MASTER

Value and performance measurement systems in the Dyadic Open Innovation Collaboration between Industry and Academia
a case research study of Company and University (C&U) collaboration - Philips Lighting & TU/e Partnership

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Preface

This master thesis report represents the culmination of a life and academic project I wanted to achieve since a long time ago: To study at a master level in a foreign country. Coming to The Netherlands was not an easy decision. I left behind the comfortability of a job, the warm and charming environment, my family, and friends in Costa Rica. But, when in 2013 I got the admission to the Innovation Management Master Program at TU/e, I was completely sure this adventure will represent a stepping stone in my professional career that I am eager to start.

This research is an interesting project I decided to carry on. First, it provides a practical solution to a real-life problem that two organizations (public and private) want to solve. Second it contributes to the academic literature related to Open Innovation practices. A topic that paid my attention since the beginning of the master studies. And third, it was a great opportunity to demonstrate the knowledge acquired because of the master program, and also to learn more about university and industry partnerships. I am convinced that sooner or later, the experiences earned because of this project will help me to further contribute to the field of innovation practices.

This project could not have been completed without the aid of a few people. I would like to state my acknowledgement to my mentors, Thijs Peeters, Bob Walrave and Elke den Ouden for their collaborative support, useful insights and recommendations during the execution of this project. Also my appreciation to Harold Weffers, champion of this project. Our long discussing hours, debating, and proposing alternatives of solutions were infinitely useful for this research. Harold’s participation in this project was incredibly beneficial for the understanding of the context in which this research takes place. A special acknowledgement to all those who collaborated with this research during the interview sessions. Their insights, thoughts and opinions made possible this project.

Additional appreciation to my family. My parents and sister who supported me since I just decided to plan this journey in The Netherlands. To my relatives at Eindhoven for their support during these two years. To all my relatives in Costa Rica who also supported me when they realized about this academic endeavor. To my friends, here, there and over there all across the world who encouraged me before, during and after this adventure.

Last, but not least, I would like to state my appreciation to the Ministry of Science, Technology and Telecommunications of the Republic of Costa Rica for providing the partial funds to support this master studies throughout the scholarship funds of the Human Capital and Innovation for Competitiveness Program.

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Summary

This thesis project is executed by following a case research study to create a value and performance measurement system using Balanced Scorecards (BSCs) for the research partnership between TU/e and Philips Lighting. This case research is circumscribed Open Innovation theory, with its focus to further understand how to measure collaboration’s performance in a dyadic base: Company and University (C&U). Its main research question is the following (Chapter 1):

What are the key components of a Value and Performance Measurement System within the context of a C&U innovation collaboration partnership between TU/e and Philips Lighting?

The literature review (Chapter 2) of this research first provides an overall discussion about Open Innovation theory. Its concept, elements, and archetype processes. Then, it further elaborates on the specifics of Open Innovation networks: Key characteristics of Open Innovation network are discussed, the importance of alliances between industry and academia, and facilitating factors of these alliances are argued as well. An essential topic discussed is centered on how to measure value and performance on the dyadic collaboration partnerships between commercial firms and a university. In this regard, three main trends are identified within the academic literature: (1) Impact of intangible outputs of university and industry collaborations (George, Zahra & Wood, 2002; Hanel & St-Pierre, 2006 and Lööf & Bronström, 2008), (2) single operational metrics (Lundberg et al, 2006; Dooley & Kirk, 2007 and Laursen & Salter, 2006), (3) and value and performance systems (Philbin, 2008, Perkmann, Neely & Walsh, 2011) using BSCs (Al-Ashaab et al, 2011 and Hellström & Jacob, 1999). The third trend I used as main academic input to design the value and performance measurement system for the TU/e and Philips Lighting partnership.

This study is executed as a case research study as main research method (Chapter 3). Case research is appropriate for exploratory studies (Bhattacherjee, 2012) within real-life or business related contexts (Yin, 2003 & Gummensson, 2000) when the target audience, e.g. managers, must implement findings related to the study. It is also useful when trying to understand in depth historic, present and/or future events and relationships among them (Gummensson, 2000), bounded by time and activity (Crewell, 2003). The methodology is partially adapted from the regulative process cycle (van Strien, 1997). It incorporates a descriptive analysis of the collaboration partnership between Philips Lighting and TU/e, then it assesses the strategic collaboration plans of both organizations, and evaluates the current state of the collaboration activities. Its main data collection methods included semi-structures interviews, and secondary data analysis. The information was interpreted and analyzed via content analysis, and workshop sessions useful to finally design of value and performance mechanism system proposed as possible intervention.

As part of the problem analysis (Chapter 4), it was possible to identify the following: The alliance strategy is materialized through the establishment of a vision statement that incorporates key and common activities (research and development) for both organizations (Porter, 1996): Responsible research and innovation shared activities (structurally aligned). Furthermore, the partnership has put in place a set of strategic goals that serve as main guidance mechanisms that facilitate evaluation of strategy’s execution (Collins & Porras, 1996). Furthermore, there is an organizational structure that enables deployment of the strategic objectives, communication, tracking and analysis of results.

Following with the problem analysis, additional adaptation of the current measurement of the collaboration activities is required (Al-Ashaab et al, 2011, Chesbrough, 2003b; Kaplan, Norton & Rugelsjoen, 2010). Currently, value and performance is being measured through KPIs targeted to the
following strategic objectives: Creation and dissemination of knowledge, and human capital development. Other strategic objectives, mentioned in the vision statement, are not currently being measured: *Add significant value with economic relevance delivering economic pay-off, and consolidate and expand continuously learn and to add more value through expanding the ecosystem*. These last two objectives are referred to as possible improvement opportunities for value and performance measurement by interviewees. As such, the current way of measuring value and performance do not fully cascade the organizational vision and strategic objectives into the all applicable perspectives for strategic follow-up (Norton & Kaplan, 1992).

In order to overcome the above mentioned findings, a proposed value and performance measurement system using BSCs was designed (Chapter 5). Its main intention is to incorporate the vision statement, strategic objectives, and the adapt / create (sub)-perspectives with respective KPIs (Chesbrough, 2003; Norton, Kaplan & Rugeljsoen, 2010, Al-Ashaab et al, 2011 & Hellström & Jacob, 1999). These perspectives are the following (bottom-up approach): (1) A financial perspective which includes a funding and financial stewardship sub-perspectives. (2) A foundation sub-perspective *capacity building*, which is part of the partnership processes perspective. (3) A Partnership processes and a growth perspective which include a span of human capital, knowledge and ecosystem sub-perspectives. Finally, (4) the stakeholder perspective is the top one, directly linked to the vision statement. The (sub)-perspectives are complemented with a set of KPIs, included to evaluate all the important aspects of the partnership (Perkmann, Neely, & Walsh, 2011). These KPIs were formulated based on the current list of KPIs used by the two organizations and on the ones recommended by Al-Ashaab et al (2011), Perkmann, Neely, & Walsh, (2011) and Philbin, (2008). These metrics were allocated considering an input, process-based and output approach as extracted from the interviews in order to assess impact in one (sub)-perspective at the expense of another. With the implementation of this value and performance measurement system, the partnership will be able to better leverage and master this relationship and streamline its processes for future collaborations (Melese et al, 2009).

Additional recommendations (Chapter 5) are provided as part of the implementation of this solution. These recommendations span from setting-up targets and thresholds, strategy and results communication, how to facilitate the expansion of the current ecosystem by including new actors, social aspects within the collaboration, and continuous review and adaptation of the value and performance measurement system. These suggestions represent possible new projects by their own and as such, it is also advised to the partnership to include them as part of their project portfolio management to track advance and future implementations.

This study looked for further contributing to the academic literature related to BSCs within the context of C2U Open Innovation partnerships. This research was specific by considering only aspects of value and performance of concern of the two organizations involved in this partnership. It can be considered as an additional example on how BSCs and performance metrics should be created and/or adapted within this types of partnerships. It should also serve to practitioners as a comparative guide on how implement a C2U value and performance measurement system.

Finally, suggestions for future research rely on the conditions that facilitated how an academic institution (co)-leads a partnership as in this case, and how it could potentially (co)-lead and build an innovation ecosystem by attracting more complementors to the current partnership. Another future research direction relies on how to implement a value and performance measurement system applicable to the context of multi-party partnerships.
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1 Introduction
This report contains the analysis and results to design a value and performance measurement system in a Company and University (C&U) partnership within the context of Open Innovation collaborations. A measurement system using Balanced Scorecards is designed and proposed as main solution of a real-life alliance between TU/e and Philips Lighting. In this chapter, first it is provided a brief theoretical-based introduction, the respective problem statement and contributions to the academic literature. Next, the set-up of research (sub) questions are provided as main guidelines of this case study research. Finally, the report outline is provided as well.

1.1 Introduction and Problem Statement
Open Innovation is a recent concept which is being increasingly practiced by different organizations, both private and public. The main idea behind is that a single firm is less efficient by developing new innovations by its own. Instead, companies should focus on how to use external and internal ideas, and internal as external paths to market to advance technologies (Chesbrough, 2003a, 2003b & 2004). The concept of Open Innovation is based on the landscape of abundant inflows and outflows of knowledge (Chesbrough, 2003a & 2003b) needed to accelerate the internal innovation processes and also to expand the markets for external use of innovations (Gassmann, Enkel, & Chesbrough, 2010).

Furthermore, Open Innovation can also be considered as a method on how firms develop strategies to improve their innovation processes (Etzkowitz & Leydesdorff, 2000), based on the fact that companies with open search strategies for new technologies tend to be more innovative (Laursen & Salter, 2006) and are able to enhance their innovation intensity (Becker & Dietz, 2004).

Alliances among different actors around Open Innovation activities are dynamic since they evolve through time according to the dynamics of business and technologies (Chesbrough, 2003b; Chesbrough, 2007 and Chesbrough & Prencipe, 2008). In the context of academia and industry collaborations, these partnerships represent a specific way on how to engage into Open Innovation activities (Gassmann & Enkel, 2004), where universities are taking a key role in the generation and diffusion of knowledge for industrial innovations agents (Mansfield & Lee, 1996 and Etzkowitz, 2003).

As a result, there is a transformation of academia into a source of innovations, transforming the innovation processes from internal within the firm to one between and among organizations (Etzkowitz, 2003). As a result, universities are key actors of Open Innovation initiatives (Chesbrough, 2003b) to partner with since they become key contributors to economic and industrial developments (Etzkowitz & Leydesdorff, 2000).

The increasing practice of Open Innovation activities and its potential benefits for commercial and academic organizations stimulates the need to further understanding how to measure collaborations performance in a dyadic base: Company to University (C2U). Current literature focuses in the development of process-based performance measurement systems (Philbin, 2008 and Perkman, Neely & Walsh, 2011) and on the adaptation of Balanced Scorecards (BSC) to the specific characteristics of the collaboration activities (Hellström & Jacob, 1999 and Al-Ashaab et al, 2011). The work of Al-Ashaab et (2011) and Philbin (2008) are the only ones with empirical validation in specific C2U collaboration contexts. Both studies carried out survey-based consultations to different and knowledgeable external stakeholders and their findings and suggestions were then applied to the design on value and performance mechanism systems. As such, further empirical studies are needed in this topic applied to the specific characteristics from the inside of a C2U alliance partnership. This study is intended to design a value and performance measurement system by using a BSC in a real-life collaboration partnership...
between academia and industry. It aims to further contribute to the academic literature by providing an specific case research study. It analyzes the innovation-related collaboration partnership between Technische Universiteit Eindhoven (TU/e) and Philips Lighting, both organizations located in the province of Noord Brabant, The Netherlands. This case research study provides a specific analysis from the insights of the two organizations by taking into account the current statement vision, strategic objectives and by a deep understanding of opinions of key stakeholders involved in this partnership. As a result, this study is specific and applied since it does not look for deducting a solution from external sources of information.

The need of a management oriented method and tool to measure collaboration performance is key for further strategic decision making, able for adaptation and shaping the evolution and dynamics of the collaboration partnership. As indicated in the literature review section, each collaboration partnership is unique, with its own characteristics and strategic objectives. As such, it is advised to adapt or develop beyond the traditional set of perspectives of BSC’s (Chesbrough, 2003; Norton, Kaplan & Rugelsjoen, 2010, Al-Ashaab et al, 2011 & Hellström & Jacob, 1999) within the context of C2U collaborations, linked to the strategic vision and success factors (Norton & Kaplan, 1993) set by the alliance partners. Moreover, it is crucial to provide commercial and academic organizations with a detailed description on how to assess their strategic areas of focus (perspectives) when implementing a performance measurement system with BSC’s. The way as a BSC is used will influence the organization’s performance (Braam & Nijssen, 2004).

This collaboration partnership is chosen because of the high economic and technological importance of Philips Lighting within the region of Noord Brabant, its historic ties with TU/e and because of the fact that TU/e and the Lighting Division represent a partnership characterized in a dyadic basis. Furthermore, both organizations have signed-off a long term (ten years) collaboration agreement in 2014, intended to cooperate in the development and exploitation of new innovations “…bringing solutions to grand societal challenges” (Eindhoven University of Technology, 2014). This alliance exemplifies a clear indication on how these two organizations decide to formalize more hierarchical ties, intended to broaden their existing technological capabilities, reflecting more trust and high commitment (Dittrich & Duysters, 2007 & Eindhoven University of Technology, 2014).

1.2 Research Question and Sub Questions

Based on the strategic and long term characteristics of this dyadic partnership, this case study research analyses and proposes a value and performance measurement system needed for strategic decision making. Therefore, the following research question is proposed:

What are the key components of a Value and Performance Measurement System within the context of a C&U innovation collaboration partnership between TU/e and Philips Lighting?

Furthermore, it is necessary to fully understand the respective strategic path both organizations want to pursue, and the current state of the collaboration efforts in order to develop and implement the value and performance measurement system for the C&U partnership. This analysis fits with the theoretical argument discussed in this study: From the importance of this collaboration, main factors that facilitate this collaboration to happen and the archetype processes of both organizations within the context of Open Innovation. Also, it discusses the shared strategic vision that drives the efforts of this collaborations alliance, its current success factors, areas of impact (perspectives), measurement
methods, use of KPIs and respective alignment among different actors involved in this partnership. According to this, the following sub research questions are proposed:

- **What are important characteristics of a relevant performance measurement system?**

- **What are the main characteristics of this partnership within the context of Open Innovation?**

- **What is the strategic path of the collaboration partnership for both organizations?**

- **What is the current state of the value and performance measurement mechanisms of this collaboration partnership?**

### 1.3 Report Outline

This report is organized as follows: Chapter 2 details the respective literature review in which this study is founded and serves as input information in order to answer the research (sub) questions. This is based by the integrations and reflection of the Open Innovation theory, dyadic innovation networks and collaborations, and how to measure value and performance within these contexts. Chapter 3 explains the research methodology used in this thesis. It also reflects about the quality aspects of these methods. Chapter 4 consists of the problem analysis, initiating with a brief historic background description of the partnership alliance between TU/e and Philips, followed by the assessment of their strategic collaboration plans, current state of collaboration activities. It also provides the results gathered from interviews and analysis of secondary data. Finally a discussion of results is provided by answering respective (sub) research questions and providing a solution direction. Next to this, Chapter 5 focuses on the design of a value and performance mechanism system by incorporating the findings of Chapter 4 and theoretically based on Chapter 2. Finally, Chapter 6 provides conclusions and recaps on the answers to the research (sub) questions, the theoretical contributions of this study, respective managerial implications and limitations, and suggestions.
2 Literature Review

This literature review aims to analyze how alliances between industry and academia are characterized within the context of Open Innovation collaborations and argues the need for a measurement system and tool(s) to assess value and performance for strategic decision making. First, an explanation of Open Innovation is provided, its respective implementation elements and process archetypes. Second, innovation networks and alliances are explained as a strategy of Open Innovation. The dynamics and adaptive processes around collaborations are discussed, followed by the description and role of academia within partnerships. Finally, value and performance mechanisms are discussed in different viewpoints, from impact on innovation performance, single operationalized measures and strategic process-based perspectives with the use of Balance Scorecards.

2.1 Open Innovation

Henry Chesbrough coined the term Open Innovation in the early 2000’s as a new paradigm where companies can use external and internal ideas, and internal as well as external paths to market to advance technologies (Chesbrough, 2003a, 2003b & 2004). The concept is based on the landscape of abundant knowledge (Chesbrough, 2003a & 2003b) needed to accelerate the internal innovation processes and also expand the markets for external use of innovations based on the inflows and outflows of knowledge (Gassmann, Enkel, & Chesbrough, 2010). In this regard (Figure 1), the innovation funnel becomes porous (Chesbrough, 2003a & 2003b) since its respective processes do not necessarily take place within the boundaries of firms, thus the innovation processes are distributed among a larger number of actors, e.g. customers, universities, suppliers, companies, etc (Elmquist, Fredberg & Ollila; 2009). Saying this, different innovation projects can be launched from internal or external sources and new technologies can enter at different or various stages of the innovation funnel and also projects can go to market in many different ways (Laursen & Salter, 2006).

![The Open Innovation Funnel (Chesbrough, 2003b)](image)

The traditional model of Closed Innovations requires control by firms to generate ideas, then develop, build market, distribute service, finance and support on their own by firms (Chesbrough, 2003a & 2003b). With Open Innovation, the traditional model is challenged by increasing fast times to market (Chesbrough, 2003b), the gradual availability of knowledge workers, a higher availability of venture capital market specialized to create new firms and an increasing scope of capable external suppliers (Christensen, Olesen, & Kjær, 2005).

The notion of Open Innovation is not an altogether new phenomenon since other scholars (e.g. von Hippel with lead user research, Cohen and Levinthal and their absorptive capacity studies) have made
some previous contributions (Christensen, Olesen, & Kjær, 2005). Also, high tech companies, e.g. Xerox or Intel have implemented similar strategies from previous years (Chesbrough, 2003b). However, Open Innovation practices and studies are in a continuum since more companies, research organizations and universities are putting into practice this paradigm (Gassmann, Enkel, & Chesbrough, 2010).

Enkel and Gassmann (2004) have identified that high product modularity, high industry speed, more explicit and tacit knowledge required for development, highly complex interfaces and the creating of positive externalities; are the most important determinants that ease the implementation of Open Innovation practies. However, other studies (Rodrigues, Maccari, & de Abreu Campanario, 2011) have mentioned that adherence to the technological footprint as main inducer of the Open Innovation processes, and search of incremental innovations facilitate its implementation. Also, Guan et al (2009) indicate that the need for radical innovations induce into collaborations with research institutes and universities. Thus, there is a wide field of evidence that demonstrate the need and importance of Open Innovation nowadays and why it is being implemented in different organizations.

Finally, even though there are quite visible motives for initiating into Open Innovation practices, organizations also face certain kinds of risks, such as: a potential loss of knowledge if mismanaged, higher coordination costs, as well as loss of control and higher complexity. As part of their internal barriers, firms might face difficulties in finding the right partner, imbalance between open innovation activities and daily business, time and financial resources not fully available for open innovation activities (Lichtenthaler & Ernst, 2007).

2.1.1 Elements of Open Innovation

There are three important elements for the implementation of Open Innovation: Business Models, Structure and Culture (Chesbrough, 2003a). These elements will be discussed since they are key to understand and evaluate inside the firm before to implement any Open Innovation activity.

2.1.1.1 Business Models

These are the methods of doing business by which organizations can sustain themselves: generate revenue. They also indicate where the firm is positioned in the value chain. Their main functions rely on the value proposition, the targeted market segment, the structure of the value chain, estimate cost structure with its profit potential and position of the firm within the value network. Finally, business models formulate a competitive strategy (Chesbrough & Rosenbloom, 2002; Chesbrough, 2006). Their ultimate role is to ensure the technological core of the innovation delivers value to the customer (Chesbrough & Rosenbloom, 2002).

2.1.1.2 Structures

Open Innovation is also viewed as collaborative process among different parties, rather than as a commercial market of ideas (Elmquist, Fredberg, & Ollila, 2009). As a result, organizations are able to collaborate at any stage of the innovation funnel (Laursen & Salter, 2006; Chesbrough, 2003b) with the integration of suppliers, customers and external knowledge sourcing (Gassmann & Enkel, 2004; Enkel, Gassmann, & Chesbrough, 2009). Because of this, firms need to take into account external knowledge exploitation as a strategic activity (Lichtenthaler & Ernst, 2007) in order to engage into collaboration activities. The appropriate partner to engage with and the respective collaboration strategy will be determined on the phase of the development of the new technology.
2.1.1.3 Culture
Based on Elmquist, Fredberg and Ollila (2009, p 331-332), “...resistance towards Open Innovation was found as powerful forces inside the organization worked to harness current technology rather than search for new technologies”. This could happen because of different factors: set of values within the company, concrete artifacts like incentive systems, information systems and communication platforms, project decision criteria, supplier evaluation, etc.(Gassmann, Enkel, & Chesbrough, 2010). As a consequence, the Not-Invented-Here Syndrome (NIH) or the Not-Sold-Here Syndrome (NSH) among the employees can happen as roadblocks for Open Innovation (Chesbrough, 2003b). The importance to overcome these issues is that companies and organizations face that cooperation with externals is core to increase innovativeness and reduce time to market (Christensen, Olesen and Kjær, 2005).

2.1.2 Archetypes Open Innovation Processes
The innovation process needs complementary contributions that might come from different types of players (Christensen, Olesen, & Kjær, 2005). Based on this, three types of archetypes of Open Innovations processes are identified (Figure 2): Outside-In Process, Inside-Out Process and Coupled Process (Gassmann & Enkel, 2004; Gassmann, Enkel, & Chesbrough, 2009).

![Figure 2: Archetypes of Open Innovation Processes (Enkel, Gassman, 2004; Enkel Gassman & Chesbrough 2009)](image)

In the Outside-in process, companies will be enriching their own knowledge base through the integration of suppliers, customers, and external knowledge sourcing. This can be achieved by, e.g., customer and supplier integration, listening posts at innovation clusters, applying innovation across industries, buying intellectual property, investing in global knowledge creation (Gassmann & Enkel, 2004; Enkel, Gassmann, & Chesbrough, 2009) and/or sourcing and acquiring (Dahlander & Gann, 2010).

Regarding to the Inside-out process, companies can earn profits by bringing ideas to market via selling and revealing IP (Dahlander & Gann, 2010) and achieve strategic opportunities, thus multiplying technology by transferring ideas to the outside environment. With this approach, companies focus on externalizing their knowledge and innovation to bring ideas to market faster than they could through internal development processes (Gassmann & Enkel, 2004; Enkel, Gassmann, & Chesbrough, 2009). As a consequence, inside-out processes provide positive business performance, specially at different industry environments (high transaction rates, technology turbulence and competitive intensity) (Lichtenthaler, 2009), but it also provides non-monetary (strategic) benefits, e.g. new market
knowledge, stronger organizational and process structures for inside-out activities, set industry standards, among others (Lichtenthaler & Ernst, 2007).

The final archetype is the Coupled Process, in which there is co-creation with complementary partners through alliances and joint ventures. In this regard, give and take are factors crucial for success. With this approach, companies combine the outside-in and -in processes; so in order to do both, companies co-operate with other partners over long periods of time via strategic networks. Success of this archetype is determined by the company’s ability to find and integrate the right partner(s) that can deliver the competencies and/or knowledge required to gain a competitive advantage in the own industry or sector. (Gassmann & Enkel, 2004; Enkel, Gassmann, & Chesbrough, 2009).

Both, elements and archetype processes are interrelated and involve external parties. Appropriate management will be of key importance to determine successful implementation of Open Innovation within organizations (Chesbrough, 2003b). These elements and archetypes can be included as part of the organization or alliance vision, which should reflect a fit among the activities the organizations execute (Porter, 1996). Furthermore, a deployment of strategic objectives may serve as guidance mechanisms (Collins & Porras, 1996) in order to materialize a Open Innovation strategy and vision.

2.2 Innovation Networks and Collaborations

As mentioned, organizations are creating and engaging in collaboration networks to open up their innovation processes, so they can accelerate their internal innovations and also expand the markets for external use of innovations; this based on the inflows and outflows of knowledge (Gassmann, Enkel, & Chesbrough, 2010). These networks are also referred as external sources of technologies (Chesbrough & Prencipe, 2008), which are quite important in sectors where technologies change rapidly and their life cycles are short (Dittrich & Duysters, 2007). Based on Melese et al (2009), innovation collaborations are a major change in firm’s strategic directions, where companies with open search strategies for exploration and exploitation of new technologies are found as more innovative (Laursen & Salter, 2006), since collaborations enhance innovation intensity from the firm’s side (Becker & Dietz, 2004).

2.2.1 Innovation Networks: Dynamic and Adaptive Processes

Innovation networks are dynamic, they evolve by means in which firms adapt and align their business models, so with their networks they can access the required resources needed to sustain business growth (Chesbrough & Prencipe, 2008). By doing this, companies elaborate collaborative ties that are low in terms of commitment and reversible at the early stages of development. This is due to the high levels of uncertainty associated with a certain technology; therefore organizations create connections with, e.g., research centers or universities intended to explore technological solutions (van de Vrande, Lemmens, & Vanhaverbeke, 2006; Chesbrough & Prencipe, 2008). They also search for new technological capabilities, look for weak ties with partners, they reflect an opportunistic behaviour characterized by low commitment and establish non-equity agreements (Dittrich & Duysters, 2007).

Later on, when uncertainty has decreased (e.g. because of R&D investments), firms tend to engage into governance modes that are less reversible and more hierarchical, moving to more exploitative ties with, e.g., suppliers and/or customers (van de Vrande, Lemmens, & Vanhaverbeke, 2006; Chesbrough & Prencipe, 2008). Here, organizations broaden existing technological capabilities, reflect more trust and high commitment and are more likely to establish equity agreements (Dittrich & Duysters, 2007). As
seen, “the dynamics of technology development should reflect the dynamics of a firm’s network” (Chesbrough & Prencipe, 2008 p. 414).

2.2.2 The Dyadic Collaborations between Academia and Industry
Universities are taking a role of knowledge generation entities (Etzkowitz, 2003) engaging into more collaboration ties with industry since they are key actors in “...originating and promoting the diffusion of knowledge and technologies that contribute to industrial innovations” (Mansfield & Lee, 1996 p. 1047). Universities are presumed as vital sources of local knowledge spillovers since they are seen as valuable partners for new ideas and knowledgeable collaborators (Ponds, van Oort, & Frenken, 2010).

The need of Academia and Industry collaboration relies on different aspects. From the university’s side, their nature, structures and governance regimes limit them to further develop innovations at later stages (e.g. product development, marketing, commercialization, among others); thus it is easier to partner with firms instead of developing innovations by themselves (Picado Arroyo et al., 2015). From the firm’s side, the speed of market, shorter product life cycles and the need to take into account external knowledge exploitation as an strategic activity (Chesbrough, 2003b; Lichtenthaler & Ernst, 2007) to complement internal R&D (Becker & Dietz, 2004) force companies to embrace business models that facilitate partnership with universities (Chesbrough, 2006). These collaborations can be materialized as institutionalized ways, e.g. research partnerships and research services (Perkmann & Walsh, 2007) or in a more individualized approach, where researchers interact in consultancy activities or joint research with firms (D’Este & Patel, 2007). As noted, there are outflows and inflows processes of a coupled Open Innovation archetype process at both, academic and commercial organizations, in this dyadic collaboration, especially with partnership arrangements (Enkel, Gassman, 2004; Enkel Gassman & Chesbrough 2009).

Certain kind of factors facilitate the collaboration process between universities and industry. Fabrizio (2006) mentions that regimes, type of knowledge and competences of firms facilitate the process of knowledge exchange within this dyadic network. Willingness of firms to search and screen technologies and knowledge significantly affect the collaborative projects (Fontana, Geuna & Matt, 2006). Here, internal R&D has a key part in the identification of external technological opportunities and exploitation of externally acquired technologies (van de Vrande, Lemmens, & Vanhaverbeke, 2006). Furthermore, initiatives and capabilities of both parties have a positive impact in the collaboration process (Lai, 2011). Finally, geographical proximity and the quality of the academic institution are key variables on firm’s decision to collaborate (Laursen, Reichstein & Salter, 2011).

Importance of the collaboration networks with universities relies on the fact that their collaborative relationships go further than generic links, these relationships play a stronger part in creating new innovations (Perkmann & Walsh, 2007). Companies which engage in open search strategies tend to be more innovative (Laursen & Salter, 2006). From the side of universities, collaboration ties represent a way they can embrace the so called third mission of contributing with economic development (Etzkowitz & Leydesdorff, 2000). Contributions are not just limited to novel inventions and radical innovations, universities are also quite important at latter stages of the innovation process and moving to more entrepreneurial roles by commercializing technologies (Perkmann & Walsh, 2007 & 2009); rather than on the early stages of innovations (van de Vrande, Lemmens & Vanhaverbeke, 2006). This situation confirms from a theoretical point of view, that the dynamics of technology development
reflect the dynamics of the network (Chesbrough and Prencipe, 2008), since universities are evolving to more important participations at latter stages of the innovation funnel.

There are certain advantages of this dyadic network, specifically on the C2U collaboration efforts. These collaborations enable a better leverage of existing relationships, it is possible to master current agreements and streamline processes for future collaborations. However, there are also some disadvantages; for example there might be limited to certain capabilities and expertise if firms partner with a single university, academic research might be limited in terms of scope and the university can be seen as a company’s extension. Finally, collaboration activities might cope issues related to confidentiality, publishing, intellectual property and ownership (Melese et al, 2009).

As noted, the collaboration process between one commercial company and an academic institution involves several features that justify why these organizations collaborate, where several factors are identified as facilitators of this collaboration process at both sides. As a consequence, both university and company, may take profit of the advantages while formalizing into dyadic collaboration ties. However, possible disadvantages need to be identified in order to set-up expectations and properly manage outcomes. Figure 3 briefly summarizes all the characteristics involved in C2U collaborations.

<table>
<thead>
<tr>
<th>Reasons to Collaborate</th>
<th>Facilitating Factors</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Organizations</td>
<td>Speed of market and shorter product life cycles force to seek and exploit new sources of knowledge.</td>
<td>Willingness to seek for external knowledge.</td>
<td>Companies tend to be more innovative.</td>
</tr>
<tr>
<td></td>
<td>Need to complement internal R&amp;D</td>
<td>Internal R&amp;D as screening agent of external knowledge.</td>
<td>Leverage of existing relationships.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Internal capabilities and initiatives.</td>
<td>Master current agreements and streamline future collaborations.</td>
</tr>
<tr>
<td>Universities</td>
<td>Nature, structures and governance regimes limit to further develop innovations at later stages.</td>
<td>Geographical proximity to firms.</td>
<td>Opportunity to embrace the so-called third mission.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quality of the academic institution</td>
<td>Master current agreements and streamline future collaborations.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Internal capabilities and initiatives.</td>
<td></td>
</tr>
</tbody>
</table>

Figure 3: Summary of C2U Collaborations Characteristics (Arroyo et al, 2015; Becker & Dietz, 2004; Chesbrough, 2003b; Lichtenthaler & Ernst, 2007; Fabrizio, 2006; Laursen, Reichstein & Salter, 2011; Laursen & Salter, 2006; Perkmann & Walsh, 2007; Fontana, Geuna & Matt, 2006; Etzkowitz & Leydesdorff, 2000 & Melese et al, 2009)

2.3 Value & Performance Measurement in the Academia & Industry Collaborations

How to measure value and performance in the collaborations between academia and industry is a topic that has been studied in different perspectives. Chesbrough (2003b & 2004) has mentioned the importance to adapt usual metrics and create new ones for managing open innovation activities. By doing this, organizations need to cope with certain challenges when measuring performance, such as intangible and complex project outputs, benefits of project outcomes may be realized in the long term and decision making on how performance should be judged and compared against with (Daniel,
So, it is difficult to set clear objectives or to evaluate outcomes in collaboration activities due to the uncertain nature of some research activities (Perkmann, Neely, & Walsh, 2011). The following paragraphs will discuss and compare differences found in the literature, while Appendix 1 briefly summarizes the main findings and differences in terms of assessment criteria on how to measure value and performance.

By trying to overcome the above mentioned difficulties, some scholars have focused their research efforts on the impacts of collaborations and firm’s innovation outputs. Cheng Guan, Yam and Mok (2005) measured novelty of industrial innovation and found a positive relation with university collaborations in China. George, Zahra and Wood (2002) found how firms with university linkages are able to attract more technological alliances, obtained more patents, have lower R&D expenses and have higher financial performance. Furthermore, based on an econometric perspective, Hanel and St-Pierre (2006) indicate that collaborations have positive impacts on innovation originality and on performance indicators in the context of Canadian manufacturing firms. Finally, Lööf and Bronström (2008) found a positive influence on the innovative activity and innovation sales of large manufacturing companies. All of these research approaches confirm the added value of collaborations in the context of Open Innovation activities. Collaborations between industry and academia are not except to contribute for more innovative outputs (Laursen & Salter, 2006) and enhance innovation intensity (Becker & Dietz, 2004) as discussed previously. However, these studies do not address the issue on how to measure innovation value and performance in the context of Company to University (C2U).

Other studies have focused on very specific operationalized metrics to understand the impact of C2U collaborations. In this regard, Lundberg et al (2006) have analyzed these partnerships by using two indicators: Co-authored publications and co-funding; based on the fact that co-authorship not necessarily happens because of co-funding, thus they suggest these two complementary indicators to measure the collaboration effects. Next, Dooley and Kirk (2007) link collaboration success with knowledge transfer related metrics, so measuring the rate of knowledge development and speed of knowledge transfer and exploitation. And finally, Laursen and Salter (2006) discussed that patents can only be considered as a partial indicator of the innovation process since most of patents are not commercialized. Also, many innovations are not even patented or partly covered by patent protection. These studies represent an attempt to provide firms with some useful metrics for innovation value and performance in their C2U collaboration efforts.

As shown, there are different academic efforts on how to measure value and performance in the collaboration activities of industry and academia. Still, the above mentioned studies do not cover in a integral way several indicators in different perspectives, since no single indicator can represent all the salient aspects of collaboration activities. Therefore, a set of measures is required for a value and performance measurement system (Perkmann, Neely, & Walsh, 2011) useful for strategic guidance in research and innovation development, and for managerial and decision making purposes (Rohrbeck & Arnold, 2006). A value and performance measurement system will be quite convenient within the context of a coupled archetype process of Open Innovation, where formal and hierarchical collaboration efforts are made in order to work in C2U alliances (van de Vrande, Lemmens, & Vanhaverbeke, 2006; Enkel, Gassman, 2004; Enkel Gassman & Chesbrough 2009). Also, a value and performance measurement system can be accompanied with a performance measurement tool, with SMART metrics (Specific, measurable, achievable, realistic and timed-based) (Philbin, 2008).
Following the above argument, a first approach to discuss is the performance measurement tool developed by Philbin (2008). It includes a framework of inputs, transformational and output processes with a feedback loop (Figure 4) for further learning and adaptability of the collaboration activities. A similar proposal is, theoretical-based, the balanced performance measurement system developed by Perkmann, Neely and Walsh (2011). It includes a success map that allows organizations to identify several measures of each stage component of the measurement system. This success map is divided in four different stages which include Input, In-Process, Output and Impact perspectives with their respective metrics (Figure 5). The impact stage mainly centers on the benefits delivered by alliances in terms of business performance.

As discussed, both measurement systems, Philbin (2008) and Perkmann, Neely and Walsh (2011) are intended to be used in C2U collaborations and their process-based approach plus the use of several indicators provide useful strategic guidelines for value and performance measurement. These guidelines are based on theoretical frameworks of successful collaboration partnerships and both proposals have in common a process-based approach. However, in both studies is not clear the difference of strategic perspectives to be measured. According to Figures 4 and 5, both proposals converge into measurement processes. Finally, the work of Philbin (2008) is the only which is augmented by research with several stakeholders of real-life collaboration partnerships, so at least it provides empirical evidence of its potential applicability.

An alternative option to discuss is the use of a Balanced Scorecards (BSC) with strategic perspectives applicable to C2U collaborations. The use of BSC is quite useful to measure value and performance (Al-Ashaab et al, 2011). A BSC cascades the organizational vision and strategic objectives into four main traditional perspectives for strategic follow-up: customer, financial, internal business process and
learning and growth. With those perspectives, the BSC allows to identify if the business have improved in one area at the expense of another (Norton & Kaplan, 1992). But, as stated by Chesbrough (2003b), the traditional perspectives of the BSC are not necessarily appropriate and nor useful to measure the outcomes of open innovation activities. So, the implementation of BSC’s within the context of C2U alliances need to show flexibility in order to adjust to new perspectives (Kaplan, Norton & Rugelsjoen, 2010). Therefore, as empirically demonstrated, the way a BSC is used influences organization’s performance (Braam & Nijssen, 2004).

Following the previous discussion, the work of Al-Ashaab et al (2011) provides a set of perspectives related to competitiveness, innovation, sustainable development, human capital, strategic partnerships and internal business processes. These perspectives were determined based on the identification of literature trends on research collaborations and confirmed based on surveys with ten different collaboration partnerships in the UK. Additionally, the earlier study of Hellström and Jacob (1999) provides a set of complementary and different perspectives as well (theoretically-based): fertility (related to the proportion of projects developed, spin-offs, etc), reach (related to the structure and connections of the network), financial success, education (use and exploitation of educational and human capital resources), publications and management of intellectual property. This particular study only focuses on the determination of the mentioned perspectives, but it lacks of further development into the specialization and operationalization of the proposed perspectives. It also lacks of empirical testing as Al-Ashaab et al (2011) did provide. The later one tests their tool with two additional collaboration projects. With this empirical testing, firms selected the most applicable perspectives to their particular needs. As a result, it can be noticed how firms adequate their strategic goals to new or adjusted perspectives as noted by Chesbrough (2003b) and Kaplan, Norton and Rugelsjoen, (2010). Comparison of the perspective differences proposed by Norton and Kaplan (1992), Hellström and Jacob (1999) and Al-Ashaab et al (2011) is shown in Appendix 2.

Based on this evidence, it can be seen how different scholars have tried to address the issue on how to measure value and performance in the industry and university collaborations. As discussed, three main trends are identified: First, those authors who based their research methods on statistical and econometric analysis, focused on the general impacts of industry and university collaborations. Second, those who targeted the industry and university collaborations on C2U partnerships by using single and specific operationalized metrics. Finally, the development of value and performance measurement system and the use of BSC’s as integral and management oriented tools for decision making. Important to notice that the use of different perspectives rely on the strategic objectives of the collaboration characteristics assessed by the studies discussed here. It is also important to understand how the works of Philbin (2008) and Perkmann, Neely and Walsh (2011) provide a process-based approach, with inputs, in-process and output metrics. This particular feature is not present in the works of Ashaab et al (2011) and Hellström and Jacob (1999). As seen, value and performance measurement systems is a broad topic subject for further theoretical and empirical development. This is concluded based on the diverse approaches and research methods taken by all authors while addressing this theme.

2.4 General Conclusions and Research Direction
This literature review has analyzed how commercial firms engage into Open Innovation activities by strategically adapting their business models, internal processes and culture in order to operate in one or several of the archetype processes. Innovation networks and collaborations represent one of those
strategic decisions in which companies pursue to be more innovative (Laursen & Salter, 2006) and enhance their innovation intensity (Becker & Dietz, 2004). As discussed, collaborations between commercial firms and academic institutions are also part of this set of benefits since universities are seen as a valuable partner for new ideas and knowledgeable collaborators (Ponds, van Oort, & Frenken, 2010). These collaboration partnerships are facilitated by internal and external factors of both parties.

Collaborations are dynamic and evolve next to the development of innovations (Chesbrough & Prencipe, 2008), where both, firms and universities also evolve along the stages of the innovation processes. Based on this, it is critical to measure performance and adapt the respective measurement mechanisms and tools to this dynamic environment. As noted, the reviewed literature provides some examples on how different scholars have evaluated the issue of value and performance measurement within the context of industry and academia collaborations. The implementation of strategic sets of perspectives, a process-based review approach and the use of BSC’s offer quite practical guidelines for managers and practitioners to track strategic objectives and decision making. The use of performance measurement mechanisms and tools denote a formalization of organizations to further understand, evaluate and improve their collaboration efforts within the context of Open Innovation. This strategic view is important for collaborations between industry and academia because of the need to track adequacy against partnership objectives, improve the current collaboration efforts and set further strategic paths for future collaborative activities (Al-Ashaab et al, 2011; Philbin, 2008; Perkmann, Neely, & Walsh, 2011 and Rohrbeck & Arnold, 2006).

An understanding of the current state of the collaboration activities between both partners can provide important highlights in terms of business areas of interests, methods and metrics that may be useful for further development of a value and performance measurement system. With this information, further research can be executed in order to align with the strategic path of the areas subject for performance measurement. As such, new or adapted perspectives can be used when applying BSCs (Kaplan, Norton & Rugelsjoen, 2010), expected goals can be set and complementary metrics can be added into the measurement system. As discussed, the way a BSC is used will influence business performance (Braam & Nijssen, 2004). With it, companies will be able to analyze the effectiveness of their business models (Chesbrough, 2006) and will also be able to adapt to different managerial and organizational skills depending on the type of innovation they will be developing (Abernathy & Clark, 1984 & Martin, 2012). From academia’s side, universities will be able to evaluate their contribution to industrial innovations (Etzkowitz & Leydesdorff, 2000) and enable a better leverage of existing relationships (Melese et al, 2009).
3 Research Design

The proposed research approach of this thesis is explained with its main execution activities. Next, the respective methodology in terms of research techniques and data collection methods is also explained.

3.1 Research Approach

This section briefly explicates the set of steps used to assess the problem under concern of this study, which are partly adapted from the regulative process cycle (van Strien, 1997). It initiates with a descriptive analysis of the collaboration partnership between Philips Lighting and TU/e, then it assesses the strategic collaboration plans of both organizations and evaluates the current state of the collaboration activities. A design of value and performance mechanism system is proposed as possible intervention as well. Appendix 3 provides a visualization of this approach.

Important to mention that the plan of action is limited to provide recommendations when implementing the value and performance mechanism system. Additionally, validation of the tool is left out the scope of this study since it is required to fully implement the tool beforehand. These two steps fully depend on the agreement and decision of senior and functional representatives of both organizations about when and how to implement the solution and based on suggestions provided in this study.

3.1.1 Partnership Background Information: TU/e & Philips Lighting Business Unit

This first part is intended to provide a brief descriptive overview of both organizations and their collaboration activities. It describes the partnership’s main characteristics and its objectives according to the agreement signed off in 2014 as main background input information. This section serves as brief introduction to the next sections which describes the partnership structure.

3.1.2 Assessment of Strategic Collaboration Plans

Identification of the strategic path for collaboration happens in this second part. The main goal here is to identify the main characteristics of the partnership between TU/e and Philips within the context of Open Innovation. Furthermore, the partnership’s and/or individual organizations’ vision is identified with its subsequent strategic objectives and perspectives. This part is mainly targeted at senior levels at both organizations, specifically members of the Steering Committee, as they provide the strategic path in which value and performance measurement takes place for strategic decision making. This part of the report is aimed to answer the first and second research sub-questions.

3.1.3 Current State of Collaboration Activities

This second part was proposed to understand the current state of the collaboration activities between both organizations. It was intended to identify alignment or gaps between the strategic vision and objectives put in place for the partnership collaborations and the functional areas executing the collaboration activities. It also focused on the identification of current methods being used on how both organizations measure value and performance, which included the identification of current KPIs, potential new perspectives for BSC’s and decision making processes. This step matches with the third sub-research questions provided in Section 1.2, and it is targeted to Topic Owners at the two organizations as main responsible for the execution of the research projects.

3.1.4 Design of the Value & Performance Measurement System

Finally, the design of the value and performance measurement system using BSC’s is provided. Designing the measurement system and its BSC is based on the results of the previous sections. The value and performance measurement system also integrates the main findings related to the alignment
between senior and functional managers as discussed in the previous section. Drafts were created during workshop sessions held with the manager of the Intelligent Lighting Institute as main nexus organization for relevant activities at TU/e with respect to intelligent lighting within this partnership. These sessions had the goal to obtain feedback and adjust the tool to the requirements of both organization(s). Next to this, complementary KPI's were proposed to fulfill any gap related to value and performance metrics found as a result of the current state analysis of the collaboration activities.

3.2 Methodology

This study is aimed to analyze qualitative data inputs by following a case research approach, this based on the fact that case research is suitable when the research focus is on a contemporary phenomenon within some real-life content (Yin, 2003). Case research is also convenient in business environments, when the target audience, e.g. managers, must implement findings related to the study, and when trying to understand in depth historic, present and/or future events and relationships among them (Gummensson, 2000), bounded by time and activity (Crewell, 2003). These characteristics match with the context of the collaboration partnership between TU/e and Philips Lighting for research purposes.

3.2.1 Data Collection Methods

In order to gather data, semi structured interviews and secondary data analysis were performed as main data collection methods at all phases. These two methods are considered as appropriate data collection methods for case research (Gummensson, 2000; Yin, 2003 & Price, 2012).

Semi-structured interviews consist of few general questions, they prompt to allow participants to freely talk about an interest topic, so the topic can be further explored. It also gives the responded the opportunity to move the interview at different directions, pointing out more sub-topics (Price, 2012 & Blumberg, Cooper, & Schindler, 2011)). Furthermore, interviews have an important role when key stakeholders, e.g. directors, managers and other key functional personnel as in this case, are involved when trying to get data and information related to organizations’ vision, strategies and future objectives for value and performance measurement (Norton & Kaplan, 1993). However, semi-structured interviews require a sequence of questions based on a topic, facilitated by the use of an interview guide to avoid possible interviewer bias (Price, 2012 & Blumberg, Cooper, & Schindler, 2011). Based on this, interview questions were appropriately created to facilitate data that will respond the research and sub-research questions for this study (Maxwell, 1996).

Secondary data analysis is data that was previously collected and tabulated by others, and is available and suitable to address the research question(s) (Bhattacherjee, 2012). For the purposes of this study, secondary data analysis was used to assess the current methods of value and performance measurement at the company, also to evaluate the strategic path both organizations want to purse based on management reports / reviews or other sources of data. Part of the limitations of secondary data analysis mainly reside on the scientific methods used to previously collect the data, thus compromising the adequacy on addressing the research question (Bhattacherjee, 2012).

3.2.2 Interview Sampling and Respondent Confidentiality

Coordination and set-up of interviews were made by the assistance of the Intelligent Lighting Institute at TU/e. A total of ten 10 interviews were executed. Three of them with members of the Steering Committee (2 of TU/e and 2 of Philips Lighting), and 4 interviews were executed with Topic Owners (2 of TU/e and 2 at Philips Lighting) and with 2 coordinating representatives at TU/e.
Confidentiality was kept at the different steps of research: data collection, data cleaning, and dissemination of research results (Guillemin & Gillam, 2004). Consent form and its respective explanation were included as part of protocols before the initiation of interviews (Blumberg, Cooper, & Schindler, 2011). Finally, references and quotes of interviews were coded based on Table 1 plus the number of the respective representative.

Table 1: Confidentiality Coding

<table>
<thead>
<tr>
<th>Description</th>
<th>Coding</th>
<th>Amount of Interviewees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steering Committee University</td>
<td>SCU</td>
<td>2</td>
</tr>
<tr>
<td>Steering Committee Philips Lighting</td>
<td>SCP</td>
<td>2</td>
</tr>
<tr>
<td>Topic Owner University (includes the coordinating representatives)</td>
<td>TOU</td>
<td>4</td>
</tr>
<tr>
<td>Topic Owner Philips Lighting</td>
<td>TOP</td>
<td>2</td>
</tr>
</tbody>
</table>

3.2.3 Analysis Methods

Content analysis was used as main qualitative method to analyze the collected data and information. This is a systematic analysis of the content within a text. The use of coding techniques let to identify data and mark it with theme labels, following by further analysis trying to compare those labels with previous fragments of other labels. Then, a comparison with other fragments from other data sources (e.g. interviews and secondary data) were done to identify similarities, trends or gaps in the information. Next, this new information was compared with literature to identify potential gaps for further intervention or recommendations. Finally, assessments of following interviews were executed to determine if they contain new useful information (Bhattacherjee, 2012; Blumberg, Cooper, & Schindler, 2011 & Price, 2012).

3.2.4 Workshop Sessions

Once results from interviews were analyzed, then workshop sessions took place by including key stakeholder(s) of this alliance (Norton & Kaplan, 1993). In these sessions data was presented, compared, analyzed and discussed in order to design the Value and Performance Mechanism System. Within these sessions, brainstorming activities were executed in order to align ideas and provide direction to the final solution. Brainstorming sessions were used as means of idea generation in management related contexts when defining strategy related tasks (Christensen C., 1997). Finally, draft solutions were provided before each workshop session. These draft solutions contained additional ideas and solution proposals created as part of a nominal technique that complemented the brainstorming for idea generation (Boddy, 2012).

3.2.5 Securing Quality of Data

Controllability, reliability and validity of data were taken into account, this to guarantee quality of this research and as a result, respective interview outputs were useful during the design of the value and performance mechanism using BSC’s.

In order to have controllability; interview protocols were created. The main objective was to assure that results were reproducible, so when the research is repeated, the same results should be expected (Blumberg, Cooper, & Schindler, 2011). Interview protocols also served as means to have reliability based on a structured planning. Respective supervisors reviewed related documentation to avoid possible interviewer bias. Next to this, participants (interviewees) were properly informed prior to perform the interviews. With this, it was intended to achieve the same results if the researcher, instrument or respondent differ (Blumberg, Cooper, & Schindler, 2011 & Price, 2012). Two interview
protocols were created, one targeted to the Steering Committee members (the strategic oriented one) and another one targeted to Topic Owners (the operational oriented one). Protocols are found in Appendix 4 and 5.

Finally, validity is the extent to which the results from a measure represent the variable they are intended to (Price, 2012), as such the relationships of those results adhere to the context under research (Maxwell, 1996). In this regard, content validity was mainly addressed by using already established guidelines from earlier studies (Norton & Kaplan, 1993) and/or tailored questions were constructed based on the findings of the literature review of this study. These questionnaires were reviewed by respective supervisors. Moreover, pre-testing activities took place with the aid of supervisors in order to guarantee validity of the results by adherence to the context being investigated in this study (Maxwell, 1996). The goal was to guarantee that the research instruments (interview questionnaires) measure what they are intended to measure (Price, 2012).
4 Problem Analysis
This chapter first offers a case description of the partnership. Second, it provides the main findings out of interviews and from secondary data about this strategic alliance. Third, a discussion based on findings is provided as well. Lastly, final conclusions and a solution direction are argued.

4.1 Case Description
This section is presented in three main parts: Partnership background information, an assessment of its strategic plans and finally a brief description of the current collaboration plans.

4.1.1 Partnership Background Information: TU/e & Philips Lighting
TU/e and Philips Lighting have been key actors for the development of the Eindhoven region. Philips Lighting is a legal entity independently of Royal Philips. It traces back to early 1890’s when the company initially manufactured light bulbs. Today, Philips Lighting is dedicated to the design, development and distribution of smart lighting technology systems targeted to public spaces, office and industry, and retail and hospitality (Philips Lighting, 2016). TU/e was founded in 1956 as the second university of technology in The Netherlands. Its strategy is focused on providing strong higher education, leading a remarkable position in research and knowledge valorization by means of a major source of knowledge, technology, and new business in a knowledge-based economy (Eindhoven University of Technology, 2016). Inside TU/e, the Intelligent Lighting Institute (ILI) is the main nexus organization for relevant activities with respect to intelligent lighting. It focuses on relevant research related to intelligent lighting and on lighting with the objective to “…investigate novel intelligent lighting solutions that will become within our reach by the large-scale introduction of LED technology, with a special emphasis on how these new solutions might affect people” (Eindhoven University of Technology, 2016). It integrates multiciplinary collaboration efforts within the university at different departments and with other public and private organizations.

Late in 2014, TU/e and Philips established a long-term (ten years) collaboration partnership focused on research programs intended to cooperate in the development and exploitation of “…large-scale projects designed to accelerate digital innovations” (Eindhoven University of Technology, 2015) in the lighting sector, as in other exploitable areas of interest (Eindhoven University of Technology, 2014). This partnership spans over different research programs and it is aimed to integrate at various levels of the lighting value chain (TU/e & Philips, 2016). Furthermore, based on a structural alignment between the two organizations, it is expected to share and maximize results in an integral manner, and to bring significant contributions to meaningful innovations in the lighting sector. Moreover, with this partnership it is also expected to enhance human capital and reinforce their position in the innovation field (TU/e & Philips, 2016). Finally, this partnership was previously preceded by shared research projects via different initiatives. In that sense, those previous collaboration initiatives served as momentum mechanisms to continue with research and innovation projects (Eindhoven University of Technology, 2015).

4.1.2 Assessment of the Strategic Collaboration Plans
The partnership is driven by a common vision statement and strategic goals established by the two organizations. In this regard, both organizations have defined specific areas of interest and roles for
Further research and development activities. The most important elements extracted from the vision statement are listed below:

- **Responsible research and innovation in a long term perspective.**
- **Integration of topics and programs spanning over different sections of the lighting value chain.**
- **Structurally alignment of efforts, sharing and maximizing results in order to bring a significant contribution to meaningful innovations.**

Specific objectives were put in place as part of the partnership vision. These strategic objectives extent over different themes wherein the two organizations want to make an impact on, and they represent the main mechanisms to achieve the elements of the strategic vision:

1. **Enhance human capital development.**
2. **Strengthen the position in the scientific and innovation landscape.**
3. **Significant added value with economic relevance delivering economic pay-off.**
4. **Being recognised as leading in the area of research & innovation in science & technology.**
5. **And finally, to consolidate and expand continuously learn and to add more value through expanding the ecosystem.**

The deployment of the above mentioned strategic goals is applicable at different programs of interest of this alliance and have a crossfunctional interrelation at both organizations.

Finally, this strategic alliance between TU/e and Philips Lighting has also set-up roles through their individual and shared innovation processes. As seen in Figure 6, TU/e and Philips Lighting have a shared participation at all stages along the innovation funnel. On the first hand, TU/e as an academic institution, leads at the front-end of innovations by doing basic research. On the other hand, Philips Lighting leads at the back-end of innovation by doing experimental development. It is important to mention that there are cycle processes that facilitate feedback loops at intermediate stages of innovations.

**Figure 6:** Shared Innovation Process (TU/e & Philips; Berhout et al; 2006 & Schoen et al; 2015)

### 4.1.3 Current State of the Collaboration Activities

TU/e and Philips Lighting have put in place a strategic partnership division useful to develop and assess their collaboration plans. First, there is a High Level Group (HLG), which is composed by representatives of the board members of both organizations (and other representatives as well). This HLG meets every six months and in those meetings the HLG evaluates in a broader scope the entire set of collaborations.

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1 Full text of the vision statement is not presented in order to keep confidentiality of critical strategic information.
including this one in particular. Second, there is a Steering Committee that is basically responsible for the strategic/tactical initiatives related to the Lighting Flagship. It is composed by members of the two organizations as well. This Steering Committee meets every six months to track advance and/or deviations to the strategic plans. This happens at least, one month prior the HLG meeting. Lastly, there are Topic Owners, who are in charge of the operational execution itself and follow-up of the strategic vision and roadmap. They meet on a more regular basis based on the needs of a particular topic or project. As in the other cases, there are representatives of both organizations as well.

Figure 7 illustrates the organizational division for this partnership. First, the top-down relationship is depicted by the vertical arrows. It is by this means that the strategic objectives, their respective plans and targets are cascaded to the lower levels of the organizations. And second, the bottom-up curved arrows indicate the reporting and feedback paths up to the higher levels. It is in this path where the different Topic Owners and other functional representatives report results to the Steering Committee and then to the High Level Group.

This alliance has decided on a set of KPIs that currently measure important aspects to achieve the strategic goals explained in Section 4.1.2. These KPIs are commonly addressing strategic areas or perspectives related to Human Capital (e.g. numbers of PhD candidates working on research projects, number of hires at Philips Lighting upon conclusion of research projects, among others) and on Knowledge (e.g. number of publications, conferences, filed patents, etc.). The use of KPIs is applicable to the different programs in place for this alliance.

4.2 Findings

Results from interviews and secondary data are reported as follows: First, it is explored how Steering Committee members visualize this partnership within the context of Open Innovation theory. Second, a comparison is made on how Steering Committee members and Topic Owners are aligned in regards to the strategic collaboration plans and areas of focus for value and performance measurement. Finally, improvement opportunities mentioned by both groups are presented as well.

4.2.1 TU/e and Philips Lighting Partnership within the Context of Open Innovation

Three main dimensions are presented in order to understand the Open Innovation context in which this partnership operates: Importance of the partnership, facilitating factors of the collaboration and archetype processes of Open Innovation. Findings are extracted from interviews held with Steering Committee representatives and by comparing the partnership vision statement.
**Importance of the Partnership.** At both organizations there are different reasons why it is important to collaborate with each other. From the university side, this collaboration lets to provide added value to the society by means of applied innovations. By doing this, it permits to keep a continuum of research funding for future investigations. This lets both organizations to keep track of scientific and market trends for the development of new innovations. This is achieved by the exchange of professionals (researchers) who can work part-time at both organizations. As an additional point, it opens up the opportunity to get in contact with other actors within the lighting ecosystem.

From the Philips Lighting point of view, there are three main reasons to cooperate. First, networking lets the organization to get connected to other knowledgeable people in the scientific and technology fields. As a consequence, the organization can get connected to other companies/organizations as well. As such, it can broaden the community, which results in getting more inputs and ideas for future applications. Second, the organization can get access to new people (students and professors) who are educated in specific fields. These people can eventually be hired, growing the internal capabilities of the organization. Finally, as indicated by SCP1, “it is wise to cooperate with an academic institution in order to advance [our] own internal innovation processes...” and move technologies into the market.

**Facilitating Factors of the Collaboration.** Interviews revealed there are a few factors that facilitated this partnership to happen. First, geographical proximity is acknowledged to play a key role because it is convenient to partner with a nearby organization, since it facilitates social and work interaction.

> “Proximity is definitely an advantage. If you look at Philips [Lighting], you will see that they have a research center in Shanghai and they collaborate with a Chinese university close by, they have a lab in Eindhoven and they collaborate with us, and they have a lab in [Boston] and they collaborate with [MIT]. They are looking for the knowledge close by, because [it is] easy to transfer knowledge... (SCU1)”

Second, from the Philips Lighting point view, there is recognition about the quality and competences that characterize the research activities at TU/e. In this regard, TU/e and the region of Eindhoven are recognized by Philips Lighting interviewees as leading drivers in the research and development of lighting solutions.

> “The level of knowledge of the university is world class... there is little benefit or advantage to engage or cooperate with a mediocre institute, because you are a leading lighting company and you want to work together with leaders in their specific area (SCP1).”

> “Some regions are very good at specific things, that is also the region where we want to work together with partners, because we want to tap into these ecosystems... (SCP1).”

Finally, from the TU/e side, the university does not fully have the capabilities to advance technologies into the market. Philips Lighting knows about the recent trends in the lighting market. Therefore, it is also wise to partner with a leading commercial organization in this specific market, since knowledge generated at the university or by the two organizations can move in a more efficient way through the different stages of development and reach the market.

**Archetype Processes of Open Innovation.** As shown in Section 4.1.2 (Figure 6), there are shared roles between the two organizations. Those roles include cycle paths along the different stages of the innovation funnel. According to SCP1, this model confirms how this shared model facilitates innovations to move through the different stages of development by complementing their own capabilities. Furthermore, as extracted from the SCU1 interview, this shared participation is a materialization of working together as partners, creating solutions with added value for society:
“I think what you need to do is to have people at the very basic side doing fundamental research, and that fundamental research could generate seeds that could end up something that end in products, solutions for Philips [Lighting]. Then, there are people who are taking these seeds and are applying them into the right context. So, they see it’s growing… and if it is applied, it can become a possible prototype of some idea of a system or solution (SCU1)

4.2.2 Strategic Alliance and Value & Performance Measurement

This section provides the results comparison between the Steering Committee members and Topic Owners regarding the vision strategy, its strategic objectives, strategic perspectives for value and performance measurement, and improvement opportunities. These dimensions are aligned with the cascading and interrelations expected as part of a value and performance measurement system (Norton & Kaplan, 1992). Table 2 summarizes these results.

**Partnership Vision.** As seen from the university perspective, the partnership vision is pictured as a way on how to create meaningful innovation in order to provide a positive impact on people’s lives. This is achieved by means of strengthen collaboration with multidisciplinary cooperation that complements internal capabilities at both organizations. From the Philips Lighting point of view, the partnership vision entails how to remain competitive in this dynamic sector by developing meaningful innovation with societal impact. These two points of view are in alignment with the vision statement (Section 4.1.2.)

**Strategic Objectives.** All levels at both organizations, responded on the following strategic objective as the common objectives for this partnership: Creation and dissemination of knowledge, and human capital development. Besides those, it is mentioned by the SCU2 the importance of strengthen the partnership as an important key objective of this alliance. It is noted how interviewees do not elaborate on the following two strategic objectives from the vision document:

- **Add significant value with economic relevance delivering economic pay-off.**
- **Consolidate and expand continuously learn and to add more value through expanding the ecosystem.**

Instead, these two objectives are indicated by interviewees as possible new perspectives for value and performance, and they are even mentioned as improvement opportunities as described in the following paragraphs.

**Strategic Perspectives.** It is noticed how all interviewees followed the same approached as with the strategic objectives regarding two specific perspectives: 1) Knowledge creation and dissemination for new technology applications, and 2) human capital development. The last one has a different importance at both organizations. For the university, development of human capital is seen as a way to achieve the creation and dissemination of knowledge, that can be useful for Philips Lighting. For the firm, the attraction and retention of valuable personnel is a key activity since it permits to further grow its internal capabilities. For both, it is quite important to exchange professionals since that generates more knowledge in-outflows and it represents as a way to foster shared collaborations.

Other perspectives are also mentioned. The financial perspective is visualized in two ways. On the first hand, for all Topic Owners it is important to track current spending / control of program execution and available funding. This can be categorized as financial stewardship. On the other hand, Steering Committee members state the importance to track possible new sources of funding. At all cases, the financial aspects are seen as means to generate an impact on the other perspectives of importance:

“[Financial] that’s more like means to the end. I think the basic why we are doing this together is to have innovations together, that can be products or services of Philips [Lighting]. And to have human
capital exchange. What you need for that is to do research together, but to do that you need funding, but funding is not an aim in itself (SCU1)"

The strategic partnership perspective is the last one. As extracted from SCU2, it is important to understand how the partnership is achieving its goals by shared collaboration and activities. This is linked to the strategic objective visualized by this representative. This perspective looks for how to foster more shared participation at all levels, by providing shared funding, shared research, shared publications and IP and how to enhance the exchange of professionals between the two organizations.

Finally, the current set of KPIs only measures the current set of perspectives: Knowledge and human capital development. According to this, there are no indicators on how to measure the additional possible perspectives as indicated previously. In terms of possible adaptations to the current and possible new perspectives, all Topic Owners are in favor on having different sets of KPIs (input, process-based and outputs). This is found as practical considering the fact that research is a long process which should not be measured only based on output KPIs.

**Improvement Opportunities.** From the university point of view, Steering Committee and Topic Owner representatives indicate the importance on how to foster shared participation and collaboration by both organizations at all levels. This is consistent with the strategic objective and perspective for value and performance measurement. Furthermore, the importance of including more actors within the ecosystem is also mentioned as an important feature. It is key to notice that this particular improvement opportunity is already included as part of the strategic objectives stated in the vision statement. Lastly, as indicated by TOU4, how to improve the cohesion at functional levels is an issue that should be taken into account, next to value and performance measurement.

From Philips Lighting point of view, it is important to include new actors and extend the lighting ecosystem. This indicates the importance of this particular perspective by both organizations. Furthermore, from a more practical point of view, the need to set-up targets or thresholds (based on the SMART principle) is imperative in order to evaluate the achievement or exceed goals. Next to this, a more appropriate communication means should be included for information purposes and keep tracking of performance against goals and targets. The current way value and performance is being measured needs more structure in order to finally connect all the elements of the strategic vision and objectives into a more comprehensive way.

### 4.3 Discussion

This section discusses the main outputs found from interviews and secondary data analysis. It first argues about the main characteristics of this partnership within the context of Open Innovation. Then, it discusses the links and gaps among the alliance strategic vision and objectives versus the finding from interviews and description of the strategic partnership.

**Open Innovation Context.** This particular partnership has communalities with other aspects of the Open Innovation theory according to the analysis of the strategic objectives and outputs of interviews. First, the importance related to the development of human capital is evident since it is incorporated as one of the first strategic objectives. It is clear how this particular characteristic is included as a key aspect of the strategic vision (Vanhaverbeke, 2013). From the university side, human capital development is a key way on how to create and disseminate knowledge for society, business and scientific environments. From the commercial organization side, development of human capital is seeing as ways on retaining valuable and knowledgeable resources. And for both, there is an interest on exchanging valuable professionals carrying out research, docent and/or mentoring activities at both sides. Second, the need to complement internal capabilities (Becker & Dietz, 2004) is evident since there is a desire to lead the
scientific and technological lighting sector and become key actors within the lighting ecosystem by facilitating innovation processes and incorporating innovation complementors (Gassmann, Enkel, & Chesbrough, 2010; Adner, 2012). Third, this partnership also includes as a key objective the added value and economic pay-off to society (Etzkowitz & Leydesdorff, 2000) as an important aspect to consider as part of its strategy. Finally, increase of innovativeness (Laursen & Salter, 2006) by developing more meaningful innovations that can reach the market in a faster pace is also a key goal to achieve.

In regards of the facilitating factors, the ones mentioned by interviewees are in alignment with previous empirical evidence provided by different scholars. The geographical proximity and quality of the academic institution (Laursen, Reichstein & Salter, 2011), and the need to advance internal innovations from the firm’s side by complementing its internal capabilities (Chesbrough, 2003a, 2003b & 2004) contributed to build this partnership. Important to mention that for the TU/e side, the university does not fully have the capabilities to advance technologies into the market. Philips Lighting knows about the recent trends in the lighting market. Therefore, it is also wise to partner with a leading commercial organization in this specific market, since knowledge generated at the university or by the two organizations can move in a more efficient way through the different stages of development and reach the market (Picado Arroyo et al, 2015). This can be categorized as a reciprocal trust on the internal capabilities that both organizations have as discussed by Lai (2011).

The roles that both organizations have put in place are a key characteristic of this partnership. This participation follows a Coupled Process, where the two organizations combine the outside-in and –out Open Innovation archetypes (Figure 6). This is in alignment to the statements of Gassmann and Enkel (2004) and Enkel, Gassmann and Chesbrough (2009), who indicated that this particular archetype is characteristic over long periods of time via strategic networks, and its success is determined to the abilities of organizations to find the correct partner. In this sense, one of the organizations takes the lead, while the other supports it. This varies depending on how developed a particular technology is along the innovation funnel. This characteristic can be partially explained based on the model of Berkhout et al (2006) and Schoen et al (2005), who emphasize on the fact that innovation processes follow a cycle path with interactions of scientific and technological push, and business and markets pull forces. This cycle path is understood by fact that Philips Lighting leads the pace from the recent market trends and TU/e is knowledgeable about the most recent scientific trends. Furthermore, there are feedback loops along the different stages of innovation to facilitate better and more applications of knowledge based on interaction and change.

To finish, it was mentioned that previous collaboration activities by both organizations enabled a better leverage of existing relationships (Melese et al, 2009); materialized by formal and hierarchical ties, looking for broaden their existing technological capabilities and reflecting high commitment (Dittrich & Duysters, 2007). This is reflected by the partnership vision, strategic goals and areas of interest.

In accordance with the explanation provided in the previous paragraphs, there is support to the sub-research question: What are the main characteristics of this partnership within the context of Open Innovation? There is evidence about the importance of this collaboration at both sides and also on the drivers that facilitated this partnership to happen within the context of Open Innovation theory. Finally, it was possible to circumscribe the participation of each of the organizations along the innovation funnel concerning shared activities with cycle paths, led by technological push and market pull forces.
**Strategic Vision.** The current strategic vision of this partnership includes a core ideology concerning responsible research and innovation shared activities (structurally aligned) performed by the two organizations. As seen, there is a fit among the activities the two organizations carry on (Porter, 1996). The two organizations are both committed to research and development in order to provide added-value to society, business and scientific landscape by means of meaningful innovations in their long-term partnership. This is materialized by seeing-up the strategic vision and objectives as guidance mechanisms to evaluate achievement on those goals and as consequence, positioning this alliance as key actors within the lighting sector (Collins & Porras, 1996).

**Value & Performance Measurement.** As indicated in Section 4.1.2, there is an organizational division in three main stages that facilitates the creation of strategic objectives, plans and operational execution. The way as this organizational division is structured should facilitate a top-down communication process and a bottom-up feedback and reporting path (Figure 7). As a result, it should also be expected to have a clear linkage among the different strategic goals and how they are currently being assessed by all actors within this partnership (Norton & Kaplan, 1992). However, based on Section 4.2.2, all functional and/or operational representatives elaborated only on the following strategic objectives: Enhancing human capital development and on the creation and dissemination of knowledge as the most important strategic areas of focus, cascaded from the strategic vision of the partnership (Chesbrough, 2003b; Lichtenthaler & Ernst, 2007 & Vanhaverbeke, 2013). This can be understood by the fact that the two organizations are deeply committed on these two objectives as discussed previously. Likewise, the current list of KPIs partially covers some of the strategic objectives set by this alliance. As said, the knowledge and human capital are the core perspectives currently measured.

Possible perspectives related to the strategic partnership (joint alignment), financial and expanding the ecosystem are actually already included as strategic objectives in the vision statement, but mentioned as possible improvement opportunities for future measurement. The strategic partnership is mentioned as a possible new perspective by SCU2. This implies how to track shared activities made by the two organizations as a clear indication of trust in this particular partnership, which is formalized with a hierarchical ties, and it looks to broaden their existing technological capabilities and reflecting high commitment (Dittrich & Duysters, 2007). In addition, this is reflected in the current vision statement which emphasizes on structural alignment the partnership efforts and by sharing results. Next, it was stated how different representatives visualize finance as new perspective: As financial stewardship for funding and spending control, and how to attract new funding for future projects. This is key since by means of funding it can be extrapolated the economic contribution and pay-off of new innovations generated within this partnership (Etzkowitz & Leydesdorff, 2000), as such this perspective is seen as a means on how to influence other key strategic perspectives. In regards to the consolidation and expanding the ecosystem, there are also no means on how to measure this particular objective. As a consequence, there is no official tracking on the creation of potential new projects with other possible complementors of this alliance: companies and industry that may have interesting ideas to be used in the ecosystem as sources of innovations, or in any other case, to be able to find external exploitation channels of knowledge and will facilitate advance of technologies (Gassmann, Enkel, & Chesbrough, 2010; Adner, 2012). Based on this, and in accordance with the strategy, this particular alliance shall serve as building stone to broaden the lighting ecosystem and should be measured and evaluated.

It can be argued that the current way as this alliance is evaluating value and performance based on KPIs do not fully link all the strategic objectives set by this partnership, as a result, there is no full cascading
effect from the vision, strategic objectives and KPIs (Norton & Kaplan, 1992). According to this, it can also be argued that the current value and performance mechanism requires further adaptation of the current set of perspectives of traditional BSCs or creating new ones applicable to this partnership (Al-Ashaab et al, 2011; Chesbrough, 2003b; Kaplan, Norton & Rugelsjoen, 2010). This argumentation is based on the fact that the three perspectives referred to as improvement opportunities are included in the current set of strategic goals as detailed in Section 4.1.2, but not included as part of value and performance measurement. Finally, this argumentation is in alignment with the observations made by Philips Lighting representatives, who indicated that the current way value and performance is being measured needs more structure characterized by the inclusion of targets / thresholds.

This previous discussion provided answers to the sub-research questions detailed in section 1.2, Chapter 1: What is the strategic path of the collaboration partnership for both organizations? What is the current state of the value and performance measurement mechanisms of this collaboration partnership? It was possible to describe and discuss alliance strategy, the current state of the collaboration activities and how value and performance is measured, linked to the strategic objectives and which gaps are visible.

4.4 Conclusions and Solution Direction
This Chapter provided a descriptive analysis and background information about the alliance and its strategic collaboration plans. With it, it was possible to identify how this partnership fits within the context of Open Innovation theory by analyzing its importance, facilitating factors and roles of both organizations along the innovation funnel.

Moreover, it was possible to analyze how the alliance strategy is materialized through the establishment of a vision statement that incorporates key and common activities (research and development) for both organizations (Porter, 1996). Next to this, the set-up of strategic goals serve as main guidance mechanisms that facilitate evaluation of strategy’s execution (Collins & Porras, 1996). This is accompanied by the organizational structure set-up by this alliance in a way that it is meant to enable deployment of the strategic objectives, communication, tracking and analysis of results.

In regards of the current state of the collaboration activities, interesting findings were discussed: (1) respective tracking of shared partnership, financial and ecosystem perspectives and, (2) how different Steering Committee representatives and Topic Owners elaborated on these three possible perspectives as improvement opportunities for value and performance measurement. Both findings can be explained based on the fact that the current set of KPIs, presented as a BSC, do not fully cascade the organizational vision and strategic objectives into the all applicable perspectives for strategic follow-up (Norton & Kaplan, 1992). According to this, the current tracking and measurement of specific goals is limited only to the knowledge and human capital development strategic perspectives. As a consequence, there is no full link among all different perspectives needed to track as part of the value and performance measurement, based on KPIs, as BSCs are supposed to do so (Norton & Kaplan, 1992).

To close, the current measurement of value and performance requires for adapting traditional perspectives, or creating new perspectives and incorporate them into the BSC (Al-Ashaab et al, 2011, Chesbrough, 2003b; Kaplan, Norton & Rugelsjoen, 2010). In consequence, an adaptation of the current method on how to measure value and performance is needed. A 3rd Generation BSC will help to incorporate vision and objectives of the partnership, cascade and link the additional and/or adapted perspectives with their own KPIs in order to assess impact at different levels (Lawrie & Cobbold, 2004).
### Table 2: Results Comparison – Steering Committee Members and Topic Owners

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<td></td>
<td><strong>Steering Committee University</strong></td>
<td><strong>Topic Owners University</strong></td>
<td><strong>Steering Committee Philips Lighting</strong></td>
<td><strong>Topic Owners Philips Lighting</strong></td>
</tr>
</tbody>
</table>
| **Partnership Vision** | Innovation & Societal Impact  
Creation of meaningful innovations in lighting to improve people’s lives (SCU1) | Innovation & Societal Impact  
Development of new applications, based on knowledge, with a social impact | Competitiveness  
To enable Philips Lighting to remain as leader in the dynamic and Lighting sector (SCP1) | Competitiveness  
To keep competitiveness in the transforming lighting sector |
|                        | Shared Partnership  
Shared vision in strengthen the collaboration, multidisciplinary, and generation and dissemination of knowledge (SCU2) | Shared Partnership  
Complement internal capabilities at both organizations | Innovation & Societal Impact  
Development of innovations in lighting to improve people’s lives. |
| **Current Strategic Objectives** | Creation and dissemination of knowledge | Creation and dissemination of knowledge | Creation and dissemination of knowledge | Creation and dissemination of knowledge |
| **Development of Human Capital** | Development of Human Capital | Development of Human Capital | Development of Human Capital | Development of Human Capital |
| **Strength the partnership (SCU2)** | Knowledge  
Creation and dissemination of knowledge for new technology applications | Knowledge  
Creation and dissemination of knowledge for new technology applications | Knowledge  
Creation and dissemination of knowledge for new technology applications | Knowledge  
Creation and dissemination of knowledge for new technology applications |
| **Possible Perspectives for Value & Performance Measurement** | Human Capital  
Development, exchange and participation of human capital in order to create and disseminate knowledge and be attracted by Philips Lighting | Human Capital  
Development, exchange and participation of human capital in order to create and disseminate knowledge | Human Capital  
Development, exchange and participation of human capital in order to create and disseminate knowledge | Human Capital  
Development, exchange and participation of human capital in order to create and disseminate knowledge |
|                        | Knowledge  
Creation and dissemination of knowledge for new technology applications | Knowledge  
Creation and dissemination of knowledge for new technology applications | Knowledge  
Creation and dissemination of knowledge for new technology applications | Knowledge  
Creation and dissemination of knowledge for new technology applications |
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Development, exchange and participation of human capital in order to create and disseminate knowledge | Human Capital  
Development, exchange and participation of human capital in order to create and disseminate knowledge | Human Capital  
Development, exchange and participation of human capital in order to create and disseminate knowledge | Human Capital  
Development, exchange and participation of human capital in order to create and disseminate knowledge |
<p>|                        | Attract valuable human capital to the firm | Attract valuable human capital to the firm | Attract valuable human capital to the firm | Attract valuable human capital to the firm |</p>
<table>
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<tr>
<th>Topic</th>
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<th>Topic Owners University</th>
<th>Steering Committee Philips Lighting</th>
<th>Topic Owners Philips Lighting</th>
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<tbody>
<tr>
<td>Ecosystem</td>
<td>Current partnership as a building stone to broaden the lighting ecosystem.</td>
<td>Ecosystem How to leverage / share knowledge for meaningful applications at front and back end of innovations</td>
<td>Ecosystem Current partnership as a building stone to broaden the Lighting ecosystem.</td>
<td>Ecosystem How to leverage / share knowledge for meaningful applications at front and back end of innovations (TOP2)</td>
</tr>
<tr>
<td>Strategic Partnership</td>
<td>Shared goal achievement by both organizations (SCU2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of KPIs</td>
<td>N/A*</td>
<td>Inputs, process-based and output based</td>
<td>N/A*</td>
<td>Inputs, process-based and output based</td>
</tr>
<tr>
<td>Improvement Opportunities</td>
<td>How to foster shared participation within the partnership at all levels and programs?</td>
<td>How to track the inclusion of new actors by expanding the ecosystem?</td>
<td>Better structure on value &amp; performance measurement Operationalization of current and/or additional perspectives</td>
<td>Extension of the ecosystem as part of value and performance measurement (TOP2)</td>
</tr>
<tr>
<td></td>
<td>How to enhance shared participation within the partnership (TOU4)?</td>
<td>Setting-up targets for exceeding expectations</td>
<td></td>
<td>Set-up of SMART target / threshold values (TOP3)</td>
</tr>
<tr>
<td></td>
<td>How to improve the cohesion at functional levels (TOU4)?</td>
<td></td>
<td></td>
<td>Better communication of results, goals and changes about the strategy</td>
</tr>
</tbody>
</table>

Notes:
1. Information within brackets refers to the confidential coding as described in Table 1, Chapter 3.
2. Assessment of KPIs was made only with Topic Owners as detailed in interview protocols
5 Design of a Value & Performance Measurement Mechanism Using BSCs

This chapter describes the design of the solution proposed for the C2U partnership. It first explains the main structure of a Value and Performance Measurement System using BSCs, its (sub)-perspectives and respective adaptations, linkage among the different strategic and tactical objectives, and the inclusion of KPIs. This solution is created according to the following inputs: Partnership vision and strategic objectives, results gathered from interviews, and outputs from the workshop sessions.

5.1 Creation and Adaptation of (Sub)-Perspectives

This section elaborates on the proposal for a value and performance mechanism system. It first explains how new (sub)-perspectives are created and adapted (Chesbrough, 2003; Norton, Kaplan & Rugelsjoen, 2010, Al-Ashaab et al, 2011 & Hellström & Jacob, 1999). Justifications are provided and interpretation on how these (sub)-perspectives fit within the purposes of a BSC by following a bottom-up approach. There are four main perspectives which include a set of sub-perspectives: (1) The financial perspective is divided in funding and financial stewardship sub-perspectives. (2) The foundation sub-perspective capacity building is part of the partnership processes perspective. (3) Partnership processes and growth include a span of human capital, knowledge and ecosystem sub-perspectives. Finally, (4) the stakeholder perspective is the top one, directly linked to the vision statement (Figure 8).

![Figure 8: Strategic Roadmap for Value & Performance Measurement](image)
5.1.1 Financial Perspective

As extracted from the interviews and workshops, the financial perspective is proposed as a foundation perspective, playing an enabling role for the subsequent perspectives (Kaplan, 2001). According to this, the adaptation of this perspective follows the findings explained in Section 4.2.2 by dividing it in two levels: Funding and financial stewardship that serve as foundation sub-perspectives, located at the bottom of subsequent (sub)-perspectives.

**Funding.** With the inclusion of this particular sub-perspective, the partnership looks for exploitation of existing funding sources currently available. Also, it is intended to leverage and/or develop new sources of funding, and explore future ones by influencing key stakeholders based on the outputs of the research projects. These funding sources might be public, private or public-private (see Figure 9). The importance of growing the sources of funding relies on the need to increase the amount of monetary resources, thus raising the amount of research projects. For instance, the individual or shared developments generated because of this alliance can be utilized as lobby mechanisms to get access to funding, that could (not) be possible to get by the separate partners. This can be achieved by providing the impact of innovations developed by the partnership in terms of societal, scientific, technological and/or business relevance depending in the funding source. This sub-perspective is aligned to the strategic objective “...influence programs for public private partnerships and public funding.”

![Figure 9: Visualization of Funding Sub-Perspective](image)

**Financial Stewardship.** How to manage the current available funding, program spending and control are topics of importance for the partnership. By including this, the alliance will be able to evaluate execution of the program management portfolio and as a result, it will be able to track sufficient funds to keep building the partnership capacity. Furthermore, it implies accountability on how the current available funding is been spent by the different programs under execution. By spending wisely the available research funds, the partnership will be able to provide evidence in terms of accountability and further influence funding programs for future research projects.

![Figure 10: Visualization of Financial Stewardship Sub-Perspective](image)

5.1.2 Partnership Processes and Growth Perspectives

As indicated, the partnership processes and growth perspectives are taken into account as core perspectives for value and performance measurement. Within these, the sub-perspectives of human capital development, knowledge and ecosystem are included and span from partnership processes to
growth (see Figure 8). Human capital, knowledge and ecosystem are considered as important aspects of value and performance measurement because of their potential to provide a societal, scientific and technology impact. In addition, a foundation sub-perspective named capacity building is included as part of the partnership processes perspective. This last sub-perspective is intended to provide sustainability of the other three sub-perspectives.

**Capacity Building Sub-Perspective.** This particular perspective is proposed as a result of the workshop sessions held with ILI representative(s). It is founded based on the practical knowledge and experience by currently managing and running this partnership, and on the fact that the partnership involves longer sustainability to keep it up and running.

The partnership needs continuous follow-up since there will be resources coming in and out according to the completion of successive research and development projects. Replenishment of vacancies and current staff is crucial since it permits to build the required capacity to directly sustain the knowledge and human capital sub-perspectives. It also indicates the real possibilities to have new research projects coming to the pipe line. It also serves as sustainability foundation for the ecosystem sub-perspective. However, it is expected to have an indirect effect on this last one (see the green arrows as depicted in Figure 8). For the purposes of the three sub-perspective capacity building serves as inputs for sustained execution and future growth of the partnership. The KPIs related to this sub-perspective are targeted to identify the need to fulfill of research resources and potential new ideas (Section 5.3).

**Human Capital Sub-Perspective.** As it was indicated in Section 4.2.2, the two organizations have separate and shared aims by developing human capital. TU/e looks for developing human capital as a way to achieve the creation and dissemination of knowledge. Furthermore, training of knowledgeable resources is a key activity in order to have possible candidates that can be useful for Philips Lighting (e.g. master students, doctorate candidates, etc.). For the company, the attraction and retention of talent is key since it lets to grow its internal capabilities. These are indeed different, but complementary approaches on this particular sub-perspective. In addition, for both organizations, the exchange of professionals is quite important for the purposes to (co)-create knowledge in-outflows as it represents a way to foster shared collaboration. This can be visualized as per Figure 11, where the direction of human capital development is represented via arrows.

By including this sub-perspective into the partnership processes perspective, the organizations will be able to track the current amount of resources allocated at the different projects being executed. This is led by the capacity building sub-perspective which serves as inputs as illustrated in Figure 8. Furthermore, with the span of this sub-perspective into the growth perspective, the alliance will be able to track the end results at the conclusion of research projects. Finally, by including this sub-perspective the cascading effect from the strategic vision will be kept (Vanhaverbeke, 2013).

![Figure 11: Visualization of Human Capital Sub-Perspective](image-url)
**Knowledge Sub-Perspective.** As extracted from the interviews and vision statement, the creation and dissemination of knowledge is considered as a strategic activity which is linked to the following objectives:

- *Strengthen the position in the scientific and innovation landscape.*
- *Being recognised as leading in the area of research & innovation in science & technology.*

As indicated in Section 4.3 the creation and dissemination of knowledge are common, shared key activities executed by both organizations incorporated as part of their vision statement (Porter, 1996). This is materialized by the current shared innovation processes model of the two organizations (refer to Figure 6, Chapter 4). This argumentation motivates to keep this sub-perspective as part of the partnership processes and growth since the alliance will be able to track current execution (with process-based metrics) and growth (outputs) of their separate and shared research activities. Moreover, knowledge can be considered a key output because of the development of human capital as also discussed in Section 4.3. As a result, it fulfills the strategic objective to have the partnership “...recognized as leading in the area of research and innovation in science and technology”. Furthermore, this sub-perspective will permit the partnership, by measuring via KPIs, the success of the research programs. With it, the organizations will be able to evaluate its innovative outputs by formalizing this partnership as an open strategy for knowledge exploration and exploitation (Laursen & Salter, 2006).

**Ecosystem Sub-Perspective.** The alliance is considered to run in a innovation “space” within the intelligent lighting ecosystem. Within this space, both, the university and the firm work together with common, temporarily and long-term objectives adapted along time. This denotes a dynamic environment in which the partnership currently works. While occupied on the development of new technologies, both partners might find that certain innovations may not fit within their shared or individual capabilities or interests. Furthermore, other new collaborative research projects require larger consortia and as such, there may already be opportunities for an “expanded ecosystem” by considering the use of relevant technologies in such a setting by other partners. By doing this, the alliance will reflect more dynamics based on the advance of technologies (Chesbrough & Prencipe, 2008). This is in alignment with the strategic objective: “…consolidate and expand continuously learn and to add more value through expanding the ecosystem.” This can be understood by the fact of acquiring and advancing new knowledge will help to strengthen the position in the lighting and innovation ecosystem by finding external exploitation channels (Gassmann, Enkel, & Chesbrough, 2010; Adner, 2012).

This sub-perspective is put in place to integrate different levels of the of the lighting value chain. This will be accomplished by looking for partners / complementors within the lighting ecosystem itself, but avoiding to engage with competitors of the firm. Also, it is important to consider other potential actors within a broader innovation ecosystem that might help not only to develop possible new technologies, but to possibly expand the current value chain or create possible new ventures outside the lighting value chain.

Figure 12 illustrates the previous explanation, where the Flagship (the partnership) is located within the lighting ecosystem (light blue cloud), surrounded by a broader innovation ecosystem (blue cloud). The arrows represent the in-outflows of knowledge at both, the lighting and broader innovation ecosystem where the partnership can bring-in more actors, and in-outbound knowledge transfers.
5.1.3 Joint Partnership Perspective
The joint partnership perspective is the top one, directly linked to the strategic vision. It is driven by the fact this partnership is intended to provide an impact with meaningful innovations by structurally aligning the efforts and sharing results by both, TU/e and Philips Lighting. It is proposed to offer evidence of the joint work executed as part of this alliance by means of evidence of joint (in)tangibles outputs. It will provide evidence of the impact of the partnership as a single entity and its actors. It will also aid decision makers to visualize the balanced contribution of both parties. This perspective is based on the previous (sub)-perspectives: Knowledge, Human Capital, Ecosystem and Financials.

By including this separate perspective, it is expected to use it as influence mechanism to get more funding sources and thus, creating a link with the foundation financial perspective in order to get more funding for future research projects. This is explained in the next section of this Chapter by describing the alignment among the different strategic / tactical objectives.

5.2 Link among the Strategic and Tactical Objectives
Each of the (sub)-perspectives proposed above have their own specific objectives. Few of them are strategic while others are more tactic (e.g. capacity building sub-perspective). The interrelation of these objectives is of great importance since it serves as linking mechanism from the strategy, as such it helps to avoid problems when mapping causality among the different objectives (Northcott & Taulapapa, 2012 and Lawrie & Cobbold, 2004).

Figure 13 illustrates the link and relationships among all the different objectives. As indicated in the previous section, financial objectives serves as the basis for value and performance measurement, directly linked to the partnership processes (building capacity). Building capacity serves as well as foundation objective (directly related) to the following ones: Enhance human capital, (co)-create and disseminate knowledge and lead in the area of R&D. These objectives also have direct relationships respectively as shown in Figure 13. In addition, it is interpreted these objectives will have an indirect effect on the objective to expand the ecosystem since the later depends on other indirect factors (networking, knowledge created, business opportunities, etc.). This is represented by the dotted lines in Figure 13.

The attraction of talent, an objective primary of the interest of Philips Lighting, is fed by the objectives “enhance human capital, co-create and disseminate knowledge and expand the ecosystem”. This comes from the fact that the creation of useful knowledge, materialized by applied technologies, serves as an indication of the capabilities and abilities of future personnel that could be attracted by Philips Lighting. The identification of knowledgeable candidates can also happen by expanding the ecosystem and including relevant actors within the value chain.
By leading in the area of R&D, (co)-create knowledge, attract talent and expand the ecosystem; it is expected to positively impact in bringing significant contributions to meaningful innovations. This is based on the different views by which contributions can be evaluated. These contributions will serve as main evidence mechanisms to positive influence funding programs (public, private and/or both) and thus, increase funding for more research projects. Influence in funding programs can also be directly linked to the capacity building required for future projects, and indirectly linked by a wise spending as indicated by the objective of account available funding. According to this, and as seen in Figure 13, the link of the several objectives follow a cycled route and create a continuum for future research projects during the lifespan of this alliance.

Figure 13: Cause & Effect Diagram with Strategic and Tactical Objectives
5.3 Inclusion and Types of KPIs for Value & Performance Measurement using BSCs

As argued in Section 2.2.3, a set of measures is required to evaluate value and performance of all the salient aspects of the collaboration activities (Perkmann, Neely, & Walsh, 2011). The inclusion of KPIs will complement the value and performance measurement system, since KPIs will serve for managerial and decision making purposes in the collaborative research and development activities (Rohrbeck & Arnold, 2006).

Regarding the type of KPIs to be used, in Section 4.2 it was indicated that all Topic Owners are in favor of having input, process-based and output metrics. According to this finding, the proposed value and performance measurement system includes this feature within and across its different (sub-)perspectives. As such, the financial perspective has its own input, process-based and output indicators. The partnership processes includes inputs and process-based KPIs, while growth and joint partnership perspectives include output KPIs. Capacity building sub-perspective KPIs are the input metrics for the following metrics: Knowledge and human capital. With this approach, the alliance will be able to identify impact in one area at the expense of another.

The inclusion of these KPIs is organized per (sub)-perspectives with their respective strategic objectives by following the template of BSCs (Norton & Kaplan, 1992). It denotes the final step in order to cascade the alliance vision, its strategic (sub)-perspectives and objectives. The set of KPIs is created in accordance with the metrics currently used by the partnership, and by following / adapting the ones provided by Al-Ashaab et al (2011), Perkmann, Neely, and Walsh (2011) and Philbin (2008). Source reference is included as a numbered superscript at each KPIs as detailed in Table 3. Moreover, as indicated in Chapter 4 ; the impact of this partnership is not directly measured in economic value at all. Instead, it is measured in terms societal and scientific and technology impact (e.g. transfers and invention disclosures/patent filings as proxies for future potential economic value). This impact will be measured according to the adaptation, creation and interrelation of all the (sub)-perspectives proposed for value and performance measurement.

The above mentioned interrelation of KPIs could be understood with the following example: The number of opportunities identified in the strategic roadmap denotes future research projects. Those opportunities trigger submitted funding proposals, if accepted, they trigger the aperture of research vacancies and internship assignments. These vacancies are formalized as hires within the project portfolio. Once these hires are in effect, candidates and students submit paper / IP proposals. If accepted, they are materialized as scientific publications and IP. According to these, and other outputs, then a candidate might be hired by Philips Lighting at the end of the research project. Furthermore, if the outputs of these research projects are satisfactory, they could be used as influence mechanisms in order to get more funding for research projects. This explanation exemplifies the alignment from the strategic strategic objectives, (sub)-perspectives and operationalization via KPIs for the value and performance measurement system using BSCs.

Finally, Table 3 has columns to include targets/threshold and initiatives also as part of the template of BSCs (Norton & Kaplan, 1992). However, these two last items are left blank since they are discussed as possible recommendations as additional activities when implementing this value and performance measurement system. Section 5.4.2 elaborates on those recommendations.
<table>
<thead>
<tr>
<th>Perspective</th>
<th>Sub-Perspective</th>
<th>Objectives</th>
<th>KPIs</th>
<th>Type of KPI</th>
<th>Target / Threshold</th>
<th>Initiatives</th>
</tr>
</thead>
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<td>Financials</td>
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<td>Influence funding programs &amp; Add value with economic relevance</td>
<td># of new funding sources identified (^2)</td>
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<td># of submitted funding proposals (new, public, private, public-private) (^2, 3)</td>
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<tr>
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<td></td>
<td></td>
<td># of approved funding proposals (new, public, private, public-private) (^2, 3)</td>
<td>Output</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Amount of funding provided by Philips Lighting (^2)</td>
<td>Output</td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td>Amount of funding provided by TU/e (^2)</td>
<td>Output</td>
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<td>Stewardship</td>
<td>Account available funding</td>
<td>Total annual budget for investment in partnership (^2, 3)</td>
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<td>Annual spending in partnership (^2)</td>
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<td></td>
<td></td>
<td># of open internships (BSc, MSc) (^2)</td>
<td>Input</td>
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<td></td>
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<td></td>
<td></td>
<td># of open part-time vacancies at Philips Lighting (^2)</td>
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<td></td>
<td></td>
<td></td>
<td># of open part-time vacancies at TU/e (^2)</td>
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<td></td>
<td></td>
<td># of opportunities identified in the roadmap (^1, 4)</td>
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<td>Enhance human capital</td>
<td># of Philips Lighting staff involved (^1)</td>
<td>Process-based</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td># of TU/e staff involved (^1)</td>
<td>Process-based</td>
<td></td>
<td></td>
</tr>
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<td></td>
<td></td>
<td># of candidates hired (PhD, PDEng, Post-Docs) (^2, 4)</td>
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<td></td>
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</tr>
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<td></td>
<td></td>
<td># of internships (MSc, BSc) (^2)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td># of candidates about to finish (PhD, PDEng, Post-Docs) (^2)</td>
<td>Process-based</td>
<td></td>
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</tr>
<tr>
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<td></td>
<td></td>
<td># of internships about to finish (MSc, BSc) (^2)</td>
<td>Process-based</td>
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</tr>
<tr>
<td>Knowledge</td>
<td>(Co)-create and disseminate knowledge</td>
<td># of invention disclosures (^1)</td>
<td>Input</td>
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<td></td>
</tr>
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<td></td>
<td></td>
<td># of submitted patents (joint or individual) (^1, 3)</td>
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<td></td>
<td></td>
<td># of submitted papers (joint or individual) (^1, 3)</td>
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<td># of accepted ideas for outbound transfers (^2)</td>
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<td></td>
<td></td>
<td># of licensing options (^1, 2)</td>
<td>Input</td>
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<td></td>
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<td>Sub-Perspective</td>
<td>Objectives</td>
<td>KPIs</td>
<td>Type of KPI</td>
<td>Target / Threshold</td>
<td>Initiatives</td>
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<td></td>
<td># of persons hired by TU/e $^{2}$</td>
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<td></td>
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<tr>
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<td></td>
<td></td>
<td># of part-time hires at Philips Lighting $^{2}$</td>
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<td></td>
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<tr>
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<td></td>
<td></td>
<td># of candidates graduated (PhD, MSc, BS, PDEng) $^{1}$</td>
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<td># of filed patents (joint or individual) $^{1,3,4}$</td>
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<td></td>
<td></td>
<td># of approved publications (joint or individual) $^{2,3,5}$</td>
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<td></td>
<td></td>
<td></td>
<td># of conferences (joint or individual) $^{1,3}$</td>
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<td></td>
<td></td>
<td># of transfers within Philips Lighting $^{1}$</td>
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<td>Ecosystem</td>
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<td># of outbound transfers $^{2}$</td>
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<td># of inbound transfers $^{2}$</td>
<td>Output</td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td># of new actors involved (companies, personnel) $^{2}$</td>
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<td>Partnership</td>
<td>Bring significant contribution to meaningful innovations</td>
<td>Ratio of part-timer workers (total &amp; separate) $^{2}$</td>
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<td></td>
<td></td>
<td></td>
<td>Ratio of joint / separate publications $^{2}$</td>
<td>Output</td>
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<td></td>
<td></td>
<td></td>
<td>Ratio of joint / separate IP $^{2}$</td>
<td>Output</td>
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<td></td>
<td></td>
<td></td>
<td>Ratio of joint / separate conferences $^{2}$</td>
<td>Output</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Ratio of funding of Philips Lighting &amp; TU/e $^{2}$</td>
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<td></td>
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</tr>
<tr>
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<td></td>
<td></td>
<td>Ratio of separate funding $^{2}$</td>
<td>Output</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sources of KPIs:

1: Current partnership’s KPIs
2: Developed during the workshop sessions
3: Al-Ashaab et al (2011)
4: Perkmann, Neely, & Walsh (2011)
5: Philbin (2008)
5.4 Conclusions & Recommendations about the Value & Performance Measurement System

To close this Chapter, final concluding remarks regarding the Value and Performance Measurement System are argued, and recommendations for its implementations are suggested as well. These recommendations might be considered as side future projects to further improve this solution according to the evolution of the partnership.

5.4.1 Conclusions

This Chapter was intended to respond to the sub-research question (Section 1.2): What are important characteristics of a relevant performance measurement system? This was made by following the discussion from Chapter 4, where it was stated that Philips Lighting and TU/e partnership required a more structured, alignment and cascading effect in its value and performance measurement system. A 3rd Generation BSC (Lawrie & Cobbold, 2004) was proposed as solution direction in order to incorporate the vision statement, strategic objectives and the adaptation / creation of (sub)-perspectives with respective KPIs (Chesbrough, 2003; Norton, Kaplan & Rugelsjoen, 2010, Al-Ashaab et al, 2011 & Hellström & Jacob, 1999).

In accordance with this previous statement, this Chapter elaborated on the different features required for a value and performance measurement system: It was possible to determine a strategic roadmap by creating and adapting the strategic (sub)-perspectives according to the findings out of interviews, vision statement and workshop sessions. This led to offer a strategic roadmap built on a causation and effect approach among the different strategic and tactical objectives of this partnership. By doing this, it was possible to connect the different interrelations among those objectives (Northcott & Taulapapa, 2012 and Lawrie & Cobbold, 2004). Next, KPIs were included in order to evaluate all the important aspects of this partnership (Perkmann, Neely, & Walsh, 2011). These KPIs were formulated based on the current list of KPIs used by the two organizations and on the ones recommended by Al-Ashaab et al (2011), Perkmann, Neely, & Walsh, (2011) and Philbin, (2008). These metrics were allocated considering an input, process-based and output approach as extracted from the interviews.

5.4.2 Recommendations

The first proposal is setting-up thresholds / targets and initiatives as key activities needed to complement the value and performance mechanisms system. With them, the partnership will be able to compare current performance against the future aims of the alliance in a short-, middle- and/or long-term periods. Defining target / thresholds is extracted from interviews (see improvement opportunities in Table 2, Chapter 4). Their inclusion will let the alliance to compare current results and then determine (under/over)-performance. The main challenge relies on the fact that projects might differ in terms of objectives, time and the amount of resources involved. Also, the differences in terms of scientific disciplines, and specific attributes of each projects and topic add complications to set-up general targets / thresholds. However, this issue might be solved by looking at past performance of completed projects (Perkmann, Neely, & Walsh, 2011). With this information, both organizations will be able to identify the real capabilities of their research collaborations based on real data and lessons learned. Following this discussion, initiatives are an important aspect of BSCs as well. These are the means by which the alliance will be able to accomplish its targets (Kaplan, 2001). Initiatives should be consistent with the overall value and performance measurement system (Norton & Kaplan, 1996; Al-Ashaab et al, 2011). As it happens with targets, the partnership is advised to include the respective initiatives according to the lessons learned, and independent characteristics of each of the research programs and topics. In both cases, target and initiatives should be set in a specific manner and not in a generalized way. This requires the agreement and understanding of all actors involved in the partnership as found out in the discussions held during the workshop sessions. As a reminder, strategy and value and performance
measurement should focus on the outputs that the partnership wants to accomplish, and not on the initiatives being implemented.

The second recommendation offered to the partnership is the creation of a communication plan of the vision statement, strategy, and results versus objectives among all the actors involved in the partnership. An explicit strategy will guide participants in making decisions that are aligned with the strategic and tactical objectives of the alliance (Porter, 1996). A good communication plan will allow all participants will understand the current and/or future changes in the strategy. This communication should contemplate, at least, two main characteristics: (1) Communication means and tools (e.g. communication letters, emails, meetings, etc.) and (2) an explicit and targeted message, so participants can understand it correctly, and act consequently according to the vision statement, strategy and strategic objectives (Kotter, 2007). A clearly communicated strategy will raise the awareness of the BSC’s performance management potential (Northcott & Taulapapa, 2012). This is an central aspect to consider based on the scientific and business dynamics in which this partnership is involved.

The third recommendation relies on side activities that could help to expand the current lighting ecosystem. As explained, this is a feature integrated as a sub-perspective of the value and performance measurement system. It should serve as a tool to identify and (co)-create knowledge of other external parties of the alliance in order to integrate actors at different levels of the lighting value chain as discussed in Section 5.1.2. However, this objective should be accompanied by other initiatives that will facilitate this to happen. The partnership should consider to implement mechanisms that facilitate innovation processes for individual actors, the creation of the innovation community (van der Borgh, Cloodt, & Romme, 2012), and trans-organizational knowledge management (Carayannis, Alexander, & Ioannidis, 2000). The challenge in this scenario is how to integrate externals and those mechanisms into this particular setting in which the university and the company have established a shared ambition. The current flagship collaboration in the Health Care sector could be an interesting benchmark in this regard since it involves the integration of the company, the university and a medical center.

The fourth recommendation is related to the evaluation of social cohesion, and enhance shared participation among several actors within the partnership. This particular recommendation was extracted from interviews, provided by TOU4. According to this, it is advised to the partnership to evaluate, and include as needed, possible measures and initiatives that will permit to identify social aspects within the collaboration as additional aspects to measure as part of the value and performance measurement system (Phibin, 2008).

A final recommendation is related to the continuous review and adaptation of the value and performance measurement system. This recurrent revision is critical considering that Open Innovation activities evolve through time according to the dynamics of business and technologies (Chesbrough, 2003b; Chesbrough, 2007 and Chesbrough & Prencipe, 2008). Based on this, strategic revisions should take place and thus, assess the adequacy of the current research programs, topics and projects based on the new research interests of the partnership. This value and performance measurement system should be seen as an adaptive tool according to the dynamics of the partnership.
6 Final Conclusions & Recommendations

This case research study aimed to answer the following research question: What are the key components of a Value and Performance Measurement System within the context of a C&U innovation collaboration partnership between TU/e and Philips Lighting? This question was answered by first analyzing how this partnership is characterized within the Open Innovation theory. Based on this analysis, it was possible to understand why this partnership is important for the two organizations, the main reasons that motivated this partnership to happen, its facilitating factors, and the archetype process carried out by the alliance. The roles the two organizations have put in place for their shared research activities is quite interesting. Their research and development activities follow a cycle path with interactions of scientific and technological push, and business and markets pull forces (Berkhout et al, 2006 & Schoen et al, 2005).

Furthermore, it was possible to analyze the main strategic path of this partnership, in which the vision statement incorporates key common activities for the two organizations (Porter, 1996). Followed by the elaboration of strategic goals as guidance mechanisms (Collins & Porras, 1996), and the organizational structure in place in order to deploy, communicate, track and analyze results. These two elements are quite aligned with its archetype process since there are connections with the vision statement and strategic objectives (e.g. human capital development and (co-)creation and dissemination of knowledge as common activities, and development of meaningful innovation). In regards of the current status of value and performance, Chapter 4 elaborated on the important components of value and performance discussed by different stakeholders in this partnership. These elements were incorporated in order to offer a proposal of a value and performance measurement system using a 3rd Generation BSC (Lawrie & Cobbold, 2004).

The understanding of the context in which this partnership operates, plus taking into account the insights and opinions of key stakeholders and current strategic path and objectives, led this research to finally come out with a proposed solution to measure value and performance in an integral manner. It incorporates the vision statement, strategic objectives, created and adapted (sub-)perspectives and includes KPIs for respective measurement and it is adapted to the current needs of the alliance (Al-Ashaab et al, 2011, Chesbrough, 2003b; Kaplan, Norton & Rugelsjoen, 2010).

With the implementation of this value and performance measurement system, the partnership will be able to better leverage and master this relationship and streamline its processes for future collaborations (Melese et al, 2009). This can be accomplished by following recurrent reviews of its strategy and objectives, but also with the adaptation of the measurement systems according to the dynamics of the partnership (Chesbrough, 2003b; Chesbrough, 2007 and Chesbrough & Prencipe, 2008) as recommended in Section 5.4.2

6.1 Theoretical Contribution of the Study

As discussed in Chapter 2, value and performance measurement is a topic that has been assessed in different approaches by scholars. Some argued how to evaluate intangible outputs of university and industry collaborations (George, Zahra & Wood, 2002; Hanel & St-Pierre, 2006 and Lööf & Bronström, 2008), others proposed single operational metrics (Lundberg et al, 2006; Dooley & Kirk, 2007 and Laursen & Salter, 2006), and others emphasized on value and performance systems (Philbin, 2008, Perkmann, Neely & Walsh, 2011) using BSCs (Al-Ashaab et al, 2011 and Hellström & Jacob, 1999). As such, this study looked for further providing to the academic literature a real-life case which can be used for reference when trying to analyze value and performance in the C2U collaborations.

Following the discussion on the previous paragraph, the findings of this study are presented by taking into account information from the insights of the collaborations. This is achieved by analyzing outputs
of interviews held with key participants of this partnership, integration of a theoretical-based framework, and by incorporating the participation of key stakeholder(s) during the workshop sessions. As a result, this study is specific by considering only aspects of value and performance of concern of the two organizations. Likewise, it can be considered as an additional example on how BSCs and performance metrics should be created and/or adapted within Open Innovation partnerships. According to the methodology used in this study, it was possible to adapt and create (sub-)perspectives, showing flexibility based on the important aspects to be measured by the alliance (Chesbrough, 2003b and Kaplan, Norton & Rugelsjoen, 2010).

In regards of Open Innovation theory, this case research confirms how commercial organizations and research universities decide to strategically engage in partnerships. According to this, the importance of this partnership, its facilitating factors and archetype processes of Open Innovation are in alignment with the Open Innovation academic literature. An additional contribution to the literature relies on demonstrating the common, shared ambition of the organizations and how TU/e has an equal leading role within this partnership. This situation might be categorized as an example on the shift that universities are taking with industrial partners (Perkmann & Walsh, 2009), and it is presented as an interesting case as a Company & University partnership instead of Company to University. The latter implies direction, while the former might imply a shared ambition, materialized by the shared vision, partnership organizational structure and shared research roles.

6.2 Managerial Implications
This study provides a proposal of a value and performance measurement system for Philips Lighting and TU/e. This measurement system reflects today’s needs and aspects of importance for the two organizations. The partnership should be aware of the fact that collaborations of this kind are dynamic, and evolve next to the development of innovations (Chesbrough & Prencipe, 2008). As such, the salient features included in this proposal might change according to the developing of new technologies and/or business and academic needs. Based on this, it is advised to the alliance to recurrent (re)evaluate this value and performance mechanism system and adapt it according to future needs. As indicated by Braam and Nijssen (2004), the way as a BSC is used will influence organizations’ performance.

Suggestions for implementation of the value and performance measurement system are discussed in Section 5.4.2. These suggestions are based on the findings from interviews and discussions held during workshop sessions. They are intended to offer additional mechanisms and tools when fully implementation will start. Suggestions are related from setting-up targets and thresholds, strategy and results communication, social aspects within the collaboration, and how to facilitate the expansion of the current ecosystem by including new actors. These suggestions represent possible new projects by their own and as such, it is also advised to this and other partnership(s) to include them as part of their project portfolio management to track advance and future implementations.

Finally, this case research study might serve as a comparative example when setting-up C2U value and performance measurement systems. Although each partnership is unique, with its own vision, strategy and objectives; this study might serve to practitioners by following its methodology. As a result, decision makers and stakeholders will be able to create specific value and performance measurement systems and thus, contributing to provide more empirical evidence in this specific context.

6.3 Limitations & Suggestions for Future Research
This study was carried out by following a qualitative research approach since it was intended to provide precise answers to specific research questions (Price, 2012); as detailed in Chapter 1 of this paper. The main method used was case research, appropriate for exploratory studies (Bhattacherjee, 2012) within real-life or business related contexts (Yin, 2003 & Gummensson, 2000) as analyzed in this report. With
case research studies it is possible to capture a rich array of contextual data and let to analyzing data in different perspectives; thus delivering richer interpretation of phenomena (Bhattacherjee, 2012). However, case research studies are criticized due to subjectivity since interpretation of results heavily depends on the observational and integrative ability of the researcher. Additionally, inferences are contextualized to a specific case, and as a consequence generalization of the results of this paper cannot be assumed (Gummensson, 2000). Finally, this case research involved no experimental control, as a consequence internal validity might remain weak (Gummensson, 2000 & Bhattacherjee, 2012). Hence, interview protocols were proposed for validity assurance as part of this study to overcome the above mentioned issues (see Appendix 4 and 5).

In regards of future research, literature consulted for this research is company centric, from the Open Innovation theory (Chesbrough, 2003; Chesbrough, 2003b and Melese et al, 2009), and the dyadic partnerships between company and universities. The last one implies a direction from the company to university (C2U) collaborations (Mansfield & Lee, 1996; Becker & Dietz, 2004; Fabrizio, 2006; Fontana, Geuna, & Matt, 2006; Laursen, Reichstein, & Salter, 2011; and Picado Arroyo et al, 2015). Additionally, other sources have shown that the role of universities within collaborations relies on complementarities within innovation ecosystems (Chesbrough & Prencipe, 2008; Rothaermel, Agung, & Jiang, 2007 and Wissema, 2009). However, as discussed in Chapter 4 and Secton 6.1, the current partnership between TU/e and Philips Lightings present a shared, common ambition; where that company to university direction does not necessarilly apply. In this regard, TU/e has an equal leading role within this partnership. As such, it is interesting to investigate on the conditions that facilitated how an academic institution (co)-leads a partnership, and how it could potentially (co)-lead and build an innovation ecosystem by attracting more complementors to the current partnership.

Finally, this particular case research centered its attention to design a value and performance measurement system in a dyadic partnership. It might serve as the basis for case research studies in the context of multi-party partnerships since there is a strategic objective on expanding the current lighting ecosystem. According to this, the partnership could still be used to investigate how to adapt and implement a value and performance measurement system in a situation where more actors are involved within a partnership. The inclusion of potential more actors within the current partnership might represent one element that characterizes the dynamics of the alliance (Chesbrough, 2003b; Chesbrough, 2007 and Chesbrough & Prencipe, 2008).
Bibliography


### Appendix 1: Summary of Value & Performance Mechanisms University & Industry Collaborations

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Does it measure Innovation value and performance in C2U Collaboration?</th>
<th>Single Operationalized Metrics (Type of Metric)</th>
<th>Performance Measurement System (Type of Tool)</th>
</tr>
</thead>
<tbody>
<tr>
<td>George, Zahra and Wood (2002)</td>
<td>No</td>
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<td>Hanel and St-Pierre (2006)</td>
<td>No</td>
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<td>Lööf and Bronström (2008)</td>
<td>No</td>
<td></td>
<td></td>
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<tr>
<td>Lundberg et al (2006)</td>
<td>Yes</td>
<td>Co-authored publications &amp; co-funding</td>
<td></td>
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<tr>
<td>Dooley and Kirk (2007)</td>
<td>Yes</td>
<td>Knowledge transfer: Rate &amp; speed of knowledge</td>
<td></td>
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<tr>
<td>Laursen and Salter (2006)</td>
<td>Yes</td>
<td>Patents</td>
<td></td>
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<tr>
<td>Hellström &amp; Jacob (1999)</td>
<td>Yes</td>
<td>Balanced Scorecards &amp; perspectives</td>
<td></td>
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<tr>
<td>Al-Ashaab et al (2011)</td>
<td>Yes</td>
<td>Balanced Scorecards &amp; perspectives</td>
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**Appendix 2: Comparison of Perspectives for Value and Performance Measurement in the C2U Collaborations**

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<tr>
<td>Norton &amp; Kaplan (1992)</td>
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Appendix 3: Visualisation of Research Approach

Historic Description TU/e & Philips

Assessing Strategic Collaboration Plans

Current State of Collaborations

Design Value & Performance System

Feedback Loop

Descriptive:
- Historic review of both organizations
- Past collaboration activities
- Current collaborations

Strategic Assessment:
- Assess Open Innovation Characteristics of this partnership
- Identify the individual / partnership vision
- Determine perspectives for performance measurement
- Determine strategic goals for collaborations

Descriptive:
- Identify possible links / gaps between senior and functional management strategic vision and objectives
- Current methods & KPIs to assess collaboration performance

Contemplates:
- New perspectives
- Strategic Objectives
- Process-based review: Inputs, In-process & outputs
- KPIs
Appendix 4: Interview Protocol – Strategic Vision and Objectives of the Collaboration Activities
This interview protocol focuses on the identification and data gathering related to the strategic state of the collaboration activities between the two organizations. It is targeted to senior/high level hierarchical roles at both organizations since it asks questions related to the vision and strategic objectives of the C2U partnership.

Introduction

Self-Introduction: I am Daniel Calvo Camacho from Costa Rica, candidate of the master of science in innovation management at Eindhoven University of Technology. I am currently doing research on Value & Performance Measurement Systems in the Open Innovation Collaborations of Company to University (C2U).

Aim of this Study: The aim of this study is to analyse the current collaboration activities between both organizations, TU/e and Philips Lightning Business Unit. Outputs of this interview will be used to design a Value & Performance Mechanism based on BSC’s useful for strategic evaluation of value and performance.

Confidentiality: No personal and/or confidential information will be shared outside the research team. Audio recordings are made, however they will not be distributed and will not be played back in the presence of persons other than the researchers. The material will be used only for scientific analysis.

Part I: Open Innovation
The questions are intended to initiate general discussion about the current collaboration activities between the two organizations and identify the main reasons and facilitating factors behind TU/e and Philips joint efforts with this partnership.

1) Can you tell me about the current collaboration initiatives (projects) between TU/e and Philips?
   Sub-Questions:
   o To what extent are these projects basic or applied research?

   Notes:
   o Mentoring and commitment by both organizations.
   o Remind the collaboration agreement signed-off in 2014.
   o Elaborate on exploration, exploitation, basic and or applied research projects as needed.

2) Why is it important to currently collaborate with Philips - TU/e?
   Notes:
   o Remind the collaboration agreement signed-off in 2014.
   o Look for the main reasons both organization are collaborating together.
   o Introduce the concept of complementarities if needed.
3) What do you think are important factors / drivers that facilitate this partnership initiative to happen?

Notes:
- Elaborate at commercial organizations: Seek for external knowledge, Internal R&D as screening agent of external knowledge, Internal capabilities and initiatives.
- Elaborate at academic organizations: Geographical proximity to firms, quality of the academic institution, Internal capabilities and initiatives.

4) What’s the role of TU/e – Philips in these collaboration efforts, considering both organizations within the innovation funnel?

Notes:
- Elaborate about the innovation funnel if needed.

5) Which business functional areas / academic (sub)departments are subject to collaborate with TU/e - Philips?

Part II: Strategic Partnership
This section focuses on the identification of the strategic issues of importance of the collaboration activities between TU/e and Philips. Based on this, questions are targeted to identify the organizational / partnership vision and areas of interest subject of value and performance measurement.

6) What is the vision that both organizations have put in place with their collaboration efforts?

7) What are organizations’ / partnership’s strategic areas of focus for these collaboration activities?

Sub-Questions:
- In your opinion, is the ____________ perspective a strategic area of focus?
- What about the __________ perspective?

Notes:
- Elaborate on the concept of perspectives as needed.
- Traditional Perspectives: Customer, financial, internal business process and learning and growth.
- Complementary Perspectives: Competitiveness, innovation, sustainable development, strategic partnerships, fertility, knowledge (publications), IP management, others.

8) What are the organizations’ / partnership’s strategic objectives put in place to support those strategic areas/ perspectives of focus?

Notes:
- Remind about the collaboration agreement signed-off in 2014, bounded in the Flagship.
- Consider separate organizations’ visions in order to understand context of their collaboration activities, this in case there is not a shared vision.
- This can also be understood as critical success factors when measuring value and performance.
Sub-Questions:
- How those success factors / objectives are related to the organizational / partnership value & performance perspectives?

9) What kind of organizational / business decisions are made when assessing value and performance of those collaborations?

Sub-Questions:
- Who make those decisions?

10) How often do you envision reviewing the strategic results of this partnership with the other partner organization?

Notes:
- Revision at strategic levels.

Probe Questions
Probe questions are intended to further gather data in case interviewee is giving closed answers or not fully elaborating on his/her responses.

- Could you give me an example?
- Could you elaborate on that idea?
- Could you explain that further?

This interview protocol is intended to assess the alignment of strategic path lower levels of both organizations. Furthermore, it assess the current methods and metrics used to evaluate and measure value and performance.

Introduction

Self-Introduction: I am Daniel Calvo Camacho from Costa Rica, candidate of the master of science in innovation management at Eindhoven University of Technology. I am currently doing research on Value & Performance Measurement Systems in the Open Innovation Collaborations of Company to University (C2U).

Aim of this Study: The aim of this study is to analyse the current collaboration activities between both organizations, TU/e and Philips Lightning Business Unit. Outputs of this interview will be used to design a Value & Performance Mechanism based on BSC’s useful for strategic evaluation of value and performance.

Confidentiality: No personal and/or confidential information will be shared outside the research team. Audio recordings are made, however they will not be distributed and will not be played back in the presence of persons other than the researchers. The material will be used only for scientific analysis.

Part I: Alignment of Strategic Objectives at Functional Areas
This section is entirely dedicated to the identification of alignment between the strategic vision and objectives set by senior management and by functional owners.

1) What is the vision that both organizations have put in place with their collaboration efforts?

2) What are organizations’ / partnership’s strategic areas/ perspectives of focus for these collaboration activities?

   Sub-Questions:
   o In your opinion, is the _______________ perspective a strategic are of focus?
   o What about the ___________ perspective?

   Notes:
   o Elaborate on the concept of perspectives as needed.
   o *Traditional Perspectives: Customer, financial, internal business process and learning and growth.*
   o *Complementary Perspectives: Competitiveness, innovation, sustainable development, strategic partnerships, fertility, knowledge (publications), IP management, others.*

3) What are the organizations’ / partnership’s strategic objectives put in place to support those strategic areas/ perspectives of focus?

   Notes:
   o Remind about the collaboration agreement signed-off in 2014.
Consider separate organizations’ visions in order to understand context of their collaboration activities, this in case there is not a shared vision.

This can also be understood as critical success factors when measuring value and performance.

**Sub-Questions:**
- How those success factor / objectives are related to the organizational / partnership value & performance perspectives?

---

**Part II: Assessment of BSC’s as a Value & Performance Mechanism**

This section focuses in the identification of current methods being used on how both organizations measure value and performance, which includes the identification of current KPIs, potential new perspectives for BSC’s and decision making processes.

4) How does the organization currently evaluate value and performance of those collaborations?

5) Which kind of metrics are currently used in order to assess value and performance of those collaboration?

**Sub-Questions**
- Can you please share the current KPIs being used?
- How do those metrics complement / relate to the strategic objectives already placed by both organization?

6) What do you deem important characteristics of a relevant performance measurement tool for these collaboration efforts?

**Notes:**
- Relate to BSC’s and other sets of perspectives.

7) What is your opinion about potentially using input, process-based and output metrics for future value and performance evaluation?

**Sub-Questions**
- Besides the set of KPIs currently used, which other metrics do you consider appropriate for value and performance measurement?

**Notes**
- Link with the sets of perspectives.

8) How often does the organization evaluate value and performance of those collaborations?

- Who participate in those evaluations from both organizations?

9) What kind of organizational / business decisions are made when assessing value and performance of those collaborations?

- Who make those decisions?
10) How are results and decisions shared?
   - Internal in the organization.
   - With the other partner (Philips – TU/e).

11) How often do you envision reviewing value and performance next to the other partner organization in order to track progress against the vision and strategic objectives?

12) What improvement opportunities do you see while measuring value and performance of those collaboration activities?

**Probe Questions**

Probe questions are intended to further gather data in case interviewee is giving closed answers or not fully elaborating on his/her responses.

- Could you give me an example?
- Could you elaborate on that idea?
- Could you explain that further?