in organisations: fundamental/basic research, applied research and development research. These can also be said to be three stages in any innovation to product process.

![Figure 5: From fundamental research to developmental research](image)

**Basic research** (also called pure research or fundamental research) is a “systematic study directed toward greater knowledge or understanding of the fundamental aspects of phenomena” (Mahdjoubi 2009). It is more open-ended, with no specific end product in mind.

**Applied research** is a form of “systematic inquiry involving the practical application of science. It accesses and uses some part of the research communities’ (the academia’s) accumulated theories, knowledge, methods, and techniques, for a specific, often state, business, or client-driven purpose” (Mahdjoubi 2009).
Development research is defined as the “systematic study of designing, developing, and evaluating instructional programs, processes, and products that must meet criteria of internal consistency and effectiveness” (Richey 1994). It is generally geared towards a tangible product.

Structure of R&D departments/groups

Typically, academic research groups consist of a research group leader, post-doctoral students and some PhD students carrying out research in universities. They are generally financed by external research grants that the leaders apply for (Olsson et al. 2012, p. 608). Commercial research, on the other hand, is conducted by graduated scientists in business organisations (these research groups are led by seniors). Such research is expected to produce measurable results, which increase the competitive advantage and introduce innovations in the market (ibid.).

Commercial R&D departments in companies are often more hierarchically structured than academic research groups, where it is difficult to deduce the power play. Small teams of scientists and engineers might undertake product development projects; these teams might be led by project managers, who are supervised by lab heads, who report to division heads, who in turn report to corporate executives (Amabile et al. 1996, p. 1156). However, too much hierarchy creates barriers to information flow and hence hampers collective and organisational learning (Yukl 2009, p. 52). Shared values should be built with the stakeholders and the members of the organisation, which will lead to knowledge acquisition, encouragement of win-win solutions to conflicts, and application of common interests (Yukl 2009, p. 52).

3.3.4. Team structure and nature of R&D teams

Team structure represents the complexity and degree of formality of R&D teams (Wei et al. 2010, p. 276). A “collectivist culture” is seen in innovative firms, where creativity is fostered and nurtured. The group makes decisions co-creatively, learns and innovates together as one entity (Amabile et al. 1996, p. 1155, Judge et al. 1997, p. 73 f, Misra 2011, p. 31). A highly talented, well-organised team can fail if there is a low level of cooperation and mutual trust amongst its members (Yukl 2010, p. 365).

The nature of R&D teams in universities and industry is quite different from traditional project teams in companies, the latter being more focussed on immediate results and competitive advantage over other firms (Wei et al. 2010, p. 266). Individuals in R&D teams generally have a high level of intellectual abilities, are autonomous workers, self-managing and the leaders in such teams are typically from a technical background rather than a managerial one (Wei et al. 2010, p. 267).

In the context of OI, two very fundamentally and functionally different groups (academia and industry) come together for the purpose of collaborating on a common ground, bringing varied expertise. The challenge of such teams is that the academic partners also have other academic duties to fulfil, like giving lectures or conducting own research (Lehrer et al. 2009, p. 275). The commercial partners on the other hand, are part of an organisation and can have other projects on the side (ibid.). Hence, the leaders of such teams need to ensure that work of the collaborative project is not compromised in any way.
3.4. Leadership in R&D

Leadership has been defined by a multitude of authors in various ways. It is the ability of an individual to influence, motivate and enable others to contribute to the effectiveness and success of the organisation (House and Aditya 1997, p. 409, Yukl 2010, p. 21). Effective leadership usually involves an appropriate mix of task-oriented and relationship-oriented behaviours (Yukl 2010, p. 366). Müller and Turner (2010, p. 446) conclude that different competencies are required in leaders for different projects. High critical thinking, influence, motivation and conscientiousness is seen in all project managers of successful projects (ibid.). Leadership in R&D is required to be studied because generic leadership which includes position power, conformity and organisational commitment is seen to be counterproductive to creativity-centred R&D projects (Mumford et al. 2002, p. 713). It is rather autonomy, intrinsic motivation and critical orientation which is required in a leader of creative domain (Mumford et al. 2002, p. 712, Hunter and Cushenbery 2011, p. 255).

One of the greatest challenges for leaders is to create the conditions which facilitate, encourage and sustain innovation and organisational learning (YuKl 2009, p. 50). A number of authors have tried to develop clear and distinct theories for leadership, specifically targeted towards R&D, but a clear theory has not been deduced yet (Nippa, p. 6, Wei et al. 2010, p. 267). Seminal work has been done by Elkins and Keller (2003, p. 587) in advancing the role of leaders in R&D, where they have posited that transformational leadership fits the context well. However, the focus of transformational leadership on the inspirational characteristics of the leader and not so much on the relationship between the leader and the team is still lacking. Furthermore, it is interesting to take this discussion a step further and try to deduce the leadership characteristics in leaders in an OI context.

Elkins and Keller (2003, p. 587) suggested three leadership theories central to R&D leadership research: Transformational leadership, Leader-member exchange theory (LMX) and Strategic Leadership. For the scope of this thesis, the focus of the following sections will be on Transformational Leadership, LMX Theory and Collective Leadership. Transformational leadership has been widely associated with R&D firms and is said to be highly prevalent and required in such a dynamic environment (Elkins and Keller 2003, p. 588, Gilmore 2011, p. 10). LMX focusses on the relationship between leaders and members and how such a relationship fosters performance in R&D teams (Atwater and Carmeli 2009, p. 270). Finally, collective leadership has been identified in the R&D field, especially where organisational and role shifting is required and widespread (Friedrich et al. 2009, p. 934). Strategic leadership was not considered in the scope of this thesis, as collective leadership examines the leadership in group functioning at the operational level, as compared to strategic leadership which is more at a strategic and organisational level.

In the following section, a generic idea of the multiple roles that a leader plays in R&D organisations as well as the contingencies are presented, and then theories for leadership are explored.

3.4.1. Role of a leader in R&D

examined that a project leader in R&D needs to possess technical expertise as well as managerial influence due to the wide range of activities that need to be performed like leading the team, promoting, inspiring, interfacing, facilitation of knowledge, competency development and guiding and supporting the team members throughout (Mumford et al. 2002, p. 735, Wei et al. 2010, p. 271 f, Stoker et al. 2001, p. 1142). They are also required to span boundaries and engage with the stakeholders and be aware of the strategy and mission of the organisation to keep the research viable and stakeholders satisfied (Mumford et al. 2002, p. 735, Berson and Linton 2005, p. 52).

Wei et al. (2010, p. 270) found that mostly leaders in R&D have a steering rather than a directing approach to their team members. They mainly communicate the aims and the priorities, motivate autonomy, and finally energise the team with the vision of reaching the objectives. It can be said that they display a hands-off approach with letting the team members independently conduct their work. Charisma also plays an important role in the functioning of R&D teams, especially if there is paucity of time and budget. Stoker et al. (2001, p. 1147) hypothesise that the combination of consultative leadership and charisma might be the most effective technique for managing R&D teams. A strong working culture can be created by the influence of the team leader, which is emulated by the members (Wei et al. 2010, p. 272).

The key role of a leader in R&D is at the problem-definition phase or the evaluative phase. Leaders must actively participate in idea generation and use interactional tactics to encourage it (Mumford et al. 2002, p. 721). Motivation does not suffice in a creative environment, in contrast, there is a need to involve people in the task and better structure the idea. Some of the tactics used are definition of challenging goals and peer pressure and providing enough autonomy to the members (Mumford et al. 2002, p. 722). Social skills of the leader are important for idea promotion and sense-making capabilities, coaching and communication skills. Indirect and direct persuasion techniques are required as well as wisdom and flexibility to see all the connecting aspects to a project (Mumford et al. 2002, p. 718). Hence, a leader needs to balance a multitude of role and responsibilities in R&D based organisations or teams.

It would be noted in the following sections how leadership thrives in an R&D context, focussing on the role that a leader plays in such an environment, as well as the relationships between the leaders and the followers and their critique are presented. The theories would be presented covering the main points and the prevalence and success of such in a creatively-inspired R&D teams/organisations. The aim would be the merger of the three theories to get a holistic picture of leadership in R&D and in effect, in OI.

### 3.4.2. Transformational leadership & Transactional leadership

Transformational leadership is often considered synonymous with charismatic leadership. It attempts to raise the consciousness of the members by appealing to their moral values (Yukl 2010, p. 263). Such leaders set more “challenging expectations and typically achieve higher performance” (Avolio and Bass 2002, p. 1, Bass and Riggio 2006, p. 3). It has four components: idealised influence (charisma), individualised consideration, intellectual stimulation, and inspirational motivation. Transformational leaders are effective communicators and provide constant and constructive feedbacks which promote radical innovations. They motivate individuals to think collectively and for the benefit of the organisation through idealised influence, elevating the desires of the followers for achievement, goal sharing, enlarging and motivating the followers’ self-worth (Avolio and Bass 2002, p. 2 f, Bass and Avolio 1990, p. 24, Bass and Riggio 2006, p. 6, Berson and Linton 2005, p. 52, Yukl 2009, p. 51). They increase
the individuals' motivation and encourage them to share and pursue innovative ideas/vision which in turn promote radical innovations (Jansen et al. 2009, p. 8, Yukl 2009, p. 51). Intellectual stimulations leads to out-of-the-box thinking and innovative thinking processes.

Transformational leadership has been identified to be conducive to an R&D environment. A dynamic environment is supportive of transformational leaders as opposed to a stable environment where a transformational leader’s qualities are less useful and can be misconstrued as “wacky” (Jansen et al. 2009, p. 10). Berson and Linton (2005, p. 52) and Howell and Higgins (1990, p. 319) claimed that transformational leaders are more risk-taking and favourable to innovation. Such qualities are open to innovation in leaders who engage in OI, where the environment is dynamic and involves a certain amount of risk. Leaders who are willing to take the extra step to bring the two collaborating partners together need to possess some characteristics of transformational leadership.

Transactional leaders, also referred to as “value-free leadership” (Gilmore 2011, p. 12), on the other hand, engage in exchanges where individuals are rewarded and recognised for accomplishing the assigned tasks. Individual, group work and performance are tracked with active monitoring and corrective actions suggested; and hence, not encouraging learning processes for exploratory research and innovations (Jansen et al. 2009, p. 8, Yukl 2010, p. 263). However, Yukl (2009, p. 51) argues that transactional leadership might be applicable for improving existing processes and projects. Leaders can facilitate discovery and innovation by encouraging and rewarding effective communication, allowing greater access to information and encouraging the followers to network more and build their network (Yukl 2009, p. 52). An extreme form of transactional leadership is Lassiez-faire leadership, where leaders insulate themselves from the organisation and the members, which hampers collective learning and provide no leadership whatsoever (Bass and Riggio 2006, Yukl 2010, p. 278).

**Transformational vs. Transactional Leadership**

Transformational leaders are more strongly correlated to higher research productivity, satisfaction and overall organisational success (Bass and Avolio 1990, p. 223). Furthermore, they possess the ability to transcend self-interests and stimulate creativity with a focus on collective development (Bass and Avolio 1990, p. 222). It is a step up from the “business deal like theory” of transactional leadership, which involves a rigid structure of goal setting, planning and organising, rewarding/material gain, disciplining and controlling. Such a behaviour would not only inhibit subordinate participation, but can also have a negative impact on R&D teams as it might hinder its creative nature (Bass and Avolio 1990, p. 221 f). A charismatic leader in an R&D project group can encourage the kind of bold and unconventional work by professional employees, that is often needed to generate technological innovations (Keller 1992, p. 491).

Nevertheless, in addition to the transformational style, we expect to find participative and supportive quality of leaders to be more dominant in OI. It is assumed that both the leaders of the respective partners would not only support their own teams but also the partners’ to deliver a successful project.

Birnbaum (1992, cited in Gilmore 2011, p. 13) asserted that purely transformational or purely transactional leaders in universities are rare, rather leaders should utilise transformational and transactional leadership approaches according to the situation.
**Shortcomings of transformational leadership**

Charismatic and transformational leadership expect and demand higher performance levels from their subordinates but also provide them with intellectual stimulation and individualised support (Carmeli and Schaubroeck 2007, p. 46). Although, it increases the leader’s influence, it might not increase collective learning and long term organisational effectiveness. It can even impede collective learning, as the followers expect the leader to know best and not much efforts are made by the followers. They are even less likely to challenge the leaders for pursuing a new way of working or strategy (Yukl 2009, p. 50). Hence, transformational leaders have the potential to inhibit the nature of ‘collaborative innovation-driven teams’.

Transformational leadership theory is very leader centric rather than being relationship or follower centric. It does not focus on how the relationship between leader and follower is initiated and developed. Additionally, there are no feedback loops from the follower to the leader; rather it is a one way influential relationship with only the leader impacting the follower (Graen and Uhl-Bien 1995, p. 221, Scott and Bruce 1998, p. 4).

We hypothesise that the basic nature of leadership in OI is collective learning and intellectual stimulation as the two forces of academia and industry join hands to innovate and deliver knowledge. We also expect, due to the close knit working of the two partners, that a strong feedback loop exists between the leaders and the followers as well as between the collaborating partners in OI. However, transformational leadership does not focus on the relationship between the leaders and team members neither on the partners. Hence, there is a need to look at the holistic picture of leader-member relations. Therefore, the next section will detail LMX theory.

### 3.4.3. **Leader–member exchange (LMX)**

Leader–member exchange theory is based on the social exchange between leaders and followers (Atwater and Carmeli 2009, p. 266, Graen and Uhl-Bien 1995, p. 225). LMX stresses on a two-way interpersonal process between leaders and followers by involving in an interactive participation in which each can influence the behaviour of the other. Leaders engage in high quality exchange relationships that include providing subordinates with challenging tasks, risk-taking ability, recognition and motivate creativity and innovation (Elkins and Keller 2003, p. 600). Leaders and members form dyads (i.e. a close relationship) which are nested in groups, teams and organisation (Olsson et al. 2012, p. 605).

LMX includes facets of transactional and transformational leadership to better explain the stages of relationship development. At the initial point of contact, the relationship is mainly transactional. But with time, the relationship grows from a mere professional relationship to a psychological relationship of trust, support, and consideration. This leads to a high leader–member exchange, which is more transformational in nature (Graen and Uhl-Bien 1995, p. 221, Scott and Bruce 1998, p. 4).

High LMX characterises trust and respect, collaboration and cooperation between individuals and the group. It also facilitates to perceive the organisation as a whole and as supportive of innovation (Scott and Bruce 1994, p. 586). It fosters creativity and has a positive effect on the innovative behaviour of subordinates, through the creation of facilitating task conditions, development of subordinate skills and self-efficacy, and reduction of fears of negative evaluation of innovative ideas (Atwater and Carmeli 2009, p. 270, Li and Liao 2014, p. 861, Scott and Bruce 1998, p. 5, Volmer et al. 2012, p. 456). High LMX leaders, having an emotional and instrumental nature, encourage those with innovative problem-solving styles to
higher levels of autonomous behaviour while they diminish the perceptions of risk for those with lesser innovative styles (Amabile et al. 1996, p. 1166, Atwater and Carmeli 2009, p. 271, Scott and Bruce 1998, p. 5).

Olsson et al. (2012, p. 606) claim that LMX operates not just on the dyad level but also on the group level. The authors argue that a good relationship between the leader and members in a group is conducive to creative performance. Creative performance is different for academic and commercial research groups. The former are driven by publications whereas the latter are motivated by the development of new technologies, new products and patents. The authors found that high LMX contributes to more publications and hence higher creative performance in academic research groups. In commercial research groups, however, high LMX relates to lower number of patents and hence, lower creative performance (Olsson et al. 2012, p. 608, 616).

**Autonomy**

High LMX gives autonomy and discretion to followers for innovation to emerge. Scott and Bruce (1994, p. 600) and Volmer et al. (2012, p. 456) have researched the moderating role of job autonomy in the LMX-creativity environment. Autonomy is the extent to which an employee can determine pace, sequence and methods to accomplish tasks. It gives them the opportunity to develop new and useful ideas and demonstrate originality, which is highly favourable for an R&D environment (Volmer et al. 2012, p. 458).

Employer and team members with higher autonomy feel responsible for their jobs and are more likely to pick up creative work than those with less job autonomy, who are restricted in operation and method choice and have just predefined tasks to carry out, much like a mechanistic job (Volmer et al. 2012, p. 459). Working in autonomous jobs, the leaders and individuals can work together or even interchange work for more creative work involvement (Volmer et al. 2012, p. 458, 462). We assume that autonomy is one of the most important characteristics in an OI environment, and the collaborating partners have autonomy to discover and innovate, and a neutral exchange of ideas can happen for technological innovation, which is the central aim of OI.

**Empowerment**

Another important factor, that has a high impact on LM relationships, is empowerment (Harris et al. 2009, p. 372). The authors predict that when both LMX and empowerment are high, most positive outcomes are expected and vice versa. If the employee is highly empowered, the role of a supervisor/leader is redundant, as the job provides the motivation which is associated with positive outcomes. High LMX is required for employees to experience positive outcomes of the job (Harris et al. 2009, p. 373). Organisational support towards innovative behaviour motivates individuals to pursue innovative ideas (Scott and Bruce 1994, p. 584). Hence, the role of the leader is to empower the individuals to work towards the task at hand and collaborate with partners for technological innovation in OI.

However, Li and Liao (2014, p. 861) note that although high LMX relates to higher employer-employee relationship and trust, it can have a negative effect on the collaborative work of the individuals in a team, where invisible boundaries may be set up, which can hamper team performance in the long run. Thus, if the leader builds unequal and sometimes more favourable relationships with some team members as compared to the others, it can lead to a number of interpersonal problems between the team members as well as hamper collective thinking of the
3.4.4. Collective leadership

It is furthered by Bryman (2007, cited in Kligyte and Barrie 2014, p. 158) that in higher education, the followers require more collaborative and indirect leadership. There is however, very little research done on academic leadership. Collegiality is understood as an individual’s ability to collectively work with others towards “common goals, including social and intellectual engagement with colleagues” (Kligyte and Barrie 2014, p. 160) and participation in institutional administrative, managerial and mentoring processes. The characteristics thus fit quite closely with those required in leaders and individuals involved in academia.

Collective leadership can be defined as dynamic and multi-level process where a leader or a group of leaders utilise skills and expertise suited to the situation at hand or even collectively pursue a goal as leaders with different specialisations. It is perceived as more beneficial than traditional leadership practices of exchange and visionary thinking (Friedrich et al. 2009, p. 933, Wang et al. 2014, p. 190). Friedrich et al. (2009, p. 933) posit that leadership is not confined to a specific person but is situational and context-dependent. The leader identifies champions who excel in a particular field and bring different expertise and skills to the table which increases performance (Friedrich et al. 2009, p. 934, Howell and Higgins 1990, p. 320). Having diverse and varied expertise is beneficial to team performance (in line with cross-functional teams), but it is even greater when there is increased collaborative behaviour and information exchange (Friedrich et al. 2009, p. 935). There is effective delegation of responsibilities based on the context, which leads to better collective group functioning and team effectiveness (Pearce and Sims 2002, p. 191, Wang et al. 2014, p. 191). In the R&D field, Wei et al. (2010, p. 271) observed that there was no competition between the different individuals seen, rather it was a collaborative environment with everyone sharing ideas on an intellectual level.

We expect that such a leadership style is widespread in R&D teams, especially in universities, as various actors are PhDs, postdocs, principal scientists, graduate students. In this context, some of the leadership roles can be delegated to PhDs and postdocs by the team leader, who can be champions in certain fields, and where a very collective and collaborative environment fosters. Such a spread out leadership and role taking is highly conducive in an OI environment, where there is less order in functioning and operation.

Communication

Communication is the central construct in collective leadership as it is in LMX. Through communication, the leaders present their information and share with the group and vice versa (Friedrich et al. 2009, p. 936, Pearce and Sims 2002, p. 179). The team’s tasks and skills need to be aligned to be effective (Yukl 2010, p. 483). Leaders consult and give feedback to individuals who have a shared understanding of a situation and who have the competence, relevant knowledge and experience to participate in the leadership process (Friedrich et al. 2009, p. 938). This can lead to revision stages, alignment of team goals, team performance and effective problem-solving. Leaders can engage in direction-giving, meaning-making and empathetic language to get their ideas across to the team (Friedrich et al. 2009, p. 941, Pearce and Sims 2002, p. 179). It further deepens relationships, creates alignment, and enables new realities (Roberts and Coghlan 2011, p. 244).
Collective leadership facilitates team's problem-solving, communication, goal setting and performance, planning and task co-ordination (Friedrich et al. 2009, p. 946, Hui-Bing Xiongping 2014, p. 927, Wang et al. 2014, p. 187). However, there is a downside to collective leadership that too much collaboration can lead to group thinking which negates the advantage of diversity in a group (Friedrich et al. 2009, p. 946). For effective collective leadership, a leader needs to possess conceptual skills for effective identification of problems, structuring of the group work and clarification of objectives; interpersonal skills for effectively distributing leader responsibilities, facilitating information exchange, motivating and maintaining positive affective climate; and finally, technical skills for identifying problems, structuring work tasks and distributing leadership roles (Friedrich et al. 2009, p. 947, 948, Yukl 2010, p. 483).

It is furthered by Li and Liao (2014, p. 861) that since individuals have different contributions to the team, differentiation benefits team performance, but it also can cripple team performance by setting up barriers between the individuals in the team. Furthermore, the power in a collegial/collaborative organisation is dispersed among experts who have significant autonomy. Also, such an organisation is inherently conservative and unable to rapidly respond to changes in the environment due to its collective nature.

<table>
<thead>
<tr>
<th>Leadership Theories</th>
<th>Key Authors</th>
<th>Key Characteristics</th>
<th>Relevance to R&amp;D</th>
</tr>
</thead>
</table>
| **Transformational leadership** | - Avolio and Bass  
- Bass and Avolio  
- Bass  
- Berson and Linton  
- Jansen et al. | - Idealised influence  
- Charisma  
- Individualised consideration  
- Intellectual stimulation  
- Inspirational motivation  
- Feedback (L→M) | - Risk taking  
- Intellectual stimulation |
| **Leader-Member Exchange** | - Atwater and Carmeli  
- Graen and Uhl-Bien  
- Harris et al.  
- Olsson et al  
- Volmer et al.  
- Scott and Bruce | - Formation of dyads  
- Interactive involvement  
- 2-sided feedback loop  
- Autonomy  
- Empowerment  
- Support | - Feedback loop  
- Autonomy  
- Empowerment |
| **Collective Leadership** | - Friedrich et al.  
- Wang et al.  
- Li and Liao  
- Pearce and Sims | - Collaboration  
- Communication  
- Diverse teams  
- Shared understanding | - Joint problem-solving  
- Communication  
- Task co-ordination |

*Table 3: Leadership Theories used in the OI context*

### 3.4.5. Leadership in collaborations

The question is hence, how leaders in both organisations play a role in facilitating such an OI collaboration and examining if collaborations require different and more demands from leaders. Given the nature of these blocs of academia and industry, with their nature of professional autonomy; attempting to impose a common and forced vision from the start of the collaboration would likely be unviable and counterproductive (Martin et al. 2013, p. 204).

In a collaboration, generally two types of leadership are seen: dominating leadership, where one of the partners makes the important decisions and controls innovation objectives and methods; and consensus leadership, where the two collaborating parties always come to a
consensus and decisions are taken jointly. Davis and Eisenhardt (2011, p. 169) criticise these two forms of leadership in collaborations and introduce a rotating leadership process, where alternating complementary decision-making exists between the collaborators.

The crux of the leadership challenge is to bring subgroups together in such a way that “a balance is achieved between maintaining their internal cohesion, while acknowledging the potential for external conflict caused by inter-group diversity” (Sullivan et al. 2012, p. 43). The key challenge for leaders in a collaboration is bringing all the collaborating partners in a “shared power arrangement where they can pool information, other resources and activities around a common purpose” (Crosby and Bryson 2005, p. 184). Leaders effectively rely on team leadership for efforts which cannot be accomplished by the individuals alone (Crosby and Bryson 2005, p. 189). Team leaders should nurture communication that “aligns and coordinates members’ actions, builds mutual understanding and trust and fosters creative problem-solving and commitment” (Crosby and Bryson 2005, p. 190). For such communication to be effective, an atmosphere of openness, information exchange and respect is required (ibid.).

Linden (2002, cited in Sullivan et al. 2012, p. 45) focused on the achievement of process tasks and identified four specific qualities for leaders in a collaboration—“being resolute, focused and driven especially about collaboration; having a strong but measured ego; being inclusive and preferring to ‘pull’ rather than ‘push’; and, finally, having a collaborative mind-set”. Team leaders also facilitate the individual group members to achieve their personal and professional goals in relation to the collaborative work. For such a venture to be successful, a shared understanding of the collaborating partners’ mission, vision, rules and norms are required (Crosby and Bryson 2005, p. 190). The collaborating partners and the team leaders must seek towards mutual empowerment of the team members and their leadership capabilities. A key point to note is that leaders must facilitate and maintain the enthusiasm of the team members throughout the relationship (Crosby and Bryson 2005, p. 196).

Hence, it is expected that a more collaborative leadership is assumed by both parties, with the leader of the research group at the university maintaining the standards of his/her research group and the subordinates; and the leader at the R&D group at the company doing the same. It is expected that a very collective and peaceful environment ensues between the two collaborating partners with both giving ample respect and freedom to work towards their research objectives and towards the collaborative research objectives in their own best possible way.

3.5. Summarizing findings and identifying a research gap

After reviewing the literature, it can be concluded that a lot of research has been done on OI in the last decade, and on leadership over a significantly longer period of time. However, the meaning of OI is still debated (Elmquist et al. 2009, p. 327, Huizingh 2011, p. 7) and no defined theory exists for determining the leadership style in an OI collaboration between academia and industry. The predominant research methodology in the field is qualitative research, especially single case studies on successful and early adopters of OI have been conducted, that are descriptive by nature (West et al. 2014, p. 807).

The literature review has revealed several research gaps. First, OI literature concentrates on the company perspective, whereas the view of external partners, such as academic institutions has been underrepresented (Du et al. 2014, p. 828). In order to gain a more holistic picture of the significance of the OI model for other stakeholders and investigating its societal benefits, more research here would be necessary. When focusing on the collaborative relationship between
academic institutions and industry, mutual benefits attained by the two collaborating partners would also be explored. Second, scholars have focussed mainly on the top firm level, as the adaptation of an OI model is seen as strategic decision that is made at the top management level (Chesbrough and Brunswicker 2014, p. 16, West et al. 2014, p. 809). In contrast, there is a dearth of research on the R&D project level where innovation and new product development actually happens (Du et al. 2014, p. 837, Vanhaverbeke et al. 2014, p. 116), and the role of leadership in the day-to-day activities.

Through this academic work, we want to distinguish the characteristics in the three theories described above in the R&D work environment and discuss their commonalities. It will also be explored how leaders in an R&D environment facilitate unity in the collaborating unit, and how the differences between the team members, if any, are managed. Hence, there is a need to simultaneously investigate LMX, transformational leadership and collective leadership behaviours and how these can be complementarily used in an OI context. In an OI setting, the question arises, who is taking the leadership role and what factors in leadership are responsible for furthering the collaboration.

In conclusion, to combine the research gaps identified, this thesis aims at examining industry-academia collaboration in R&D projects, examining the benefits and detriments for both parties involved. Thereby the focus will be at the project level, analysing the predominant leadership styles in R&D teams. We will include research teams from projects with both large corporations, as well as a few SMEs, as we assume that company size does not have a deep impact, when analysing industry-academia collaboration.

### 3.6. Conceptual framework

The aim is to develop a framework for leadership in open innovation for R&D projects which encompasses the nature of OI, including the inputs, benefits, drawbacks and the managerial challenges of OI; and the three key theories of leadership mentioned, taking into account the characteristics which are relevant in an Open Innovation R&D environment. All the key points from the framework are covered during the data collection and have been evaluated in the qualitative analysis. This framework is a more detailed and focussed extension of the OI illustration mentioned in Section 3.3.2.

We assume that the system of university-industry is confined in a frame of leadership where the two co-operating partners are influenced by the leaders in each of the two blocs. We want to explore what the nature of OI is based on the type of financial and human resources, what the potential benefits for the two parties could be, and what is the basic reason they collaborate. Then the potential drawbacks, if any, of the collaboration are explored. It is important to elaborate on the benefits and the drawbacks, as these hold the main drivers for collaboration. The managerial challenges are included as they lead to the leadership aspect and to any problems that managing such a collaboration can have. The possible outputs from an academia and industry are incorporated into the framework as this gives a holistic understanding of the exploration of the nature of OI. Next the nature of leadership is explored and whether there is a dominant leadership role assumed by one of the partners and the characteristics they possess. From the three theories described in literature, leadership characteristics which are useful in an R&D setting are selected. It is assumed that similar features would be displayed by leaders in R&D projects in OI, adding on to the collaborative nature of such a relationship. The characteristics selected are intellectual stimulation of the group and the collaborating partner,
autonomy of the partners and of the team members, empowerment of the individuals and the team for working towards the collaborative initiative, joint problem-solving and effective and two-way communication between the leaders and the followers and also between the industry and university. This is done so as to best predict the nature of a leader in an R&D project in OI.

The framework represents a theoretical view of how the nature of OI and leadership aspects can be explored in the best possible way, and we expect this framework to hold in similar studies with similar parameters. We expect the framework to represent transferability and generalizability as it covers a range of aspects involved in OI and leadership. However, the framework is restricted in the academia-industry collaboration; and cannot be applicable to other forms of collaboration like industry-industry or industry-government.

![Figure 6: Framework for Leadership in Open Innovation Projects between Industry and Academia](image)

<table>
<thead>
<tr>
<th>Input</th>
<th>Academia</th>
<th>Industry</th>
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<tr>
<td></td>
<td>* Financial resources</td>
<td>* Access to academic expertise</td>
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<td></td>
<td>* Human resources</td>
<td>* Problem-solving</td>
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<tr>
<td></td>
<td>* Ideas and knowledge</td>
<td>* Tangible, marketable research outcome</td>
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<td></td>
<td></td>
<td>* Access to governmental funding</td>
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<th>Benefits</th>
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<tr>
<td>* Access to funding</td>
<td>* Access to funding</td>
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<tr>
<td>* Applicability of research, potential commercialisation of ideas</td>
<td>* Applicability of research, potential commercialisation of ideas</td>
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<td></td>
<td>* Access to academic expertise</td>
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<tr>
<th>Drawbacks</th>
<th>Academia</th>
<th>Industry</th>
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<tr>
<td>* Loss of academic freedom</td>
<td>* Loss of information and reputation as inventor</td>
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<th>Industry</th>
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<td>* Leadership/Stakeholder management</td>
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<td>* IP management</td>
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<th>Industry</th>
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</thead>
<tbody>
<tr>
<td>* Knowledge</td>
<td>* Solution for concrete problem</td>
<td></td>
</tr>
<tr>
<td>* Publications</td>
<td>* Knowledge</td>
<td></td>
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<td>* IP/Patents</td>
<td>* Technology</td>
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<td></td>
<td>* Products</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Who is the leader?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Joint Problem-solving</strong></td>
</tr>
<tr>
<td>* Academia and industry jointly solve problems.</td>
</tr>
<tr>
<td>* Team members are intensively involved in problem-solving in OI.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Autonomy</th>
<th></th>
<th>Empowerment</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Leaders and teams of both academia and industry are autonomous.</td>
<td></td>
<td>* High empowerment in members negates the need of a leader.</td>
</tr>
<tr>
<td></td>
<td>* Autonomy is highly valued in an R&amp;D environment.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intellectual stimulation</th>
<th></th>
<th>Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Leaders stimulate out-of-the-box thinking required in OI.</td>
<td></td>
<td>* Extensive communication between academia and industry.</td>
</tr>
<tr>
<td>* Leaders influence intellectual thinking.</td>
<td></td>
<td>* Regular communication between teams.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Which theory fits best?</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Transformational Leadership</td>
</tr>
<tr>
<td>* LMX Theory</td>
</tr>
<tr>
<td>* Collective Leadership</td>
</tr>
</tbody>
</table>

*Figure 6: Framework for Leadership in Open Innovation Projects between Industry and Academia*
4. RESEARCH METHODOLOGY

After having defined the research philosophy and scientific approach as an academic starting point in the second chapter, in this section a more practical approach to research methods is taken. The choice of research strategy and design, as well as the process of data collection and analysis are addressed and compared to alternatives, revealing the motivation for the methodological choices and chosen data collection techniques. Justification for designing the interview guide as our instrument for collecting data is given. Further, we will reflect the extent to which criteria of truthfulness and authenticity are fulfilled to enhance the quality of this study. Finally, ethical issues involved in conducting interviews are discussed critically.

4.1. Research strategy

Research strategy is the general plan of how the researcher will proceed to answer the research question (Saunders et al. 2012, p. 680). It can be seen as the general orientation to conducting social research, choosing between the use of qualitative or quantitative data collection strategies (Bryman and Bell 2007, p. 28). We understand the significance of achieving methodological coherence throughout the research design (Edmondson and McManus 2007, p. 1155), which we have attempted to do as will be displayed in the following sections. As explained in the chapter on research philosophy, we take the ontological position of a constructivist as we think that reality is subjective and cognitively constructed on an individual basis (Long et al. 2000, p. 190). We perceive knowledge as subjective and dependent on individual experience; taking an interpretivist epistemological position (Long et al. 2000, p. 190). Hence, as social researchers we aim to grasp the subjective meaning of social actions (Bryman and Bell 2007, p. 728).

4.1.1. Qualitative research

As a consequence of our constructivist and interpretivist approaches, and following the mainstream stance in research methodology literature, the most suitable research strategy for our study is of qualitative nature (Bryman and Bell 2007, p. 402, Long et al. 2000, p. 191, Morgan and Smircich 1980, p. 498, Morgan 2007). Since qualitative research emphasizes words rather than quantification in gathering and analysis of data (Bryman and Bell 2007, p. 28), advocates stress its potential rigour and conceptual power (Collier et al. 2012, p. 217). In qualitative research, the point of view of the participants is the driver for research orientation, whereas in quantitative research, the researcher is the driving force (Bryman and Bell 2007, p. 425 f.). Qualitative research focuses on understanding the social world through considering and interpreting the individuals’ perspective, i.e. taking an interpretivist epistemology (Bryman and Bell 2007, p. 402). Since this study examines the nature of OI and leadership styles in research teams that are formed by individuals, qualitative research serves the research objective. In comparison to quantitative research strategy, the qualitative researcher strives for a closer involvement with the people being studied and tries to take their perspective. The researcher seeks a contextual understanding of the situation being studied (Bryman and Bell 2007, p. 418).

It is argued that researchers should aim for a methodological fit between the status of theory development in the field of interest and research methodology. As Edmondson and McManus (2007, p. 1155) point out, it is more suitable to employ qualitative data for research areas where the status of theory development is rather nascent/ poor, in order to fully understand the phenomena studied, whereas quantitative research is better conducted to test more mature
theories (Eisenhardt and Graebner 2007). In the field of OI (and innovation management),
theory development can be seen as rather nascent, as the theoretical contributions were mainly
made in the last decade. Research on leadership aspects is more established, however,
leadership in an R&D context, and especially in an OI context, has received little attention in
literature. Hence, it can be argued that this thesis rather deals with nascent theories, which
justifies the use of qualitative data, as suggested by Edmondson and McManus (2007, p. 1155).
Qualitative research is usually associated with an inductive approach to theory, i.e. the
generation of theory (Bryman and Bell 2007, p. 28 f., Long et al. 2000, p. 195). However, we
use an abductive approach to theory (as explained in Chapter 2.2) in connection with a
qualitative research design, as we think that gathering qualitative interview data is the best way
to explore the phenomenon of leadership in an OI context and to explain patterns.

4.1.2. Exploratory nature of research
The research strategy applied in this thesis is connected with the objective of the undertaken
research (Saunders et al. 2012, p. 159). As explained before, the purpose of this thesis is to
explore leadership styles that can be found predominantly in R&D environments. Therefore,
the nature of our research strategy can be described as exploratory. An exploratory study aims
to seek new insights about a topic of interest, to ask open questions to discover what is
happening, and assess the topic in a new light (Saunders et al. 2012, p. 171, p. 670). A benefit
of exploratory research is its flexibility and its adaptability to change. In an exploratory study,
the direction of the study can be changed slightly during the process of study, as findings are
made from collected data which imply to change the focus (Saunders et al. 2012, p. 171).
Exploratory qualitative research is a fitting strategy, especially when little is known about a
phenomenon in the organisational literature (Edmondson and McManus 2007, p. 1177).
The design of an exploratory study applies to our study, as we aim to interview organisation
members of research teams for exploring the nature of collaborations and the phenomenon of
leadership in OI, and interpret their answers and our observations. We delimit hereby our
research from descriptive studies that aim at creating an accurate profile of events or situations,
as well as explanatory studies that establish causal relationships between variables (Saunders
et al. 2012, p. 171f.).

4.2. Research design
After having set a qualitative, exploratory research strategy as the broad direction for this study,
decisions about research design and research methods have to be made. Research design is a
framework for the collection and analysis of data that is suited to answer the research question
and meet research objectives (Bryman and Bell 2007, p. 39). It provides a reasoned justification
for the choice of data sources, collection methods, and analysis techniques (Saunders 2012, p.
680).

The use of the terms research design and research strategy are not consistent throughout
literature on research methodology, as Bryman and Bell (2007, p. 29, p. 39ff.) use the terms in
a reversed way than Saunders et al. (2012, p. 158 ff.). Bryman and Bell (2007, p. 39) distinguish
between five predominant research designs in business research: experimental (and quasi-
experimental) design, cross-sectional or social survey design, longitudinal design, case study
design and comparative design. In contrast, Saunders et al. (2012, p. 191) define the cross-
sectional and longitudinal designs simply as a distinction between two different time-horizons that studies focus on. They differentiate between experiment, survey, case study, action research, grounded theory, ethnography, archival research, narrative inquiry, mixed methods as “research strategies” which parallels research design (Saunders et al. 2012, p. 173). In the following section, the characteristics of potential research design which fit our research objective are discussed.

4.2.1. Cross-sectional design

Cross-sectional design involves gathering data on several cases, concentrating on various individuals, organisations or regions, at a single point in time (Bryman and Bell 2007, p. 55, Saunders et al. 2012, p. 190). This study can be defined as cross-sectional, as data will be collected more or less simultaneously over a short period of time. As we are not interested in a long-term development, but rather in the current status of collaboration of industry with external partners in R&D, we consider gathering data at a single point in time as adequate. More than one case is examined, because we are interested in variation regarding teams and organisations where OI happens, and aim at exploring patterns. In this study, data will be collected on comparable units, i.e. project teams, across different organisations and countries (Sweden, the Netherlands, and the UK).

Typically cross-sectional studies are associated with the use of quantitative or quantifiable data and used in connection with questionnaires or structured interviews (Bryman and Bell 2007, p. 55f.). However, a cross-sectional design may also use qualitative data as a research strategy, such as conducting unstructured or semi-structured interviews with several participants (Bryman and Bell 2007, p. 59, Saunders et al. 2012, p. 190).

There are certain delimitations in respect to a cross-sectional study. First, the existence of relationships can be detected by taking a cross-sectional design, but it is not suitable for clearly revealing causality between different factors, as data is gathered at a single point in time (Bryman and Bell 2007, p. 56). However, finding causality is not the purpose of this study, rather it is identifying patterns and relationships in OI and leadership styles. For this aim, a cross-sectional research design is adequate. Second, it must be taken into account that findings of this research can differ in a long-term study. For answering our research question, we rely on the answers of the leaders and followers that are based on their subjective perception of behaviour and memories of events and actions. As a result, a challenge associated with cross-sectional research design is ensuring internal validity and generalisability of findings (Bryman and Bell 2007, p. 56). These concerns will be addressed in the subsequent section about quality criteria (see Section 4.5).

4.2.2. Is it a multiple case study or a survey? – Neither nor

Besides having classified this study as a cross-sectional study, it is not indubitably clear which research design fits our research purpose best, as our study possesses criteria for both case studies and surveys.

Case studies are rich, empirical investigations of a particular phenomenon, usually using multiple sources of data (Saunders et al. 2012, p. 666). The researcher aims at “recognizing patterns of relationships among constructs within and across cases and their underlying logical arguments” (Eisenhardt and Graebner 2007, p. 25). Eisenhardt and Graebner (2007, p. 25) state
that using (multiple) case studies for generating theory is a reasonable and interesting research strategy. It can be argued that multiple case studies are superior to single case studies by increasing generalisability, flexibility, and analytical power (Eisenhardt and Graebner 2007, p. 25). Multiple case study design aims at comparing and contrasting the cases that are included (Bryman and Bell 2007, p. 64). However, when applying the criteria of Bryman and Bell (2007, p. 64) we realize that the focus of this study lies not on the unique contexts of the individual cases, but rather on the sample of cases, with the objective to produce general findings. The focus of this study is on generalising the OI concepts and leadership characteristics that are needed in an OI environment in an R&D context. These criteria account that we actually follow a cross-sectional design rather than a multiple case study design.

On the other hand, this particular study features several characteristics of a survey strategy. A survey research collects data on more than one case, using a cross-sectional design (Bryman and Bell 2007, p. 56, Saunders et al. 2012, p. 190). However, surveys employ a very structured approach to collection of data (usually quantitative) by using a questionnaire or structured interviews, which allows easy comparison. This criterion does not fit with our research objective and the strategy of an exploratory study, as we prefer a more flexible design and use qualitative mode of data collection for a deep understanding of the interviewee’s perception of leadership.

As a result, we realize that our research design possesses several features of multiple case studies and of social surveys; however, some crucial characteristics are not fulfilled. Hence, in this study the term “cross-sectional research” describes our research design best.

4.3. Data collection

In this study, semi-structured interviews with representatives from academic, industrial and governmental institutions are conducted. In the next chapter this data collection method is discussed and the process of searching for and selecting respondents. The interview partners are presented and the interview guide is introduced.

4.3.1. Data collection method - Semi-structured interviews

In the following, the research method which fits our research purpose for gathering data will be discussed. We have decided to use a single qualitative method for the collection of data (Saunders et al. 2012, p. 161), as we use interviews as our primary data source. Other possible methods would have been participant observation, examining documents, or administrating self-completion questionnaires, among others (Bryman and Bell 2007, p. 39f.). However, we believe that an interview method reflects our constructivism ontology and the interpretivist epistemology in the best way (Mason 2002, p. 63), as we are interested in the different perceptions of the team members, i.e. how they perceive leadership and OI processes in their research project. This will be explored by asking in depth-questions to leaders within research project teams. Due to our subjective undertones, face to face interviews are a better means of investigating the social meanings (Long et al. 2000, p. 195). Thereby we aim at gathering rich, empirical data in a highly efficient way (Eisenhardt and Graebner 2007, p. 28).

Interviews can be categorised as structured, semi-structured or unstructured interviews (Saunders et al. 2009, p. 374). Whereas structured interviews ask exactly the same questions in the same order (Bryman and Bell 2007, p. 732), semi-structured and unstructured interviews
employ the research with more flexibility in order to get the information needed and are the predominant data collection methods in qualitative research (Bryman and Bell 2007, p. 473, p. 733). Unstructured interviews only contain a list of topics or issues, baring the risk that comparability of gathered information is not given, as the interview may take an unintended direction (Saunders et al. 2009, p. 375).

Semi-structured interviews are based on the assumption that the gathering of data takes place as an interactive dialogue between interviewer and respondent (Mason, 2012, p. 62, Saunders et al. 2009, p. 375). Due to the exploratory nature of our research, we identify a semi-structure as the best way to conduct interviews. As typical for semi-structure, the interviews in our thesis followed an informal and flexible style, which allowed us to modify the questions as the interview progressed. More detailed questions were asked in places where statements were ambiguous, which allowed us to perceive the respondents’ information in a better way. We asked open-ended questions that give more flexibility and impact to the respondent as they do not present the respondent with a set of possible answers (Bryman and Bell 2007, p. 730). As a result, semi-structured interviews are suitable for our exploratory study, as they allow to gain background information and a contextual understanding of the observed phenomenon (Mason 2012, p. 64, Saunders et al. 2009, p. 377). The attempt to talk interactively, listen carefully and understand the person being interviewed in detail, is aligned with our interpretivist epistemological approach (Mason 2012, p. 64).

Using interviews as a primary source for qualitative data is often criticised as being biased and not equally trust-worthy as quantitative data (Eisenhardt and Graebner 2007). However, these challenges can be overcome by careful research design, being precise, rich presentation of evidence in tables and appendices, and clear statement of theoretical arguments, which we aim to pursue in the following (Eisenhardt and Graebner 2007).

### 4.3.2. Respondent selection process

In the following, the selection of units of interest is discussed. For the purpose of this research, we follow a purposive sampling technique which is primarily used in qualitative studies. Purposive sampling is selecting units based on specific objectives related to answering the research questions (Teddlie and Yu 2007, p. 77). It allows the authors to select a sample of most suitable interviewees that fulfil certain characteristics and cases that are particularly informative (Bryman and Bell 2007, p. 499, Saunders et al. 2012, p. 287).

We do not determine a certain sample size in advance of the studies, as we aim to conduct as many interviews as feasible and necessary for reaching theoretical saturation (Bryman and Bell 2007, p. 460). As the research objective is to investigate leadership in an OI context, the sample consists of leaders in research teams of universities and companies, if possible on both sides of the collaboration.

In order to recruit a sample of willing interviewees, we contacted university departments of Umeå University, as well as academic institutions in Sweden, the Netherlands, Germany and the UK. First, we investigated which research groups of various departments of Umeå University and other Swedish universities (Luleå University of Technology and Chalmers University of Technology) as well as Heriot-Watt University, Edinburgh, had external collaborations. Second, through academic literature, companies in Europe were found and contacted which participate in OI research, especially in case studies. This gave us an indication that these companies were open to academic research.
In relation to qualitative research, often a lack of transparency in sampling is criticised, such as, that the selection process for interviewees or the sample size are unclear (Bryman and Bell 2007, p. 497). Also in this study it could be criticised that the sample was not chosen systematically. Further, a tendency for convenience or opportunistic samples is criticised. The purposive of this study is not to define and interview a representative sample from the whole population, as it is with quantitative research, but rather to explore patterns in the leadership under OI (Teddlie and Yu 2007, p. 77; Bryman and Bell 2007, p. 497).

In total, 105 inquiries were sent to potential interview partners, of which 60 to academic institutions and 45 to companies. The response rate was around 35 percent. Responses from both groups included positive answers, expressing the willingness to participate in the research project, as well as negative answers, indicating that the work practices would not meet the criteria of OI, or that an interview was denied due to a lack of time. Finally, 18 interviews were conducted in person or by telephone/Skype, which took between 30 and 90 minutes each, and were always attended by both authors.

### 4.3.3. Background of interview partners

Following the research method described in the previous chapter, the interviews were conducted in different countries and with three kinds of organisations. The considerations which were made when choosing the countries for the sample of this study are explained in Appendix 3. Background information on the OI projects and organisations of the respondents (from universities, industries and intermediaries) in this sample are given in Appendix 4.

For this study, we tried to cover industry-universities collaboration, in addition to briefly touching upon the role of intermediaries and government in OI so as to better understand the role of each at the project level. We decided to not restrict our study to a particular field of science or industry. We are aware that the research field/industry can have a relevant impact on research and OI practices and leadership style but we are assuming that due to the collaborative nature of such practices, some common leadership characteristics would be deduced. As far as we know, a potential impact of the research field/industry on OI collaboration and leadership style has not been considered in the OI literature. Considered fields of research/industries in this study are physics (e.g. laser technology, optics, microelectronics), chemistry (e.g. fertilizers, soil contaminants, detergents), traffic safety, and information technology (e.g. software development), among others.

The main criteria for selection was that the respondents needed to be involved in OI projects, preferably at the operative research project level. Thereby, the OI practices at the project level and the leadership aspects regarding the collaborative partners could be explored. In the academic institutions, the respondents were usually heads of research labs, professors of departments or principal scientists. They were mostly involved in research and were the main contact persons for the industries with which their respective organisations were collaborating. We interviewed seven different respondents from four different universities. Out of these, six were professors and heads of research of their department, and only one respondent was speaking on behalf of the research group, and was a post-doctoral research fellow.

Respondents from industrial partners were usually heads of research departments or managers (being in a position of having both practical research and managerial tasks). They also had to be in direct contact with universities to have a breadth of knowledge regarding the collaborative projects and the operational level functioning. Seven interviews were conducted from five
different organisations. Three out of the seven respondents held the position of researcher or principal scientist. It was discovered that they handled most of the managerial and administrative tasks in addition to the research activities.

We discovered during the course of our interviews that the government and intermediaries play an important role in the university-industry collaborations, and hence we decided to include them in our research sample. It is not the most structured way of selecting sample, but we felt it was imperative that they were included to have a holistic picture of the research, especially about the nature of OI. The intermediaries, either directly belonged to a governmental institution (e.g. Vinnova,) or were part of a joint research unit/centre where partners from the industry, academia and public authorities cooperate (e.g. SAFER at Chalmers Technical University, Gothenburg and CDT at LTU, Luleå). Four interviews were conducted with the intermediaries from three different organisations. Respondents were usually responsible project managers or programme managers and had a working knowledge of projects going on in these institutions. However, in order to understand the role of mediators, we also interviewed leaders at a higher hierarchical level, in order to get a holistic picture of OI collaboration between industry and academia and how these institutions are facilitating that.

<table>
<thead>
<tr>
<th>Interview</th>
<th>Type of OI Actor</th>
<th>Country</th>
<th>Function</th>
<th>Organisation</th>
<th>Interview Date</th>
<th>Duration (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1</td>
<td>University</td>
<td>UK</td>
<td>Prof., Director of research</td>
<td>Heriot-Watt Univ.</td>
<td>31/10/14</td>
<td>48</td>
</tr>
<tr>
<td>U2</td>
<td>University</td>
<td>UK</td>
<td>Post-doc researcher</td>
<td>Cambridge Univ.</td>
<td>04/11/14</td>
<td>37</td>
</tr>
<tr>
<td>U3</td>
<td>University</td>
<td>Sweden</td>
<td>Prof., Programme manager, Head of research</td>
<td>Umeå University</td>
<td>05/11/14</td>
<td>72</td>
</tr>
<tr>
<td>U4</td>
<td>University</td>
<td>UK</td>
<td>Prof., Head of research lab</td>
<td>Heriot-Watt Univ.</td>
<td>05/11/14</td>
<td>44</td>
</tr>
<tr>
<td>U5</td>
<td>University</td>
<td>Sweden</td>
<td>Prof., Head of research lab</td>
<td>Umeå University</td>
<td>05/11/14</td>
<td>75</td>
</tr>
<tr>
<td>U6</td>
<td>University</td>
<td>UK</td>
<td>Prof., Head of research lab</td>
<td>Heriot-Watt Univ.</td>
<td>10/11/14</td>
<td>90</td>
</tr>
<tr>
<td>U7</td>
<td>University</td>
<td>Sweden</td>
<td>Prof., Head of research lab</td>
<td>SLU Umeå</td>
<td>13/11/14</td>
<td>58</td>
</tr>
<tr>
<td>I1</td>
<td>Industry</td>
<td>UK</td>
<td>Section Head</td>
<td>P&amp;G</td>
<td>07/11/14</td>
<td>35</td>
</tr>
<tr>
<td>I2</td>
<td>Industry</td>
<td>Sweden</td>
<td>Head of R&amp;D activities</td>
<td>AVL</td>
<td>07/11/14</td>
<td>60</td>
</tr>
<tr>
<td>I3</td>
<td>Industry</td>
<td>Netherlands</td>
<td>Manager</td>
<td>Philips</td>
<td>11/11/14</td>
<td>30</td>
</tr>
<tr>
<td>I4</td>
<td>Industry</td>
<td>Netherlands</td>
<td>Principal Scientist</td>
<td>Philips</td>
<td>11/11/14</td>
<td>30</td>
</tr>
<tr>
<td>I5</td>
<td>Industry</td>
<td>Netherlands</td>
<td>Technology Manager</td>
<td>Philips</td>
<td>14/11/14</td>
<td>32</td>
</tr>
<tr>
<td>I6</td>
<td>Industry</td>
<td>UK</td>
<td>Senior Research Scientist</td>
<td>Toshiba</td>
<td>17/11/14</td>
<td>32</td>
</tr>
<tr>
<td>I7</td>
<td>Industry</td>
<td>Netherlands</td>
<td>Researcher</td>
<td>Holst Centre</td>
<td>21/11/14</td>
<td>29</td>
</tr>
<tr>
<td>M1</td>
<td>Intermediary</td>
<td>Sweden</td>
<td>Programme Manager</td>
<td>Vinnova</td>
<td>06/11/14</td>
<td>34</td>
</tr>
<tr>
<td>M2</td>
<td>Intermediary</td>
<td>Sweden</td>
<td>Researcher</td>
<td>SAFER</td>
<td>07/11/14</td>
<td>35</td>
</tr>
<tr>
<td>M3</td>
<td>Intermediary</td>
<td>Sweden</td>
<td>Project Manager</td>
<td>LTU Luleå</td>
<td>14/11/14</td>
<td>45</td>
</tr>
<tr>
<td>M4</td>
<td>Intermediary</td>
<td>Sweden</td>
<td>Deputy Director</td>
<td>SAFER</td>
<td>18/11/14</td>
<td>54</td>
</tr>
</tbody>
</table>

Table 4: Respondent Information
In the data presentation and analysis, the abbreviations U1-U7 will be used for indicating that a university representative was quoted, I1-I7 relates to the industrial partners, and M1-M4 to the representatives of intermediary organisations.

4.3.4. **Interview guide**

The interview guide used for companies and universities (see Appendix 1) in the observed research teams consists of questions that are grouped according to the different concepts of OI and Leadership that will be explored further in the thesis. Follow-up questions that depend on the context and aim to give a deeper understanding of the phenomenon being studied were asked when appropriate. The set of questions changed regarding whether the respondent was belonging to an academic or industrial partner.

The interviews were initiated with a brief introduction of us as researchers, a concise introduction of the topic and our aim for the research and why we found the respondents ideal for our research. The interview was initiated with demographic questions, getting to know about the organisation and the role of the respondent in it. Second, we were asked more specific questions about the research team that the respondent was involved in. Thereby, we were interested in the nature of research projects (i.e. fundamental, applied or developmental research), the location of the research group, and the characteristics of the research team (e.g. team size, type of team members). Third, questions referring to the OI concept and the nature of collaboration between the interviewee’s organisation and the industrial or academic partner were explored. We were interested in when and by whom was the collaboration initiated, and asked for the purpose and the perceived benefits (and pitfalls) of the collaboration, the roles of the representatives of the different actors involved, and the power they have in decision-making. Also, practical managerial aspects of the collaboration were enquired, like the funding of the collaborated project, the setting of project boundaries, and the existence of a project agreement.

Further, we were interested in how formally the R&D projects are managed in the day-to-day work, referring to the frequency of meetings, the existence of regular project reviews. Moreover, we were interested in the management of intellectual property rights over the research outcome and who it belonged to.

Fourth, questions concentrating on the leadership aspect of the collaboration were probed. Thereby, we asked both questions with which we could indirectly identify a leadership style, and also reflective questions on how the person was perceiving their own leadership style. For example, it was asked how the leader manages the collaboration between the university and the company and if they take a different style when dealing with industrial or academic partners. Also, the interaction with the team members, which is essential for identifying a leadership style was explored, by asking for task autonomy given to the team members, means of directing them, the existence of feedback loops, and the leader’s handling of mistakes and team conflicts.

4.4. **Data analysis**

The objective of the data analysis of our theses is to identify patterns. Therefore, a thematic content analysis is made, coding for evidence of constructs (Edmondson and McManus 2007, p. 1160).
4.4.1. Interview transcription

Interview recording is one of the crucial elements for the content analysis of qualitative interviews, as a researcher needs to know not only what was said, but also reflect and interpret the findings from the data (Bryman and Bell 2011, p. 482, Saunders et al. 2012, p. 505). This allows a thorough examination of what the respondent was saying and indicating at, which can be used as a powerful aid to critically analyse the responses and report the findings (Bryman and Bell 2011, p. 481). Recording of interviews must follow all the ethical considerations which will be described in Section 4.6.

Interview transcription, although highly time-consuming and often given the least amount of attention, is highly recommended in order to have a detailed record of what was said as an analytical aid (Bryman and Bell 2011, p. 481, Saunders et al. 2012, p. 505). Saunders et al. (2012, p. 550) advise to transcribe the recorded data as soon as possible, so as to get the best analysis at a later stage. The interviews were transcribed shortly after the interviews were conducted by listening to the recorded interview and manually typing what was said. These transcriptions have been kept private and have not been shared with any other person, keeping in line with the ethical considerations of confidentiality and anonymity.

4.4.2. Data categorization

The first step after data transcription is categorising and rearranging the data into meaningful chunks to better understand the categories and sub-categories and to derive meaning from them. The first step in identification of categories is guided by the research questions and the objectives of the study (Saunders et al. 2012, p. 557). Due to the large amount of rich qualitative data, Bryman and Bell (2011, p. 571) state that it is easy to get lost in it, and fail to deliver the purpose of the study and contribution to the business and management community. Hence, it made sense for us to employ the use of Computer-Assisted Qualitative Data Analysis Software (CAQDAS) (Bryman and Bell 2011, p. 597). We used the software NVivo, to assist us in categorising and visualising the data better. Coding the data using the software is one of the key stages in categorising the data into concise and understandable bits. It aids us in identifying relevant themes and patterns which will help in the analytical process.

Following the categorisation of data using the software, the approach taken to analyse the data is template analysis. This follows the abductive nature of our study as template analysis combines a deductive and inductive approach to qualitative analysis by employing the use of the codes and nodes created in the software (Saunders et al. 2012, p. 572). It is also flexible enough to allow us to add relevant themes as and when they occur in the data. It can be revised and reviewed at frequent intervals till all the data has been coded and analysed (ibid.).

Template analysis helped us as a first step in analysing the data and identifying key points made by the respondents. We divided the data into two main categories: OI and Leadership. The categories were then defined more and sub-divided by consulting the literature. This provided us with a framework with clear and cogent categories which are useful for touching upon the key points made in the literature and verifying or refuting those made by the respondents. This followed a deductive approach where data was collected and verified using the theory. From then on, a thorough analysis of the data was done to explore the underlying concepts and key terms used by the interviewees, which are of interest to us. It is noted that all the themes were not covered in the sub-categories derived from the literature and some further findings emerged while analysing the data and hence new categories were defined, and placed under one of the
two main categories, OI and leadership, to have a formalised structure. This followed an inductive approach to data.

Revisions were done to identify any repetitions and related patterns, which were merged into one category. A thorough analysis of the words used by the respondents was done; as closely related words might have been used by them to stress on a single common theme (research head, principal scientist, leader, manager – all refer to a leader). Some outliers were also identified which were not stressed upon by most of the respondents, but by one or two. Such themes were also included in the study so as to not miss out on any rich and relevant piece of information.

The table below outlines the main themes and categories identified from the data and the literature review. The main categories for Open Innovation are the type of OI collaboration, benefits and drawbacks of such collaborations, managerial challenges and the formality of project management. For leadership, the data will be analysed regarding which party is taking the leader, what the role of the reader implies in relation to the individuals and to the team, and the leadership characteristics, such as intellectual stimulation, autonomy, empowerment, communication and joint problem-solving. These have been detailed in the literature and we believe that these are key factors and themes which will have an impact on the findings of our study.

<table>
<thead>
<tr>
<th>Open Innovation</th>
<th>Leadership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature of OI collaborations</td>
<td>Nature of leadership in OI projects</td>
</tr>
<tr>
<td>* Type of OI collaboration</td>
<td>* Who is taking the lead?</td>
</tr>
<tr>
<td>- Inbound/ outbound OI strategies</td>
<td>- Industry/university</td>
</tr>
<tr>
<td>- Degree of openness (Acquiring/ Sourcing/ Revealing/ Selling)</td>
<td>* Role of a leader</td>
</tr>
<tr>
<td>- Governance form of collaboration (market, partnership, contest, user innovation)</td>
<td>- In relation to the individuals</td>
</tr>
<tr>
<td>- Type of research (fundamental, applied, developmental)</td>
<td>- In relation to the team</td>
</tr>
<tr>
<td>* Benefits and drawbacks of OI</td>
<td>* Leadership characteristics</td>
</tr>
<tr>
<td>* Managerial challenges</td>
<td>- Intellectual stimulation</td>
</tr>
<tr>
<td>- Leadership/ Stakeholder management</td>
<td>- Autonomy of members</td>
</tr>
<tr>
<td>- IP management</td>
<td>- Empowerment</td>
</tr>
<tr>
<td>* Formality of OI project management</td>
<td>- Communication</td>
</tr>
<tr>
<td>- Contractual situation</td>
<td>- Joint Problem-solving (task co-ordination)</td>
</tr>
<tr>
<td>- Tracking of project progress and reporting</td>
<td></td>
</tr>
<tr>
<td>- Nomination of project manager</td>
<td></td>
</tr>
<tr>
<td>- Use of project management tools</td>
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</tbody>
</table>

*Table 5: Template Analysis OI and Leadership Codes*
4.5. Assessing the research quality

Choosing semi-structured interviews can impact on the quality of the empirical material collected. In the following, we will reflect upon the trustworthiness and authenticity of this thesis, based on quality and truth criteria that can be applied for qualitative studies (Lincoln and Guba 1986). The purpose of discussing relevant criteria is to facilitate the reader’s assessment of the quality of this study.

When assessing the quality of quantitative research, usually the criteria reliability and validity are evaluated (Bryman and Bell 2007, p. 410). However, the nature of qualitative studies is different: due to the uniqueness of social phenomena, studies are difficult to replicate. As a result, there is a dispute among social researchers, if the criteria reliability, validity and generalisability should just be slightly altered for qualitative research (Mason 2002, p. 38), or that alternative criteria need to be applied (Bryman and Bell 2007, p. 411, Lincoln and Guba 1986, p. 18 f.). In the following, we follow the approach of Lincoln and Guba (1986) and evaluate the trustworthiness and authenticity of this study.

**Trustworthiness**

The trustworthiness of this study is increased by addressing the four preliminary criteria credibility, transferability, dependability and confirmability. First, credibility is the match between the empirical observations and the theoretical ideas that the researchers build up (Bryman and Bell 2007, p. 410). This criterion parallels internal validity in quantitative research (Bryman and Bell 2007, p. 411). On the one hand, it is argued that internal validity is typically weak in cross-sectional studies, as mere associations are made, than unambiguous causal relationships are explored (Bryman and Bell 2007, p. 58). On the other hand, credibility can be a strength of qualitative research, especially when the researcher takes the time needed to deliver a deep description of the phenomenon and ensures congruence between observations and concepts (Bryman and Bell 2007, p. 410). For credibility in qualitative research, it is important that the factors observed are actually capable of answering the research question. The results should be plausible for both the respondents and the study’s readers (Miles and Huberman 1994, p. 278). In this study, we aim to increase the credibility by ensuring that the research is conducted according to the “canons of good practice” (Bryman and Bell 2007, p. 411). As we think that the nature of OI and leadership style can be identified by interviews, we conducted face-to-face and virtual interviews via skype and telephone.

Second, the criterion transferability is concerned with the possibility of generalizing the information gained from the inspected sample to a broader one. It, thereby parallels the criterion of external validity for quantitative research, i.e. to what extent findings apply to other contexts (Bryman & Bell, 2007, p. 410 f.). Typically transferability of qualitative studies is seen as weak, as sample size is small (ibid.), and, as we follow a constructivism approach, we understand that social settings are unique and are not easily replicated (LeCompte and Goetz 1982, p. 35). Hence, generalisability is not the main concern of an exploratory qualitative research. However, Lukka and Kasanen (1995, p. 86) argue, that generalisability from qualitative research is higher than usually considered, as researchers try to understand the context deeply and get a sound knowledge about prior studies. Both qualitative and quantitative research face similar opportunities and challenges regarding generalisability, as they are based on assumptions that need to be revised and interpreted (Lukka and Kasanen 1995, p. 78, p. 86).

There are different levels of generalisability: from sample to population, analytic (theory-connected) and case-to-case transfer generalisability (Miles and Huberman 1994, p. 279).
Whereas a generalization from our sample to the population will not be accomplished by our research, we strive for a certain analytic and case-to-case generalisability. In other words, it is not claimed that the results of this study are generalisable to all companies and organisations that are engaging in OI. Rather, the results allow theorizing on the topic of leadership in OI contexts. It can be argued that some of findings could potentially be generalisable to a certain extent. We intend to increase the transferability of this study by providing a detailed description of the research methodology and the findings, and explaining the data analysis decisions in detail. This provides a reader with the information needed to judge potential transferability to other contexts (Bryman and Bell 2007).

Third, the notion dependability is related to the quantitative criterion of reliability (Bryman and Bell 2007, p. 411). It is concerned with the consistency of the results and replicability at another point in time (Lincoln and Guba 1986). As mentioned before, the notion of dependability is difficult to fulfil in qualitative research, especially as we take a constructivism stance to ontology, believing that social phenomena are unique and the circumstances of a social study are not easily replicable. The dependability of research can be increased by employing an external auditor who assesses the quality of the study. We address dependability partly by consulting with the supervisor, who can, to a certain degree, be seen as an auditor.

Fourth, confirmability is concerned with the objectivity of the research (Bryman and Bell 2007, p. 414). As stated before, we are aware that our preconceptions and personal values as researchers have an influence on the way research is conducted and results are interpreted. However, we aim to gain the highest objectivity possible, which is addressed by creating awareness of these impacts, mutual checking and feedback from the supervisor.

**Authenticity**

Besides addressing these mentioned criteria for gaining trustworthiness of the research, a qualitative study needs to be authentic. Authenticity is given by compliance with fairness, ontological, and tactical authenticity of the study (based on Lincoln & Gruba, 1986, p. 18f.). Fairness is reached by showing different viewpoints on the concepts of OI and leadership. Tactical authenticity is reached by asking open questions in semi-structured interviews which gives a strong voice to the interviewees to demonstrate their views of the topic. Besides it gives respondents a sense of control over the interview, rather than just being the mere subjects of investigation.

To sum up, it was demonstrated that this study meets the criteria for trustworthiness and authenticity to a high extent. As mentioned before, a qualitative study can hardly be objective and replicable as compared to a quantitative study. However, due to a detailed and thoughtful dealing with research methodology, interview data, and analysis, this study aims at delivering a contribution to the field of our research and fulfils quality criteria.

**4.6. Ethical considerations**

It has been stressed by several authors in social sciences, to be aware of and follow certain ethical principles throughout the research process; that guide the conduct of the authors and approach towards the subjects being studied (Bryman and Bell 2011, p.128, Saunders et al. 2012, p. 226). There are various situations while doing research, where ethical considerations are brought up, and it is, hence, imperative to be aware of them and the importance they hold.
There is a commonality and generality found in the principles laid out by wide range of communities like social ethics researchers, scholarly associations, universities, which have been briefed by Diener and Crandall (1978, cited in Bryman and Bell 2007, p. 128) and are effectively broken down into four: informed consent, confidentiality and privacy, avoidance of deception and harm to participants. The ethical considerations in this thesis were followed in accordance with the guidelines laid down in the Thesis Manual of Umeå School of Business and Economics (USBE 2014). A deontological approach has been taken throughout this research, whereby strict rules have been followed concurrently, and no trade-offs were made from the rules during the research process (Saunders et al. 2012, p. 227.). Furthermore, to ensure that the research is conducted by adhering to all ethical standards, several actions were taken at each stage of the research:

The interviewees were informed in advance, via email, at the first point of contact about the nature of study being undertaken and their role in it. Subsequent clarifications were made if necessary, when some doubts arose regarding the research and the findings. We also offered to share our findings with the respondents, guaranteeing complete transparency in research. The information was provided to us by the free will of the respondents. This is done so as to provide all the information to the participants to make an informed and freely formed decision to participate in the research. Therefore ensuring that the research subjects (respondents) were truthfully informed and respected during the research.

During the interview process, the time duration of the interview is respected and the central theme of the interview was informed before commencing. Hence, we adhere to the principle of informed consent; and deception in any form is avoided (Saunders et al. 2012, p. 128). We understand the sensitive nature of our research, as views and opinions are shared about other people working in the same organisation or social groups and the respondents have placed their trust in us to not use the information in any inappropriate way. Therefore, complete anonymity was offered to the respondents, and the decision was left up to them, if they wanted to remain anonymous or not. Furthermore, the data provided as well as the interview transcripts have not been published in this thesis or made public in any form, and the contents are not known to any other persons except the authors of this thesis. Hence, the ethical codes of confidentiality and privacy are maintained. Saunders et al. (2012, p. 231) identified that reliability of the data is also enhanced when anonymity and confidentiality are maintained.

Particular attention must be devoted to the ethical principles while doing qualitative research, (in our case) as the researcher has high control over the experimental setting and has a tendency to be more compassionate about the human feelings and responsibilities (Easterby-Smith et al. 2002, p. 76). Hence, we have tried to detach ourselves, to the best of our ability, from the experimental setting and any influence that we might impinge upon the respondents. Ethical and moral codes of conduct are extremely important in research; and when strictly followed, the participants are more comfortable in sharing the information. In effect, a relationship of trust is formed with researchers; which leads to richer data, a deeper understanding of the field of study and in effect, robust results from the findings.
5. DATA PRESENTATION AND ANALYSIS

In the following, the data gathered in 18 interviews will be presented. In the first part, findings on the nature of OI collaborations are discussed, followed by the findings on leadership aspects in such OI collaborations.

5.1. Findings on OI collaborations

It will be debated how OI collaborations are perceived, innovation strategies found in our sample, the role played by governmental agencies and policies, benefits and potential drawbacks perceived by the collaborating parties, managerial challenges identified, and the future development of OI perceived by respondents.

5.1.1. Types and nature of OI collaborations

When analysing the type of innovation strategy from the perspective of the industry partner, it is found that in all OI collaborations of this study inbound strategies were practised, exploring external knowledge. Only few companies participated in the licensing of patents, which is a form of knowledge exploitation, i.e. an outbound strategy. Further, it can be noticed that for some industrial partners, collaboration with academia is not the only type of OI alliance, as collaborations with suppliers or non-competing companies also played a role. It is perceived that behaviour and motivation differ between the types of partners, and as a consequence also the management of the collaboration is different.

“Someone who is going to be a supplier for you, if they deliver a successful project, is very different in motivation than an academic institution.” (I1)

Establishing the first contact

As diverse as the nature and governance forms of OI collaborations, is the party which establishes the first contact for an OI collaboration. Also, the typical source of ideas for a new R&D project differs in each relationship: it is found that there is no typical initiator in OI collaborations or projects, but is case dependent i.e. any party could initiate the project. From several interviews with professors, it is found that during the last decades, the attitude of academia towards industrial collaboration has changed. Whereas once a strict separation between universities and companies was the norm, nowadays collaboration with industry is not just accepted, but explicitly favoured and supported.

“I was involved in a start-up company in the laser field in 1979. This was not well received by my colleagues (...). We were described by the professor of history as ‘academic prostitutes’, because we were bringing commerce into the university. I was quite shocked and despondent about it.” (U6)

The industrial partners who were interviewed, have often been involved in partnerships with universities for several years, where projects with PhD students evolve on a regular basis. In these long-term partnerships, sponsoring PhD students has become the norm and students are seen as a constant and essential part of the R&D team. The ideas for new R&D projects develop continuously, often driven by the head of R&D department or by market research of the company, which detects a certain business need which is then translated into a research project.

“We sought positions for students and also for traineeships for students, so from that point, it evolved into a kind of a sponsored structural collaboration.” (I3)
In other interviews, it is reported that researchers at universities were predominantly taking the initiative to set up a collaboration with the industry. The predominant driving force, apparently, is the researchers’ need for financial funding of their ideas for R&D projects. In other cases, researchers actively sought the intellectual exchange with companies in order to find out what research problems they had and suggest a research project on that basis.

“A few years ago, it was the industry pulling towards the universities, and nowadays, it’s more like the universities are coming forward to get involved in the industrial projects.” (I3)

“Normally it is not so much bottom up projects coming from the industry, it is more we selling our ideas to them. So it is more top down.” (U3)

It is found that some universities encourage collaborations with industry and establish contact between academic research groups and companies that are potentially interested in the field of research. They aim to meet the potential industrial sponsors’ demands, provide help with legal issues, and support the set-up of spin-off companies out of an R&D project. Thus, these institutes act as mediators between industry and research groups at university.

“We’ve got a department in the university called Technology Transfer. (...) When my patent was awarded (...), they put that on the university website, saying that: ‘We got that technology developed. If you are interested, if you think that is useful, please contact us.’ (...) They established the contact and then we took over and talked to the company.” (U4)

In addition to the two parties actively involved in R&D, we found that national governments and the EU are funding projects which are explicitly aimed at OI, bringing research-focused companies and universities together. In these cases, an intermediary sets up an innovation project and searches for partners by a public call for bids, to which research teams from both universities and companies can apply. As a representative from Vinnova explained:

“The calls are usually our initiatives. They can depend on different things: a huge demand, or the government telling us to do something. Or they can be based on some kind of statistics that something needs to be done in a certain area. (...). Then when they are launched it is up to everyone, to compete for the money.” (M1)

In other cases, the intermediary itself approaches the universities and industrial partners, based on the existent network of the intermediary. This is especially the case in joint research centres.

**Nature of OI between academic institutions and industrial partners**

As pointed out in the literature review, it is also confirmed in the interviews that the nature of OI collaboration between industry and academia is multifaceted. Most respondents saw the relationship as a collaborative partnership, which is often characterised by a long-term relationship, mutual trust and respect, where all parties involved would contribute with their different skills and capacities to the research outcome. In that way, all parties would benefit from the collaboration in an optimised way.

“It is more of a partnership. (...) We each respect what the other brings to the table, and we like to set up where everybody’s interests overlap.” (U1)

Trust and openness were perceived as crucial aspects which need to dominate this kind of highly sensitive work of conducting R&D jointly, as a university representative pointed out:

“We have got a very friendly relationship. That helps us, because we don’t need to worry about them taking your technology and not paying for it or anything like that.” (U4)
In order to preserve the exclusivity of the relationship, some respondents reported that a certain agreement is made, which clarifies that for future R&D projects, the two parties are the preferred partners. If the company has an idea for a suitable R&D project, they would contact the research group at university first, and the other way around.

“We are like their preferred supplier and they are our preferred manufacturer.” (U4)

However, in many collaborations the respondents reported that research is actually not done jointly, in the terms that researchers would exchange ideas on a daily basis at the operational level. In those cases, collaborations were perceived as a kind of supplier-customer relationship, where the academic institutions are “supplying” innovative ideas and research outcomes, whereas the industrial partners behave as customers and users of the research outcome.

“It is quite common that they will just split up the work and work separately. They just come together in the end and put all the pieces together. It is quite common also (...) that universities are seen as kind of resources, or suppliers of the knowledge and the industry partners are just there to more or less utilise the results that the university presents.” (M2)

**Differences in types and objectives of research**

The nature of research found in these projects ranked from fundamental to applied. In general it can be noticed that research at universities has rather a long-term orientation and is more fundamental, whereas research at companies is more short-term oriented and applied. The majority of industrial respondents stated that the favourable R&D projects need to have a clear connection to a specific technology, as it needs to promise a commercial value and return on investment in the near future. As one interviewee described accurately:

“Research at the university is more directed to the principles, the mechanistic, the basic science, trying to understand the details, and the companies are more interested in large-scale tests, into product development (...). I see them as very complementary. Things that we find out on the basic science site, sometimes they are applicable also on practical things.” (U7)

These different orientations and goals of research can hamper the collaboration between academia and industry, and create the need to find a common ground, an overlapping interest in research, as was acknowledged by interviewees from both sides: “When you talk to a company you talk business, and you talk research to a university (...). When you approach a company, you see what the business interest is for them, while at university, they are keener on fundamental research.” (I7). Despite the different focuses of research, collaboration was generally perceived as complementing each other and fruitful for both parties involved.

**Who is funding the projects? – Role of government initiatives**

The funding of OI projects can be arranged in different forms. Surprisingly, the industrial partner does not contribute the major part of the funding, as we had assumed on the basis of the OI literature. This is the case in just a few R&D collaborations, where the company either contributes with a lump sum, bears the expenses for PhD students’ salaries or pays a certain price per hour for the researchers’ work on the project. In one case, it is stated by an industrial partner that the R&D project is initiated due to the specific need of a customer who would finance the project. This type of funding by a customer also bears difficulties in terms of tangibility and transparency of the project, since defining the scope and tracking the progress is difficult, due to the typically uncertain nature of research.

However, the majority of the OI projects in this study were funded to a large extent by public
grants, both from national and EU institutions. Moreover, the degree of funding seemed to relate to the type of research. Fundamental research projects, where it is often unclear if they will ever lead to a product that can be commercialised, are less frequently supported by industrial partners, but more often rely on public funding. The more applied the research, the more companies seem to be interested and willing to contribute financially. It is surprising to observe the extent of dependence of companies on applying for public research grants, both on national and EU level, which are subject to strict requirements. This aspect has not been considered much in OI literature. Further, it is found both in the UK and Sweden that in the last decade R&D centres have been established as catalytic meeting places in order to stimulate OI endeavours, funded by national or European innovation initiatives.

“The technology transfer group is kind of a mediator. These people got funding by the European commission to do so. The EC obviously wanted to exploit the technology in Europe” (U4).

The reasons for the governments to invest in OI collaborations are explained in terms of the benefits for the economy and the society by certain research projects.

“Our goal is to make Sweden richer, to make Sweden a more innovative or a more competitive country.” (M1)

The role of governmental agencies like Vinnova is to decide which projects are worth public funding and provide the monetary resources. During the project execution phase, usually the governmental agency is rather passive, as it does not take an active part in decision-making or execution of the OI projects. Depending on the importance and dimension of the project, the intermediary checks the process of the project more or less regularly and evaluates the outcome at project completion, which can be the basis for the decision of repeated funding in the future. To summarise and conclude, a respondent from a centre of excellence in Sweden elaborated on the breadth of impact of these groups on various units.

“Our focus is to collaborate in a quadruple-helix model, with industry, public authorities, researchers and also with citizens. (…) It is not always about business projects, but it can also be about social innovation, more related to the societal aspects of innovation.” (M3)

Reflecting on the role of governmental initiatives, the question remains open, if OI would happen to the same extent without public funding. Availability of funding seems to be a driving factor for collaboration decisions, especially for SMEs, as they often cannot afford to finance a complete R&D project by themselves, and are dependent on external funding.

“I would say we would probably not involve the universities to the same extent that we do now, if it was not necessary due to the funding situation.” (I2)

5.1.2. Perceived benefits for the collaborating parties

As suggested in the theory chapter, reasons for collaboration of both industrial and academic partners differ. There have to be mutual benefits to get engaged in an OI collaboration. The following quote from an interview with a university Professor summarizes well the main motivation for industry and academia which were found in the majority of the interviews.

“My interest is funding my research group, and doing some interesting science, their interest is to have solutions to the problems that they have. What we do is that we explore where that overlaps and then we can all be happy. And, as long as we can find something where the interests overlap, then we have a project that we can develop.” (U1)
The industrial partners perceived similarly that an OI collaboration is highly beneficial for both parties involved. OI deals with conducting research in a network, which brings different knowledge and capabilities together. These collaborations are fruitful for both parties, as expertise from both partners come together.

“I think the benefits for all partners really is that this is a good way of nurturing researchers (...), for getting access to projects which you probably could not do on your own, without a partner, because you have to get the critical mass of knowledge that makes us together in high-level groupings and consortia.” (M4)

Benefits for the industrial partners

From the perspective of the industry, certain reasons were mentioned predominantly for the collaboration: access to expertise and knowledge, a higher cost-effectiveness of R&D and the access to talented students for internship or hiring. These findings confirm what has been found in literature on academia-industry collaborations.

First, access to state-of-the-art expertise and to research facilities at universities was mentioned frequently by industry representatives. The complementary know-how of academic researchers, the opportunity to access a wider network of research expertise and leading edge technologies, is seen as highly beneficial.

“Direct benefit is direct access to university for top academic brains to work on some of our problems. (...) We get to influence some of the research things that they are interested in.” (I1)

Second, and connected with the first reason, is that participating in an OI project is more cost-effective, as the access to qualified staff, facilities and equipment is generally cheaper than doing research in-house. Further, as mentioned before, collaborating with academic partners opens the possibility to receive public funding and respond to the requirements of governmental or EU initiatives.

“The advantage is that we can use the university’s facilities. (...) Most universities have very good facilities and a reasonable staffing level for doing this. Whereas for Toshiba to start out and do this would be prohibitively expensive. (...) We don’t have to go and buy the equipment, and we can collaborate with people at the universities who have the technique.” (I6)

Third, OI collaborations enables companies to gain access to highly-qualified students for training and potential hiring.

“First of all it is about people who may in the future join Philips innovation. The university is known for very talented people. The good thing is, if you collaborate with universities, you bring PhD students inside for a graduate assignment. And this is one of the principal reasons to collaborate with universities.” (I5)

“They also had the opportunity to see many of our students and postdocs in action working with them, sometimes in the company and mostly in our labs. And this was sometimes what can be called long job interviews for the students. That’s a significant benefit.” (U6)

Further, approaching university partners offers solutions to specific problems or simply helps to define the problem in order to be able to approach it accurately.

“We get good access, brainstorming, they help not only on actual work but also with some of the problem definitions (...). So after a good conversation with the academics we might define the problem slightly different, so they could solve it themselves or they direct us to different people who could help with that.” (I1)
In contrast to what was expected, potential benefits of OI collaborations such as risk sharing or enhancement of the corporate image were not mentioned by the interviewees.

**Benefits for the academic institutions**

First, similar to the motivations of industrial partners, also for universities financial aspects play a major role when deciding to collaborate with the industry. Often academic researchers need to search for funding for their research ideas, therefore companies become favoured partners to gain funding from external research bodies or governments. Second, interviewees also mentioned that collaboration enhances practical and business relevance of research. It might give the university access to business opportunities, e.g. exploitation of research capabilities and results or deployment of IP rights to obtain patents.

“We can publish papers on our ideas, but we want people to use it! That's the incentive. (...) Publication is fine, but in our case, research is very applied, and we wanted people to use it. We wanted the technology transferred.” (U4)

Third, collaboration with industry can be beneficial on an individual level, for the personal experience of the university researcher. It provides training and opens networking and employment opportunities in the industry, especially for PhD students. Besides, students can gain managerial knowledge and skills which might benefit them in their professional future.

“It’s very important for them to understand what the “real world” is like. (...). This is kind of a network of people is very useful, which are very tangible benefits.” (U6)

The access to facilities was not just mentioned from the industrial side, but also the other way around, as in some cases, the companies had better equipment, especially for testing.

“And generally, it’s kind of a mutual agreement that both parties get benefit. The students get to use the equipment and Toshiba gets to use the time and the skills of the students.” (I6)

The described benefits highly correlate to what has been described in literature. Other potential benefits like a service to the industrial community/society were not mentioned by any interviewee, such as, OI as a contribution to regional or national economy, a quest for recognition by the academics or for achieving eminence/university prestige.

5.1.3. **Potential drawbacks of OI**

Besides potential benefits of an OI collaboration, also some drawbacks and potential conflicts were mentioned. It can be said, that the respondents in this sample elaborated more on the benefits of such a collaboration than on drawbacks, showing a largely positive attitude towards OI. The drawbacks are presented in the following sections, segmented between what was mentioned by representatives from the industry and from academia.

**Difficulties perceived by industrial partners**

The described difficulties largely apply to what is found in literature. The usual speed of working processes in industry and academia differ. Also, structures of companies are changing fast, whereas the academic world is perceived as more stable, as was described by industrial representatives.

“The dynamic here at Philips is so much more intense than the dynamics at universities, because organisations change, people change jobs, (...) because we have new customers.” (I5)
“Some of the disadvantages are that the universities tend to run on their own time scales, so it is very difficult to make a rigorous research plan.” (I6)

On respondent pointed out that there is a lack of understanding by the academic researchers for the company’s problems. Another perceived drawback is that professors often lack time to contribute satisfactorily to the joint research project. Communication and arranging meetings may be challenging.

“Sometimes the challenges we face that the engagement of the academics into one team is difficult. They have little time to contribute to that.” (II)

Potential drawbacks from the perspective of academic partners

Also from academic researchers it is stated that conducts in industry and academia differ from each other and that communication might be difficult. Also, the clash of short-term and long-term orientation of industry and academia were mentioned.

“Normally it is quite difficult to communicate with the industry as we both speak different languages. We don’t understand them and they expect us to be a service partner for them.” (U3)

Respondents mentioned frequently a potential conflict of interest, when they often have to deal with two roles at the same time. Occasionally, professors felt that the OI collaboration leads to a digression from university’s core objective. This represents a compromise of academic freedom that may have a negative impact on culture of open science.

“And the main issue for me is to explain, it is a bit like schizophrenia, am I here to sell you a fertiliser today, or am I sitting here as a scientist? Which hat do I have? As a researcher your main asset is your credibility.” (U7)

It is reported by respondents that there might be a conflict regarding the publication of research results. For academic researchers, publishing papers is important for their curriculum, whereas companies typically aim to conceal an invention as long as necessary from the public for gaining a competitive advantage.

“This is quite a difficult thing to manage. The purpose [of academic research] is that you publish as much as possible, especially if you have a good technology going, and as quickly as possible. But, if you are a company, you don’t want that.” (U6)

“We researchers live on our records of publications. The PhD students need to publish their dissertations. So we have delayed publishing results, so that the company has more time to take care of the knowledge.” (U5)

As was mentioned before, some researchers felt that the collaboration with the industry was reducing their academic autonomy to some extent. However, collaboration with the industry also increases likelihood of a commercialisation of the invention/solution to a specific technological problem, as applying for and maintaining a patent is cost-intensive.

“You have given up some freedom as a researcher, and you feel that your brain is now partly owned by the company. (...) On the other hand, if you have that idea as a private person and you don’t have a lot of a lot of money on the bank, it is hard for you to take over all these costs for developing something.” (U7)

In contrast to what is found in literature, concerns regarding quality issues were not mentioned by the interviewees. A potential diversion of energy and commitment of individual staff
involved in interaction with industry, away from core activities, which might have negative effects on the curriculum, is not seen as problematic.

The potential drawbacks perceived by the collaborating partners lead us to the managerial challenges of OI. As one respondent summarised fittingly:

“It seems like a very straightforward activity, to do research and so on, when you have a good definition of the subject and researchers available. But, fact is, it is a very dynamic process. (...) The management of this kind of collaborations requires constant attention.” (I5)

5.1.4. Managerial challenges and management of OI projects

In the following, challenges for project managers/leaders of OI collaborations that were identified in the interviews are presented.

Managerial challenges

One challenge that was mentioned by several parties is that different stakeholders with different expectations are involved in the project. Effective stakeholder management can be a key issue for a good collaboration. “People from the industry and academia come from different organisational cultures, we have different ways of working in project, and have different expectations what the project manager should do. You need to be aware of the fact that people have different experiences, and you need to address that in order to create something together.” (M2)

Communication and mutual understanding of the parties involved, are perceived as very important in the collaboration.

“It’s the most important feature of working across such a boundary, that the academic has to understand what are the drivers and boundary conditions for the person on the other side of the boundary. (...) It’s quite important and probably the most important for such a partnership, to understand what goes on at the other side of the boundary.” (U6)

Another issue is that in a “pure” OI project, when representatives from different organisations come together to research together, they are still employed by the home organisation with corresponding responsibilities. A representative of an intermediary mentioned that the time restriction that researchers have due to further responsibilities in the home organisation, can be a critical issue, as it can be complicated to get the team members together. Besides, many researchers are handling several projects at one point in time. For a project manager, leading the team without having the official authority over the team members can be challenging.

“One big challenge for everyone, mainly in the industry, is that you have competing interests. Your organisation wants you to be in the home organisation and work there, and then there might be more urgent areas than research. (....) It might be competing with the interest of the immediate boss in the home organisation and the pressure of being there.” (M4)

Contractual situation

The degree of formal project management in the OI collaboration of this sample differs significantly. In most cases there is a formal agreement, defining the duties of the parties involved, which was confirmed by the majority of the interviewees. All projects that are (partly) funded by the public have high requirements on detailed agreements and regular reports.
“We have between research partners a consortium agreement, on how to deal with expected outcomes, how to live together and how to manage problems and on how to divide money.” (U5)

In some cases, an initial collaboration for one project is continued and regulated in an umbrella agreement, where general rules of collaboration are set. Typically a second specific project agreement exists that defines the scope, budget and time frame of the projects more specifically.

“We always have a project agreement. We have two types of agreement. One, what’s the project, funding. Other one is about the intellectual property arises through who owns what.”(I1)

However, in one case, it is documented that the collaboration is managed in a very informal way where no or little official document exists, as the partnership is long-term and based on mutual trust. However, this case is rather the exception than the norm.

“Academics are bright enough to know if we agree to do something and they don’t, we are not going to fund them again. So we don’t need a contract because they will do what they say because otherwise they will not get any money.” (U1)

**Intellectual property (IP) management**

In the interviews we explored if IP is perceived by collaborating partners as a hindrance to OI and how it is objectively managed. As IP is a critical topic for both parties, project agreements for OI collaborations usually include a passage about IP or a separate agreement is set up. The vast majority of interview partners stressed the importance of IP rights in the R&D business and the need to control it carefully. A generalisation cannot be reached on the ownership of the IP. It is case-specific depending on who the sponsor of the project is and who has stakes in the publication/commercialisation of the ideas. As one industrial respondent pointed out:

“Intellectual property is handled in an agreement. (...) Making such an agreement is extremely difficult, because most companies are very strict about IP, and that applies to all parties involved. Regarding IP rights, the negotiations are very hard.” (I5)

Universities are usually highly interested in owning IP rights. In other cases, the industrial partners were granted the IP rights. However, it is commonly perceived that applying for and holding a patent is very cost-intensive. Therefore, in a large number of cases, the companies were granted the rights for IP. On the other hand, a common practice is that the universities maintain the IP, but authorise the company to use it:

“We own the IP, then we grant them loyalty-free non-exclusive right to use it for their internal company business. That means if we want to commercialize it we still have rights to do that but the company itself has rights to use the research they paid for. It’s quite reasonable.” (U1)

**Tracking of project progress and reporting**

The degree of formality regarding regular progress reports also differs between the projects. Again, the EC demands rather regular reports, at least annually, whereas projects which are not involving public funding can be tracked rather infrequently, leaving more freedom and less control to the project manager. Other interviewees reported that reports are indeed made, but usually in a very informal way.

“Progress reports are not done in such a way that there is a lot of paperwork, but there is this brief progress report and it’s done by emails, and no formal report or something like that.” (I3)
“It varies, it can be quite informal and quite formal. Some of the government-funded projects are quite disciplined, quarterly reports are often required, quite higher level of definitions of what are the deliverables through the projects. For internal projects it’s quite informal, especially the trust grows between individuals from projects and academics.” (I1)

It is stressed by various respondents that a collaboration with an academic partner is usually less formal and more relaxed than with a private company, as the university is not really seen as a contract partner who needs to comply strictly with contract requirements.

“There is a clear difference between university and our customers. With companies is much more formal, because the contract are much more restricted about guarantee, warrantee, disclosure and about payments (...). With the university, it’s more like an effort obligation. So the university puts in the effort that we agree. But in the end, if they don’t succeed, it is what it is. So they don’t get hung up on the contract, and even we don’t.” (I3)

As an industry representative elaborated, a lot of effort is put at the initiation of the project in order to clearly define the scope, however, the execution is led more informally.

“I think we are a little “hands-off” with the universities, so we put more effort in the beginning to problems statement and then we can get that right. (...) So our approach is to spend more time at the beginning, getting the scope and the definition of problems right. Then things generally run smoothly.” (I4)

Nomination of project manager

It is found that both in projects which were predominantly located at a university or at an industrial location, usually an official project manager is nominated, who could be from either of the partners. These project managers are taking a leadership role in this collaboration and are typically the leaders, to whom we refer to in the residual thesis. In most collaborations, it is found that the project managers were responsible for the “every-day decisions within the targets of the project, about managing resources and keeping the budget and the time of the project” (I2). The described function applies highly to classic project management, where a project manager is seen to be responsible to manage that the agreed scope, budget and deadline of the project are met. However, “the role of a project manager in such a project where you have multiple stakeholders might be different from a traditional project manager in a regular company” (M2). The tasks and duties of the project manager seem to differ between OI projects, from being highly actively involved in the research on a daily basis to having merely an administrative role. This will be explored further in the leadership part of the analysis.

Use of project management tools

It can be stated that most OI projects, especially those that are set and led mainly at university, do not make use of project management tools or software that are used in project-based companies. Usually the processes are not standardised, as the project manager has a lot of freedom on how to best manage the project, plan and organise financial and human resources. The following quote describes how an intermediary was trying to standardise the project processes more and implement some form of project control:

“The plan needs some timing and objectives and an outline of the project (…). At the end of the project you have to make sure that you had used your resources wisely and that you have reached the objectives. (…) We have very good project management tools on the web that we really work with. It was difficult to establish it. There is a person tracking these projects.” (M3)
The frequency of meetings differs a lot and depends on the overall length of the project, closeness of collaboration and exchange intensity of the project phase. In these meetings, usually both parties give and receive input to come to a common ground in which both are interested in, and make decisions for further direction of research.

To summarize, the findings on the formality of the collaboration show that there is a tendency that R&D undertakings in an OI context are indeed organised in project forms, where a project manager is appointed and a project agreement regulates the rights and duties of the collaborating parties. However, in practice, the extent to which project management activities are adopted, differs significantly. Whereas in some organisations, regular meetings with updates on the progress of the project, regular control of the budget, a reporting culture, and the use of project management tools are established, other organisations handle project management in a rather informal and less organised way. It can be observed that in companies and the intermediary institutions, the project management approach in general is more formalised than in universities. This correlates with the observation of Du et al. (2014, p. X), that science-based partners prefer a less formal approach to project management.

5.1.5. How is the future of OI projects perceived?

When representatives from intermediaries were asked about the expected future of OI, it is noted that the quantity of such collaborations has increased over the last years and the trend is expected to continue. An interviewee is of the opinion that the term OI might not be used that much in the future, but the phenomenon of industry and university working together will not disappear as it is beneficial for both sides.

“I think it is a general trend that all big companies are reducing their long term corporate research programmes and they try to buy in to get more work done at the universities. (I4)

“OI as a term is maybe more of a managerial fad, something that is very popular right now. (...)But it highlights the need we have to collaborate in order to create innovation and to find solutions for problems where we can’t find all by ourselves. That need won’t go away, even if we maybe won’t use that word OI anymore. So, many organisations in industry and academia and society partners, will need to learn more how they can interact with others, and how that influences their own organisations. It will still be a topic in the future.” (M2)

5.2. Findings on leadership style in R&D

In the following, the findings on leadership in R&D including the nature of leadership in R&D OI projects will be described, identifying the different leadership characteristics involved and the major challenges faced by the leaders in the OI context.

5.2.1. Nature of leadership in OI projects

The following sections deal with the nature of leadership in OI projects. Firstly, it is explored if there is one organisational entity which is making the major decisions and driving the research and the project in particular directions. Further, the role of a leader at an operational level in relation to individuals, to the team and finally, the role of the leader in furthering the relationship between the academic and the industrial partners is explored.

Who is taking the lead?
This section deals with the organisational aspect of leadership in OI projects, exploring if either of the partners are taking the lead and making major decisions in the collaborative projects. We got varied answers, identifying either the industrial or the academic partner as the leader. In most of the cases, the decisions were reported to be made jointly in a balanced and democratic way and an equal partnership fostered between the two.

“Toshiba is giving the university money and helping out the university, but the university doesn’t want to be seen to have to operate in that manner. It’s a very flexible agreement, it is not driven by one party, and it has to be a very mutual agreement.” (I6)

In some interviews it was stated that the professor at the university is driving the research, and the company is rather holding back, occasionally giving recommendations. An example can be the management of a PhD project, where the university professor has more control over the scope of the project. In two cases, the researchers owned patents in their respective research area. If the company wished to work further on that base, the researchers had a strong position and major influence on decisions. Also the personality of the researchers seems to play a significant role, as some seemed to have a higher business-orientation than others, approaching the universities.

“I am taking the decision [of joining a collaboration], because it is a patent and my name is on the patent. (...) So then you can decide with whom you want to collaborate. The university cannot stop you and they cannot force you.” (U4)

However, mostly respondents stated that the companies have the relevant decisive influence. But the universities can also influence the direction of the projects as they possess more technical expertise and better know the limits of the technologies involved. Sometimes, a collaboration occurs just because a problem needs to be solved, and the universities are perhaps the most cost effective way.

“The golden rule applies – ‘who has the gold makes the rules’. Companies have the money. You would be daft not to listen to what they’re saying (...). So we generally have pretty amicable discussion about the direction of how the project goes.” (U1)

In the next section, three crucial factors which define the role of a leader in a collaborated OI project will be revealed. It is important to deduce the leadership practices and their behaviour towards the individuals, a team and role in relationship development with the collaborating partner to truly understand the research questions posed in the thesis. This would also aid us in discovering the leadership characteristics required in an OI environment. It must be noted that we have taken a leader’s perspective; and there can be differences when a similar study is conducted taking the perspective of the followers.

**Role of a leader in relation to the individuals**

This section deals with how a leader plays a crucial role in moulding and influencing the individuals, like the PhD students who are typically working on a particular part of the project and are highly dependent on their supervisor for direction and intellectual stimulation. The leaders are responsible for providing motivation and leading the followers to the solutions of the problems, and giving them the autonomy to discover things on their own, what the issues could be and how they can be resolved. As is put into words by one of the respondents:

“I direct them in the right direction. But getting the actual work done, is their responsibility, their duty.” (U4)
A hands-on approach is not always required in an R&D OI context, rather a more autonomous and trusting environment needs to be facilitated by the leaders. It is important for leaders to realise that the team members (PhDs) and the collaborating partner (either in university or industry) are people of a high intellectual level and need to be treated in that way.

“You treat them like real people not just like slaves to do your work.” (U1)

“I don’t think it’s useful for the student to be carried over the line, carried all the way. I think it’s very important for them to do their own thing.” (U6)

A general trend is seen of an open-door policy in universities and industries where the team members were free to come up to the leader and express their concerns and news on the progress of the project. Also, making mistakes is seen as a crucial factor in the learning process and is never frowned upon or seen as a negative indicator as is cogently articulated by one of the respondents from the industry:

“Mistakes have to be made. Where there is work, there are mistakes.” (I4)

Another factor which determines the role of the leader in relation to individuals is the “touch factor”, i.e. how visible are the leaders to the team and how involved are they in the work being done in the projects, in contrast to doing just the administrative and managerial work. It is seen that most of the respondents from the universities had frequent formal and informal meetings with their team to check on the progress of the projects. A general trend in the industry is seen that the majority of the respondents were responsible for administrative work and project management, devising timelines, scope etc. and not much involved in the research work. 3 out of 7 respondents from the industry mentioned that they had running projects and were involved in R&D as well as the administrative work.

“In my case the door is open all the time. Whenever there is a problem, and also good ideas, any good news, it is always fine. I see them (the students) all the time.” (U4)

Role of a leader in relation to the team

In this section the role of a leader with the team is explored. The topic of team dynamics has not been elaborated, as it is out of scope of this study, however the relationship of a leader with the team in general, how the group behaves and the leader’s perception of his/ her own leadership style is touched upon. It will be explored if the relationship is a formal or a more informal one and how the leader facilitated an open and research environment in the team.

It is mentioned by most of the leaders in the universities, industrial partners as well as the intermediaries that their engagement is seen as highly important. Leading by example and motivating towards the end goal is crucial in keeping the team and work on track.

“If you engage yourself, and I always try to engage myself and I know that engagement is like a virus. If I’m not engaged, then I can’t expect the others to be engaged as well.” (M3)

Ownership towards the work is also seen as an important factor in the leader-members relationship. The leaders felt responsible for the team members and their work, but it is also necessitated by a few respondents that the leaders would not be responsible for actually doing the work of the team, rather guiding them in the right direction.

A general trend is seen in industries and universities that most of the interactions between the leaders and the team were quite informal and an open atmosphere is necessitated by the leader to openly express the concerns. A “family-like” environment is created, where the members felt
comfortable with the leader and informal relationships were developed to increase solidarity amongst the team members.

“We had a good relationship, we were at the pub on Fridays by 5 in the university pub.” (U6)

A combined effort of the team is put into the difficult tasks, with all the members supporting and facilitating each other and immense inter-group work is involved. Team spirit is increased by the leader. The leader can at times act as a supervisor over all the activities and be actively engaged in the process, and also be open to be questioned and refuted on accounts. As is mentioned by one of the respondents,

“(…) creating the spirit of team work, this is our team work, this is our mission, let’s climb Mount Everest.” (M3)

Role of a leader in the development of relationship between academia and industry

The following section explores how the leader plays a part in bringing the groups at the university and the industry closer. Various themes are uncovered in this section.

It is noticed generally that although there is always a defined context, in a university-industry collaboration, there is typically no forced argumentation by any one of the parties. It is expected that industries drive the research as they have a financial impact on the universities, but that could not be conclusively confirmed by the gathered data. Both the parties seemed to be quite independent, with the leaders facilitating the information flow between the university and the industry. In an OI collaboration, the university research groups were at times motivated to explore the project more and discover the intricacies and the extents of the project. This falls exactly on the reasoning of why companies decide to participate in an OI collaboration with university/science-based partners. This allows them to not only have the desired technology or product, but due to the explorative nature of the university research groups, the end-result can be much more defined and more information can be gathered about the topic in question. The group leaders at the universities also felt that they needed their freedom and autonomy to work on the projects, without much interference of the industries.

Communication is seen as an important factor in bridging the gap between the universities and the industry. It is mainly facilitated by the group leader at the academic institution or the leader of the industrial partner, and through regular contact, a malleable flow of information and ideas can happen. It is seen that effective communication by the leader also played an important part in facilitating the vision and the objectives of the project to the group members. It is also noticed that the leader is often held responsible for the group, at the university-industry interface and represents the work being done.

“So the way success works, you have to actually go and talk to people and you have to talk to them to find out what their problems are…. And we talk to the people, which one of them is the closest to your current interest. So asking intimation like that, yes you find out what real problems are…. they will help me by letting me know what really important things they worry about. And I reflect back to them.” (U1)

5.2.2. Leadership characteristics

In this section, the leadership characteristics which have been identified in the literature to be crucial in understanding the nature of leadership in OI are presented. It is also explored if there is a definite style that the leaders adopt which plays a dominant role in an OI R&D project.
Mentoring and coaching

It can be noticed, that most of the R&D project leaders at universities never had any formalised leadership training. Nonetheless, it is expected from them to be able to lead a team of diverse individuals and guide their career paths. However, it is generally seen that the leaders of the groups/ professors are responsible for teaching and supervising PhD students, they are often taking a leadership role within the academic institution and elaborating their leadership informally by working in practice (rather than receiving a formal training).

A generic coaching style is examined, when the respondents explained how they dealt with individuals and how they facilitated, encouraged and sustained the interest of their team. Sometimes a directive stance had to be adopted by the leaders as well, especially at the onset of projects. It is also deduced that there could be a difference in the way leaders treat their subordinates, depending on the stage of the project, which is mentioned by just one respondent, who had had previous industry experience in a multinational organisation and is now a professor at a university.

“There are times you need to be directive but you sort of explain them that your job is perhaps to be directive really early on. But then very rapidly more to coaching and then the supporting.” (U1)

It is also seen that a distributed leadership existed in both universities and industries where leadership responsibilities were either delegated to some postdocs or PhDs or it is their own initiative to guide and coach the new PhDs and graduate students. It is examined that when the leader started to trust the members of the team, more responsibilities were given to the members, as is expressed by one of the respondents:

“Increasingly, day-to-day problems were approached to the post docs, and this was part of their job, their training to take some second level management role.” (U6)

We are assuming that most leaders have a particular leadership style and they are not psychologically aware of it, due to not paying much attention to the impact of their leadership style on the members. This absence of awareness of a particular leadership style, articulated by most of the respondents, is a strong indicator that formal leadership training is not provided and the leaders were ignorant of their leadership styles.

Intellectual stimulation

Intellectual stimulation, although an important factor in transformational leadership, is not explicitly mentioned by any of the leaders. It is assumed that the people involved in OI projects as well as R&D projects are highly motivated intellectually, and there is no special need to stimulate them to lead them towards a common objective.

Autonomy of members

It is noticed that an autonomous environment persisted in OI relationship within defined boundaries, as is noted by all the respondents. It is expressed by the leaders that going beyond the boundaries of the project, is considered as not only difficult, but also “impractical”. It is observed that autonomy is highly valued by the leaders and they motivated the individuals to explore the opportunities that lay in the R&D project for them.

“I kind of encourage the students to look ‘around’ the project, to broaden their horizons, and to think beyond the project. But I’m also quick to tell the students if they are making a mistake or they are doing something that has been done before.” (I6)
It is also seen that autonomy is highly desired by the industry and the universities, as they believe that it facilitates the initiation of creative ideas which can prove to be breakthroughs in the project, increase profitability and competitive advantage or even lead to the discovery of something completely novel.

“Sometimes I want them to take more autonomy. It’s more difficult to take one’s own line of research than to move into another line.” (I4)

**Empowerment**

It can be noticed that empowerment and motivation can be established by the team members themselves. A general trend is seen in the universities that people are self-motivated towards the OI project, but if not, the role of the leader becomes more crucial in empowering the individuals towards the common objective. As analysed in the ‘mentoring and coaching’ section, the leaders need to motivate the members, but it is not always required.

“By articulating that vision, you are never in a position where you have to be directive and have to tell people how to do this, because they know enough, so that what they want to do for themselves.” (U1)

It is prominent in the industry side however, that none of the respondents mentioned that they are self-empowered or they empower each other. It is mostly the role of the leader to empower the individuals especially when the task is challenging. It is believed that the central task of the leader, in the industry and the universities is to communicate the vision of the task at hand and empower the individuals.

**Joint problem-solving (task co-ordination)**

It is noted by all the participants to have a sense of ownership for the work that is being done. The people from the universities and the industry were aware of being part of this collaboration between academia and the industrial partners and what responsibilities they had. It can hence be inferred that the teams although quite autonomous, were also a part of an OI environment which is held together by the joint project being done, and for the most part had a “one-team” thinking. There is an effective flow of information and no competition whatsoever is observed in any form. One of the reasons for such a positive behaviour can be that the industrial partners involved had long term relationships with the universities. Co-ordinated problem-solving is fostered by the leaders from both the universities as well as the industry. It is important for the leaders to make the team aware of the high stakes involved and communicate effectively to the team what needed to be done and what is expected from them. It is noticed that the leaders had a very challenging role to play in an OI setting due to the high number of different stakes in the project.

“So, normally it feels like one team behaviour. I think the long term relationships with university and academics makes that easier.” (I1)

“It’s a very flexible agreement, it is not driven by one party, and it has to be a very mutual agreement.” (I6)

“Because we talk about, here’s how the money comes in, and here’s what we said we are going to do, and it’s important to be inclusive. It’s not like I’ve done this now, and it’s your problem, well we are doing this guys, this is what we agreed to do it, and these are the reasons why we think it’s a good idea to do it.” (U1)
Communication

Communication is seen to be one of the most important and generalizable aspects in this study. It is observed that constant communication is a crucial factor in collaborative OI projects. The leader played the principal role in such activities, whether it is collaborating for a new project, an ongoing project or communicating with the partners.

Intermediaries were discovered to play an important role in bridging the gap between the industry and universities. It can be deduced that intermediaries are seen as a common ground where leaders from both the collaborating partners can discuss their common objective on a neutral ground. Although, it is mentioned by only one respondent exclusively from the university, it is articulated by all the leaders from the intermediaries of their role as a “communication-bridge” between the universities and industry, in the OI process.

“It is quite difficult to communicate with the industry as we both speak different languages (...). So, it is not so easy to have an understanding with each other. (...) We had to arrange meetings with institutes and the institutes are much better to discuss with than industry.” (U3)

It is also noticed that there is a need for constant communication between the university and the industry to have a pipeline of projects. It is the duty of the leader to be in constant communication with the “network” to gain more projects. Therefore, it can be deduced that various managerial and soft skills would be required by the leader to successfully “win more projects”.

Decision-making

It is noted in the industry that there is a clear leader who took most of the major decisions. Consensus building is seen as a common practice, especially for important decisions, but the authority of the final call rested with one person. Similar council-like decision-making practices were seen in universities also, with generally the group leader discussing with his/her peers and team members before making a final judgement. This indicated high trust amongst the team members and the leader. A similar observation is noticed when decisions had to be made regarding the collaborative project, the leaders from the two parties counselled each other, and both weighed what can and cannot be done, and then a mutual decision is taken.

“So we discussed them at different management levels (...). In any discussion you come to the conclusion. And very often this conclusion is shared, and when the conclusion is shared, then I can say yes or no.” (I5)

Another observation from the respondents is that most of the times, there are PhD students involved in the OI projects and the decisions regarding the project, the mentoring and decision of the career trajectory is influenced by the institution where the PhD is hired. Hence, for example, if a student is involved in an OI project and is placed at the university most of the time, the supervisor at the university is responsible for the PhD and his/her contribution to the project. Then, the role of the participating company is to set the boundary conditions and suggest some possibilities. Management structures are put in place by the industry to monitor the progress, and there are regular interactions between the university group members and the industry. It is also seen that in some major projects with large public funding, there are decision-making committees where important stakeholders have a seat. It is noticed in such cases that the intermediaries also played an important role and have a high influence on the direction of the OI project, in addition to the industry and the university. This is however, only mentioned by one respondent.
To summarise, decision-making in OI projects is noticed to be very subjective and an overall generality could not be achieved as to deduce if the university, industry or the intermediaries were taking the major decisions or driving the direction of the OI project. The only generalisation that can be made is that there is an intermingling of the university and industry and decisions were made using consensus building.

### 5.2.3. Challenges in leadership

There is a unanimous agreement by all the respondents, both from universities and industry that managing the PhD projects in the best possible way is the biggest challenge they faced. Hiring PhDs, motivating them and devising a career trajectory for them is perceived to be one of the most crucial tasks. Part of the reason for such an occurrence can be explained that PhD projects have an important role to play in the research of the universities and industry alike. It is also mentioned by some of the respondents from the universities that getting the project done on time and delivering quality results is crucial as it could affect the future of the OI relationship between the university and the industry. The explanation behind this is that the industry invests considerable amount of capital in the OI research in the universities and a certain return is expected in a limited time frame. It is the task of the leader to ensure the smooth functioning of the project and meeting the deadlines.

> “The most challenging is to stay focused (...). Four years for a study seems long, but before you know it, the time is ending, so keep focused and discuss regularly and ask regular feedback and don’t get lost in detail.” (I3)

It is also stated by respondents from the industry that finding the balance between a technically creative job, the confines of the company like budget, timescales and quality; and giving the freedom to explore and create something new were perceived as particularly challenging. Surprisingly, the management of the collaboration between industry and academia is not considered as too challenging by either of the sets of respondents.

> “I think the balance in very upstream technical creative job and balance between being very open and giving freedom to the people to explore, create, understand problems and getting very specific and very disciplined in terms of delivering something, so it’s a balance I sometime it get right and sometime I don’t” (I1)

Hence, to conclude, we have analysed various aspects associated with OI and leadership in the previous sections, with special attention given to the nature of OI between universities and industries. The benefits for an OI collaboration for the two parties have been analysed effectively using the data as well as the leadership characteristics which play a role in furthering the collaboration have been highlighted and examined.

### 5.3. Updated template

From the various findings in the data collection and analysis, we see that there is a need to review the template that we had formed on the basis of the theory. There were a few findings which we had not anticipated in the theory which proved to be significant factors for our results. The updated template is in presented in the table 5, with the updated findings represented in red.

<table>
<thead>
<tr>
<th>Open Innovation</th>
<th>Leadership</th>
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69
As has been discussed in the analysis, the extensive impact of national governments and European initiatives as a provider for funding is emphasised in almost every interview, and therefore has been added as a relevant code for the template analysis. For the leadership aspects, it is found that the leader of the respective organisation (university or industry) had a central role to play in furthering the relationship between the two partners, in addition to the role they play in managing their own group. Furthermore, it is observed that leaders perceived decision-making and joint problem-solving as different, and it is found that decision-making is crucial in the collaborative project, as it shows where the power lies and which partner can take decisive action in relation to the collaborated project. Mentoring and coaching, although considered important in traditional R&D, is not perceived to be as important in the literature review, but the respondents placed an emphasis on this characteristic and how it plays a role in defining leadership in an OI context. And finally, there is no mention of explicit challenges that leaders face in OI in the literature, but it is a widely discussed by most of the respondents, and is hence placed in the updated template.
6. DISCUSSION

In this section the findings from the analysis of the data collected will be discussed. These findings will be related to what has been investigated in the literature review and will aim to answer our proposed research questions. Thereby we concentrate on the most valuable and important findings which contribute to the research objective and to new knowledge. First, we address the nature of OI collaboration which is identified in our sample, linking the practices identified to formality and project management practices. Second, findings on leadership will be discussed, discussing the nature of leadership involved in furthering an OI collaboration and the characteristics which play an important role; concluding with a summary of the sub-research questions and research objectives and hence, answering the core research question.

6.1. OI projects between academic and industrial partners

In the following, the nature of OI projects will be discussed, aimed at answering the three research questions which have been introduced in the first section of this study. Thereby, we will reflect which innovation strategies we found in our sample, what benefits and potential drawbacks are perceived by the collaborating parties, how OI is managed between academic and industrial partners and which managerial challenges are identified.

6.1.1. Types and nature of OI collaborations

✔ What characterises the nature of OI collaborations between academia and industry?

In this study, several interviewees elaborated on how the attitude to collaboration in R&D has changed over the last decades. It is commonly perceived that both academia and the industry have opened up regarding innovation practices. Nowadays, the predominant perception is that, it is not feasible for an organisation to conduct R&D on its own due to its high costs of activities and/or missing expertise, but conducting R&D jointly with a partner can create significant value. It was realised in the industry that it makes sense to collaborate with external partners to “tap into the knowledge and expertise of bright individuals outside our company” (Chesbrough 2003c, p. 38) and that they do not need to innovate alone, in order to profit from it.

However, the degree of openness of companies differs and the management of IP is still perceived as a challenging topic. It seems that companies tend to control IP quite strictly rather than engage in the trade of IP, licensing their own ideas and buying others’ IP when it advances their own business model. As a result, it can be stated that companies have largely, but not yet completely, internalised the principles of OI that Chesbrough (2003c, p. 38) had formulated.

Even though all participating organisations in this study fulfilled the characteristics of such OI collaborations, the majority of the participants were not aware of the concept of “Open Innovation” as introduced by Chesbrough. The reasons for such an occurrence are multifaceted: first, as a business and general innovation management topic, the corresponding literature might be known more among people at strategic levels of an organisation than at the practitioners’ project level. It can be assumed that researchers probably educate themselves more by focusing on relevant publications within their field of research, than reading broader management literature. Second, doing research jointly with an external partner has often been practised for years as industry-academia collaboration, without referring to it as an OI project. This
observation corresponds to the notion by Trott and Hartmann (2009, p. 715), that the concept of OI is actually not a completely new phenomenon, but has been practised under different terms and is connected to other management areas.

In general, it can be stated that OI literature almost entirely takes the perspective of companies. It is found that the terms and concepts of OI are more widely known among industrial partners than among researchers at university. Not surprisingly, representatives from the intermediaries we interviewed were highly aware of the OI concept, as one of their main tasks is to further industry-academia collaborations.

When analysing the type of innovation strategy from the perspective of the industry partner, it is found that in all OI collaborations of this study, inbound strategies were practised, exploring external knowledge. Only few companies participated in the licensing of patents, which is a form of knowledge exploitation, an outbound strategy. Further, it is noticed that for some industrial partners, collaboration with academia is not the only type of OI alliance practised, as collaborations with suppliers or non-competing companies also played a role. It is perceived that behaviour and motivation differ between the types of partners, and as a consequence also the management of the collaboration is different. However, this is merely a side-remark as other OI collaboration forms of companies were not analysed in this study.

**Nature of OI between academic institutions and industrial partners**

As expected, all collaborations analysed in this thesis can be categorised as private-open innovations according to the framework by Huizingh (2011, p. 3). From the industrial perspective, the innovation process is opened up to universities, but the innovation outcome is first not made accessible to public, however, a proprietary innovation for the collaborating company or licenses to use the invention are licensed by the university.

As pointed out in the analysis chapter, the majority of respondents saw the collaboration as a collaborative partnership, aiming at a long-term relationship, from which both partners would benefit. The relationship is characterised by mutual trust and respect, where all parties involved would contribute with their different skills and capacities to the research outcome. In contrast to the equal partnerships that is perceived in many OI collaborations, some of the interviews gave the impression that the OI partners are not really conducting research together, but working quite separately. In those cases, collaborations are seen as a sort of supplier-customer relationship, where the university is perceived as a “supplier” of innovative ideas and knowledge, whereas the industrial partners act as customers.

These observations can be related to the framework of governance forms in OI collaborations by Felin and Zenger (2014, p. 919 f.). In the latter, when the company is merely presenting a problem to an academic institution and asks for solution, the relationship corresponds to a market or contractual governance form. In contrast, when the relationship can be described as collaborative and equal, where both parties contribute actively to the innovation process and there is a high level of open communication and interaction, one can speak of the governance form of a partnership.

According to the framework of Dahlander and Gann (2010, p. 701) who distinguish between pecuniary and non-pecuniary interactions of inbound and outbound OI, we found both acquiring and sourcing inbound activities in this research. Taking a firm’s perspective, acquiring takes place when the company is contributing financially to the research activities, which typically happened in the form of: investing a lump sum, sponsoring PhD students or paying a certain wage per hour for the research activity. In few cases, a specific customer need is identified to
be behind an R&D project, but that is rather an exception than the norm. However, in contrast to what is expected based on the literature review, these pecuniary interactions of the industrial partners were relatively rarely found. Often no market prices were paid in exchange, but the company contributed in non-monetary forms such as the provision of research personnel or material. In the majority of the cases explored, the major part of the funding is derived from public funding.

As it is displayed in the analysis, governmental policies and activities certainly play a major role in OI collaborations, on the one hand for the funding, and on the other hand for their occasional managerial interference. They can play a decisive role in getting the collaborating partners together and correspond to the role of a bridger (Agogué et al. 2013, p. 4).

6.1.2. Perceived benefits and drawbacks for the collaborating parties

✓ What are the benefits and drawbacks of an OI collaboration between academia and industry? Which partner is benefiting more in this collaboration?

When asking the representatives from the collaborating parties about the motives and benefits of an OI approach to research, the answers conformed to a large extent what has been discussed in the relevant literature. For the industrial partner, the economic benefit of getting access to high quality (human and technical) resources for low costs (comparatively to in-house R&D) is a main benefit. The academic partners stressed that the driving forces from an institutional perspective are the practical relevance of research and the access to information that is relevant for business. Further, on a personal level, it is stressed that collaboration with the industry enhances the career opportunities of the academic researchers, especially the employability of PhD students.

Interestingly, a large amount of respondents mentioned that they were working together with the other partner in order to get access to public funds. One interviewee from an industrial partner, admitted that he doubted that collaborations would be practised to the same extent, if the national and European funding policies would not require them to do so. Often the possibility to receive a public grant for an R&D project is based on the condition that there is a collaboration between academic and industrial partners. Therefore the question can be raised, whether OI collaborations are predominantly adopted because the collaborating partners really understand and relate to the philosophy and the opportunities of OI, or because they are mainly driven by governmental incentives. It could be discussed whether this form of economic intervention by the government serves the purpose of furthering innovation and well-being of the society well, or is merely an unjustified artificial stimulus at the expense of taxpayers. As far as we know, this aspect has not received much attention in the OI literature and would be an interesting topic for future research. In contrast to what had been found in literature, a potential loss of knowledge for companies is not perceived as a threat, neither is it seen as a danger to lose control or lose the reputation of being the inventor of a certain technology.

To conclude, OI collaborations are perceived as highly beneficial for both academia and the industry. No clear answer can be given which partner is benefiting more from that collaboration. The potential financial reward for companies, to get access to talent and on-the-edge scientific research is highly appealing, especially because in many cases, public authorities give access to funding. It can be can be concluded, that it is generally highly beneficial for companies in
the technology industry in Sweden, the Netherlands and in the UK to open up their R&D activities to external partners, and particularly to collaborate with universities.

6.1.3. Managerial challenges and project management practices in use

✔ How are OI projects managed and what are the challenges involved?

In this study, we perceived how the degree of formality of OI projects is managed and how it differs. As far as we know, in the OI literature, no connection has been made between OI endeavours and project management techniques. It is found that the term “project” is indeed used by the majority of the organisations. The term “project manager” is commonly used in some organisations, however, the employment/role title such as “head of research” is more established. The task responsibilities of the OI project managers (or project leaders) differ within the collaborations, between being highly involved in the research itself and rather fulfilling managerial tasks, as will be discussed in the leadership part.

It is perceived that R&D projects with science-based partners are managed in a less formal way than with industrial partners. Meetings are held on a regular basis, but the frequency differs considerably. Usually a certain form of documentation is demanded, however, these reports are mostly done in a rather rough way, as reporting is not perceived as a key aspect of managing the project. It can be concluded that OI projects are controlled and reported less strictly than collaborations with market-based partners (or partners in traditional customer-oriented projects). This corresponds to the observation by Du et al. (2014, p. 831) that less formal monitoring and scope control is needed from the companies’ perspective in a collaboration with academic partners.

As was outlined before, the management of IP is perceived by both academic and industrial partners as a major managerial challenge. In the study, it is seen that in the vast majority of OI collaborations, high attention is paid to IP issues and usually solved by detailed regulations in an agreement. The common notion found in the literature is largely confirmed that there are different mentalities about publishing and sharing intellectual assets between the partners, as regular publications are important for academic researchers, whereas companies decide on the point of time of publishing an invention depending on business aspects. From the universities’ perspective, IP restrictions can become controversial and clash with the notion of scientific freedom, as academia aims to serve the public in general, thereby publishing results as fast as possible, in order to contribute to knowledge development in the field and make the researchers’ name known in the academic community. However, companies often have tactical considerations to hold back inventions. From the companies’ perspective, IP is not perceived as a highly critical issue in collaborations with universities, as academic partners are not seen as competitors or a threat for business. (Certainly, this aspect also contributed to the positive perception of collaborations with universities from the industrial perspective.). This can cause a conflict between the parties, however, it is usually solved by negotiating a compromise and setting up an agreement. It can be concluded that IP is generally not perceived as a hindrance to OI collaborations, but as a manageable issue.
6.2. Leadership aspects in OI projects

In the following, leadership aspects of OI projects will be discussed, including the role of the leader in OI projects, which collaborating party is taking the lead, what specific characteristics are required in leaders and to what extent traditional leadership theories hold in OI contexts.

6.2.1. Role of the leader

✓ What is the role of a leader in OI? How does (s)he further the collaboration?

Re-examining the literature on the role of a leader, it is reported by Elkins and Keller (2003, p. 587, 593) that a project leader in R&D needs to possess technical expertise as well as managerial influence due to the wide range of activities that need to be performed. Leaders play a multitude of roles including leading the team, promoting, inspiring, interfacing, facilitating knowledge, competency development and guiding and supporting the team members throughout (Mumford et al. 2002, p. 735, Wei et al. 2010, p. 271 f, Stoker et al. 2001, p. 1142). The leaders were also required to span boundaries and engage with the stakeholders and be aware of the strategy and mission of the organisation to keep the research viable and stakeholders satisfied (Mumford et al. 2002, p. 735, Berson and Linton 2005, p. 52).

All these factors were observed in the team leaders of both the universities as well as the industries. However, it is seen that due to the technical backgrounds of the team leaders, they did not inherently possess managerial skills, but this is not perceived as a hindrance by the leaders. It is observed from the interviews that the leaders in universities and industry had not received any managerial or leadership training to enhance their soft skills, from their respective organisations. It is assumed that, since the leaders in the universities generally had had long experience of working with students, mostly as university professors, they got an informal on-the-job training. The system is a bit more formal, related to trainings in the companies, but extensive training is not provided and the leaders had mostly risen from technical backgrounds only.

Leaders actively participated in idea generation (Mumford et al. 2002, p. 721), which is confirmed by the interviewees. Most of them were participating in the research being done or wished to have more involvement in the projects. This is so because their duties were not limited to the intellectual work, but they also had managerial and administrative duties to perform, like application for grants, keeping tabs of the finances of the project, defining new projects, and devising timelines. It is also understood that sometimes leaders needed to engage the whole group and delegate responsibility to their subordinates to better manage the work.

To talk about individuals and teams in R&D, they mostly have high levels of intellectual abilities, are autonomous workers, and self-managing (Wei et al. 2010, p. 267). It is confirmed by the interviewees (who were mostly leaders) that a constant need of supervision is not required in the teams, rather the main work of the leader is to provide direction and support to the team members. The members were quite autonomous and had a set of tasks which they were responsible for. A hands-off approach is mostly noticed in the teams with the leader always available for discussion, as and when it is required. It is mostly seen that the leaders had an open-door policy and were very approachable by the members. A casual and friendly environment is fostered by the leaders; and the members were encouraged to work and explore possibilities in the defined context of the work being done by the research group. High co-
operation and mutual trust amongst the members as well as the respective teams, which is furthered by leaders, were seen as crucial factors for a successful OI collaboration. This is done by an intermixing of the two teams on occasions and working at each other’s facilities when the need arose. These findings show that a leader is indispensable in an OI environment. Our findings also refute what is said in the theory that there is no need of a leader in an R&D environment. We in fact feel, that the role of a leader becomes even more important in an OI context, which is a step-up up from the traditional R&D.

Hence, our findings confirm what is said in theory about the complexities involved in the role of a leader. To concisely put the findings and the theory together we can conclude that the key role of a leader in an OI project is not just at the problem-definition phase as is in R&D projects (Mumford et al. 2002, p. 721), rather a continuous presence and involvement of the leader is required throughout the duration of the project. We confirmed with our findings that leaders use interactional tactics to encourage idea-generation amongst the team members as well as the collaborating partner, which is achieved through motivation (Mumford et al. 2002, p. 721). Even though motivation plays a major role in fostering the open environment, it is seen that it is not highly required as the team itself is quite motivated to work towards the OI project. Some possible reasons can be that the universities have had long relations with the industrial partners and working collaboratively is in fact the norm rather than exception, therefore the team members are very comfortable with working with the industrial partners. Another reason is that the university members, especially the team, are excited at the prospect of working with the industry to gain some industrial experience as well as explore some potential future options. Furthermore, it is noted that the industrial partners had state-of-the-art equipment which can be used by the academic members, which serves as additional motivation. Indirect and direct persuasion techniques are required, as well as expertise and flexibility, to see all the connecting aspects in a project (Mumford et al. 2002, p. 718). The leader also played an important role in furthering the academia-industry relationship, by interacting with the other party on a regular basis and publicising the work being done at the university or industry in order to attract potential partners for the future. Hence, it can be established that a leader needs to balance a multitude of roles and responsibilities in R&D-based organisations or teams for OI collaborations.

6.2.2. Leading organisation

✔️ Who is the leader in an OI collaboration – industry or academia?

Having talked about the multiple roles played by a leader in an OI environment, the next question that arises is who is the leader in the collaboration- the university research group leader or the industrial partner? Before we arrive at the answer, we would like to touch upon the differences noticed in the teams of universities and industries in our study, as that is a defining factor for a collaborative OI project. The teams in the universities were more autonomous and having a pace of their own, while the industrial teams were less autonomous, with a higher strategic objective of the company in mind and the work performed. It is reported in the literature that the teams in industries were more focussed on immediate results and competitive advantage over other firms (Wei et al. 2010, p. 266). Extensive information exchange occurred at the common ground of OI as well as a high level of communication fostered between the partners, which will be elaborated in the later sections.
It is observed generally that although there is always a defined context, in a university-industry collaboration, there is typically no forced argumentation by any one of the parties towards the work performed. Both the parties seemed to be quite independent, with the leaders facilitating the information flow between the university and the industry. In an OI collaboration, the university research groups were at times motivated to explore the project more and discover the intricacies and the extents of the project. This falls exactly on the reasoning of why companies decide to participate in an OI collaboration with university/ science-based partners. This allows them to not only have the desired technology or product; but due to the explorative nature of the university research groups, the end-result can be much more defined and more information can be gathered about the common research field or a particular project. Hence, managing such a unique environment can be challenging to the leaders as they need to be aware and be able to manage the two parties with different ways of doing work.

It is expected that leaders from the industrial partners drive the research and take the leadership role as they sometimes have a financial impact on the universities, but that is not confirmed by the gathered data. In some of the cases, it is noted that the industries played a big part in the collaboration, including providing funding for the project as well as being the leading force behind the project, deciding on the following steps, the timelines etc. Such a relationship is seen as a supplier-consumer relationship, where the university is providing the necessary services and the industry is getting the maximum benefit from the results. However, since the universities are very independent entities, and have a high impact on the definition of the project, they can be seen to play a leadership role in an OI project. But this is also not confirmed in the data collected. This makes the definition of a leader in an OI context very ambiguous. Nevertheless, it is seen that the work done in the projects is highly collaborative and there is an intermixing of competencies from both the partners. Therefore, it is deduced from the data collected as well as the literature on the nature of the university and industry research, that there is no clearly defined leader in an OI project.

Since the interviews were conducted with both industry and universities, a general trend is observed in all the data collected that there were in fact two leaders within one project, one from the university and one from the industry. The leader from the university is generally the research head of the group, and the leader from the industrial partner is a project leader or a manager. The person from the industry played more of a managerial role, overseeing the timescales and the progress of the project, and the leader from the university is more responsible for the tangible research done and the results produced. They combined different competencies to achieve a higher objective for the OI project. Sometimes, the leader is even the project manager of the intermediary which is facilitating the collaboration. However, this conclusion can be construed to be dependent on individual cases which has been discussed in the limitations which are presented later in the study.

6.2.3. Required leadership characteristics

✓ What specific characteristics are required in leaders in OI?

Certain characteristics were identified to better understand the true nature of leadership in R&D OI projects. The considered factors were selected from popular leadership theories dominant in an R&D environment, which are elaborated in the next section. Certain characteristics which were not identified in the theories were identified and categorised after data collection as they
proved to play an important and significant role in getting a holistic picture of the leadership involved in R&D OI projects.

The most important characteristic identified is autonomy, which gives the opportunity to members to develop new and useful ideas and demonstrate originality, which is highly favourable in an R&D environment (Volmer et al. 2012, p. 458). In the data collected, we noted that autonomous environment is highly desired by both collaborating partners, internally as well as with each other. It is seen that each of the partner’s autonomously working towards the pre-defined target to be achieved. Autonomous working is in fact favoured as it gave the freedom to each of the partners and the members involved to investigate the work in the best possible way. It is also observed that too much involvement of the leader at each and every stage of the project is not required, rather it is mostly at initiation and reporting stages. Leaders were, however, always available to the team, if and when some issues had to be discussed. In some cases, heavy involvement of the leaders is seen in the project, performing the experiments, but this is in no way seen to hamper the autonomy of the group or the functioning of the project.

Working in autonomous jobs, the leaders and individuals work together and interchange ideas for better creative work involvement, and hence, higher creativity (Volmer et al. 2012, p. 458, 462). All the leaders interviewed, felt that flow of creativity as well as a supportive nature of a leader is an important characteristic in furthering the OI collaboration. As is articulated before, the boundaries or scope were fixed due to the defined nature of the OI project. The respondents felt that any research that is being done by any of the members related to the project, although autonomously must be beneficial to the OI project in some way. Hence, autonomy is seen to play an important role in furthering the relationship between academic and industrial partners and also within the team.

Joint problem-solving is also seen as an important characteristic in determining the nature of leadership in R&D OI projects. This is a part of collective leadership, in which the leader plays an important role in facilitating a team’s problem-solving abilities (Friedrich et al. 2009, p. 946). It is felt during the interviews that the two parties jointly take decisions on major steps to undertake in the collaborative project and enough autonomy of the parties exists when deciding on everyday problems. This fits well in the argument of OI, the basis of which is that the two collaborating parties come together to work on complementary or common projects to get better results and gain an outside perspective on the projects in question.

Communication played an important role in the collaboration between the industrial and academic partners. Leaders consult and give feedback to individuals as well as the other party who have a shared understanding and interest in the project (Friedrich et al. 2009, p. 938). It is seen throughout, that the leaders played the primary role in communicating with the other partner and were the “face and voice” of the collaborative project. Leaders actively engaged in direction-giving, meaning-making and empathetic language to get their ideas across to the team as well as to the partner. (Friedrich et al. 2009, p. 941, Pearce and Sims 2002, p. 179). Effective communication led to revision stages, alignment of team goals, team performance and effective problem-solving. A need of constant communication is necessitated by the leaders to keep in touch with their partners and the progress of the project, as well as to search for new projects and potential partners to maintain or increase the competitive advantage, either of the university or the industry. Hence, it can be deduced that a successful leader in an R&D OI project needs not just have the technical expertise, but also needs to know the managerial tactics to influence the partners in a positive way by clear communication.
The literature stressed that, organisational support towards innovative behaviour motivates individuals to pursue innovative ideas (Scott and Bruce 1994, p. 584). Empowerment is expected to play a major role in motivating the team members towards the OI project. However, it is found that it did not play a defining role in furthering the collaboration. It is seen to be an insignificant factor, especially in the universities and held minimal importance in the industry. It is also noted that an excellent relationship existed between the two partners as well as between the leaders and their teams internally, hence suggesting a high LMX. It is suggested by Harris et al. (2009, p. 372), that when both LMX and empowerment are high, most positive outcomes are expected and vice versa. Since the employees were highly empowered themselves as perceived by the leaders in the interviews, according to the literature, the role of a supervisor/leader is redundant, as the job provides the motivation which is associated with positive outcomes. What we examined is that empowerment and motivation can be established by the team members themselves. However, everyone cannot be empowered in the same way and to the same extent, and there the leader is seen to play a role in empowering the individuals to overcome any difficulties and motivating them towards the common objective. The leaders’ role is enhanced even further when the task at hand is especially difficult. It is then their duty to lead the team and motivate the members, however, such cases are noted to be negligible. Furthermore, the leader is a prominent figure in the collaborative project in providing direction and defining the scope of the project. Hence, it can be concluded that a constant need of leaders to empower the individuals and the partner is not required, but their presence is nevertheless indispensable in an R&D OI project.

Intellectual stimulation is an important characteristic of transformational leadership, but it is seen to not play any significant role in the OI projects. Intellectual stimulation by the leader furthers innovative thinking and provides technical expertise to the members. The reason for not finding any traces of intellectual stimulation can be justified by the argumentation that the team members are hired because of their high intellectual ability and hence, do not need any special stimulation from the leader. Negligible data input is provided on this characteristic, and hence we conclude of its low importance in furthering an R&D OI project.

Mentoring and coaching were deduced from the data and were seen to play a major role in the internal group activities. It is necessitated that the leaders need to change their leadership style as the project progresses or if the person is new to the team. Initially, a more directive and supportive approach is taken; and then as time progresses, and the member is better settled into the project and the group, a more coaching and delegating style is acquired by the leader. This seems to be close to the situational leadership approach which has not been covered in this thesis. To study the implications of this leadership theory and to test it would require an in-depth study dedicated to situational leadership, where the researcher needs to immerse himself/herself into the study and study both the leader and the follower characteristics. Since, this is not done in this study, it can be an interesting finding to study in detail in the future. We propose that all the leaders do not go through this process, as it is heavily dependent on the abilities of the members. So, a member who gets well settled into the group and has a high level of understanding of the inner workings of the group, would not need much mentoring and coaching. Therefore, this characteristic is dependent on a case-by-case basis and also on the abilities of the members. Hence, we cannot generalise this finding for the R&D OI project, because the perspective of the members would also be required, which is not done due to the limited scope of the thesis. In conclusion, it is seen as a borderline important characteristic.

Decision-making is another characteristic which is gathered from the findings in the data. For a joint R&D OI project, it is deduced that the two collaborating parties took major decisions...
using consensus building, consulting with each other at important milestones of the project. Other than that, much autonomy and freedom is prevalent in the two teams when performing day-to-day activities. Although the two teams work together, there is a limited intermixing of the two parties, and mostly it is the leaders who are involved in the joint decision-making. However, it must be articulated that within each team, there are extensive discussions with active participation from all the team members and the leader. The final decision, by default rests with the leader, but it is seen that the leaders encourage their team members to explore the projects more and push the limits of their research to get the best result out. This action involves quite a lot of motivation from the leader which has been discussed previously.

Hence, to conclude the predominant leadership characteristics seen in R&D OI projects are autonomy, communication, joint problem-solving and decision-making. Empowerment and mentoring and coaching are seen to be borderline important and no significance is observed for intellectual stimulation.

6.2.4. Applicability of traditional leadership theories

✓ Do the traditional theories of leadership apply in OI?

Various theories have been presented in the literature on leadership, lesser so on leadership in R&D and there are no established theories yet on leadership in OI to the best of our knowledge. Since we are exploring leadership involved in R&D OI projects, we considered the popular leadership theories in R&D, and tried to decipher if they fit into the context of OI. In this thesis we considered three leadership theories central to R&D leadership research: Transformational leadership, Leader-member exchange theory (LMX) (presented by Elkins and Keller (2003, p. 587) and Collective Leadership (Friedrich et al. 2009, p. 934). We analysed the key characteristics from each of these theories as explained in the previous section. An OI environment is highly dynamic which is said to be supportive of transformational leaders, as opposed to a stable environment where a transformational leader’s qualities are less useful (Jansen et al. 2009, p. 10). It is furthered by Berson and Linton (2005, p. 52) and Howell and Higgins (1990, p. 319) that transformational leaders are more risk-taking and favourable to innovation. Transformational leadership has four components: idealised influence (charisma), individualised consideration, intellectual stimulation, and inspirational motivation. (Avolio and Bass 2002, p. 2 f, Bass and Avolio 1990, p. 24, Bass and Riggio 2006, p. 6). As can be deduced from the previous section, intellectual stimulation did not play any role in furthering the OI collaboration. Motivation is seen to be a strong factor but it had some grey areas as some of the interviewees mentioned that they did not need such motivation, as they were in fact self-motivated. Furthermore, although the leaders gave importance to individuals, more emphasis is given to the group, and the collective work that the group did towards the collaborative project. And lastly, charisma is not a factor which is measured in the thesis as it is would involve interviewing the followers. Additionally, a longitudinal study would be a better method to capture the true essence of charismatic leadership, which is not done due to the limited scope and time limit of the thesis. Since, we are looking at the operational level rather than the strategic level of the OI collaboration in our study, we deduce that transformational leadership is not dominant in the day-today working in an R&D OI project. We assume that transformational leadership can play a significant role at the strategic level, where the company or the university incorporates OI in their strategy and business model.
From the deductions made in the previous section on the various characteristics required in an R&D OI project, we conclude that it is rather a mixture of LMX and collective leadership characteristics which have shown to play a significant role in inferring the leadership in such projects. For LMX, we considered autonomy and empowerment to be dominant factors which characterise the type of leadership. As detailed in the previous section, autonomy is seen to be the most important factor and empowerment is seen to be a factor of medium importance as a clear judgement could not be made on its importance and role. However, the general characteristics which define high LMX leader were interpreted from the data collected. High LMX characterises trust and respect, collaboration and cooperation between individuals and the group. It also facilitates to perceive the organisation as a whole and is supportive of innovation (Scott and Bruce 1994, p. 586). High LMX fosters creativity and has a positive effect on the innovative behaviour of subordinates, through the creation of facilitating task conditions, group thinking and reduction of fears of negative evaluation of innovative ideas (Atwater and Carmeli 2009, p. 270, Scott and Bruce 1998, p. 5). It is noticed in general that leaders were very open and positive towards subordinates’ views and their contribution towards the project and again a high level of motivation is fostered by the leaders. Hence, LMX can be understood to be a possibly dominant leadership theory in the R&D OI context.

Collective leadership is analysed using ‘communication’ and ‘joint problem-solving’ as the main factors on which it is based. Communication is seen to be one of the most important factor in the development of the university-industry collaboration and it is also seen to be the important factor for internal operations of each of the collaborating unit. We noticed in the data collected that in R&D teams both parties had effective delegation of responsibilities, which is highly successful in the efficient working of the two teams, together and individually. Moreover, having diverse and varied expertise is beneficial to the team performance, but it is even greater when there is increased collaborative behaviour and effective information exchange (Friedrich et al. 2009, p. 935). We noticed that there is an extensive knowledge exchange, which led to better collective group functioning and team effectiveness. In the R&D field, Wei et al. (2010, p. 271) observed that there is no competition between the different individuals seen, rather it is a collaborative environment with everyone sharing ideas on an intellectual level. Joint problem-solving is the norm in OI projects, with the university and the industrial partners working towards the common objective. It is seen that sometimes the two partners were not working on the same facilities together, but a regular communication is done. The leaders from each of the collaborating parties were the interface, where the two teams met, and from there collaborative working is promoted. Hence, collective leadership is seen to be highly effective at the operational level in R&D OI projects with the leader fostering collective thinking and working of the two teams.

Certainly, it cannot be said that these theories would hold in all cases of OI because the nature of leadership is dependent on the leaders and how they best manage the collaboration. It is also of significance to note that the type of OI collaboration also plays a part in determining the validity and generalizability of these theories. Hence, we conclude that theories of LMX and collective leadership would be significant in characterising the leadership behaviours in an R&D OI context based on the data collected.
7. CONCLUSION

7.1. Summary of the findings

Based on the discussion in the previous chapter, the overall research question can be answered, exploring the nature of OI and leadership characteristics involved in collaborative projects between companies and universities.

✔ What is the nature of open innovation R&D projects and leadership involved in industry-academia collaborations?

Whereas the OI literature has taken almost entirely the perspective of companies, in this study the attempt is made to reflect in the interviews a balanced viewpoint from both industrial and academic parties. Additionally, the viewpoint of intermediaries is explored, as their significance for OI collaborations became obvious during the course of the study.

A main finding of this study is that both academic and industrial partners in Sweden, the UK and the Netherlands rely highly on public funding from national and EU grants. This external motivation for OI has not received attention by the OI scholars. Joint OI projects are predominantly conducted in applied research or development projects, rather than on fundamental research, as companies are interested in a commercialisation of the research outcome in the near future.

These aspects relate to the perceived benefits for companies to get engaged in OI collaborations. The driving force for OI is finance-related, as companies can reduce expenses on cost-intensive research activities, because funding research projects at universities is cheaper than in-house, and OI projects are frequently subsidised by public funding. Besides financial reasons, the access to state-of-the-art knowledge and technology in the specific research field and the access to talent are the main benefits for the industry. From the perspective of academic institutions, engaging in OI collaborations mainly pays off because of funding reasons. Immaterial reasons like engaging in OI collaborations for the sake of access to technical expertise, or a contribution to the society due to the practical applicability of the research carried out, were mentioned less.

OI literature so far has predominantly taken a rather positive/idealistic perspective on OI collaborations. First, the relationship is usually described as a collaborative partnership. In this study it is revealed, that this applies to some cases, however, in other cases OI collaborations were perceived as more of a market/contract/supplier-customer relationship, where mainly the industry would benefit from the research activities at universities. Second, OI literature focuses extraordinarily on the benefits for companies than shedding light on potential drawbacks and challenges of such collaborations, and how to overcome them. Managerial challenges are not given much attention in the OI literature. However, both academic and industrial partners report that managing different stakeholders and regulating IP-related issues are the main challenges perceived in such a collaboration. Nonetheless, these challenges are not perceived as insuperable hindrances, but can be met by means of attentive communication and careful agreements. The shortcomings of OI literature and the relatively thin theoretical base can be related to the fact that the field of research is relatively young.

There are some tendencies, especially at companies, to manage OI projects in a formalised way, nominating a project manager, setting up regular meetings, tracking the progress and in some cases even introducing project management software tools. However, it can be concluded that
OI projects are significantly less formalised managed than traditional project management literature would suggest.

Leadership in R&D OI projects has a very important role at the operational level. Leaders in OI do not only manage their own team, but also engage with the collaborating partner as well as their team for the purpose of R&D. It is expected that the two partners would work as one team and there would be one leader, but the findings were counteractive to what we believed. We found that there are generally two teams and mostly a few members of both the teams are engaged in the information and knowledge exchange. In addition to this, there are two leaders, one in the industry and the other in the university and neither is dominating or overpowering the other. It is a very mutual and friendly partnership with leaders from both parties having their autonomy and freedom to carry out tasks. It is found that it is in fact beneficial for the industries (being the receiver of the product or technology in the end) that universities have a lot of autonomy as they can stretch the research and discover interesting findings which will ultimately give a competitive edge to the industrial partner.

It is mostly seen that in addition to the scientific and research duties, the leaders also had to perform certain managerial and administrative work. They were also responsible for motivating their teams and drawing out project charters for future projects. The duty of getting more projects, investors and partners lies with the leader.

It is found that leaders in such collaborating organisations need to have certain characteristics, which define their leadership style as well as what type of qualities could be conducive to OI in R&D. We discovered that autonomy, effective communication, joint problem-solving and decision-making were seen as important factors which characterise leadership in such projects. It is expected that intellectual stimulation and empowerment would play an important role, but not much evidence is found for their significance. It is seen that leaders take most of the decisions jointly and also solve crucial scientific problems together. There is heavy involvement of the teams of the two organisations and much autonomy is given to them to discover and research in the defined scope of the project. From the characteristics, it is deduced that the theories suggested by Elkins and Keller (2003), transformational leadership theory is not predominantly prominent in OI projects at the operational level. Rather, it is collective leadership and LMX which play an important role. It is assumed that transformational leadership can be highly significant at the strategic level, when the organisations decide that they need to open up their R&D processes and hence charismatic leaders are required.

In an equal collaboration between universities and companies, it is hard to deduce who takes the role of a leader and who of the follower. It cannot be said for certain, when universities are involving in developmental research for a particular company, they are the suppliers and the companies are the customers, and hence having an upper hand, as they are the ones with more monetary power.

Outlook on the future development of OI

As shown in this study, in the last decade, the concept of OI has received a lot of feedback in practice and in academia. A lot of studies were published on the content, context and process of OI (Huizingh 2011, p. 7). Also several dimensions such as strategy and organisational structure were touched upon. Nonetheless, research on OI in practice and its managerial challenges is still rare (Giannopoulou et al. 2011, p. 506). As a relatively new field of research, OI provides rich possibilities for fundamental findings (West et al 2014, p. 810), and especially operational aspects/ the internal process of managing OI projects need further investigation.
Due to the increasing popularity of joint research projects with an open innovation approach, and the risks that are associated with them, there is a need to understand how to best manage such collaborations (Wincent et al. 2009, p. 55). The discussed research gaps confirm that there are still plenty of knowledge areas to explore in the field in order to better understand the process of encouraging OI in organisations and gain value from it.

The question still remains open as to how the concept of OI will develop in literature in the future. It is shown that research on OI is still in developmental stages. The concern that OI might just be a buzzword at the moment, rather than a constant phenomenon has been expressed (Giannopolou et al. 2010, p. 163 f.). However, the development of OI seems to be a sustainable one (Lichtenthaler 2011, p. 89). Huizingh (2011, p. 2) argues that OI is an applicable concept for a lot of companies and on its way to finding its final place in innovation management. Also West et al. (2014, p. 807) articulate that there is a need and also an interest in the academic field to integrate the research of OI more with management and economics literature. Eventually, the notion of OI might get absorbed in existing theories in the future.

7.2. Implications of this study

In this section, we point out various implications of our study which can be used by future leaders in OI, practitioners of OI and researchers of leadership and OI.

Managerial implications

This thesis can be used by present and future practitioners and leaders of OI, who are collaborating in the technology industry. Due to the relatively large data set and involvement of practitioners from industry, academia and intermediaries, we feel we have provided a comprehensive list of leadership characteristics and some OI practices which are crucial to OI’s success.

It has been revealed that the concept of OI in the organisation is practiced to a considerable degree, but not totally adopted in its purity, as, in certain cases the collaborating partners perceive some drawbacks, mostly regarding a perceived threat of academic independence by university members or unbalanced benefits in favour of the industrial partner. Leading in OI collaborations is not easy because of several challenges that need to be understood and targeted adequately. This observation indicates a need for higher attention by leaders on the project level, but also by managers on a higher organisational level, in order to benefit from OI collaborations to the fullest potential. Propagandising OI in organisational strategy of both academic and industrial organisations could overcome a residual reluctance and soothe doubts on such collaborations.

Further it has been shown that managerial and project management practices in OI projects are usually not standardised. Establishing processes could help to overcome some perceived barriers, such as the management of IP, or the difficulty of bringing the different working methods and speeds of industry and academia successfully together. Nonetheless, it has to be considered that this study has also confirmed the assumption that academic partners often prefer a less formalised approach to project management, which needs to be considered by project leaders in such collaborations. This thesis is not meant to be a guideline for practice, but to provide a better understanding of the complexity of managing such collaborations and the need for a more differentiated view on OI and leadership. It shows the nature of OI in joint academia-
industry R&D projects and perceived challenges, as well as the leadership characteristics needed in such challenging and complex environments.

On account of the results of the study in relation to the characteristics of leadership in OI, it is seen that intellectual stimulation is not a relevant factor for leaders in collaborative OI projects. R&D is an area where mainly “knowledge workers” are employed, having a high formal education. It is characterised by high level of dedication, interest in the topic, curiosity and motivation, which is required by the nature of task of doing research itself. It is perceived that mostly leaders do not see the need to motivate their group members or their partners intellectually, rather the leaders motivated, supported and coached their subordinates and partners as and when some hurdles arose. Motivation is furthered on a managerial level more than on an intellectual level. Other characteristics like empowerment, autonomy and constant communication between the participating members as well as within the group played an important role in furthering OI. These characteristics can be used as a starting point for new leaders who are participating in such collaborations, and for existing leaders to be more aware of such characteristics, to give them guidance on the management of the partnership as well as of the members of the group.

The results from this study also point out that no formal managerial or leadership training is given to the leaders especially from the universities. It is expected that they possess the necessary skills for leaders and can effectively lead teams and individuals successfully. We suggest that formal leadership as well as managerial training should be provided to the team leaders in both universities and industries so that they are able to better manage their teams and optimise the collaborative work environment.

Successful OI collaboration projects all showed that there is combined and mutual decision-making and a high level of support for each other. It is also noted that there is widespread joint problem-solving with initiatives from both academia and industry. The results from the study can be used for companies and universities looking to participate in OI, and the successful practices by existing practitioners can be used as a benchmark to proceed on the right path. Also, since the most widely articulated challenge is identified as management of PhD projects, this study can be used by leaders to focus on and help them to identify and prioritise the challenges faced by them in the present or future.

**Theoretical implications**

The extensive study conducted has some theoretical underpinnings as this study is a first, to the best of our knowledge, in deciphering the role and characteristics of leaders in an OI context. We would like to open the doors to further research, especially in leadership in an OI context.

The study has aimed to discover the leader in an OI collaboration between industry and academia, i.e. which party plays the dominant role in such a collaboration. Popular theories which are applicable in an R&D context have been used to have a better grounding for the study. Additionally, by looking at how the leaders manage their research groups as well as the OI collaboration projects, our study has tried to establish certain characteristics which are found in successful leaders. We hope this study opens up a way for future studies in leadership in OI, and the leadership characteristics deciphered can help in the development of a leadership theory in OI.

In this thesis we departed from the mere business focus that most OI literature takes, to a more balanced and holistic view, highlighting the perception of OI from the viewpoint of the academic and governmental partner. Further, we gained insights about working practices in OI.
on the project level, rather than on the strategic level. This contributes to the OI literature in the understanding of perceived drawbacks and challenges and stresses the need for further research on the project level and on managerial guidelines how to encourage and best manage OI collaborations between academic and industrial institutions.

The study has also explored the importance of intermediaries in an OI alliance and how they can act as facilitators of collaborations between industry and academic partners. Although much attention has not been provided to this arm of the triple helix in our study, being out of scope of the thesis, but its inevitability is unavoidable. Our findings relate to the role of intermediaries and government in playing a major part in OI collaborations can be used as a preliminary study for future work; and can also be used as a starting point in laying down policies and best practices for such collaborations. The implications are widespread and can be utilized to change the way OI collaborations are done in the future.

In this thesis a bridge is built between the contemporary topic of OI and the considerably more established research on leadership. An immense potential for further research in this combined field is shown and is further discussed in the following section.

7.3. Limitations and suggestions for further research

The research conducted has several limitations, which are discussed in the following section. These have been categorised according to research method used, sample and scope of the thesis. Based on those limitations we refer to topics where we see a need for further research.

Limitations of the research method used

Since the data collected is qualitative, it is difficult on some accounts to generalise the findings as the sample with 18 respondents is relatively small. Furthermore, the data provided from the respondents is quite subjective and unique to their organisations and hence generality is difficult to achieve. It can be suggested that for future work relating to this field, quantitative assessment can be conducted where it is easier to quantify the data and generalise it in order to determine relationships and causality and understand the context of innovation effectiveness (Huizingh 2011, p. 6 f.). On the other hand, it would also be beneficial to study the OI practices in depth in a single organisation as a case study to get a better understanding of the leadership characteristics involved in such a setting.

Qualitative interviews have a tendency to be very subjective and a drawback can be observed in the interpretation of data. Retrospective bias is also an issue as the interviewees were often referring to perception of events in the past, and they might have changed some of the details which might be crucial to our study. Besides, it can be suggested that in a study such as ours, personal interviews could have been more effective rather than over phone, as most of the interviews were conducted. We also think that being in the setting of the OI where the two partners interact, would have given us deeper and clearer insight into the operation of OI as well as the leadership styles involved. Choosing another research method than interviews like observation of the daily work in the OI projects, would have given a more complete idea how leadership in such a setting works. Thereby the reflections of the interviewee could be confirmed or inconsistencies discovered.

The research design is very subjective, such as the selection of questions for the interview guide. Some relevant questions might have been missed due to our motivation to generalise the findings. The semi-structured research design for interviews allowed us to alter the questions
in order, and ask follow-up questions, which might not have been directly in the scope of our study. Despite the clear advantage of being flexible and asking the relevant context-specific questions, semi-structured interviews bare the risk of arbitrariness and difficult comparison of the data.

**Limitations regarding the research sample**

The sample size is relatively small (i.e. 18 collaborating partners), therefore generalisations cannot be drawn easily. This is especially, because we have a quite diverse mix regarding research field, type of project, and firm size. We considered three different types of OI actors (7 academic, 7 industrial and 4 governmental actors), which might be a lot, compared to the total sample size. Besides, we conducted several interviews in the same organisation (e.g. Umeå University, SAFER, Philips), which could have influenced the findings of our study by being too focussed on the practices which are unique to these organisations. However, we think this is fairly justified, as we were focusing on research groups at the project level, not at the organisational level of the OI partners. For future study, investigating a higher number of industrial and academic partners could give a more complete picture and lead to a higher generalizability of the findings.

Initially, we planned to interview both the leader and followers of an OI project, in order to get a holistic picture on leadership aspects. However, due to limited availability of relevant respondents during the contacting phase and limited time frame of our thesis, we decided to focus merely on the leader. We think it is a reasonable decision, as it is predominantly the leader who is facilitating the collaboration with the partnering organisation, and therefore, we felt that the leader could especially give valid insights into the nature of collaboration. Nonetheless, a result of this focus and a major limitation of this study is the construction of a one-sided picture. Interviewing team members of different positions in one research group, i.e. both the leader and followers, would have given the possibility to cross-check the findings on leadership styles. Revealing whether the perception of the leadership style by the leader and by the followers are similar, would have enhanced the credibility of the findings.

Additionally, it would have been more insightful if we would have explored leadership aspects on both sides of an OI collaboration, i.e. including a representative from the university and the industry (and if applicable, a representative from involved third parties such as government representatives). In this thesis, we were able to get both perspectives in just one collaboration (i.e. with the University of Cambridge and Toshiba). For future studies, exploring the perception of leadership and the nature of collaboration from both perspectives (academia and industry) would give a complex picture of the topic and increase the generalizability of data.

**Limitations due to the restricted scope of this study**

As we focused in this study on the aspects of leadership in the OI collaboration, there are certain aspects that lie out of scope and we do not claim to contribute to them, which might be explored in future research. First, we are not comparing leadership in traditional “closed” R&D to OI projects. Therefore no conclusion can be drawn, whether the required leadership skills in the contrasting settings actually differ. Furthermore, we are not trying to make any assumption or draw any conclusion about the spread and distribution of OI practices, compared to “closed” internal R&D models, i.e. placing them on a continuum. Projects which fulfil the criteria of an OI project with academic and industrial partners were included in the sample. Therefore, further investigations could consider the degree of openness of an organisation, i.e. where on the continuum from closed to open innovation the participating organisations would be located.
Second, we did not consider the time aspect of the collaboration, i.e. how long the investigated collaboration or research project have been going on. Attitudes of the team members might change over time, as trust might have been established or certain informal working patterns might get established, among others. Also the leadership style might change over time. It is assumed that more directive and hands-on leadership is required at the beginning of the project. In the middle of the project, there is more freedom to explore the possible research avenues in the defined context and a coaching style is required. It is assumed that towards the end of the research project, the leadership would be more directive and more task oriented to deliver the project on time. The change of leadership behaviours during the continuum of time can be an interesting field of research for the future.

Third, we deliberately focussed on the analysis of the leadership style by means of few theories, which were considered the most appropriate, as they were referred to the most in the literature on leadership in R&D. Thereby, other leadership theories such as situational leadership are not considered.

Fourth, research on OI has mostly solely taken the perspective of large manufacturing enterprises that are leading innovators (van de Vrande et al. 2010, p. 224, Spithoven et al. 2013, p. 555) Thereby the focus is primarily on the technology industry (Westergren and Holmström 2012, p. 209, Chesbrough and Brunswicker 2014, p.18). We have mostly focussed on large multinational organisations and not much on the SMEs which comprise of a significant portion of the OI market. However, very few articles have been published on the perspective of SMEs that adapt an OI concept (e.g. van de Vrande et al. 2009); as well as OI in other industries. Therefore, it could be insightful for future research to investigate whether, and if so, how firm size and industry have an impact on leadership in OI projects.

Fifth, certain further aspects were laid out of scope of this study, such as a potential impact of culture on leadership aspects, differences of organisational culture, or the impact of the field of research on the nature of working patterns. As discussed before, context factors, such as the influence of firm size and industry on the nature and leadership of an OI project are not considered. However, ignoring these aspects might lead to misleading conclusions and implications. A comparison of leadership in OI projects in different cultures, industries and companies of different size would be an interesting research topic for the future.

Sixth, in this study, we do not measure whether the leadership style has an impact on innovation performance/ the outcome of OI projects. Du et al. 2014 (p.837) found out that the degree of formality of the applied project management practices indeed has an impact on the financial performance of projects. An impact on OI practices and leadership style on the impact of innovation performance would be an interesting study field.

Seventh, the focus of our research is on leadership at the project level. Certain managerial implications, like organisational initiatives of promoting OI at a strategic level of the firm are not considered. The role of governmental policies and initiatives has been touched upon slightly, but not elaborated further in detail, and we did not compare the national initiatives towards OI collaboration. In a future study, one could analyse how initiatives of national governments and European institutions encourage OI projects.

Last but not least, other forms of OI than academia-industry R&D projects, such as OI projects with suppliers, which is practised increasingly in the high-tech industry, with customers (e.g. often practised for product design or the development of consumable goods like cosmetics or food), or with end users (e.g. for software development) have not been included. We decided to focus on R&D collaboration with academia, as we found that it is an interesting setting where
leadership structures can be explored, which would not be the case with end users or customers. Besides, we felt that such a collaboration would be more interesting than to observe leadership in collaboration with suppliers, as there might be a certain dependency and hierarchy involved, which might impact leadership significantly. Collaborating patterns and leadership in other forms of OI collaborations could be a thought-provoking field for future research.
Appendices

Appendix 1: General interview guide

A) Demographic questions
1. Can you tell us something about your organisation and your role in it?
2. What is your position/title within the organisation?
3. For how long have you been working in the company/this department?

B) Project team facts
1. What is the research project about (project objective)?
2. Do you do more fundamental research, applied or developmental research?
3. Where is the research group located?
4. Who do you collaborate with? (What kind of company, firm size?)
5. For how long has the collaboration been going on?
6. Who do you think benefits and drawbacks from this collaboration?
7. Can you tell us about the research team (e.g. regarding team size, people involved)?
8. Which roles do representatives from the company and university have? - Are there third parties involved, such as suppliers or customers?
9. How many projects is one person handling at one point of time? How much time is dedicated to the collaborative project?

C) Open Innovation
1. Who is establishing the first main contact?
2. Where does the funding for the research project come from? Who is the project sponsor?
3. How would you describe the collaboration between university and industry? Who is (actually) taking the lead?
4. How are the project boundaries set? Is there a project agreement?
5. How formally do you think the R&D project is managed?
   - How often do you meet in the team?
   - Are there regular reviews of the project process, involving management, and project sponsors?
   - During project reviews, are corrective actions identified, documented, and tracked through to project completion?
   - Are progress reports made available at the project level on a regular basis, including information on project termination and transferred results?
6. Who owns the rights over the final product/research outcome?
7. Who is making the major decisions?

D) Leadership questions
Generic Questions
1. How have you become a leader of this group? Was there any formalised training offered by your organisation?
2. What is that you do to stimulate an open innovation environment?
3. How do you manage the collaboration between the university and the company?
4. Do you take a different style when dealing with companies or with university members?
5. Can you please give us an instance of a conflict within the organisation where you facilitated a solution?
6. How do you set a clear direction when all collaborating partners/people involved have different perceptions of what to aim for and how to get there?
7. Do you actively participate in the process of research?
8. How much autonomy do you or your team members have to bring in your own ideas?
9. Would you say you are more task-oriented or relationship-oriented (i.e. more directive or collaborative)?
10. How would you describe your leadership style?
11. What are the most important and challenging decisions that you have to make as a leader (e.g. hiring decisions, financial decisions)?
12. How formalised is the task structure? Are there regular reports to hand in?

Team Questions

13. How do you lead individuals with diverse competencies, skills, cultural backgrounds and a different level of work experience to achieve your desired business results?
14. How do you facilitate trust amongst your team in the industry and the collaborating partner and the people involved?
15. How understanding are you when a particular team member is facing some problems?
16. Do you take action to improve team functioning?
17. How do you diagnose group deficiencies and how do you manage or change them?
18. Is achieving the team’s goal more important than individual objectives?
19. How would you describe the team’s climate to be? Open and willing to share the work, problems or good news?
20. Are there some social activities to increase the team spirit?

Follower Questions

21. How independent are the followers? Do they take initiative in research?
22. How often is there a feedback to followers regarding their personal and professional development?
23. How focussed are you on the personal development of the followers and how do you facilitate it?
Appendix 2: “Request for Interview” template

Dear Sir or Madam,

We are two postgraduate students doing a Masters in Strategic Project Management (European) at Umea School of Business and Economics, working on our master’s thesis titled ‘Leadership in Open Innovation’. The aim is to conduct qualitative interviews with project leaders or R&D heads (involved in a collaboration) as part of the empirical research to better understand the intricacies involved in being a leader in such an open innovation context.

Therefore we would like to ask for the following information:

- Could you kindly let us know if your company collaborates in R&D activities or product development with Universities or Academic institutions?

- If so, could you kindly refer us to the responsible department or person?

We would be highly grateful if you could participate in our research. We assure that the interview (can be conducted via Skype or phone) would not take much of your time (approximately 45 min to 1 hour), as we understand the value of it. However, the input that you would provide to us is paramount for our research.

We guarantee anonymity and we assure you that the information that you share with us would not be used for any other purpose except for this thesis, and all ethical considerations would be kept in mind while conducting the research.

Kindly do not hesitate to ask us any clarifying questions.

Thank you in advance for your attention and time. We look forward to your reply.

Kind regards,

Aakriti Singh
Jana Wenzlaff
Appendix 3: Choice of countries and cultural impact on leadership

In this study, OI projects were investigated in three countries: Sweden, UK and the Netherlands. These countries are situated in Northern/ Western Europe and belong to the EU (European Union 2014). All countries are classified as “advanced economies” (IMF 2014, p. 160) and high-income OECD countries (World Bank 2014). We chose to include countries with a similar economic strength in order to hold results comparable, as we think that this factor might have an influence on the level of innovation activity driven by the industry and government. The selected countries all rank very high in the Global Innovation Index, which ranks the innovation performance of countries based on 81 indicators. In 2014, Switzerland led the ranking, followed by the UK (2nd), Sweden (3rd) and the Netherlands (5th rank) (Cornell University 2014, p. XXIV). This index strongly indicated that these three countries are heavily involved in innovation activities and motivated us to consider them for our study. Besides, being a member state of the EU gives similar access to research groups for funding by the EU. The EC has established an Open Innovation Strategy and Policy Group (OISPG) and is encouraging and funding projects between industrial groups, academia and governments (European Commission 2014, p. 12).

When choosing the countries for this research, a potential language barrier played an important role, as we planned to conduct all interviews in English. Both in Sweden and the Netherlands we perceived no reluctance or unease of the respondents to give interviews in English, as the level of English is typically very high and does not hinder the quality of the interviews. Additionally, due to the researchers’ educational background in the UK and Sweden, and professional contacts in the Netherlands, it was a natural decision to focus on these countries.

We investigated the relationship between leadership style and OI, regardless of potential cultural differences that might impact the leadership style. We do not focus on cultural aspects in this research, as we assume that the impact of potential cultural differences on leadership will be relatively small, in comparison to the impact the special environment and task requirements that an R&D project itself have. According to the GLOBE study (House et al. 2004), the Germanic Europe (Netherlands), Nordic Europe (Sweden) and Anglo (UK) cultural clusters are placed next to each other and are culturally relatively close, regarding the nine cultural dimensions: uncertainty avoidance, power distance, institutional collectivism, in-group collectivism, gender egalitarianism, assertiveness, future orientation, performance orientation, and humane orientation. As stated by the GLOBE study, the preferred leadership style in the Nordic European countries is highly visionary and participative, while being somewhat independent and diplomatic. An ideal leader is inspiring, and involves others in decision-making (Northouse 2013, p. 398). For the Anglo countries an ideal leader is especially charismatic/value-based, participative, sensitive to people, team-oriented and autonomous (Northouse 2013, p. 399 f.). In the Germanic Europe cluster (Netherlands) the preferred leadership style is very participative while also being inspirational and independent. It is perceived that effective leadership is based on participation, charisma, and autonomy (Northouse 2013, p. 402). In other words, in all three clusters charismatic/ value-based leadership and participative leadership are preferred styles. In the Germanic cluster (Netherlands) also an autonomous leadership style is perceived as important, which is not as important in the other two clusters.
When comparing the countries regarding the cultural dimensions identified by Hofstede (2010), the countries score very similar regarding power distance, individualism and indulgence. The Netherlands scores slightly higher on pragmatism and uncertainty avoidance than the UK and Sweden. Interestingly, the only extreme difference between the countries of this research is that the UK scores very high on masculinity (66), whereas Sweden (5) and the Netherlands (14) are considered feminine countries (Hofstede Centre 2014). In feminine countries it is important to keep the life/work balance and you make sure that all are included. An effective manager is supportive to his/her people, and decision-making is achieved through involvement. Managers strive for consensus and people value equality, solidarity and quality in their working lives. Conflicts are resolved by compromise and negotiation and Swedes and Dutch are known for their long discussions until consensus has been reached. In contrast, Britain is a masculine society – highly success oriented and driven. In comparison to feminine cultures, people in the UK give much more importance to work in life and have a clear performance ambition (Hofstede Centre 2014).

*Power distance* is the extent to which the less powerful members of institutions and organisations within a country expect and accept that power is distributed unequally. All Sweden, UK and the Netherlands score low on power distance (score of 31, 35, and 38, respectively) which means that the following characterises their style: Being independent, hierarchy for convenience only, equal rights, superiors accessible, coaching leader, management facilitates and empowers. Power is decentralised and managers count on the experience of their team members, communication is direct and participative. Employees expect to be consulted, control is disliked and attitude towards managers are informal and on first name basis. Besides, Sweden, UK and the Netherlands all score very high on Hofstede’s dimensions *individualism*. In individualistic societies, the employer/employee relationship is a contract based on mutual advantage, hiring and promotion decisions are supposed to be based on merit only, management is the management of individuals.

Sweden and the UK score low on *uncertainty avoidance* (29 and 35, respectively), whereas the Netherlands is moderate (53). Those societies maintain a more relaxed attitude in which practice counts more than principles, changing plans and deviance from the norm is more easily tolerated, schedules are flexible and innovation is not seen as threatening. In work terms this
results in planning that is not detail oriented, the actual process is fluid and flexible to emerging and changing environment. A combination of a highly individualistic and curious nation leads to a high level of creativity and strong need for innovation (Hofstede Centre 2014).

As shown, according to both the GLOBE study and Hofstede’s cultural dimensions, the countries’ cultures are highly comparable. They differ mainly regarding masculinity of the UK (Hofstede Centre 2014), implying a potentially more hierarchical relationship between the leader and the team members. As a result, in this study a potential impact of culture on leadership will not be considered.
Appendix 4: Academic, industrial and intermediary partners and their research fields

Academic partners

Research groups in universities directly belonging to or associated with various industries, were included in the study, which differ regarding their history in research and closeness to industry. In order to find research groups that were practising an OI approach, we searched the universities’ websites and contacted researchers to find out which collaborations the research groups had. We especially approached technical universities because we expected a higher degree of industry collaboration, due to their technological and applied orientation.

In this study, seven respondents from four different academic institutions were interviewed. In the UK, the University of Cambridge (founded in 1209), the University of Leeds (established in 1904), and Heriot-Watt University, Edinburgh (established in 1966) were included in the sample. At the University of Cambridge, we interviewed a researcher presenting the Thin Film Magnetism (TFM) Group, which is collaborating with Toshiba. Here, we conducted interviews with representatives of both collaborating partners, as will be further described in the next section on industrial partners. The Thin Film Magnetism group is at the forefront of ultrathin magnetic film and magnetic nanostructure research (University of Cambridge 2014).

Three research groups with industry collaborations at Heriot-Watt University were included in our sample. First, we interviewed the Director of Research (Doctor in Plasma Physics) who is leading a research group on uncertainty quantification (UQ), which has developed algorithms that help the petroleum industry extract more oil, more cost-effectively. A University spin-out has further used these algorithms to develop a software tool, which was launched in 2012, and is attracting significant interest across the oil industry (Heriot-Watt University 2014b). The leader of an R&D team at Heriot-Watt explained us how R&D projects in collaboration with leading oil companies work.

Second, we interviewed a Professor in Laser Physics at Heriot-Watt University who has established and is leading a research group in Optical Holography and Micro-Optics. The research team develops technology which reduces the risk of counterfeiting banknotes. The interviewee has a patent and is being endorsed by various interested parties. In 2013, Mexico became the first country to adopt this technology and include its security features in the fifty peso banknote (Heriot-Watt University 2014c).

Third, we interviewed a (recently retired) Professor of Photonics who has led a research group at Heriot-Watt University in laser technology since 1986. This R&D team is collaborating with two leading technology companies, which develop and manufacture lasers and laser-based systems for the global industrial market. As the Managing Director of Rofin-Sinar UK Ltd states: “The majority of our current products derive from the research carried out by Prof [Name]’s team…this relationship and the Group's research outputs have enabled our company to grow consistently, accelerating during the recent recession by enhancing the performance of our laser range and expanding the applications space for them.” (Heriot-Watt University 2014a).

In Sweden, OI collaborations with four universities were explored, which differ in their academic direction. Umeå University, established in 1965, has key research fields in life sciences (especially medical and cell and molecular biology of plants), and ecology, among
others. Second, the Swedish University of Agricultural Sciences in Umeå (SLU - "Sveriges Lantbruksuniversitet", established in 1977), funded through the Swedish Ministry of Agriculture, is home to the Umeå Plant Science Centre. Besides, the study includes research centres that are associated with universities with a technological focus: Luleå University of Technology (LTU, founded in 1971), a public university in the north of Sweden, and the private Chalmers University of Technology in Gothenburg (established in 1829).

In Umeå, three professors and leaders of research groups in the field of environmental chemistry were interviewed. First, a Professor of Chemistry at Umeå University and Programme Leader of the “Bio4Energy” project, a joint research project on biotechnical tools to improve biomass production in trees. The project was established in 2009 and is a collaboration of universities (Umeå University, SLU and LTU), research institutes (Umeå Plant Science Centre, SP Processum AB), and companies from the pulp and paper industry (Bio4energy 2014). Second, another Professor of the department of Chemistry at Umeå University was interviewed, who leads a research lab that focuses on the environmental behaviour of anthropogenic compounds in the soil, water and air. The research group frequently collaborates with industrial partners. For example, the interviewee was the project leader of the Northern Sweden Soil Remediation Centre (2001-2011), a collaboration between three universities, nine local authorities, and 22 companies (MCN 2012). Third, we conducted an interview with a Professor in Ecophysiology at SLU, who is leading a research group that deals with nitrogen nutrition of plants. The research group is applying regularly for EU grants, involved in research for University spin-offs and collaborating with companies in the fertilizer industry.

In the Netherlands, we investigated R&D research group in companies that were collaborating with Delft University of Technology (established in 1842), the largest public Dutch technical university. The collaborations with the University of Leeds, LTU, Chalmers University and TU Delft will be explored from the point of view of the collaborating partner. This will be presented in the following sections on industrial partners and intermediaries.

**Industrial partners**

We focussed on the high technology sector of collaborative research between industry and academia, with mostly technical applications, and hence technology based companies were chosen. The main reason for such a choice is that high technology based companies are more geared towards OI and in general have a high number of collaborations with technical and research based universities for competitive advantage. We are aware that the industry/ research field can have a relevant impact on research and OI practices and leadership style but we are assuming that due to the collaborative nature of such practices, some common leadership characteristics would be deduced.

For our research, we conducted seven interviews with representatives from four different companies. We chose three large multi-national organisations, two located in the UK and one in the Netherlands; and two medium-sized companies in Sweden and the Netherlands. We specifically chose those organisations which have an established R&D development department or even innovation platform within the organisations so as to have the most appropriate sample for our research.

The first company that we chose is Toshiba, a multinational conglomerate corporation with headquarters in Tokyo, Japan. Within Toshiba, the most appropriate business unit for our research is Electronic Devices Business Group of Toshiba. We chose to explore Toshiba
Research Europe Ltd (TREL) Cambridge (established in 1991), which was Toshiba’s first overseas corporate-level R&D laboratory located in Cambridge, UK (Toshiba 2013). TREL actively collaborates with the University of Cambridge, one of the world’s top universities. We explored the collaboration of TREL with the Thin Film Magnetism (TFM) Group in Cambridge University. The collaborating partners mainly explore the fundamental and applied aspects of the TFM research.

The second company for our choice was P&G (founded in 1837), an American multinational consumer goods company headquartered in Cincinnati, Ohio. Within P&G, a dedicated Connect + Develop Board - part of the Company’s commitment to open innovation collaboration - identifies the potential academics partners for key projects, while university researchers also are encouraged to approach P&G with ideas. The objective is to build teams across both organisations that can respond flexibly to business, research and educational opportunities (Procter and Gamble 2014). The company’s attitude from resistance to innovations “not invented here” to enthusiasm for those “proudly found elsewhere” was highly successful (Huston and Sakkab 2006). P&G (located in Newcastle upon Tyne, UK) is in a strategic relationship with the University of Leeds which will harness academic research to develop new high-tech products, with more than 20 joint research projects (University of Leeds 2014). We studied this collaboration of P&G, and Leeds University for powder detergents in R&D Front End Innovation.

The final third company that we studied was Philips (founded in 1891), a Dutch diversified technology company headquartered in Amsterdam. It has a high focus on collaborative research and open innovation, with recent experimentation with crowd sourcing and social networking to come up with new technical solutions (Philips 2014a). Our main focus for research in Philips (located in Eindhoven, Netherlands) was in the Philips Innovation services (PINS) and Philips Research. PINS’s mission is to accelerate their customers’ innovation. We interviewed two respondents (both managers) from the Mechatronics department in PINS, who are actively involved in collaborative projects and have leadership roles in the organisations. Philips Research is involved in both inside-out” and “outside-in” innovation (Philips 2014b). We researched the “outside-in” innovation for Philips Research, by interviewing a principal scientist in Philips Research, investigating the collaboration between Philips and TU Delft.

AVL, founded in 1948, headquartered in Graz, Austria is the world's largest independent company for the development, simulation and testing technology of powertrains (hybrid, combustion engines, transmission, electric drive, batteries and software) for passenger cars, trucks and large engines (AVL 2014). AVL collaborates with various national, EU and international projects, which include a number of collaborations with industry and universities. For our study, we interviewed Head of R&D activities AVL MTC in Stockholm, Sweden; who is also a lead engineer, having a good working knowledge of the project level functioning of collaborations and of the OI strategy of the company.

Holst Centre bridges the gap between fundamental and developmental research by having an applied focus. It has various links with industry (multinationals to small SMEs from all over the world) and with various technical universities like TU Eindhoven, K. U. Leuven and University of Twente (Holst 2014). We interviewed a research scientist at the centre (located in Eindhoven, Netherlands), who is also responsible for some managerial aspects of the collaboration so we could better understand the OI activities as well as the leadership involved at the project level.
Intermediary organisations

To complete the triple helix, we interviewed a few mediators between industry and universities, so as to get a better understanding of the project level activities happening in collaborative OI projects and their understanding of the leadership role in such projects. These institutions either belong to the government or are largely funded by it. We interviewed three intermediary organisations from Sweden. Similar organisations were discovered in the UK and Netherlands, but we chose to not interview them, as we felt that the information provided was reaching a saturation stage and no further discoveries were being made.

VINNOVA is the Swedish innovation agency (founded in 2001), which strengthens and promotes Sweden’s innovation capacity for sustainable growth and community benefit, as well as funding needs-driven research. It also acts as the national contact agency for the EU Framework Programme for R&D (VINNOVA 2014). They promote collaborations between companies, universities, research institutes and the public sector. We interviewed a programme manager in the Services and ICT Division of VINNOVA (located in Stockholm) who is actively involved in the open innovation program and their intern activities involving VINNOVA’s customers.

SAFER Vehicle and Traffic Safety Centre (hosted at Chalmers and funded by VINNOVA) is a joint research unit which uses competencies from various partners from academia, society and industry with the aim to increase the competitive advantage of the centre’s partner companies and organisations. The main aim of SAFER is to make it a hub of excellence for vehicular safety. It provides multi-disciplinary research and collaboration to eliminate fatalities and serious injuries, making Swedish society, academy and industry a world leader in vehicle and traffic safety (Chalmers University 2014).

SAFER (located in Goteborg, Sweden) was specifically chosen as it fits well in the mediator category. It is placed in a Chalmers University, with strong industrial ties with large enterprises like Volvo and various SMEs. Two interviews were conducted from SAFER, one with the Deputy Director of SAFER, who could provide us with insight into the OI activities and collaborative ventures within SAFER. Another interview was conducted with an Asst. Professor at Chalmers University whose main focus is studying the managerial practices and inter-organisational collaboration in SAFER, who provided us with the project level understanding of the collaboration and the leadership involved in such projects.

Centre for Distance-Spanning Technology (CDT) is a research centre at Luleå University of Technology, Sweden, with a Quadra-helix structure which brings a close collaboration between universities, industries, government and citizens. We interviewed a project manager at CDT, who is well versed in its open innovation activities and could provide us with the project level functioning of such collaborative projects (Luleå 2014).
References


Groen, A. J. and Linton, J. D. (2010) 'Is open innovation a field of study or a communication barrier to theory development?', *Technovation*, 30(11), 554-554.


Heriot-Watt University (2014b) 'Innovative software boosts oil extraction', [online], available: [http://www.hw.ac.uk/research/impact/industry/innovative-software-boosts-oil-extraction.htm][Accessed 26 November 2014].


Van De Vrande, V. and De Man, A. P. (2011) 'A response to "is open innovation a field of study or a communication barrier to theory development?"', Technovation, 31(4), 185-186.


von Hippel, E. (2010) 'Comment on ‘Is open innovation a field of study or a communication barrier to theory development?’', Technovation, 30(11–12), 555.


