

# **Intraorganizational R&D network and strategic innovation management in a global company**

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## Abstract

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Abstract <p>This study explored the role of intraorganizational R&amp;D network for strategic innovation management in a global company. Intraorganizational network refers to the established R&amp;D network within different business units of a same company. The goal of the study was to identify the critical elements of the intraorganizational network that influence strategic R&amp;D, collaboration, and alignment within the company. Recognizing the contents of network relations and how these relations can be accessed was associated with the objective.</p> <p>The study was conducted as a qualitative single case study for a global company. The case company, with it`s headquarter in Finland, had different business units and each business units had their own R&amp;D units. The empirical data for this study were gathered by interviewing five of the senior management representatives from different business units with a semi-structured interview. Qualitative interview data were analyzed based on thematic categories and subcategories, identified within the theoretical framework and analysis, and complemented with abductive reasoning.</p> <p>For the case company, trust, responsiveness and timeliness, frequency of information exchange and their role in network were the critical network elements that defined strategic innovation and its management. Knowledge sharing and collaboration were the main contents of the network relations and accessing the quality and accessibility of network relations were identified based on governance structure and orientation. While this study mainly endorsed prior research in the field, it also supplemented existing research with new insights in filling current gaps in relation to understanding of interplay between inter and intraorganizational networks. The interplay of these networks clearly shapes how the R&amp;D networks within an organization should be visualized and what frameworks are to be consider when collaboration and strategic alignment is sought.</p>		
Keywords Intraorganizational network, Innovation, Network, Strategic Management, R&D, Collaboration, Alignment		

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## 1 Introduction

Diversification strategy is one of the four main strategies for business growth identification which enables corporates to fetch new markets they could tap into, or new products they could introduce to intensify their reach and revenue (Ansoff 1957). These diversification strategies can be *vertical*- branching out production of components, parts, and materials; *horizontal*- new products aligning to the existing business's knowledge and experience, or lateral- beyond the boundaries of the industry to which a company belongs. The rapid developments in global economy and evolving technological changes has constantly forced business to adapt diversification strategies, resulting in different business lines within a company. Conglomerate diversification, which is characterized by a single corporate group operating multiple business units within entirely different industries (Denis et al. 2002, Dhir & Dhir 2015), is becoming a global trend for multinational companies.

Although the conglomerate diversification is good for corporate profitability, it can also create isolated business units with their own characteristics and categories (Luo 2012). For instance, these self-reliant business units can have their own R&D units that focus on their own long-term growth and profitability. From corporate perspective any gain/loss in any business unit adds to corporate's profitability/loss, but it can also create situations where each of these secondary units are detached from each other and can behave like independent R&D clusters. In such scenario several factors, such as the coordination costs that arise from handling complex interdependencies among different business unit's R&D (Zhou 2011), can already set a limit. Certainly, the trade-off between the synergy and costs should be considered in aligning these independent secondary units.

From corporate's strategic innovation point of view it is very important to understand the role of these independent R&D clusters. A more eloquent causal relationship between business diversification, strategic innovation and role of internal R&D cluster is required in-order to develop meaningful network reach and effective knowledge creation, transfer, and application. Knowledge creation, management and sharing are areas where different business units can focus on influencing and improvising agile activities to generate synergistic benefits and be more effective and efficient to ensure support of the corporate strategy. By using a Case Company as an example, this thesis will try to develop an understanding why the alignment of secondary network units *i.e.*, R&D units are missing and how effective knowledge management and sharing can be improved to bring synergistic focus on developing new products. The overall outcome of the thesis is expected to identify and remove obstacles to enable fast implementation of the well-focused R&D.

## 1.1 Background

Innovation is one of the critical elements for the long-term success of companies and thus innovation should be the main goal for business growth (Ahlstrom, 2010). Traditional concept of a lone inventor followed by innovation creation through particular social functions with profitable purposes is already becoming obsolete. These days innovation is co-created and co-produced because of interaction among several players, defined within the framework of network (Öberg & Grundström, 2009). While the sources of innovations can be scattered or diversified among different inter and intra units within a network, the management of the strategic network relations to co-operate, co-create or co-invent between the business unit R&D, cooperate R&D and business is important.

The main function of R&D is to create new knowledge by recombining prevailing knowledge which can be within, beyond or across organizational boundaries/networks (Katila 2002, Rosenkopf and Nerkar 2001). Specifically, internal recombination of knowledge should enable companies to establish and keep competitive lead for a longer period of time (Chesbrough and Teece 1996). However, it appears that not all the knowledge held by a company is used in its internal recombination process (Podolny and Stuart 1995). This lack of internal recombination has been theoretically addressed as boundary-spanning roles in innovation processes (Tushman 1977) and conflicts in R&D structures (White 1961), with relationship between group longevity, performance, and communication (Katz 1982). Some research suggests that the sociometric or network models for understanding the decision making in organization can be valuable to understand the discrepancies in effective internal recombination (Argyres and Silverman 2003, Tichy et al. 1979, Tsai and Ghoshal 1998, Tushman and Romanelli 1983), a detailed understanding of the network dynamics and process to enhance the internal recombination remains unexplored.

While much focus has been on understanding strategic innovation from multi-industry aspects, it is rare that research is focused on conglomerate (multi-industry company) or within different business units in an organization. Business units R&D are often focused on developing differentiated offering for their respective business units and can be detached from agile development principles in collaborative and integrative corporate R&D. Alignment of R&D units to improve more agile activities and generate synergistic benefits in collective approach is desired to be more effective and efficient to ensure support of the corporate strategy. In this context, understanding of the structural attributes of individuals nodes in an intraorganizational network should serve as indicators of the characteristics and vibrancy in developing collaborative and integrative corporate R&D. Thus, the thesis should contribute in identifying insights of the role of intraorganizational R&D network elements and facilitate

an understanding on influencing intraorganizational network and evolution of strategic R&D and innovation management capability.

## 1.2 Thesis objectives, research questions and delimitations

The objective of the current study is to identify the intra-company innovation network and its content of the relations with respect to the case company (X), with an overall intention of developing an understanding of the critical elements in R&D collaboration between different business units, as illustrated in Figure 1. The study will be strategically helpful in identifying the critical network relations, collaborations and their elements and will have significant influence on strategic innovations decisions in intraorganizational level.

Based on this objective the main research questions are:

**What are the critical network elements that influence the strategic R&D cooperation and alignment within case company?**

The sub-questions include:

**What are the contents of the relations in the network?**

**What determines the quality of the process and how these relations be accessed?**

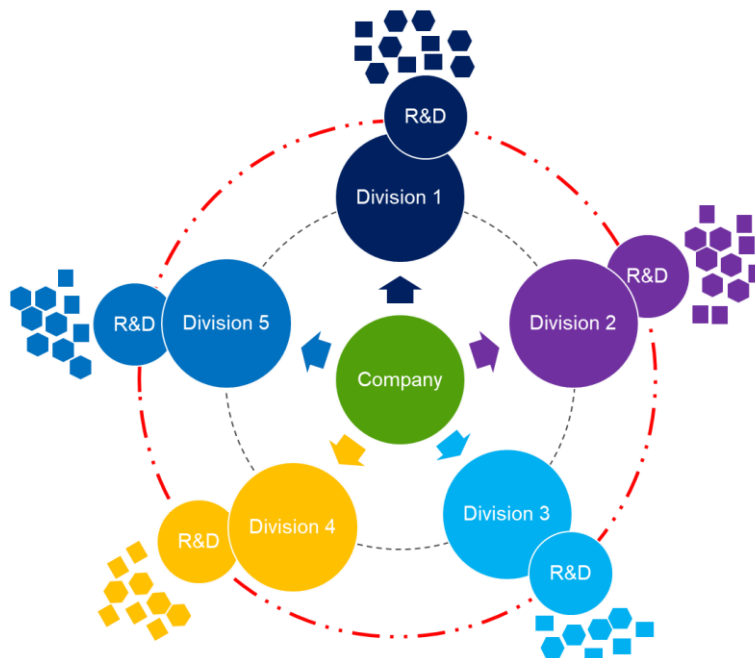


Figure 1. The network of innovation function with the intra-company network. In the illustration, company represents corporate headquarter, Divisions represent business units, R&D units represent business R&D units, and the square and hexagons represent their respective customers.

### 1.3 Scope and delimitation of thesis

The scope of thesis involves developing an understanding of the critical elements in the intraorganizational R&D collaborations, between different business units. The thesis will identify how strategic innovation can be improvised within agile framework in generating synergistic benefits and enhanced collaborations between different business units within a company. The result of this study will be valuable on a managerial level in understanding and developing better practices and tools and implementing them to achieve faster output by utilizing synergistic approaches. The identified elements should also be helpful, if implemented, in removing obstacles and should enable fast implementation of the well-focused R&D.

The empirical analysis within the scope of the thesis is limited for a specific company and within specific geographical location, and hence the outcomes of the thesis cannot be possibly generalized. The limitations of the theoretical part of thesis are made within the scope that suits the case company, and perhaps (with extreme caution) can be implemented to other similar settings.

Delimitation of this study is that the possible outcomes of the identified and suggested corrective actions for the case company cannot be validated. Additionally, the research cycle can be just a learning cycle focusing on systematic reflection to the case company as the outcomes are highly dependent on the participative nature of the participants.

### 1.4 Structure of the thesis

The thesis is structured and organized into five different parts, as displayed in the Figure 2. The introduction chapter of this thesis explains the background of the study, including the motivations and reasons behind the research interest, research objectives and delimitations of the study. Chapter two dives deeper into the subject with theoretical part introducing the readers to the key concepts and theories related clusters and network, R&D and innovation, inter- and intra- organizational network structures and their interplay for collaboration and innovation and strategic innovation management and intraorganizational collaboration. Chapter three describes the data collection process and discussions of the research philosophy and data reliability. Results, findings, and discussions of the data will be discussed in Chapter four. Chapter five will be the final chapter that illustrates the findings from theoretical viewpoints and recommends potential solutions and framework for the current and future needs from identified research perspectives.

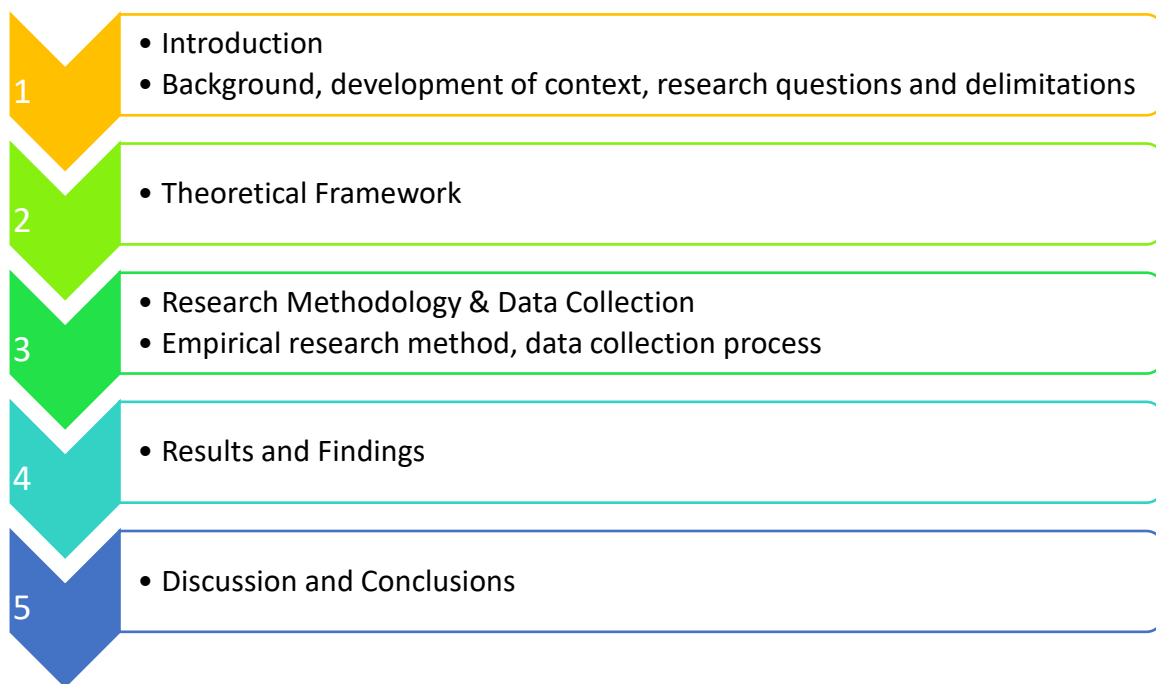


Figure 2. Structure of the thesis.

## 2 Theoretical Framework

### 2.1 Clusters and Network

In international business there is a wide discrepancy regarding the definitions and differentiation between the clusters and networks, mainly due to the complexity and the fuzziness of the cluster-concept (Martin & Sunley 2003) and network-concept (Powell 1990, Nohria et al. 1992) identities in a specific market field (Cooke 2002). The understanding of the geographical proximity is subjective as the ambiguity of the spatial scales can be problematic (Martin & Sunley 2003, Forsman & Solitander 2003).

Network is a broad terminology that is often used in different research streams within management, economics, marketing and sociology (Forsman & Solitander 2003). The terminology is often used to describe the coordination among inter- and/or intra organization with the focus being on metaphorical, graphical or mathematical approaches (Barczak et al. 2021). The metaphorical approach corresponds to the phenomenon of strategic networks referring to the coordination between different elements within the structure or hierarchy. Graphical approach refers to the connections within and beyond the enterprises, mainly in the form of mapping or imaging it (Moliterno & Mahony 2011). Mathematical approach refers to the application of graph theory and as a mathematical tool to analyze the structures (Estrada 2012). Irrespective of the approach, network can be simplified as a framework for analyzing interactions in business (Turnbull et al. 1996). The concept of network is adapted in this thesis is based on the industrial network approach, which is defined with the three building blocks in the form of actors (individuals, groups of individuals, parts of firms, firm or groups of firms), activities and resources. While the industrial network approach primarily assumes interorganizational relationship as network (Hakansson & Johanson 1992), the concept is extended to accommodate intraorganizational relationships. The extension is in line with previously established ambiguity of defining the boundaries of the network (Easton et al. 1992, Jarillo 1988, Ritter et al. 2004) as there are always some paths of relationships that connect the building blocks in both inter and intraorganizational level.

Comparing the concepts of the cluster and network, the main differences are in the characteristics of membership, base of interactions, and basis of knowledge transfer (Rosenfeld 1997, Cooke 2002, Forsman & Solitander 2003). Actor in a network has restricted membership compared to the cluster due to limited number of relationships each actor can maintain to get the access to the resources within the network (Inkpen & Tsang 2005, Giuliani 2013). Actors in a network are driven with a common business goal with direct formal part-

nerships whereas the cluster is driven with collective vision which sets the base for interaction to be informal (Lundberg & Johanson 2011). Clusters being defined by geographical proximity the basis of knowledge transfer is location driven (Bryson et al. 2000) but in network it is relationship driven as the scale of network is relatively limited compared to the clusters (Bunnell & Coe 2001).

The long term relationship between the actors, activities and resources in the network develop a joint understanding and confidence that facilitates knowledge transfer and foster organizational innovation (Forsman & Solitander 2003). The following section focuses on introducing inter and intraorganizational network, collaboration, and innovation with respect to R&D and innovation.

## 2.2 R&D and Innovation

Substantial efforts have been devoted to defining R&D (Miles 2007, Howells 2008, Hsu et al. 2015), however one of the most widely accepted definition of R&D according to the *Frascati Manual (OECD 2015)* is:

*a creative work undertaken on a systematic basis in order to increase the stock of knowledge- including knowledge of humankind, culture and society- and to devise new applications of available knowledge.*

R&D covers three types of activities: fundamental or basic research, applied research and experimental development (OECD 2015). Basic research is a work undertaken primary to acquire new knowledge of the inherent details of phenomena and perceptible evidence without any specific application or use. Basic research can be both experimental and theoretical work and is usually carried out by scientists and are not usually part of commodities being sold. Applied research is work carried out either to explore further the findings of basic research or to new methods and process to achieve specific objectives. The end findings of applied research are operational and developed ideas that are intended to be valid as methods, operations, products, or systems. A methodical work based on prevailing knowledge obtained from research and understanding that is focused on creating or improving materials, products or devices, systems, processes, or services is experimental development. (Hsu et al. 2015, OECD 2015, Schot & Steinmueller 2018) R&D activities are hence identified as being novel (aimed at new findings), creative (based on original, not so obvious, concepts and hypotheses), uncertain (uncertain about outcome), systematic (planned and budgeted), and transferable and/or reproducible (OECD 2015).

Classical innovation theories define innovation as a novel combination of prevailing resources, materials, or means of productions (Schumpeter 2017). In general, the terminology of innovation is aimed on *newness*: of idea, practice or material artefact (Zaltman et al. 1973); applied in business of manufacturing, distributing or consuming products or services or broadly (Beije 1998); to the generation, development and adaption on the part of the firm (Damanpour 1991). While invention is the first occurrence of an idea for a new product or process and makes no direct economic contribution, innovation is the initial attempt to develop a novel product or process in practice and provides economic values (Fagerberg 2004). Hence, innovation in a business context refers to the ability to create value by creating new products or services, reshaping production process or restructuring organizational practices and thus achieving competitive advantage (Kijek & Kijek 2010, Žižlavský 2013).

As discussed above, R&D and innovation is used to create value and achieve a more competitive position, with new or updated offerings in wide perspectives. Often organizations have their own R&D departments and teams that concentrate exclusively on improving their offering and processes to realize the desired phenomena, innovation. As R&D and successful innovation are time and resource intensive processes, companies often utilize both external (interorganizational) and internal (intraorganizational) network. For the convience for the scope of present thesis, R&D and innovation are used as proxy terminologies.

### 2.3 Interorganizational network, collaboration, and innovation

A wide array of previous research suggests that organization innovation is influenced by interorganizational and intraorganizational networks (Borgatti & Cross 2003, Brass et al. 2004, Phelps et al. 2012). Interorganizational networks often include organizations (e.g., research consortia, alliances, joint ventures, technology licensing deals) that are associated via contractual agreements to execute collaborative projects. Different streams of interorganizational network and collaboration have been studied including external sourcing of innovation (Rothwell 1989, Von Hippel 1976, Bergenholtz & Waldstrøm 2011), strategic alliances (Doz 1996), social capital (Batt 2008, Alguezaui & Filieri 2010) and open innovation (Chesbrough 2003, Chesbrough 2004). Interorganizational networks and collaborations are often motivated by organizational incentives for enhancing new product development and innovation by lowering internal development costs and expanding access to resources, knowledge, and innovation. Interorganizational collaboration and innovation activities are focused on external sourcing of ideas (Von Hippel 1976), technology (Mention 2011) or development (Chesbrough 2004) which can have impact on product innovation and novelty (Nieto & Santamaría 2007, Nieto & Santamaría 2010), reduce R&D investments (Chesbrough 2004) and bring quicker deliveries to market (Tessarolo 2007). The

main challenges related to interorganizational network relates to managing multiple partnership simultaneously (Frishammar et al. 2018), absorbing, translating and exploiting knowledge (Mention 2011) and even negatively shaped attitude (such as not invented here) syndrome (de Araújo Burcharth et al. 2014, Antons & Piller 2015).

#### 2.4 Intraorganizational network, collaboration, and innovation

Intraorganizational networks are connected via personal relations and consists of individuals, teams, or business units. Intraorganizational collaboration refers to the interrelations between departments, units, teams, and individuals within a firm, for example through cross-functional teams in projects or knowledge exchange between individuals. There exist several viewpoints on how intraorganizational collaboration contributes to the innovation output in an organization, resource and knowledge exchanged between individuals and business units has been the focus. Intraorganizational collaboration and innovation activities are focused on knowledge exchange (Tsai 2001, Tsai 2002, Colombo et al. 2011) and combination for joint problem solving (De Clercq et al. 2011, Carnabuci & Operti 2013) or on recombination of prevailing technologies (Carnabuci & Operti 2013). Also, other activities that can be related to intraorganizational network, collaboration and innovation include collection and exploitation of market related information (Paruchuri 2010, Atuahene-Gima 2005), coordination of internal tasks and procedures (Chen et al. 2013) e.g. safety rules and data system and managements, act as gatekeepers (Duchek 2015) and even cross-cultural negotiators (Casciaro et al. 2019). All the mentioned activities can facilitate directly on product innovation or the process (De Clercq et al. 2011, Carnabuci & Operti 2013), insourcing of knowledge (Paruchuri 2010) and cross-silo leadership (Casciaro et al. 2019) and to promptly respond to the markets and external partners (Atuahene-Gima 2005, Chen et al. 2013). For intraorganizational networks it is also equally important how the internal and external communication across the R&D teams are established and how the R&D findings and results are communicated externally to prevent mixed message or inflicting damages. As in the case of interorganizational network, the main issue of absorbing, translating and exploitation of knowledge can be a main challenge. In addition, competing for same internal resources can be a main contest in the intraorganizational network.

#### 2.5 Interplay between intra- and interorganizational collaboration for innovation

The creativity and innovativeness in both, inter and intraorganizational, networks are affected by the number, structure, and strengths of networks or contacts (Van Wijk et al. 2008). From theoretical perspective, intraorganizational networks creates vital mechanism for network knowledge diffusion and learning (Borgatti & Cross 2003, Paruchuri 2010), but

from practical perspective the characteristics of business units and organizations hosting these networks are often misunderstood. Meanwhile, research on interorganizational network usually assumes that intraorganizational units are internally homogenous (Phelps et al. 2012, Djodat & Zu Knyphausen-Aufseß 2017). In large corporates one can even assume that the intraorganizational network can mimic interorganizational network as different business units can be isolated unique individual entities (Buchholz & Rosenthal 2005). In this context, it can be assumed that the research organizations within large corporations can be considered simultaneously to be part of both intraorganizational and interorganizational network (Paruchuri 2010, Moliterno & Mahony 2011), and can be resembled as network-of-networks aka. *Nested structure* (Harary & Batell 1981). In such a context, the effects of networks at one level are contingent upon higher and lower-level networks (Moliterno & Mahony 2011). Therefore, to understand the role of business R&D on the strategic innovation and management of a firm, it is vital to consider the simultaneous effects of interorganizational and intraorganizational networks.

### 2.5.1 Coleman`s boat model and boundary spanners

Coleman`s boat model helps to develop the basic understanding and analysis of multilevel effects (Coleman 1994) on how interorganizational collaboration leads to innovation. Alliance formation based on contractual agreements and company innovation are macrolevel (organizational) relationships that relies on microlevel (personal level) processes (Felin et al. 2012) to spur innovations. Any formal and informal communication and cooperation among employees of two organizations (Janowicz-Panjaitan & Noorderhaven 2008) drives organizational learning and knowledge sharing and goes beyond alliance structures to realize innovations. Based on these macro-micro-macro reasoning, the influence of inter and intraorganizational networks in innovation can be visualized as in Figure 3.

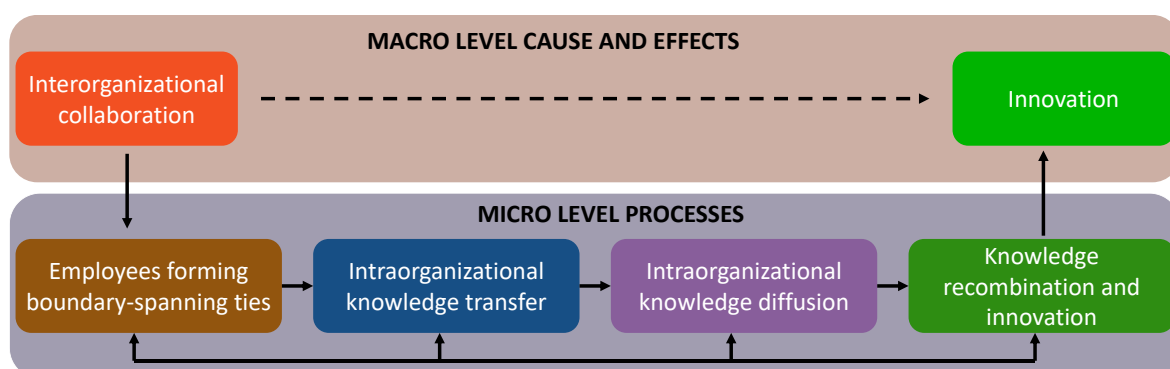


Figure 3. Coleman`s boat model of inter and intraorganizational collaboration. Adapted from (Goossen 2014).

In a multilevel network perspective, any activities by macrolevel node should impact the nodes at a microlevel. For instance, an alliance agreement at the organization level should facilitate the formation of joint project teams that involve employees from both organizations (Davis & Eisenhardt 2011). Often only a subset of all employees are participating in these joint project teams and such project teams will create new interpersonal relationships that cross their organizational boundaries. So, macrolevel network changes influence microlevel network, creating collaborate between individuals forming an alliance as an organizational boundary spanners (Van de Ven 1976a, Van de Ven 1976b).

At macro-level, boundary spanning can be seen as the interrelationship among the organization and the environment i.e., boundary spanning from the organization's perspective. At the micro level, the boundary spanner can be seen as one of the key persons within the organization integrated in external and internal networks. The organizational boundary spanners thus facilitate the transfer of knowledge across organizational boundaries as they are directed towards interpersonal collaboration in achieving a joint goal (Jarvenpaa & Majchrzak 2016). Thus, the functional characteristics of each boundary spanners (Figure 4) and their interaction in the form of structure and communication defines the actual knowledge transfer/ diffusion and thus affects company's innovation (Carnabuci & Operti 2013).

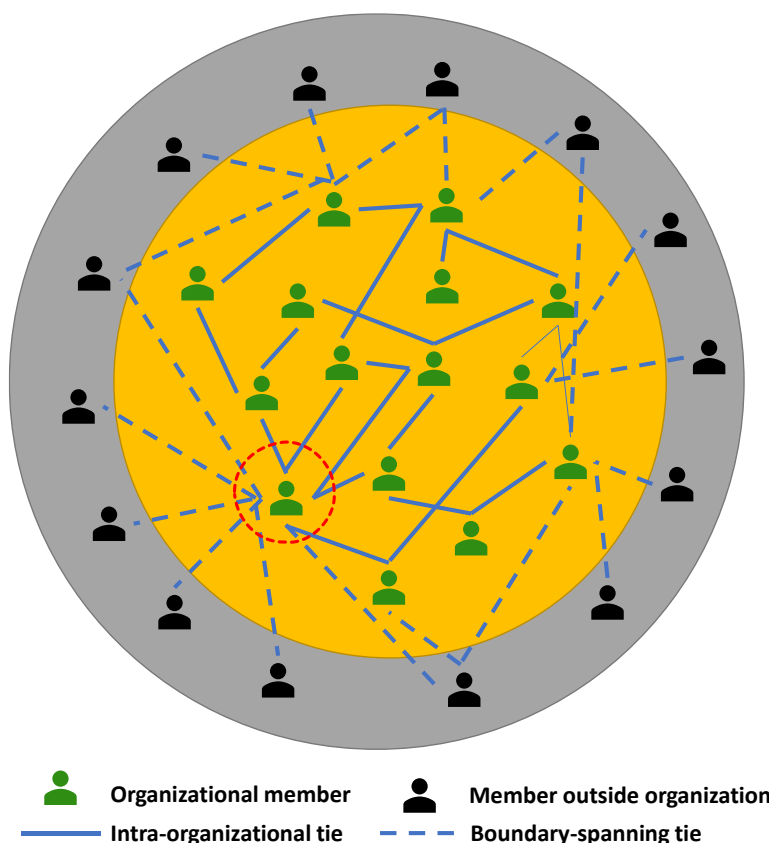


Figure 4. Relations of actor (circled in red), as a boundary spanner, with members from outside the organization and members belonging to the same organization. The model shows how the internal networks are linked through the boundary spanning ties to the external networks.

Depending on the intra- and inter- organizational network and the contractual agreements, boundary spanners are in a unique position to share and transfer knowledge and resources across organizational boundaries, (Goossen 2014, Van de Ven & Zahra 2017, Qiu & Haugland 2018) but also to serve as a knowledge gatekeeper to control the flow of new information. The gatekeepers are expected to have personal interest in gathering new knowledge, evaluating relevancy of the collected information to the organization and distributing within the intraorganizational network- creating greater exposure of knowledge (Ayers et al. 1997, Tortoriello et al. 2012). Boundary spanners are also seen as cultural brokers (Jang 2018, Casciaro et al. 2019), having interdisciplinary experience and expertise of cross-functional areas who can server as a bridge to achieve better relationships.

Innovation diffusion via boundary spanners can be characterized based on three factors- infectiousness (the likelihood of the source to share information), susceptibility (the probability that the recipient will learn and use the shared information), and proximity (the characteristics of their relationships) (Strang & Tuma 1993). Infectiousness factor relies heavily on the quality and diversity of knowledge recipient possess or can access (Borgatti & Cross

2003, Nahapiet & Ghoshal 1998). If a recipient possesses expertise and knowhow or unique information, collaboration and communication with these knowledgeable employees is desirable and intraorganizational referral network is strong for knowledge diffusion (Nahapiet & Ghoshal 1998, Argote & Ren 2012). Individual absorptive capacity is important for susceptibility as the recipient should be able to recognize the value of information, make concrete conclusions and appropriately utilize it (Ter Wal et al. 2011). Proximity characterizes the relationship between source and recipient and defines tie strength between boundary spanners. Stronger ties create trust, mutual understanding, and foster effective communication and tacit knowledge sharing (Aral & Van Alstyne 2011, Goossen 2014).

### 2.5.2 Interactions between formal and informal networks

The relation between the organizational network structure and performance has been studied extensively from managerial economics point of view with focus on operational efficiency being optimal when interactions are minimized (Lamieri & Mangalagiu 2009). Intraorganizational network and collaboration has been studied mainly based on the network structures between the connecting  $N$  nodes with the minimum required number of  $N-1$  links (Dodds et al. 2003). The formal netted structure is defined based on organizational design (Figure 5) and is usually a hierarchical pyramid structure with CEO, directors and senior managers at top, managers at middle level. The hierarchies require each node to interact directly with, on average,  $b$  other nodes where  $b \ll N$  and is generally referred as the span of control (Dodds et al. 2003). The decision-making process in such organizations are carried out by these hierarchical levels without necessarily soliciting opinions or ideas from the bottom level staff employees, who are only expected to implement them. The formal netted structure is one of the fundamental factors in shaping knowledge exchange patterns among cross-business units, as the formal chain of command ensures control and clearly delineates the roles and responsibilities of employees. Several prior studies (Garicano 2000, Pertusa-Ortega et al. 2010, Albers et al. 2016) centered on the optimality of hierarchical intraorganizational network focusing on minimizing interactions, with an aim to minimize distraction of valuable resources from productivity (Williamson 1985), for exerting control, performing decentralized tasks, making decisions, accumulating knowledge and creating collaborations.

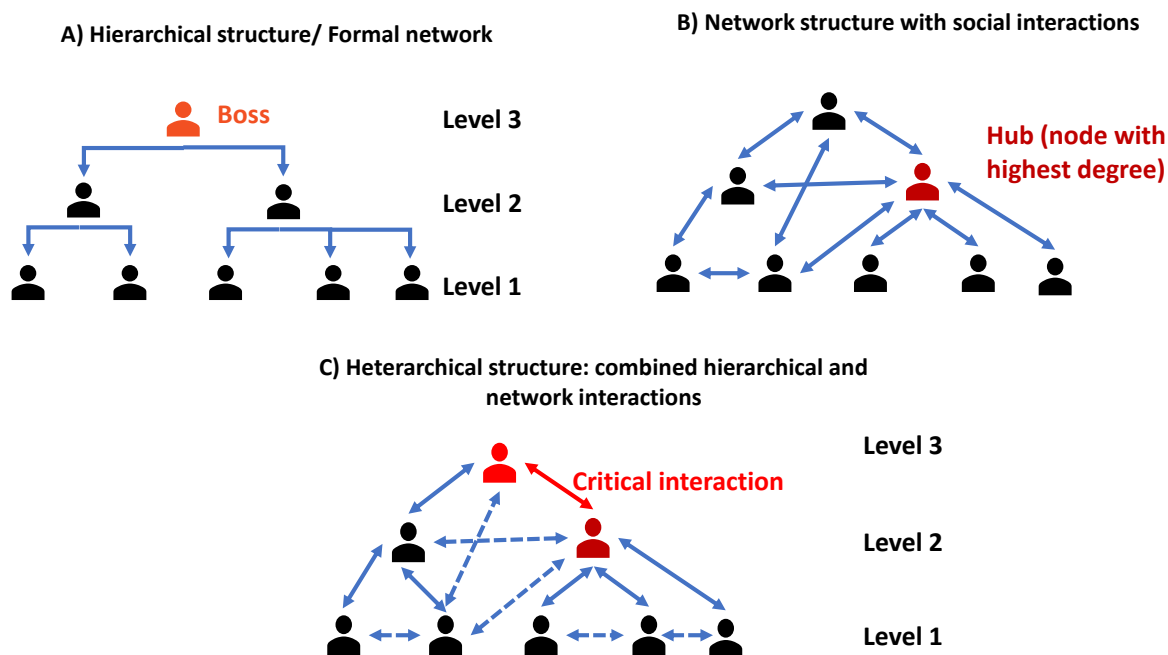


Figure 5. Network structures A) Hierarchical structure/ formal network b) Network structure with social interactions C) Heterarchical structure highlighting hierarchical and network interactions with highly connected mid node being subservient to the single node. (Cumming 2016)

Social network theories and analysis has demonstrated that irrespective of the formal netted structures in an organization, an informal network structure emerges which can have equal or more decisive role in motivating collaboration for innovation among individual teams as well as cross-business units (Brass 2003, Soda et al. 2018). While the formal netted structure and organizational interactions is relevant for firms that have low transaction costs such as for product manufacturing-oriented business (Lamieri & Mangalagiu 2009), informal relations are equally important for knowledge intensive organizations with highly transactional nature (North & Wallis 1994). The informal interaction of collaboration relies on relationships forged between employees, cooperation between teams and communication that focuses on achieving shared goals and hence can emerge as a significant component of knowledge transfer and collaboration process (Zander & Kogut 1995, Heckscher 2007). While informal network can be beneficial to create adaptive collaboration network, it can also lead to disorganization, confusion and decision making based on self-interest rather than strategic relatedness (Volberda & Lewin 2003, Lamieri & Mangalagiu 2009).

From the network perspective, organizational performance is dependent on the formal and informal structures of interactions among agents (nodes, Figure 6), that defines the lines of communication, allocation of information, distribution of decision-making authorities and provision of incentives, and can be visualized based on four different dimensions (Chang & Harrington Jr 2006). I) Hierarchical and stable network laid out as a formal network as set

out in the form of organizational chart. II) Allocation of authority to facilitate decision making, which can be modular and decentralized depending on the nature of the task. Modular structure can be based on subtask associated with a particular product line or based on similarity of task. The organizational network in such cases becomes flexible with similar horizontal positions of power and authorities aka. *Heterarchy* (Cumming 2016), which permits different nodes to cooperate while individually optimizing success criteria. III) Organizational norms and culture embedded in the network that creates “path dependency”. IV) Motivation and behavioral dependence.

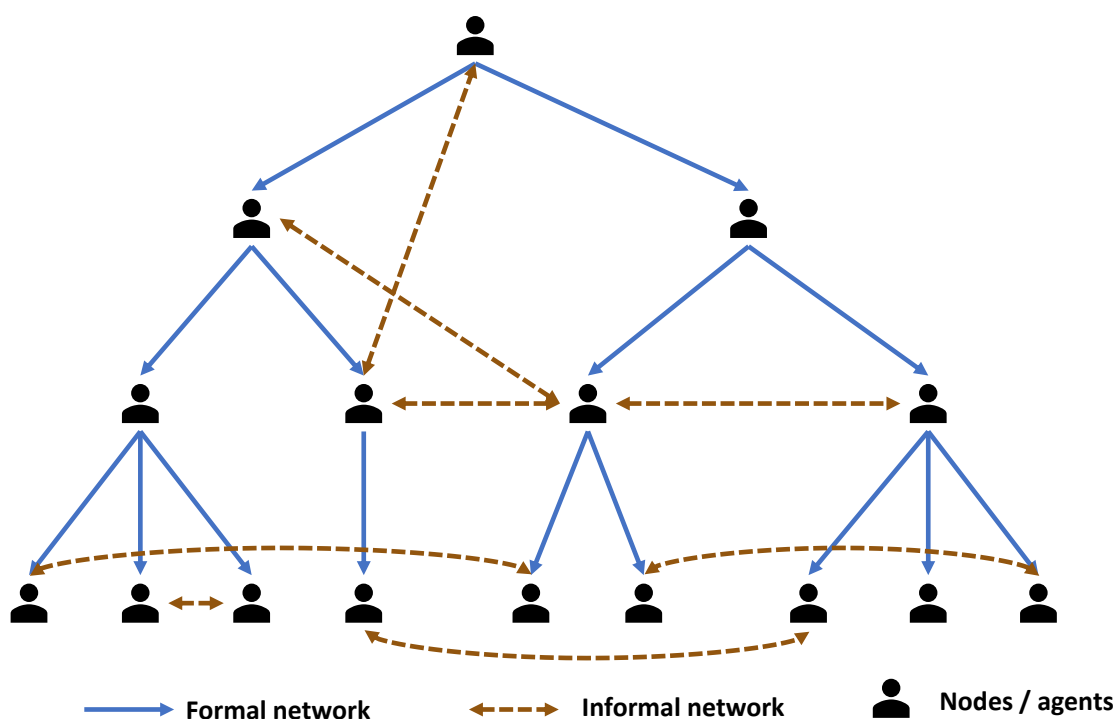


Figure 6. Interplay of formal and informal networks. Nodes represent the agents and links represent the relations between agents (Lamieri & Mangalagiu 2009).

## 2.6 Strategic R&D management and intraorganizational network relations

The perspective on organizational innovation and R&D management has changed over the years, aligning with the prerequisite of the economic evolution and moving from a technology-centered model to a more interaction-focused view (Nobelius 2004). The transformation of R&D characteristics, represented by R&D generation is summarized in Figure 7. With the changing prospects of R&D as a cumulative, evolution oriented and networked process, the key to effective R&D is improving its underlying management process.

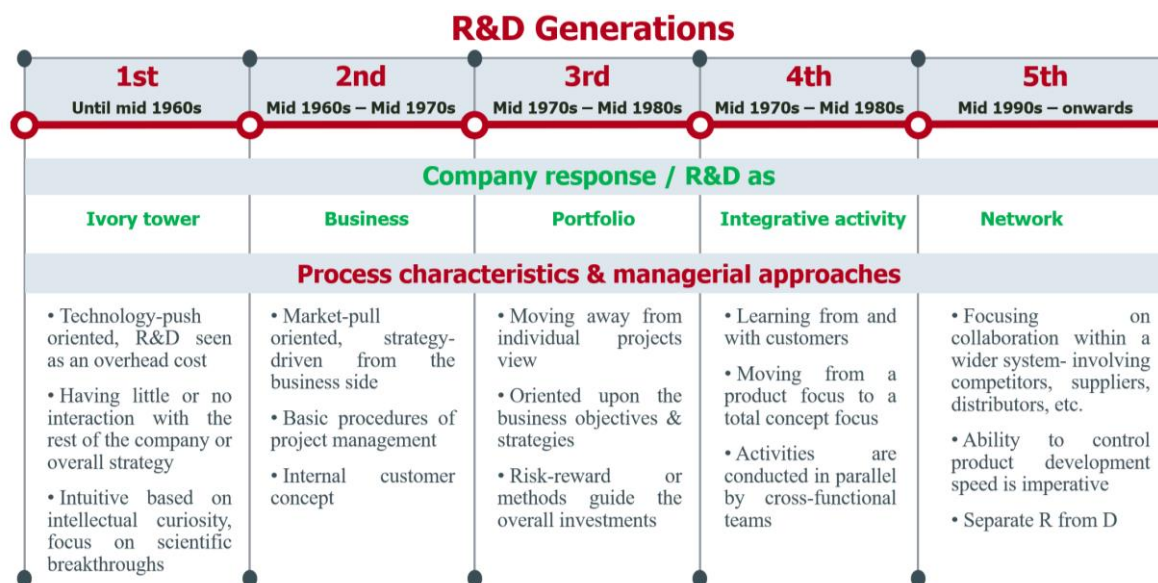


Figure 7. R&D generations, process characteristics and managerial approaches. Adapted based on several sources (Roussel et al. 1991, Rothwell 1994, Miller 1998, Chiesa 2001, Nobelius 2004, Fortuin & Omta 2007a).

Intraorganizational network can be visualized as a pattern of linkages between nodes which represent different organizational/business unit. The linkage between nodes can be one or both ways and the quality of the network relations can be perceived on the level of strategic alignment between different units (Fortuin & Omta 2007a). When considering intraorganizational R&D network it can be assumed a network between corporate headquarter and business units as the nodes with their individual or corporate R&D unit. The linkage is the information flow between the nodes such as project plans, requirements, project results and services, as well as the governance structure of the internal network. The information exchange between corporate R&D and business units should be both ways (see Figure 8), overlapping and iterative process (Fortuin & Omta 2007b) and is often guided by company's R&D competencies (Leonard-Barton 1995). Knowledge sources outside the organization, such as institutes and universities, and business to business customers of business units form the external network as shown in Figure 8.

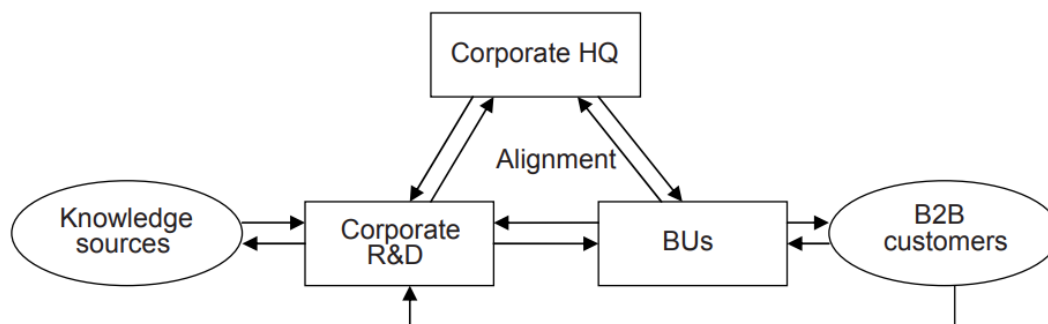


Figure 8. Network of innovation functions of multinational corporation within the intra-company network and external network relations. (Fortuin & Omta 2007a)

R&D is a highly uncertain process and hence upfront planning of innovation is limited (Kline & Rosenberg 2010). While innovation needs to be free and flexible, it is also expected to be self-organizing and self-steering (Bonner et al. 2002). From strategic management perspective, which is a dynamic process with inherent uncertainties in itself (Janszen 2000), strategic decisions are complex as the situation of uncertainty involves subjective judgements of future developments (Omta & Folstar 2005). Exploitative R&D projects are often preferred to minimize uncertainty as the progress is incremental and adds to the existing competencies and capabilities without burdening the intraorganizational network relations (Anderson & Tushman 2001, Anderson & Tushman 2018, Benner & Tushman 2003). On the other hand, exploratory R&D is more erratic, long term process and are more distant from the locale of organizational actions (Levinthal & March 1993). However, exploratory R&D offers more opportunities for radical or breakthrough innovations. The modern multinational organizations require network elements that can explore and exploit R&D rather than just looking for new combinations or configurations (March 1991). In an organization's R&D units researchers rely on their personal network of ties with colleagues to access and absorb new knowledge more efficiently (Hussler & Rondé 2007).

### 2.6.1 Role of network structure and reach

Intraorganizational network structure influences network actors or researcher's performance by facilitating transfer of new knowledge and knowhow through the boundary spanning ties, and by influencing available knowledge and resources via social connections. The network thus performs in a formal organizational hierarchy and in informal and untargeted manner such as during lunch and coffee breaks or corridor walk-ins (Latour & Woolgar 2013). The position of the network actor and number of ties in an intraorganizational network certainly determines the degree of acceleration of knowledge diffusion in the organization

(Paruchuri 2010). While more ties are expected to accelerate knowledge diffusion and improve effective referral, creating and maintaining such ties requires substantial time and resources (Carnabuci & Operti 2013). Thus, intraorganizational network structure and density can have both positive and negative effect on knowledge transfer and organization innovation.

Intraorganizational network reach determines the network connections and the number of steps between connection *aka. path length* (Wasserman & Faust 1994). High network reach increases knowledge transfer within R&D network as information diffusion and extent, speed and reliability of knowledge dissemination is large (Lazer & Friedman 2007). Lower network reach and network fragmentations suggests socially isolated researchers (Goossen 2014) that create barriers in information sharing. Higher network reach also makes strong referral network for expertise knowledge and knowhow for R&D (Jarvenpaa & Majchrzak 2016). Path length in network also has direct relation with the extent of knowledge sharing as any extra path increases the risk of knowledge not being dispersed. Network with short paths increases the speed of information diffusion and minimizes the risk of knowledge distortion. So, network with less fragmentation and higher degree or reach is important for R&D.

### 2.6.2 Intraorganizational aspect of strategic R&D management

How R&D and innovations are addressed within an organization (Akhmetshin et al. 2018), and how organization have turned to gathering, refining and assessing ideas to good use, becomes a mechanism of strategic R&D and innovation management (Heller 2006). Of course, the main question of what must be considered for the company to manage innovations effectively and efficiently (Hidalgo & Albers 2008, Blackburn et al. 2017) can only be answered by understanding that the concept of strategic R&D management being a complicated phenomenon which involves several challenges. Sharma (Sharma 1999) discussed the central dilemmas of managing innovation in large firms and this can be further elaborated based on intraorganizational network as:

- i. *Seeds versus weeds dilemma*: The dilemma arising from the overwhelming volume of new ideas and lack of constructive proofing and filtering system leading decision makers to intentionally halt and drown all ideas without thoroughly evaluating (Sharma 1999). Intra-organisation network in such situation can act as buffer (Johanson 2002) or barrier to facilitate such decisions.

- ii. *Experience versus initiative dilemma*: New innovations encounter an endless array of technical, market and intraorganizational barriers (Davenport et al. 2007). Challenge relates to the dilemma in deciding on the leadership of new innovations: choosing between initiative and enthusiasm against the experience or creating synergistic experience will alter the intra-organisational network equilibrium (Wukich & Robinson 2013).
- iii. *Internal versus external staffing*: Staffing is one of the most challenging tasks for strategic innovation management (Thamhain 1990). When personnel with necessary skills are transferred from other teams/divisions/units, they bring both knowledge and informal networks in the company. External hiring while can bring expertise know-how they consume time and resources to adapt and develop working relationships within the intra-organisational network.
- iv. *Building capabilities versus collaborating*: Sharing knowledge and resources with different organisation R&D is often considered a burden by operating businesses (Hansen 1999), subunits have competitive battles and instead focus on building their own division/unit`s capabilities.

### 3 Research Design and Methods

The goal of this study is to identify the intra-company innovation network and its content of the relations with respect to the case company, in conjunction with an overall intention of developing an understanding of the critical elements in R&D collaboration between different business units. This chapter describes the research design and methods which are employed in this thesis. The chapter opens with a case description which presents the commissioner company and the need of this thesis. After the case description, the selected research design is discussed, followed by the introduction of data collection methods as well as data analysis methods. Finally, reliability and validity of this study are critically evaluated.

#### 3.1 Case company

The case company selected for this thesis was a global industrial company with several billion Euros of revenue. It consists of several business areas with specialized R&D functions located within each business units. It has corporate R&D and business unit specific R&D, where the focus may or may not be aligned. To create more value out of its R&D and innovations, the case company needs to ensure that effective intraorganizational network and collaboration is ensured. However, having a detailed understanding of its intraorganizational network and current issues related to the network is critical in ensuring best output. By understanding dynamic interactions and information flows in intraorganizational network, it would be easier for the case company to create more value out of its R&D and innovation efforts, and improve synergistic benefits between different business unit R&D.

#### 3.2 Research methodology

The research methods depend on the nature of the problem being researched, availability and the level of research scope and aimed objectives. Business management research can be divided into theoretical, empirical, descriptive, and normative research methods. Normative research differs from descriptive research as the intention and purpose is not only to gather facts but also establish how the research could be improved (Robinson 2001). Relationship between the four research methods is shown in Figure 9.

	Theoretical	Empirical
Descriptive	Conceptual approach	Nomothetical approach Action-oriented approach
Normative	Decision-oriented approach	Constructive approach

Figure 9. Business research approaches (Kasanen et al. 1993).

The thesis project is a research based on action-oriented constructive approach. The research approach relates to problem solving in a real-life organizational setting through the holistic understanding of organizational process. Action-oriented research approach allows subjective analysis of the case studies, distinct from the nomothetical approaches or objectivist alternative (Pihlanto 1994). A constructive method is a solution-oriented normative method where target-oriented and innovative step-by-step developments of a solution are combined, and which empirical testing of the solution is done, and utility areas are analyzed (Lindholm 2008).

Constructive research approach was initially established in the field of management accounting with the aim of assisting academics in taking more active role in refining the existing practices and gaining a deeper understanding of the definite practices in organizations (Kasanen et al. 1993, Lukka 2000, Labro & Tuomela 2003). Based on these prior studies, there are six crucial steps in the constructive research approach:

- i. Find a practically relevant problem that has research potential
- ii. Examine the potential for long-term research
- iii. Obtain a general and comprehensive understanding of the topic
- iv. Innovate and construct a theoretically grounded solution idea
- v. Implement the solution and verify it in practice
- vi. Examine the scope of the solution's applicability
- vii. Demonstrate the theoretical connections and research contribution of the solution.

The research with action-oriented constructive approach was chosen for this thesis as the objective of the project is on developing an understanding of the critical elements in R&D collaboration between different business units and create possible solutions. The research aims to provide a practical solution to enhance the collaboration between different business units, based on existing and studied literature on the field. The author's personal observation and experience within the part of R&D organization has substantially supported this project.

### 3.3 Research design, data collection and analysis

Research design provides the framework for the collection and analysis of the data (Bell & Bryman 2007). This thesis research material is based on the case company's internal materials and observations. Research materials is collected mainly in the form of qualitative data. Data collection process for the thesis is defined on Figure 10. Pre-identified research problem was utilized to identify and understand the research problem by means of semi-structured interviews with senior management levels and further analysis of the obtained data was utilized to find the solutions in improving intraorganizational network, collaboration and strategic innovation and management.

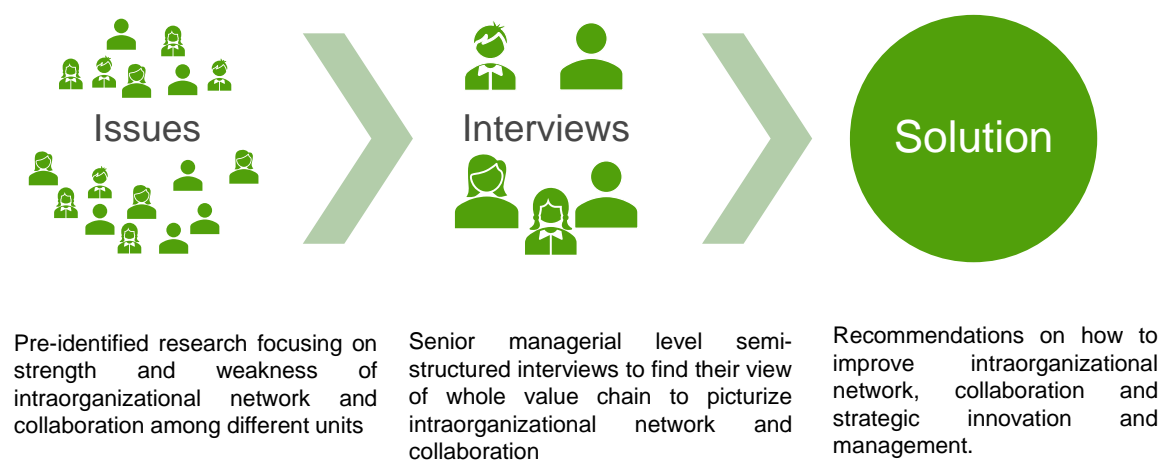


Figure 10. Research methodology and data collection implemented for the thesis.

For the first section, pre-identified research that focused on strength and weakness of intraorganizational network and collaboration among different R&D units were verified based on quantitative and qualitative study. The term pre-identified research was used here as a reference to the confidential research work carried out on the case company for the identification of collaboration and knowledge sharing, visualized based on joint IPR fillings among different intraorganizational network. Quantitative data can be either counted or compared on a numerical scale. Based on the first section of pre-identified research issues, a better

insight into the critical elements and potential solutions were sought by utilizing semi-structured interviews for the second section resulting in qualitative data. Semi-structured interviews are justified for this case as the identified factors during the first questionnaire/survey round can be utilized as a guideline or theme for the interview while keeping the interview structure flexible and adaptive as the interview proceeds (Mojtahed et al. 2014). Semi-structure interview methods are also helpful to deal with sensitive and difficult issues (Gideon & Moskos 2012), keeping the conversation flowing smoothly. One-to-one interviews were selected as such methods are proven to generate a rich, detailed and in-depth knowledge about the phenomenon under investigation (Saunders & Townsend 2016).

Qualitative data obtained for the thesis was in the form of descriptive words that can be examined for patterns or meaning by utilized coding to identify the themes that correspond with the research questions. Data analysis for quantitative research method is straightforward as it is all about analyzing categorical and numerical data using various statistical techniques. For qualitative data, data analysis is a dynamic, intuitive, and creative process of inductive reasoning, thinking, and theorizing, exploration on values, meanings, beliefs, thoughts, experiences, and feelings characteristic of the phenomenon under investigation. Qualitative data analysis predominantly involves coding/categorizing and reducing the volume of raw information based on identifying significant patterns and subsequently building a logical chain of evidence (Braun & Clarke 2006). Hence based on qualitative data from semi-structured interviews, a better insight into the identified critical elements and potential solutions were derived. Since senior managerial/directorial level influence is knowledge-intensive and have visible and direct impact on the role and scope of R&D collaboration, semi-structured interviews were conducted with different business unit senior managers/directors and their view of whole value chain expectations on strategic management of R&D was analyzed. Based on these insights recommendations on how to improve synergistic benefits between different business unit R&D was purposed as a solution.

All five of the respondents represented different business units, directly or indirectly in supporting functions within R&D and development. One of five interviewees were women, and four were men. Their length of service varied from couple of months to over 31 years. Three of the respondents had worked for different functions or business areas during their services and have had many roles and positions during their career in the case organisation. The interviews were held in October 2022. Prior to the interview, general information about the thesis, its scope and the anonymity and confidentiality were provided. Whenever possible the interviews were taken face-to-face or as virtual interviews using Microsoft Teams. Interviews were recorded by phone's voice recorder for face-to-face interviews and with Team's recording function. The duration of interviews ranged from 30 minutes to 55 minutes.

Interviews were conducted with same semi-structured format, questions being themed under three categories: background information, collaboration in intraorganizational network and functioning of intraorganizational network. The questions regarding collaboration in intraorganizational network were aimed to provide answers to the research questions “what are the critical network elements that influence the strategic R&D cooperation and alignment within case company?” and functioning of intraorganizational network questions were aimed at answering the contents of intraorganizational network relations and accessing how intraorganizational network relations can be accessed. The interview questions were also tailored based on the theories of intraorganizational collaboration, knowledge sharing and strategic R&D management. The interview questions are presented in Appendix 1.

Table 1. Summary of the interviewees.

Interviewee	Function	Business Area
I1	Senior Manager	BA1
I2	Senior Manager	BA2
I3	Director	BA3
I4	Director	BA4
I5	Vice President	BA5

### 3.4 Theme and categories used in the data analysis

The interview data were analyzed based on the simple coding of the interview data as coding allowed systematic review and categorizing the material into interpretable parts. Coding of the anonymized data was based on significant descriptive codes that were extracted from individual quote and/or expression. The first cycle of coding facilitated better data saturation and was carried out with identified relevant words and/or short phrases and expressions that were representatively assigned a comprehensive, significant, meaningful relation to the data. The second cycle of coding emphasized on extracting information which formed the basis for the themes, categories, and subcategories, as illustrated in Table 1, grounded based on the conceptual theoretical framework and main research questions within the scope of the thesis.

Table 2. Theme, categories, and subcategories used for coding the interview data.

Theme		Critical network elements		
Category	Trust	Responsiveness and Timeliness	Information exchange	Roles in network
Subcategories	Identification of network partners Known network / ally Experience and knowledge	Ease of integration of business unit request Average project cycle Ability to control product development speed	Formal / informal meeting Staff exchange Project communication	Formal Informal
Theme		Contents of relations		
Category	Knowledge sharing	Collaboration		
Subcategories	Seeking perspectives Idea sharing Sparring Best practices Learning	Decision making Joint projects Goal achievement Conflict / risk management		
Theme		Access of relations and quality of process		
Category	Governance structure	Orientation		
Subcategories	Structured feedback Funding Ownership Initiatives Intra or inter collaboration	Technology road mapping Orientation (short term vs long-term) R vs D Capacity building		

### 3.5 Reliability, validity, and generalizability

The reliability and validity of any research project is important as quality measurement, so is true for this thesis. Reliability refers to the consistency i.e. reproducibility of the results and validity refers to the appropriateness of the measures i.e. whether the measurements reflect what they're supposed to measure (Hammersley 1987). For qualitative research the context of the study is vital and hence subjectivity and interpretation can influence the reliability of the results (Schreier 2012). In order to improve the reliability of the process and results, five approaches proposed by Silverman (Silverman 2013) are also followed in this thesis whenever possible: refutational analysis, constant data comparison, comprehensive data use, inclusive of deviant case and use of table. The research procedure in this thesis also uses adequate iteration, multiple data sources, interpretations as part of data collections and relevant literature as part of interpretations for both supporting and disconfirming evidence and argumentations.

Both interview and interviewee bias can be challenging for reliability and validity of the analysis (Saunders et al. 2015, Saunders & Townsend 2016). To minimize this bias, the goal of the research is to stay objective and neutral while assuring anonymity and relaxed interview atmosphere. Findings will be presented in an explanatory nature to increase the transparency and hence reliability (Aguinis et al. 2018) of the conclusions drawn by first presenting the findings followed by interpretations. The validity of this research is evaluated from the perspectives of both internal and external validity. As the scope of the thesis is highly context dependent based on single case study, results and findings cannot be fully generalized (Bell et al. 2022).

One of the common criticism of action-oriented constructive research is its lack of generalizability (Heller 2006). While a single case study, based on action-oriented constructive research method is valid for the scope of this thesis to investigate a contemporary phenomenon in depth and based on a real-life context, a main weakness of this method is its low external validity and results not being directly applicable to the entire population or simply the theory inferred from a single case study cannot be generalized (Leung 2015). The generalization of findings should be taken flexibly while translating it into other settings as the research is situation specific and considers the situation as such rather than merely focusing on a small portion of the situation.

## 4 Research Findings

This chapter summarizes the key findings of the interview data analysis and is divided into three main themes based on research questions. Firstly, identification of the critical network elements that influence the strategic R&D cooperation and alignment is discussed based on the subcategories of trust, responsiveness, timeliness, information exchange and roles in network. Secondly, content of the network elements is discussed based on the collaboration and knowledge sharing subcategories. Next, the access of the role of interorganizational network and access of relations and quality of process is discussed based on the governance structure, orientation and identified challenges. Whenever possible anonymous statements (without even pseudonyms) in the form of direct quotations from the interview data is reported to support the results.

### 4.1 Verification of pre-identified research issues

All the interviewees agreed that the innovation cycles are accelerating and hence the speed of R&D is driven by the increasing emergence of applicable developments that can be immediately upscaled as a project. Increasing scrutiny of R&D budget and rising pressure of business to adapt to constantly shifting customer demands is intensifying pressure to quickly show results for the R&D efforts. Also, interviewees communicated that while there is enormous knowledge potential to be shared within different business units, the complexity of business specific activities and the specialized lexicon creates a sense of “black box” among different R&D units. Based on interviews it was obvious that all interviewees agreed that the transformation projects, projects beyond the short-term targets (aka. safe projects) that aim to create company`s long-term differentiation and growth, should/ must create the strategic network among different R&D units to create strategic innovations development and management. Based on the discussions the sketch of the idealistic case of intraorganizational R&D network and existing or identified network is presented in Figure 11.

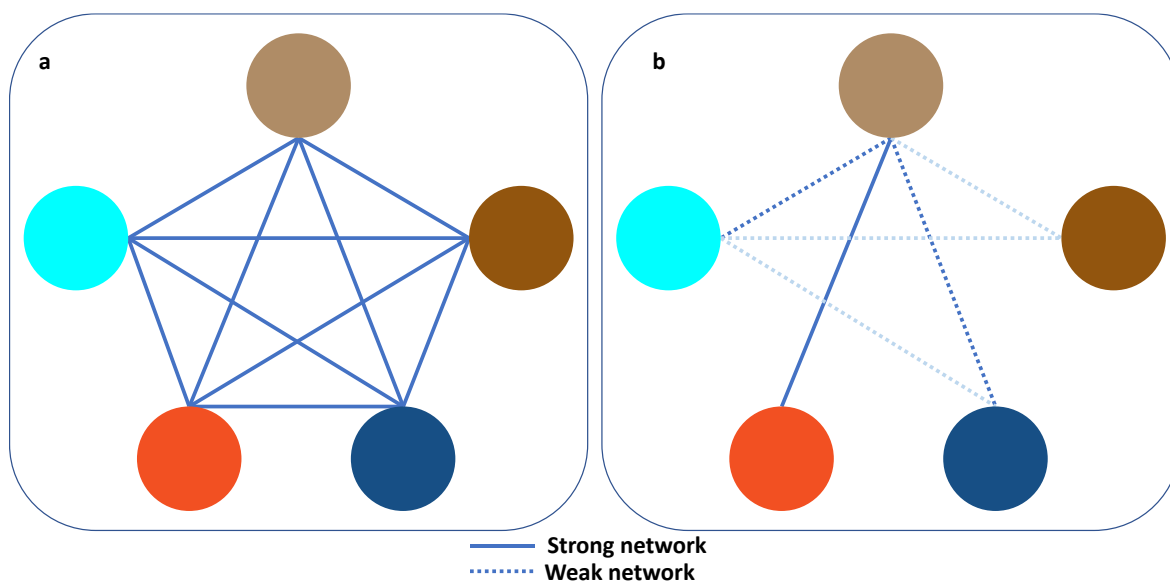


Figure 11. Network among researched business unit/ divisional R&D (circles): (a) idealistic case and (b) identified case, lighter colour of dashed lines suggests barely identified. For clarity reason network within each business unit/divisional R&D is omitted.

## 4.2 Critical network elements that influence the strategic R&D cooperation and alignment

### 4.2.1 Trust

Interviewees in their current roles identified that the main network elements for the strategic R&D cooperation and alignment, contained by their role, is mainly within their own business area and the individuals among the other teams. The respondents acknowledged that while hierarchy is important, known network or ally are preferred. Interpersonal trust among different R&D units is based on authorities and organizational norms. Identification of collaboration partner was characterized based on the need but defined usually by the profile of the collaborative personality and psychological safety. Those respondents who had worked for the company for several years already knew whom to reach for collaboration and with whom they can expect reciprocity. Other respondents preferred to utilize the formal network of managerial chain or utilize existing network to discover further potential collaboration among different R&D units.

*... Forming collaboration requires appropriateness between resources profiles, targets, incentives, and approaches.*

It is obvious based on the interviewee's response that the stronger ties and shared moral values and norms create trust and reciprocity and improves mutual comprehension and

efficiency of communication, to be open to share expertise and experience that is valuable and equally vital for sharing knowledge and developing intraorganizational collaboration.

*.. I know already that XX person in XX R&D unit is reliable and has right skills and mindset that I need for our R&D unit, so it is easier to reach him whenever I think of collaborating with that team.*

In summary, the trust was vital in defining the collaboration among intraorganizational R&D units. Network social interactions among elements such as previous colleagues and known allies were found to be the most important nodes in developing intraorganizational collaboration, whereas for developing new networks individual profiles such as flexible, open, supportive and experience and knowledgeable were more important. It was also found that the trust in the counterpart or parallel member in another team is important when it comes in building trust in defining strategic R&D collaboration and alignment. The trust and perception of the collaborating R&D unit by any members of initiating R&D unit (herein interorganizational trust) is also critical in developing intraorganizational network. Based on the interviews intraorganizational network trust can be defined as in Figure 12.

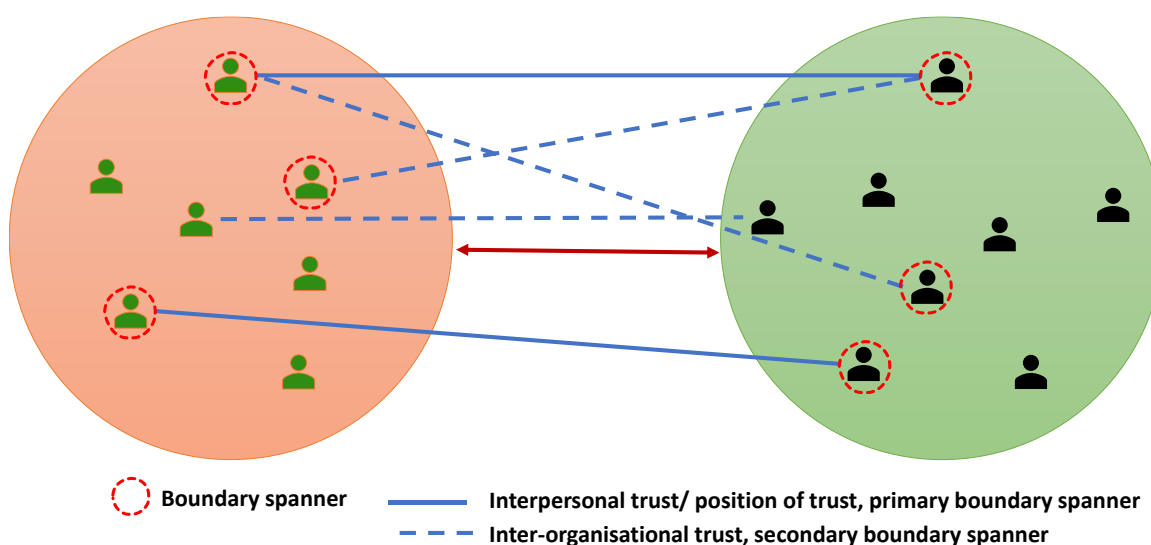


Figure 12. Intraorganizational trust and boundary spanner.

#### 4.2.2 Responsiveness and Timeliness

Responsiveness and timeliness, herein subcategorized based on the ease of integration of business units request in the R&D and project cycle or time lag in collaboration, was another critical network element that was identified by interviewees as an important network element for strategic R&D cooperation and alignment. The respondents highlighted the need of the flexibility, both in terms of business unit R&D projects and importance of joined planning in

setting-up or starting joint projects among different units. The importance of the responsiveness was stressed more by the level of influential position the respondents held in the organization. The interviewee's opinion on flexibility was also related on the timeliness, meaning the average cycle time of R&D project. Majority of the respondents who represented business functions emphasized the fact that the R&D project execution cycle should be short enough (product readiness at 1-2 years) to address the current needs of the consumers. Opinions varied a bit between the different levels of positions respondent held in the company, relaxed attitude on both business oriented short-term and strategic long-term development (product readiness after 5 years) and cooperations were discussed by those who have been working for the company for long time. Summary of the timeliness as perceived by each business areas are summarized in Table 3.

Table 3. Identified timeliness concept for R&D units within respective business areas. √√√ represents the utmost priority and √ represents opportunistic priority.

Business Area	Short term (1-2 years)	Mid term (3-5 years)	Long term (5-10 years)
BA1	√	√√√	√√
BA2	√√√	√	
BA3	√√√	√	
BA4	√	√√√	√√
BA5	√√√	√√	√

Three respondents were in an opinion that instead of merely seeing strategic R&D collaboration network it can be designed in such a way that intraorganizational R&D can be restructured based on the interorganizational concept- meaning that each business unit R&D can practically serve as customer for each other BU for strategic long-term developments. The main argument for the idea of visualizing interorganizational collaboration within intraorganizational units was the realization that it is much easier to incorporate business unit customers projects included in the R&D portfolio. While this can be implemented but the respondent also argued the need of strategic shift in governance of the corporate and business unit R&Ds and role of structured feedback. Nevertheless, majority of the respondents had common opinion that the elements for collaboration within intraorganizational network is also driven by the R&D management.

*.. we can think openly also as business unit R&D serving as a customer for other business units. This could facilitate in extending and expanding what we value, generate, and deliver in networks.*

#### 4.2.3 Information exchange

All the respondents understood the role of cooperation and collaboration in network being a reciprocally beneficial association to achieve strategic goals, by sharing responsibility, authority and accountability for R&D and product development. For strategic alignment of R&D, employees with higher influential power and those worked for longer duration stressed on cooperation or sharing information more than on collaboration. Respondents identified that the role of information exchange relates to communication of knowledge and information and builds up on achieving each unit's their own goals.

*... I think information exchange should be about what is the most strategic action for all or most of R&D teams to participate and coordinate around a given target/action/goal.*

Some of the respondents had a vague idea of what other R&D units were doing and were doubting if there were any synergies. It was obvious that some units were more proactive in information exchanges, by means of project progress updates and information meetings between the laboratories and other informal communications. Nevertheless, respondents were aware of cooperation among different R&D units, whenever possible, based on the freedom of individuals to join and participate the information exchange and discussions. Interestingly some respondents highlighted there were no clear boundaries defined so sharing information openly among intraorganizational R&D units is then dependent on individuals.

*.... we should be more secure with essential and inevitable messiness to be open, to trust and be trusted, while sharing information across intraorganizational network*

*.... Somehow it maybe there is lack of trust because we are not sharing the information. We always hear there is a firewall between the businesses, and it is a big scary thing which we don't quite understand what does it really mean? ... we don't know what we are allowed to share, there is no clear boundary defined, unlike as in case of external suppliers and customers, to what extent we share information within company R&D teams.*

*... Firewall for R&D is least we should be aiming at, specifically if it deals with strategic midterm and long-term R&D.*

Information exchange helped different R&D units to share the know-how and knowledge and help parties to acquire information that they would not otherwise have access to. To create dynamic R&D capabilities some respondents suggested that information exchange turn out to be critical to constantly adapt R&D projects, creating competitive edge on business and technology environment. Information exchanges also happened in the form of idea exchanges and validating/rea-accessing ideas in the form of informal meetings, but that required trust across different R&D units. Other forms of information exchanges such as staff exchange and joint project developments for instance were not currently a major part of the network developments.

#### 4.2.4 Roles in network- Formal vs informal network

The pre-setup organizational structure, permanent in nature, creates the formal network and mandates the task and responsibilities for both intra- and interorganizational network. The respondents agreed that the number of ties in an intraorganizational network determines the degree of acceleration of knowledge diffusion in organization and thus facilitates in strategic R&D decisions. However, respondents also highlighted that the formal network already defines creation and maintenance of ties in a network and that requires substantial time and resources.

*... in my position I am expected that I manage our R&D activities and at the same time coordinate with both internal and external networks. In addition, with all the administrative work it consumes all my time.*

The formal network for strategic R&D and management was identified more in the form of managerial roles such as project leader, coordinator or steering group members who can suggest and directly influence both the intraorganizational collaboration and alliance. Also, the formal network was identified as an initiator for new intraorganizational projects, network referral and channels for knowledge dissemination. One of the respondents highlighted that the members of his team are encouraged to be representative of disseminating and selling relevant ideas and initiatives to other intraorganizational R&D teams.

*... I encourage my team members to discuss and market their ideas internally within the company with other teams and I hope that it can led to creating new possibilities of collaboration and knowledge sharing.*

The informal network was identified not only as social significant among team members but also to create extra value and enable best practices in business unit teams. Informal networks were more utilized to validate/reassure some information, based on mutual trust and expertise. It was no wonder that participants agreed that informal networks are formed based on interpersonal discussions and were subjective based on a case-by-case basis.

*... whenever we do not have synergies or predefined collaborations or projects, I try to discuss things otherwise, for example when I am with them in lunch.*

Based on the interviews, the critical network elements based on roles in network can be related with trust, responsiveness and timeline and information exchange can be illustrated as shown in Figure 13.

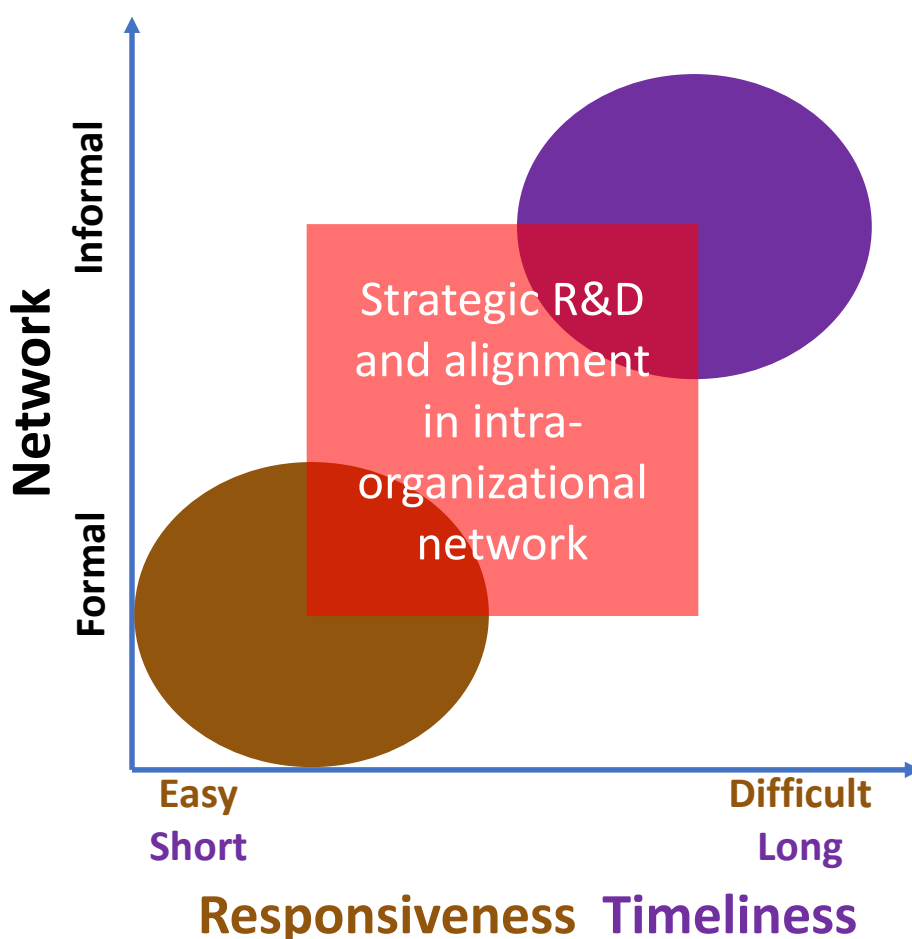


Figure 13. Roles in network and network elements in terms of responsiveness and timeliness for strategic R&D and alignment as identified by respondents.

### 4.3 Contents of network relations

The main content of the network relations among intraorganizational R&D units is the collaboration and knowledge sharing.

#### 4.3.1 Knowledge sharing

In general knowledge sharing within own's R&D teams were more prominent than across the network of intraorganizational R&D units. Respondents talked that, beyond their own team, the knowledge sharing was more focused on seeking perspectives on their developments or acquiring specific information relevant to their own vision and targets. Idea exchange among different teams were more dependent on the personal level rather than on the group level, so it appeared that the individuals were simply serving as boundary spanners in an informal network. Knowledge sharing across intraorganizational network were also focused on the areas that were aligned more on the supporting functions such as laboratory resources or other general information rather than being strategic R&D topics. General knowledge sharing included sharing knowledge related to the best practices, common analytical method development and implements and addition or modification of common facilities and resources.

*... it is just the information that I need to ask for our developments from other business. Other than that, we do not have regular contact.*

*... we were once provided training by XXX business area, and we have naturally consulted them with some laboratory test methods.*

#### 4.3.2 Collaboration

It was evident that all participants had similar opinion that collaboration allows the company to extract individual talents and to coordinate knowledge and be agile in providing solutions for business. Business units R&D were in pressure to adapt to increasing customer demands and integrate and optimize their product and service offering. The business units R&D which were already involved in joint projects, or to somewhat aligned, identified that the main content of the network relations is focused on these projects to achieve set targets and make decisions together. Collaborations were facilitated both by formal and informal networks.

*... we have joined project where we are aiming to develop strategic products across our business units and that create synergies among our R&D teams*

*and create strategic alignment. So, for us achieving targets and decision making are important in the network.*

Respondents also identified that intraorganizational collaboration is important to complement the interorganizational collaboration and strongly influences intraorganizational connectedness and alignment. Interviewees also raised an issue of informal network on forming clusters that can eventually weaken the positive impact of developing intraorganizational alliance. However, one respondent clearly emphasized on the fact that collaboration among intraorganizational units helped them to make effective decisions that are appropriate for the company's long term research and development prospects.

*... we get some contacts and inquiries that are not directly related to our business but that can be valuable for our other business areas. So, I think we should collaborate in a sense that we keep the external contacts and develop strategic fit ...*

*... sometimes I feel that we discuss too much on collaboration. I am not saying collaboration is bad but also, I think that we need to be aware of not creating forced network that bundles us away from our focus.*

Business R&D units that didn't had strong intraorganizational network integration were seeing collaboration more from conflict and risk management aspect. Risk management aspect was discussed mainly from the perspective of competing for resources, for example related to funding and utilization of supporting functions such as laboratory and piloting facilities.

*... we do not have direct collaboration with XX business unit, but we share laboratories and piloting facilities, and we occasionally discuss about resources issues in order to understand the needs and minimize risks.*

*.. I understood that the main driver in terms of collaborating for projects would be the long-term targets rather than short term targets as our business R&D is driving."*

#### 4.4 Access of relations and quality of process

##### 4.4.1 Governance structure

The interviewees discussed openly the role of the governance structure, mainly the mode of the control and coordination and related their dependence on the form of the network within the organization. Respondents highlighted the role of network communication and

the funding structure to be part of the governance structure that defines the relations and quality of the network.

*... Our steering group is composed of people from strategy, technology, and other business units and this helps us to initiate and discuss project ideas that are relevant across other business units.*

*... structured feedback that we get from upper management is helpful in defining how we should access network relations and how to quantify the quality of process.*

Some others doubted that the governance structure is dictated by the business unit directly and hence there was no need to really access other relations. Others discussed that appropriate intraorganizational commitment and funding channels might help to develop relations in the network.

*... we rely 100% on our business funding and we have little time to focus on other intraorganizational R&D units and their developments...*

To improve the access of intraorganizational strategic R&D network and devise the quality of network, respondents suggested to focus on creating strategic intraorganizational value driven team or network and implement for instance group to access ideas from seed vs weed perspectives. Respondent also justified that the initiatives and ownership are critical when thinking of intra organizational strategic R&D and management.

*... we can initiate projects that are value driven and are directly owned as part of strategic business development with different business units.*

*.. often when we think of joining efforts with different business R&D we lack the initiatives and who takes the ownership of such developments becomes a challenge.*

#### 4.4.2 Orientation

Business R&D units with short term orientation were more concerned on capacity building of their own teams and were worrying less about cross-organizational collaborations.

*...of course, most of our work research work serves for the short service this year or next year's targets so there is not much we can gain from other Business units R&D as we think they are also aligned similarly.*

*... I think we had some discussion about cross-business unit R&D projects, and it was enforced more than a year ago, but I think they haven't been proceeding so much or are very slow. This could be because of not having long term orientation.*

Respondents with long-term orientation clearly addressed the need of developing strategic R&D that aligns with future needs and collaboration and global capacity building. Respondents also suggested in implementing tools such as joint technology road mapping and making distinction between research and development based on the orientation.

*... we should make our strategic R&D vision together. It makes sense to have inclusive discussions on what are the priorities over short term and long term and how we can achieve them by utilizing our expertise across different functions.*

*... we need to also think of long-term prospects of company so that we encourage people in R&D to look on both part, short term needs of business and long-term needs which also helps them to orient and steer themselves for career developments. It is worth to have people in company that can see and collaborate beyond one business unit so that they can be flexible for future needs.*

In addition to these discussions, three respondents highlighted the need of having well defined accountability metrics for R&D groups. Specially for strategic R&D which consists of long-term high uncertainty, the accountability metrics should be effective to measure progress and outcomes. Additionally, the lengthy time between initial R&D investment to outcome really needs a systematic tracking and management tool so that intraorganizational collaboration can be reacted or promptly reoriented whenever there would be need.

## 5 Discussion and Conclusions

The aim of this chapter is to discourse the research findings from theoretical framework and previous research perspectives. The chapter is divided into six subchapters. The first three subchapters examine one research question at a time. The following subchapters reviews and discusses the main finding related to identification of the network structure among different business unit R&D and their role as intraorganizational R&D network. At the end, final conclusions are put together as a summary paragraph and managerial implications are discussed. Limitations of the research and research outlook concludes this final chapter of the thesis.

### 5.1 What are the critical network elements that influence the strategic R&D cooperation and alignment within case company?

The findings related to the critical network elements that influence the strategic R&D cooperation and alignment within the case company support the previous network research well. The intraorganizational network within the case organization, was founded based on trust, responsiveness and timeliness, information exchange and role of the node in the network.

The role of trust in innovation alliances defines the relationship (De Jong & Woolthuis 2008, Venus Lun & Panayides 2009, Wasiluk & Saadatyar 2020) that builds the network. Some research work suggests that the trust as a relational asset to maintain the network for strategic innovation alignment (Preston & Karahanna 2009, Cäker & Siverbo 2014). Others argue that higher degree of trust can be detrimental to innovation (Bidault & Castello 2010). Nevertheless, several empirical research (Cabrera & Cabrera 2005, Kucharska 2017, Thomas & Paul 2019) have demonstrated that strong ties fostered by trust generates knowledge transfer and collaborative cultures. For strategic alignment among intraorganizational R&D units both interpersonal and interorganizational trust was found to be important. Reliability, predictability, and impartiality of another R&D unit, define the physiological safety (Rempel & Holmes 1986, Zaheer et al. 1998) often based on individual perception and/or collective trust orientation among different units, were found to important for the intraorganizational trust. Hence, trust was one of the critical network elements between intraorganizational R&D units for strategic cooperation and alignment.

It is a main concern in business environment that the long-term competitiveness is unfavorably influenced by the short-range financial perspectives (Lengnick-Hall 1992). Dilemma of pursuing for strategic research projects with wide-ranging and long-term benefits are often impacted by the need of short-term solid business case with good return on investment (Mitchell & Hamilton 2007). Same concerns were observed among different R&D units

which imparted the network formation, collaboration, and strategic alignment decisions among different units. Position of the timeliness and adaptability in terms of responsiveness (Novkovic 2014) are hence important network elements that directly influence the strategic innovation and alignment.

Another identified critical network element was how often and by which means the information exchange happened among different R&D units. Organizational units with frequent information exchange, both formally and/or informally, were found to be part of intraorganizational network. The finding is supported by the fact that the interdependency within the project tasks and organizational mutuality within the participant network are known to be vital in terms of collaboration establishment and effectiveness (Chinowsky et al. 2011).

All the critical network elements were found to be subjective on the role of the actor in the node. The intraorganizational networks in the case organization were found to be both formal and informal. Regular works were mostly carried out in formal networks, confirming relational and nodal properties to be important (Cumming 2016, Tsai 2002) to ensure access to knowledge, diffusion and increase in innovation capacity (Goossen 2014, Lazer & Friedman 2007). Informal networks were aligned more on interpersonal level focusing on long-term and strategic developments as observed earlier (Bouty 2000). Informal networks were preferred also when unit's responsiveness was expected to be difficult (Kleinbaum & Stuart 2014). Irrespective of the role in the network, trust and reciprocity was important factor in maintaining interactions. The role of the network structure and reach hence is an important parameter when it comes to collaboration and strategic alignment of different intraorganizational units.

In general, previous researchers have emphasized different identified network relations as part of either interorganizational (Rothwell 1989, Chesbrough 2004, Alguezaui & Filieri 2010, Bergenholtz & Waldstrøm 2011) or intraorganizational networks (Carnabuci & Operti 2013, Goossen 2014, Ortiz et al. 2021, Yu & Chen 2020). Considering the collaboration, innovation and strategic alignment of intraorganizational R&D units is an interplay of interorganizational and intraorganizational network as discussed in previous section, the findings from this study identifies critical network elements that are relevant to facilitate strategic corporate innovation development and management.

## 5.2 What are the contents of the relations in the network?

The findings related to the main content of the exchange among different R&D units were found to be the knowledge sharing and collaboration. This is in line with earlier research that relates the evolutionary competence standpoint and embraces the resource-based

view (Burvill et al. 2018) and the dynamic capabilities framework (Teece et al. 1997). Knowledge sharing and collaboration are vital contents in the network relations as these are irreversible assets and the commitments in acquiring/developing intangible organizational possessions and tacit learning among the network should deter the duplication of valuable innovation resources and time and eventually should secure the distinctive strategic value for the organization (Sirmon et al. 2007). Knowledge sharing and collaboration across cross-functional teams or within intraorganizational R&D units can also ensure access to heterogenous knowledge (Argote et al. 2021) and increase innovation capacity.

Knowledge sharing and collaboration were facilitated both by the formal and informal network within the organization. Intraorganizational collaboration is essential to complement the interorganizational collaboration, and the synergy shows strong influence within intraorganizational connectedness and alignment. This aligns well with existing theories that support the social relationships and ties generated within the network are crucial for knowledge sharing and developing collaborations (Alguezaui & Filieri 2010, Batt 2008, Tasselli & Caimo 2019). Meanwhile, the role of the connectors or actors in nodes that serve as boundary spanners and gatekeepers are important content in the relations as they directly affect the knowledge sharing and collaboration within different intra-organizations (Huang et al. 2016, Qiu & Haugland 2018, Schotter et al. 2017, Van de Ven & Zahra 2017).

### 5.3 What determines the quality of the process and how these relations be accessed?

Assessing the quality of the strategic R&D progress and relations for the collaboration among different R&D units is a challenging task. Governance structure and orientation are two identified scopes which can access to some extent the quality of the process and how the relations are accessed. Governance structure can be seen from transactional cost (Williamson 2002) and social capital theory (Knocke 1999). The transactional cost perspective views the governance structures as being the net effects of internal and external transactions; transactions being information cost, decision cost and policing and enforcement costs. Transactional costs are impacted by the bounded rationality i.e. bounded capacity to understand business situations and by opportunism i.e., driven by individual's interest. This aligns with the findings here that the formal network is driving the governance structure within the bounded rationality whereas the informal network is driven by opportunism (Zylbersztajn & Merc Querido Farina 2005). The ultimate understanding of the balance between frequency of the transactions and how the uncertainty in long-term strategic innovation and alignment are handled within the governance network can be a parameter to access the quality of the process and relations. However, one should be aware that the

opportunistic behavior is driven based on the trust and uncertainty in dealings can increase mistrust.

Similarly, the social capital perspective of governance focuses on the degree of cohesion and degree of openness of network. This connects to the role of the network structure and reach and directly relates to the earlier identified critical network elements of trust, responsiveness and timeliness and information exchange and. High network reach increases knowledge transfer within R&D network as information diffusion and extent, speed and reliability of knowledge dissemination is large (Lazer & Friedman 2007) and creates strong governance network of expertise knowledge and knowhow (Jarvenpaa & Majchrzak 2016). Lower network reach and network fragmentations evokes socially isolated researchers (Goossen 2014) that create barriers in information sharing. Hence based on the findings and relevant discussions of prior research, it is sensible to assume that a governance structure that balance the control over the organizational innovation strategy among different R&D units should facilitate the creation of better strategic alignment within intraorganizational R&D units.

Understanding of the strategic orientation and effective balance between the short-term and long-term orientation certainly would create more strategic alignment between intraorganizational R&D and business (Fortuin & Omta 2007a). Exploration and exploitation functions should be defined strategically and clearly by involving both the R&D and business side so that the discordant between R&D and business is reduced and R&D-business gap is minimized. For instance, personal exchange between among different intraorganizational units should facilitate the role of boundary spanners and at the same time improvise knowledge transfer and diffusion throughout the organization (Foster-Fishman et al. 2001).

Another approach can be to take research and development separately so that the expectations are clear among different research and development units. This approach would allow business to focus more on the product development, meanwhile global R&D or value-based research group can focus on strategic research projects steered together by business. With the changing prospects of R&D as a cumulative, evolution oriented and networked process, the key to effective R&D hence would focus on improving its underlying management process (Schot & Steinmueller 2018). This would also help to overcome the central dilemmas of managing innovation such as seed vs weed concept, initiatives and capacity building which are important pillars for improving intraorganizational collaboration. Join technology road mapping (Potstada et al. 2016) and agile milestones based follow up of defined projects for strategic targets can also serve to address the relations and their quality across intraorganizational units.

#### 5.4 Intraorganizational R&D network structure and strategic innovation management

From the theoretical perspectives, the network concept based on the industrial network approach (Hakansson & Johanson 1992), which identifies three building blocks in the form of actors, activities, and resources, were clearly recognized for the case organization. Actors, activities, and resources were primarily the paths of relationships, that defined the boundaries and the connections (Easton et al. 1992, Jarillo 1988, Ritter et al. 2004) among different R&D units of the organization. Intraorganizational networks are connected via personal relations and consists of individuals, teams, or business units and drive the cross-functional innovation, resources, or knowledge exchange (Tsai 2001, Tsai 2002, Colombo et al. 2011). Limited number of intraorganizational connection among the actors, as observed during the verification of existing research problem, supports the concept of network instead of clusters. By ensuring restricted membership in a network, leaders of the case organization were able to maintain the relationships, activities and resources (Inkpen & Tsang 2005, Giuliani 2013). Collective vision among the actors in network was identified, only based on the informal interactions (Lundberg & Johanson 2011), thus forming localized clusters according to the needs. However, localized innovation clusters are known to serve well strategic development and alignment centered on the basic knowledge, practice-oriented expertise and innovative platforms (Mazur et al. 2016).

Intraorganizational collaboration and strategic innovation activities should be focused on knowledge exchange and combination for joint problem solving (De Clercq et al. 2011, Carnabuci & Operti 2013) or on recombination of existing technologies (Carnabuci & Operti 2013). For the case organization, focus on knowledge exchange, joint problem solving and development/optimization of new products by recombination of existing technologies were evident. As in case of earlier research, coordination of strategic internal resources and procedures (Chen et al. 2013), and gatekeepers (Duchek 2015) were clearly identified. Cross-cultural negotiators (Casciaro et al. 2019), another pillar of intraorganizational network, collaboration an innovation, was less significant for the case organization. This aligns with the current drive-in cross-cultural diversity among R&D units of the selected organization.

For the case organization, the business units had different scopes and orientation in R&D. Intraorganizational network aided more on process innovation (De Clercq et al. 2011), product optimization (Carnabuci & Operti 2013) and whenever possible insourcing of knowledge (Paruchuri 2010). Intraorganizational network are also proven to compete for same internal resources (Ortiz et al. 2021) and it was also discovered that part of the intraorganizational

network was focused on risk management related to resources. As identified by earlier research works (Van Wijk et al. 2008), the innovativeness and intraorganizational collaboration network of the case organization was found to be affected by the number of interactions and their strength and structure. Based on empirical findings, it was apparent for the case organization that the intraorganizational network resembled the same behavior of interorganizational network (Buchholz & Rosenthal 2005), as different business unit R&D were found to be isolated, at times, as unique individual entities. Thus, these results confirm the notion that the intraorganizational R&D network structure for strategic innovation and management for the different business divisions of the case organization are embedded as the synergistic role of intra- and interorganizational network or nested structure (Harary & Batell 1981) and are contingent throughout the network (Özman 2017, Yu & Chen 2020, Burt & Soda 2021).

#### 5.4.1 Interplay between intra- and interorganizational collaboration for innovation

The interplay between the intra- and interorganizational collaboration for innovation can be understood by considering the simultaneous effects of their network effects (Özman 2017, Chan et al. 2021). In a multilevel network perspective, any actions by macrolevel node should influence the nodes at a microlevel (Davis & Eisenhardt 2011). For instance, alignment in business unit strategic targets were found to influence the collaboration among aligned business unit R&D units. Certainly, macrolevel network influences the microlevel network, by forming an organizational boundary spanner as discussed in earlier research works (Van de Ven 1976a, Van de Ven 1976b, Huang et al. 2016, Schotter et al. 2017, Scott et al. 2019). Nevertheless, the restrictions and role of boundary spanners at macro- and micro- level seemed to be influenced based on the research focused on either inter- or intra- organizational dimensions as discussed previously with Coleman's boat model of inter and intraorganizational collaboration (Coleman 1994, Goossen 2014). Considering the interplay among different network elements of intra- and interorganizational networks for strategic innovation and management for large organizations with multiple business units as of the case organization, it would be more appropriate to consider three levels of social analysis (Serpa & Ferreira 2019) – macro (interorganizational), meso (inter-units) and micro levels (intra-units). The concepts of three layers of social environment are well established in social sciences (Serpa & Ferreira 2019), but similar concept for organizational network are so far overlooked. Considering that the core aim of network theories is to understand how individuals and group interact and how such relationships lead to various outcomes (Coutinho 1995, Parkhe et al. 2006, Krause et al. 2007), it would be perceptible to extend the knowledge based on established concepts from the social sciences. Thus, extending

the current understanding based on the empirical results for the case organization, the network environment for strategic innovation and collaboration within an organization can be re-defined as macro environment, meso environment and microlevel interactions. It can be related that the external environment (macro environment) first influences the organizational ecosystem or creates systematic interdependence among different business units (Will & Mueller 2020) and thus business unit R&D (meso environment) creating network or respective unit grouping, and eventually to the nodes at individual actor level (microlevel) interactions. The meso-level therefore should enable both structural and interactional approaches (Fine 2012), emphasizing shared R&D management and strategic alignment. As a result, based on the empirical study for the case organization, role of inter and intraorganizational collaboration network for innovation can be proposed as in Figure 14. The innovation and alignment among meso level is aimed at producing innovations to design new products, process, technologies, concepts, services, and solutions. The strategic innovation is introduced as a systematic approach to enhancing organizational innovation portfolio, aiming at sustaining competitive advantage and transformational growth. This assumption is clearly supported by the empirical data of the case organization wherein interviewees identified the need of rethinking on how intraorganizational network can be defined on the same concepts of supplier and customer.

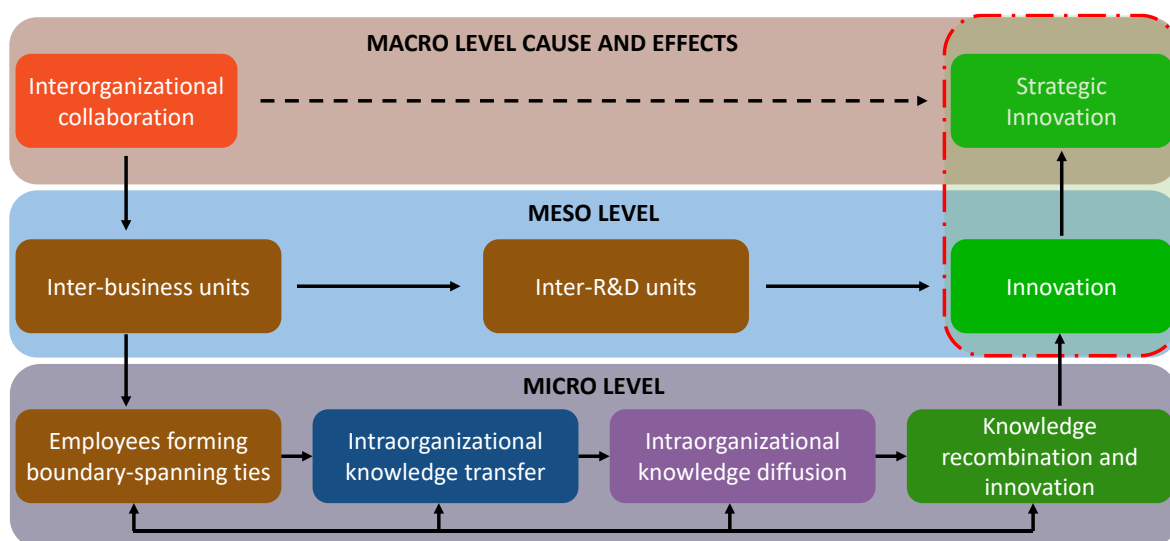


Figure 14. Inter and intra organisation collaboration for strategic innovation alignment in global organizations with multiple business units.

The innovation diffusion via boundary spanners among different level can be characterized based on the formal position of the network actors (likelihood of sharing information and probability of recipient using shared information) and their proximity or relationship (Strang & Tuma 1993). It was identified that the higher the formal position, higher will be the focus level and strong inter unit referral network. Robust referral network hence favors strong

knowledge diffusion (Nahapiet & Ghoshal 1998, Argote & Ren 2012). Also, the concept of visualizing other business units as potential customer or supplier, together with the role of responsiveness and timeliness, favors the alignment and collaboration for strategic R&D management, similarly as by creating triadic structures of boundary spanning across subunits (Tasselli & Caimo 2019). Meanwhile, the proximity was recognized as a need to create stronger ties to create trust, mutual understanding, and nurture effective communication (Aral & Van Alstyne 2011, Goossen 2014).

Based on the qualitative data and existing theories, the network for strategic R&D and management for a global company can be visualized as a collective R&D strategy that links corporate R&D and business unit R&D together, as shown in Figure 15. Indeed, on a macro level the company links intercompany network with relation to knowledge sources and business unit's customers and partners. Corporate headquarters, corporate R&D and business unit R&D then are linked as internal nodes of meso and microlevels, creating intraorganizational network. The intraorganizational network for strategic innovation management thus depends on the critical cooperation among corporate R&D and business unit R&D. A clearly defined innovation orientation among business unit (short-term) and corporate R&D (mid to long term) should facilitate the trust and responsiveness to accelerate network formation and information exchange, to enable knowledge sharing and collaboration among these nodes. The governance structure that facilitates structured feedback, well defined KPIs, initiatives, and ownership is important to keep the intraorganizational network active. The overall strategic innovation, management and alignment certainly depends on shaping, integrating, and monitoring the strategy (Brennan et al. 2020). Additionally, aligned orientation with common technological road mapping in mid to long term targets, capacity building and personnel exchange to enhance internal R&D competencies should enable clear strategic alignment among different units.

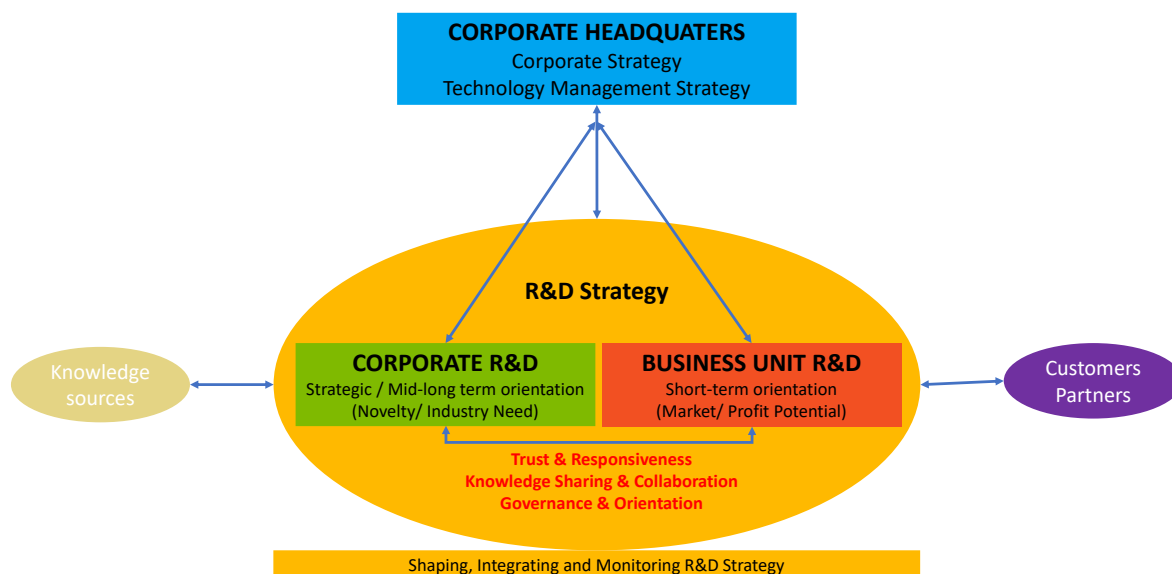


Figure 15 Network for strategic R&D and management for global company.

In summary, this case study provided general insights into intraorganizational networks from R&D perspectives, with focus on identifying critical network elements, contents, and relationship quality among different subunits. This study mainly supported prior research in the field but also supplemented existing research with new insights in filling current voids in relation to understanding of interplay between inter and intraorganizational networks. This interplay clearly shapes how the R&D networks within an organization should be visualized and what frameworks are to be consider when collaboration and strategic alignment is sought.

## 5.5 Managerial implications

This subchapter will focus on recommendations for the case organization, in relations to understanding the intraorganizational R&D network structure and utilizing it for strategic innovation management. Based on the interviews and theoretical considerations around the topics of intraorganizational strategic R&D and management following suggestions can be made:

- Clearly defining broadly defined area of short-term product developments and strategic long-term R&D/technology: It was evident for the case organization that the short-term product developments were happening within the boundaries of formal networks whereas the strategic long-term research was channeled by informal network. It would be important to make organizational structures that create a synergy to utilize the knowledge created for short-term product developments with business R&D to be shared and combined to create strategic long term competitive advantage

for the organization. This should also align with the shared goal sharing among different R&D units and clear decision-making mandates (Lee & Lee 2015, Anderson & Tushman 2018) to support collaboration and knowledge management.

- Defining focus area for business specific R&D units: All the interviewed personnel highlighted that the role of business R&D should be supporting short term product developments. Strategic long-term innovation and management should be coordinated within corporate level to have a clear alignment on corporate strategic innovation targets.
- Improving communication and governance towards orienting strategic decisions: The organizational strategic innovation and alignment could be improved by improving communication across teams, functions, and organizational units. Governance structure should be improved to create real trust among different units and align with responsiveness and timeliness concepts to improve information exchange, knowledge sharing and collaboration. Interviewees were concerned about the existing “firewall” among different R&D units as a barrier for strategic development and it is obvious that existence of any such barriers are detrimental for collaboration, knowledge sharing and alignment (Phelps et al. 2012, Van de Ven & Zahra 2017, Van Wijk et al. 2008). A governance structure that balances the control over strategic corporate R&D portfolio while maintaining effective steadiness between short-term and long-term orientation with involvement of all concerned parties should facilitate strategic alignment. Structured feedback and timely monitoring the strategic internal and external appropriateness of long-term developments is also needed.
- Alignment of intraorganizational units in strategic R&D/technology by creating value-based groups and allocating resources: While the informal network within the case organization is driving value-based groups/networks to create synergy among different R&D units to create strategic research, allocating time and resources systematically to encourage these networks would facilitate the knowledge sharing and collaboration. Other options to drive collaboration across different units could be encouraged by maintaining job rotation possibilities and generating common portfolio of ideas according to corporate strategic priorities.

## 5.6 Limitations and future research

The research of this thesis was based on context dependent single case study and thus the results should not be directly generalizable to other organizations (Bell et al. 2022). Nevertheless, the findings of this thesis should supplement some of the prior research, especially

in understanding the role of interplay between inter and intraorganizational network from the perspective of strategic innovation management. The pre-identified research issues were validated initially and some solutions were proposed based on the interviews of five interviewees from five different intraorganizational units. The heterogeneity in selection of the interviewees was done to minimize bias and create reliability and validity (Saunders et al. 2015, Saunders & Townsend 2016) as they represent different role and functions in the organization, with different experiences, locations, and their time of service. The researcher's perspective can also create some biasness to the outcome, but it was considered during data analysis that researcher's own attitudes were not impacting the results by creating well defined categorization of the interview data. The confidentiality level of organizational aspects which could not be fully considered in evaluating the outcomes of the results were omitted and hence it might also create some limitations. Certainly, complementing this qualitative study with quantitative data would help in overcoming some of the discussed limitations. Further survey and empirical study across multiple industries, in a more global context, could be performed to validate the theories presented in this thesis as solution for improving intraorganizational R&D network for strategic innovation and management. The theories purposed here as solutions certainly are more relevant in these modern times as organizational boundaries are blurred with futuristic ways of hybrid work. Also, it would be interesting to research the interplay between social network and knowledge networks, cross-border diversity, and intersection between formal and informal networks across the companies.

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## Appendix 1. Questions for semi-structured interviews

Background Information	<ol style="list-style-type: none"> <li>1. What is your role in the organisation?</li> <li>2. How long have you worked for the company? How long have you worked at current position?</li> <li>3. What kind of previous roles, functions, or business areas where you were involved for the company?</li> <li>4. Whom do you work most frequently?</li> <li>5. Can you identify main collaborators across following business areas: BA1, BA2, BA3, BA4, BA5</li> </ol>
Intraorganizational network	<ol style="list-style-type: none"> <li>1. Who are the main contacts daily? Contacts beyond your team?</li> <li>2. How do you plan/identify with whom you/your team should work for strategic R&amp;D?</li> <li>3. What is the main driver for collaboration among other business units?</li> <li>4. How do you see intraorganizational networks- formal or informal networks?</li> <li>5. How often do your unit have information exchange with other teams and what kind of information are exchanged?</li> <li>6. What kind of governance structure and funding structure do you have in your team? How is it working?</li> <li>7. Do you do personnel or project exchange?</li> </ol>
Functioning of intraorganizational network - Critical elements	<ol style="list-style-type: none"> <li>1. How is collaboration inside and outside the team managed and led?</li> <li>2. How do you access successful networks?</li> </ol>

<p>- Accessing network quality and relations</p>	<ol style="list-style-type: none"><li>3. How can the intraorganizational network be enhanced to improve strategic R&amp;D?</li><li>4. What management metrics can be taken to raise the level of strategic alignment in the innovation network?</li><li>5. Given an option- what would be your option and why: Joint projects, shared resources or value-driven network?</li><li>6. How do you find strategic alignment in generating and integrating novel business ideas?</li><li>7. Do we need to maintain autonomy for strategic long-term development or obtain synergies with ongoing operations?</li><li>8. How do you see knowledge transfer, knowledge diversity, and company`s innovation?</li><li>9. Any thoughts related to diversity among and within organisation?</li></ol>
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