

THESIS ON ECONOMICS H38

**Co-evolution of Capabilities' and
Alliance Portfolios: Multinational
Firms in Global ICT Industry**

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Declaration:

Hereby I declare that this doctoral thesis, my original investigation and achievement, submitted for the doctoral degree at Tallinn University of Technology has not been submitted for any academic degree.

/Alar Kolk/

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MAJANDUS H38

**Hargmaiste ettevõtete
võimekuste ja liitude arendamine
globaalses infotehnoloogiatoöstuses**

ALAR KOLK

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LIST OF ARTICLES

This doctoral dissertation is based on the following scientific articles, which are referred to by Roman numerals throughout the text:

- I Kolk, A. and Rungi, M. (2012). Total Exploitation Orientation in Capability Development: The Cross-case of Google, Ericsson, Microsoft and Nokia. - *Research in Economics and Business: Central and Eastern Europe*, 4(2), 5–25.
- II Rungi, M. and Kolk, A. (2012). Capability Development – No Path, Response to Competition: The Cross-case of Google, Ericsson, Microsoft and Nokia. - *The IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*, Hong Kong, China, December 10-13, 2012. China: IEEE, 2012, 689–693.
- III Rungi, M. and Kolk, A. (2011). Trajectory Evolvments of Capability Families: The Google Case. University-Business Cooperation Tallinn 2011 (214–239). - Germany: Berliner Wissenschafts-Verlag.
- IV Kolk, A and Rungi, M. (2013). Agility of Capability Development: The Multiple-Case Study of Ericsson, Google, Microsoft and Nokia. - *The IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*, Bangkok, Thailand, December 10-13, 2013. Thailand: IEEE, 2013.

INTRODUCTION

To innovate, grow and prosper, firms are challenged to find new resources through development of capabilities (Wernerfelt 1984; Barney 1991; Lippman & Rumelt 2003, Helfat and Peteraf 2003, Teece et al 2007) and forming alliances (Hoffmann 2005; Heimeriks and Duysters 2007; Ozcan and Eisenhardt 2009). Large multinational firms could find benefits from hundreds of capabilities and alliances if these portfolios are co-developed.

Developing capabilities' portfolios has been regarded as an extremely challenging area in management practice (Prahalad and Hamel 1990; Laamanen and Wallin 2009). Still, the portfolio approach has received remarkably less attention in the strategic management literature. It's still unclear how these portfolios are formed into families and how are the portfolios managed through proper configuration.

While a moderate amount of literature exists about capabilities development (Wernerfeldt 1984; Helfat and Peteraf 2003; Winter 2003; Teece et al 1997) and an adequate amount for alliances, still little is known about value creation from the perspective of co-evolution of capabilities and alliances. The co-evolution of capability and alliance portfolios is not looked at together. It provides a novel approach to the resource based view of the companies in a constant change.

The existing theories are mostly normative (Wernerfelt 1984; Collis 1994, Teece et al 1997) and rather limited to the definitions (Helfat and Peteraf 2003). There is a lack of extant empirical sources about configuration of capabilities and alliances portfolios. Also there is inadequate knowledge about the capabilities development path and how through market flux focal firms could speed up development of required capabilities.

Thus, there is a justified need to explore the capability development and portfolio formations in terms of organizational activities and strategies. This enables to increase corporate performance and enhance the scientific literature. Therefore the dissertation research is connected to the essential role of organisational capabilities in modern strategic management literature.

This dissertation outlines the role and theory of alliance portfolios in evolution of capability portfolios. The capabilities, which are formed and developed jointly with alliances, are the primary focus of the dissertation. In this thesis the capabilities are organisational routines, which consist of key competencies, processes, positions and path (Teece et al 1997).

The novel rationale of the dissertation is to advance the perspective of corporate capability and alliance portfolio development. The objective of the thesis is to contribute to the development of the collaborative capabilities portfolio concept (path and configuration orientation) and provide models for the capabilities development (agility and capability family dynamics). More specifically, this thesis investigates the capability portfolio formations by focusing on the following research questions. Firstly, how a focal firm's portfolio of capabilities evolves over periods of market cycles? Secondly, how a focal firm's alliance portfolio co-evolves with the firm's capability portfolio?

The thesis is made up of four independent research articles which are connected by a themes described above. To understand the configuration dynamics of capability and alliance portfolios the study focuses on exploration and exploitation portfolios of the capabilities and alliances (based on the first article “Total Exploitation Orientation in Capability Development: The Cross-case of Google, Ericsson, Microsoft and Nokia”, Article I).

The research results enable to develop a construct between market dynamics and the collaborative capability development. The aim is to understand the key strategies of the focal firm capability development in a strong competitive market (based on the second article “Capability Development – No Path, Response to Competition: The Cross-case of Google, Ericsson, Microsoft and Nokia”, Article II).

To map evolution of corporate capabilities, research was conducted to understand the trajectories of the capability families formation in conjunction with strategic alliances (based on the third article “Trajectory Evolvments of Capability Families: The Google Case”, Article III).

Fourth article of the study investigates the agility aspect of capability development by analysing the existence of a supportive environment in the form of a large capability portfolio and large alliance portfolio as a pre-requirement to speed up capability development in contemporary market circumstances (Article IV).

The contribution of doctoral thesis is theoretical and practical as follows:

Theoretical contribution

This thesis advances the understanding of capabilities dynamics over longer period of market evolution and the importance of the collaborative large capability portfolios development.

This thesis has developed a novel concept, namely the evolution of capability portfolio, and its configuration patterns. This concept of the portfolio and its configuration contribute to recent capabilities research (Teece et al. 1997; Zollo & Winter 2002) and research on exploration and exploitation (e.g. March 1991) with more established capabilities development techniques (e.g. Helfat & Peteraf 2003).

The literature tend to support more proactive capability development (e.g. Cohen and Levinthal 1990; Tushman and Anderson 1986) and first mover advantages (e.g. Draulans et al. 2003; Brown and Eisenhardt 1995). But empirical findings in the dissertation rather support the stand that capabilities development is initiated more by ad hoc and individual competitive actions.

This thesis brought out the importance of the large capability portfolios for new capability evolution. This enables focal firms to form new capabilities much more easily and speed up the capability development (Article IV) than acting in isolation, without interdependencies with existing capabilities. While prior literature has paid attention to cumulative learning effects and cumulative products (e.g. Wang and Ahmed 2007; Rothaermel and Deeds 2004), then effects of a large capability

portfolio have been largely left untouched or have been handled insufficiently (Helfat and Peteraf 2003).

Prior findings emphasized the greater role of exploitation than exploration (Bierly et al. 2009; Regnér 2003). There are also contra examples (Bierly et al. 2009), but these results were not analytically generalized and replicated to information and communications technologies' (ICT) industry. Now empirical proof was given of the use of exploitation also in unstable environments such as ICT. The mechanism as such is based on extensive use of exploitation capabilities and alliances to enhance the firm performance. Both, exploitation and exploration use weak and different SIC (Standard Industrial Classification) ties for better performance (Kauppila 2010; Ozcan and Eisenhardt 2009; Bierly et al. 2009; Lavie and Rosenkopf 2006). Open innovation (Chesbrough et al. 2006; Chesbrough 2003) used to be the primary agenda in corporate leadership but based on the empirics of the doctoral thesis, one may find that strong emphasis on open exploitation is the new pattern.

The thesis is strongly focused on the capability family evolution (Article I and III). In this research area prior literature propose either the ambidexterity or punctuated equilibrium approach (Boumgarden et al. 2012; Gupta et al. 2006; Bierly et al. 2009; Gibson and Birkinshaw 2004). The current research findings clearly demonstrate the prevalence of ambidexterity.

Practical contribution

This doctoral thesis is a distinctive and most comprehensive empirical analysis of the collaborative capability portfolio development in a multinational focal company. The research results benefit to executives who are responsible for capability development, but also for those managers who are setting up strategic alliances outside the firm's boundaries.

In particular, the doctoral thesis demonstrates that capability portfolio development requires systemic orchestration with alliance portfolio configuration planning over the market evolution cycles. The responsibility of the orchestration to ensure co-evolution between the portfolios of alliances and capabilities lies on the executive management in an organisation.

Management of the collaborative capability development in a focal firm is a complex activity but if organisations develop unique processes, measurement systems, configuration patterns and methods, their execution yields results on many different organisational settings. To accomplish the managerial tasks specific methodology was developed during the dissertation to aim better performance of the capabilities and alliance portfolios.

The thesis is structured into four sections as follows. The first unit presents the literature overview. The second section introduces methodologies and data structures exploited to research the capabilities and alliances. The third chapter presents the research results based on empirical case studies of focal firms in the

ICT industry. The final part of the doctoral thesis presents the key conclusions of research and defines theoretical and managerial contributions of the study.

Author's contribution

Article I. The research propositions presented in the paper were co-formulated by the author of the thesis based on his long-term research of capabilities and alliances in the ICT industry. The author of the dissertation defined and developed the key methods for the exploitation orientation research. It was based on prior scientific literature and many pilot case studies. The author developed data collection systems, organised data collection and carried out the calculations. He interviewed all the managers of the case study firms.

Article II. The author of this thesis defined the key propositions in cooperation with the co-author prior to the literature review. He collected data throughout the case studies and also made the calculations. He conducted all interviews with representatives of the case firms. Also the data collection and data systems development was performed by him. The author also participated in a conference and personally presented the research results in Hong Kong.

Article III. The author of the thesis carried out an extensive literary review and in cooperation with the co-author the review was extended. A small abstract of the review was presented in the paper. The author of this thesis defined the data collection methods and systems. He also collected data and mapped evolution of capabilities based on long-term study in the ICT industry.

Article IV. The author of the thesis carried out an extensive data collection. The author of this thesis defined the data collection methods and systems. He designed initial proposition in the article and it was part of the research rational developed based on long-term study in the ICT industry.

Author of theses has presented the research of capabilities and alliance portfolios in various conferences, including:

Kolk, A (2008). Developing Dynamic Portfolio of Capabilities. In: Proceedings of the XIX ISPIM Conference: ISPIM Conference, Tours, France - 15-18 June 2008. France: 2008.

Kolk, A; Püümann, K (2008). Co-development of Open Innovation Strategy and Dynamic Capabilities as a Source of Corporate growth. Working Papers in Economics, Tallinn University of Technology (TUTWPE): TTÜ Management Conference, 2008, 73 - 83.

ABBREVIATIONS AND DEFINITIONS

Combinative Capabilities – organisational routines that enable companies to combine systematically local search related competences inside of established firm boundaries to develop efficiently new products and services.

Directional Capabilities – organisational routines that have the ability to sense opportunities that emerge from outside of a firm's established boundaries.

ICT – Information and Communications Technologies (ICT)

Intrinsic capabilities – organisational routines that lay foundation for the ability to produce value from efficiency and refinement related processes to delivery of quality products and services.

LBS – Location Based Services are mostly smartphone based services to control for location.

MNC – multinational corporation

OS – An Operating System is a collection of software that manages computer hardware resources and provides system for computer programs.

R&D – research and development

RBV – resource based view

SIC – The Standard Industrial Classification (SIC) is a system for classifying industries by a four-digit code.

Transformative Capabilities – organisational routines that exploit firm-specific resources and capabilities inside and outside the boundaries of the firm to transform an established business model while adapting to new market conditions.

ACKNOWLEDGEMENTS

The dissertation provided an exciting and professional renewal for the author. It was a great journey in search of organisational excellence and new knowledge. It has been a process of exploration and exploitation of knowledge in many global corporations, scientific fields, universities and in many different countries. To value innovation, as a society, as a company, as any institution, and as individuals, one must embrace diversity.

There has been one stable issue in the research process. The conundrum of research has always been in the area of innovation management to inspire the author and corporations.

The international research community has been very encouraging and supportive of the dissertation work. The author's special thanks go to Professor Tomi Laamanen from Aalto University and Professor Maurizio Zollo from Bocconi University for their fruitful early comments and guidance.

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The author is grateful to different institutions that have supported the work through scholarships, including SIAR and SA Carpe. Specifically I would like to deeply thank Professor Christian Junnelius.

The thesis is based on corporate data from the ICT case organisations. The author is indebted to the interviewees and to all representatives of the case organizations in Google, Microsoft, Ericsson and Nokia for sharing their time and strategic views on collaborative capabilities' management. The author's special thanks go to Ivo Vaks.

The author considers himself very fortunate for having Professor Jaak Leimann as a mentor and coach. His endorsements, support, and encouragement to write the dissertation faster had immense impact on how the dissertation was finalised.

The final version of doctoral thesis was scientifically shaped by many professors from Tallinn University of Technology and the PHD committee. I am highly thankful to all committee members and Professor Venesaar for valuable support and comments.

Beyond everything, the most valuable support for the dissertation has been the endless support from my parents and family.

1. THEORETICAL CONSTRUCTS

1.1. Theoretical Foundations of Capabilities' Portfolio

The focal point of business increasingly is creation, integration, management and deployment of a valuable and unique resource combination (Wernerfelt 1984; Barney 1991; Lippman & Rumelt 2003).

Already in early writings of strategy the topic of organisational capabilities gained importance. To define a strategy the organisation's unique resources (Wernerfelt 1984; Barney 1991) and competences (Prahalad and Hamel 1990) are used. Alfred Chandler (1992) presented how enterprises have been transformed by organisational capabilities, and he debated that firm's capabilities enable the enterprise to create synergies.

Capabilities and their evolution is an essential topic because organisational performance and the way the existing organisational internal and external resources are exploited have strong impact on organisational competitiveness (Penrose 1959; Barney 1991; Grant 1991; Wernerfelt 1984). Evolutionary dynamics and life-cycle of capabilities are vital for the corporate renewal and growth.

The resource-based view (Wernerfelt 1984; Barney 1991) argued that organisations gain competitive advantages through the resources which are valuable, rare, inimitable and non-substitutable. For the dynamic environment, the theory of dynamic capabilities was introduced by Teece et al. (1997), who defined a framework for organisations where exploitation of internal and external competences are a capability to address changing environments.

Authors in the research stream have underlined that growing evidence suggests enterprises should efficiently and effectively create, capture and share knowledge to solve problems and exploit opportunities (Brown and Duguid 1991; Drucker 1991; Kogut and Zander 1992). As knowledge possesses tacit and explicit characteristics (Nonaka 1994), its utility for better understanding and future developments requires a proper way of presentation. The knowledge contributes to accumulation of organisational experience and organisational learning (Argyris and Schon 1978), which supports selection of vital strategies of their organisations.

Teece et al. (1997, 516) developed the dynamic capabilities approach to explain that competencies and organisational resources can be developed, deployed, and protected into dynamic capabilities as the "firm's ability to integrate, build and reconfigure internal and external competencies to address rapidly changing environments".

Some researchers have defined typologies for the capabilities (Ambrosini and Bowman 2009). Hayes and Upton (1998) divide capabilities into process-based capabilities, systems based and organisational based operating capabilities.

There are almost as many definitions and examples of organisational capabilities as there are authors in the subject. Collis (1994) defined system of capabilities through functionality to dynamic learning features. Winter (2003) proposed operational and first-level dynamic capabilities.

Cyclical dynamics is inherent for markets, industries, organisations, products and technologies. The phenomenon has been in the focus of interest for researchers for decades. For example, organisational evolution theory distinguishes four processes (variation, selection, retention and struggle) and that they accompany organisational change by being responsible for new ways of working, i.e. new configurations or organisational types (Fernandez et al. 2001).

There is clear dissimilarity concerning product and business life cycle. Zahorsky (2009) refers to the seven stages of business life cycle: seed stage, start-up stage, growth stage, established stage, expansion stage, decline stage and exit stage. But the product or service life cycle explains the development of a product or service through initial market entrance, growth, maturity and decline. Wasson (1971) recommends that companies should pursue diverse strategies at different product's evolutionary stages. Thus one can distinguish five major steps or phases in product life cycle: product development, product introduction, product growth, product maturity and finally product decline.

Just as products and businesses have a development path, known as product and business life cycle, so do capabilities. Wernerfelt (1984) developed the capability lifecycle approach and concluded that products and resources are paired. Helfat and Peteraf (2003) reported that the capability lifecycle demonstrates following phases: growth, maturity, and decline.

Capabilities may also branch into six additional branches. Capability branching occurs when the capability have a strong enough impact to alter the current development path of the capability. These branches are retirement (death), renewal, redeployment, recombination, replication and retrenchment. Branches of capability lifecycle are depicted in Figure 1.1 below (Helfat and Peteraf 2003).

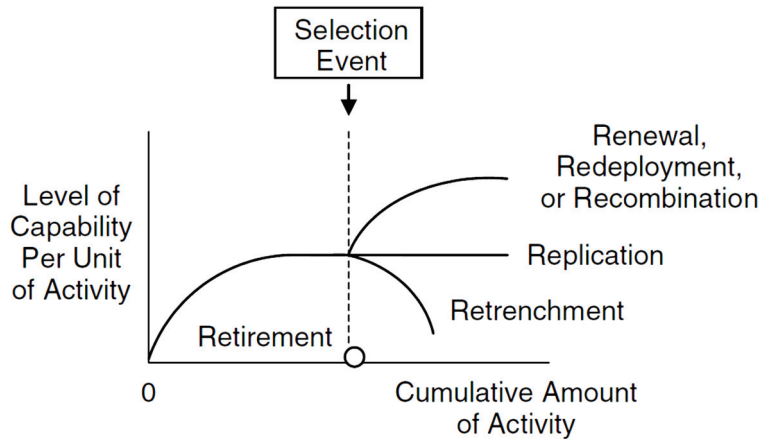


Figure 1.1. Branches of the capability lifecycle (Helfat and Peteraf 2003:1005)

Vehtari (2006) in his doctoral dissertation has presented the modified model for capability development. He distinguishes 5 business model phases: introduction,

transition phase 1 (from introduction to growth), growth, transition phase 2 (from growth to maturity), maturity and transition phase 3 (from maturity to growth). For each business model stage there are main capabilities needed. Vehtari's (2006) life cycle model emphasises the idea of value propositions and competitive priorities shifting as a product matures.

The capability portfolio approach is rather limited in the research area and therefore it is important topic to research. Development of the capability portfolio is directly linked to strategic management. It is normally associated with attempts to secure a competitive advantage and it can be seen as emerging within the most recent 'evolutionary' approach to strategy (Antonacopoulou 2006). Kogut and Zander (1992) concluded that the knowledge of a company can be viewed "as owning a portfolio of options, or platforms, on future developments".

Laamanen and Wallin (2009) distinguish four categories in the capability portfolio where a company's capabilities can be located in. According to them, capabilities can be either internal (internal resource coordination and internal market sense making) or external (external resource integration and external market interfacing).

Prahalad and Hamel (1990) viewed a firm as a portfolio of competencies, but later (Hamel 1991) stressed that inter firm competition, as opposed to inter-product competition, is essentially concerned with the acquisition of skills.

The firm embraces individuals with different competencies, and consequently, one challenge is to coordinate and utilize a range of dissimilar competencies that are spread among a large number of employees (Nordhaug and Gronhaug 1992).

"Enterprises consist of portfolios of idiosyncratic and difficult-to-trade assets and competencies" (Teece 2007, 1319). According to Laamanen and Wallin (2009), capability development would "seem to shift from one capability category to another depending on what is the next bottleneck on a company's evolutionary path".

Originally Plakoyiannaki and Tsokaz (2002) defined customer relationship management (CRM) capability as a set of the following types of capabilities: 1) Learning and market orientation capabilities; 2) Integration capabilities; 3) Analytical capabilities; 4) Operational capabilities; 5) Directions capabilities.

Author of the dissertation concludes that the research stream on the topic how firms' capabilities sustain the competitive advantage and how enterprises evolve their capabilities is diverse and systemic but the portfolio evolutionary approach of the capabilities is rather under analysed. This is the bottleneck in the future of corporate evolution. Therefore in this dissertation the author needs to enhance the body of knowledge of capabilities portfolios evolution but while doing this the author can still effectively rely on established constructs in the prior capabilities research.

1.2. Theoretical Perspectives of Alliance Portfolios

The theoretical research of alliance portfolios is still rather episodic and vague despite the increasing studies as well as managerial practices. Osborn and Hagedoorn (1997, 266) declared that “in contrast to the almost-40-year history of economics-based study of alliances, the history of strategy-based study has begun only recently”. The following table demonstrates the focus in the alliance portfolio research stream (Table 1.1.).

Table 1.1. Path and Essential Research on Alliance Portfolios

| Author(s) | Focus of the Alliance Portfolio Research |
|-------------------------------|---|
| Hagedoorn & Schakenraad (199) | Technology alliance portfolios on firm performance |
| Koza & Lewin (1998) | Co-evolution of alliances embedded in a firm's strategic portfolio |
| Gulati (1999) | Dynamic evolution of alliances and networks (social networks) |
| Baum et al. (2000) | Start-up firm alliance portfolio management |
| Rowley et al. (2000) | Partner firms (social network perspective) |
| Doz & Hamel (1998) | Bilateral alliances portfolio management by focal firm |
| George et al (2001) | Alliance portfolios and absorptive capacity on performance |
| Reuer et al (2002) | Accumulation of repeated international joint ventures know-how |
| Kelley & Rise (2002) | Technology portfolio & alliances management |
| Parise & Casher (2003) | Management of alliance portfolio performance |
| Lichtenthalers (2004) | Alliance function: Multi R&D alliance perspective |
| Lehtonen (2004) | Performance & strategic alignment of alliance portfolios |
| Hoffmann (2005) | System and tasks in alliance portfolio management, performance |
| Reuer & Ragozzino (2006) | Portfolio of international joint ventures of a focal firm |
| Hoffmann (2007) | Co-evolutionary framework of alliance portfolio strategies |
| Heimeriks et al (2007) | Differential performance & learning mechanisms in alliance portfolios |
| Heimeriks and Duysters (2007) | Alliance capability experience and performance |
| Lavie (2007) | Alliance portfolios and firm performance, value creation |
| Heimeriks et al (2009) | Alliance portfolio capability development practices |
| Lavie & Miller (2008) | Alliance portfolio, internationalisation and performance |
| Koka & Prescott (2008) | Alliance network design and position, environment change on performance |
| Padula (2008) | Alliance portfolio construction to obtain high rates of innovation |
| Ozcan & Eisenhardt (2009) | The origination of high-performing portfolios improve firm performance |

Source: Author's compilation

Three distinct but inter-related issues are addressed in alliance portfolios formation and management (Gulati 1999; Kelly and Rise 2002; Lavie 2008; Heimeriks et al. 2009):

- The underlying motivations of companies to form portfolios of alliances;
- Strategies of firms pursuing to create the portfolio;
- Alliance portfolio functionality (system and competences)

The alliance portfolio literature review contains a general overview of inter-firm cooperation and offers an insight into the dyads and inter-firm alliance relationship research and configuration aspects of the research. These approaches have not been

researched enough and there are many conceptual gaps in the literature. Therefore, the review in the Article I aimed to close this gap theoretically.

The research focus of the current dissertation is on alliance portfolios. The portfolio approach originates from the area of finances. But technology portfolio was first defined by Cooper et al. (1997) as a list of new products and R&D projects, portfolio selective frameworks (Cooper et al. 1997). Cooper et al. (2000) stated that the portfolio management has the following goals: maximizing the portfolio's value, balancing the portfolio and linking it to a corporate strategy.

Alliance portfolio is an emerging literature related to collaborative activities between groups of firms. Gomes-Casseres (1994, 63) argued that "collaboration in business is no longer confined to conventional two-company alliances, such as joint ventures or marketing accords but today we see groups of companies linking themselves together for a common purpose, and consequently, a new form of competition is spreading across global markets: group versus group".

Enterprises have to learn to manage a group of strategic alliances i.e. to manage alliance portfolios (Anand & Khanna 2000; Gulati 1999; Gulati et al. 2000; Hoffmann 2005, 2007; Lavie 2007; Parise & Casher 2003).

Some researchers have demonstrated that the portfolio approach enables companies to achieve and sustain better innovation effects (Cohen and Levinthal 1989; Cohen Levinthal 1990; Cohen and Klepper 1996; Katila and Ahuja 2002; Laursen and Salter 2006). As a result of the alliancing, companies become embedded in a dense network of relationships and they develop an alliance (Hoffmann 2005). Researchers have increasingly emphasised that there are strategic interdependencies among a firm's individual dyads and alliances (Gomes-Casseres 1996; Gulati 1998).

Researchers address diverse reasons for building alliance portfolios. "Conceiving of the firm as a portfolio of core competencies and disciplines suggests that inter-firm competition, as opposed to inter-product competition, is essentially concerned with the acquisition of skills" (Hamel 1991, 99). Gulati (1995) argued that social networks facilitate a new alliance by providing valuable capabilities and reliability of potential partners. Hamel (1991) proposed that alliances should be viewed as an alternative to other modes (i.e. market based transactions or full ownership) of skill acquisition.

As described earlier, companies increasingly form alliances while pursuing growth but they often cannot rely on single alliances. Firms develop multiple alliances with multiple partners (Doz and Hamel 1998). To enhance competitiveness and grow modern companies have a necessity to design an alliance portfolio strategy that grants access to diverse external resources. It is not easy to form and manage multilateral alliances, particularly when they include competitors. Participants must shift their perspectives from competition to cooperation and from single partner to selective multilateral cooperation (Doz and Hamel 1998).

Ahuja (2000) presented that "alliances produce inducements and opportunities". In general, one may argue that the alliance formation decision encompasses the

strategic question to answer: Why and how should a firm form an alliance? This is the foundation of the alliance strategy.

Hoffman (2007a) stressed the importance of the configuration of alliances as a fundamental of the alliance strategy. But what determines the alliance portfolio strategy? Many researchers have described diverse classifications of strategies.

Hoffmann (2007) argued that companies have to try to build stable trust relationships with their partners (generating Coleman rents) but additionally companies should continuously 'optimise' their inter-organisational relationships in an opportunistic way (generating Burt rents). Which aspect is more important in a specific case depends on what alliance strategy the company is following in this business (Hoffmann 2007). In core exploration and exploitation alliances, stability and commitment are more important than they are in probing alliances (Hoffmann 2007).

The structural conditions reflect the internal division of labour between firms in alliance portfolios. Gulati et al. (2000) have summarised that the firms' performance (rents) is partly the result of their own unique resource endowments, but partly derived from the structure of the network they belong to. The configuration design of the alliance networks has essential strategic impact. Koka and Prescott (2008) argued that the structural conditions affect firm's performance and therefore have vital managerial consequences and Stuart (2000, 809) added that "a large number of partner attributes as well as characteristics of the structural configuration of firms' alliance networks are likely to determine the magnitude of the advantage of a cooperative strategy".

The essential role of an alliance portfolio structure was stressed by Baum et al. (2000) as they demonstrated how variation in start-ups' alliance network composition rapidly produces significant differences in their performance. Also George et al. (2001) demonstrated that strategic choices in terms of structural choices and knowledge flow in the alliance portfolios' formation have strong effects on innovativeness and firm's performance.

In general, the number of alliances (centrality), dispersion, redundancy (structural) and linkage intensity (relational) are the factors that characterise an alliance portfolio configuration (Hoffmann 2007). Dos and Hamel (1998) illustrate how some alliances involve large numbers of firms, sometimes in an homogeneous network, like many banks brought together by Visa international or Mastercard, sometimes firms are involved in several alliances, particularly in information technology and health care, but some, such as Corning, find ways to keep their alliances separate and run them as portfolios of discrete bilateral relationships.

The intensity of strategic partnering tends to rise with the increasing size of companies (Hagodoorn and Shakenraad 1994). Firms expect to favour alliance partners who can offer better resource and knowledge endowments, as well as superior legitimacy benefits (Baum et al. 2000; Powell et al. 2005). In research literature many scholars stress increasing alliance portfolio centrality and heterogeneity of the portfolios' advantages for developing a large and diversified alliance portfolio.

Among many studies Gulati (1998) pointed to the strong influence of homogeneity as similarities among firms foster mutual trust, increasing the likelihood of their partnerships. Powell et al. (2005) showed that biotech firms tend to choose partners based on the ally's similarity to previous partners.

In the alliance portfolio maintenance and development perspective Parise and Casher (2003) argued that the portfolio composition will change for many reasons and create a pattern of evolution (i.e. new alliances address new market opportunities).

Padula (2008) suggested that the most beneficial alliance strategy for innovation is the one that promotes a dual portfolio structure where both cohesive and sparse relationships coexist. Therefore Padula (2008) argued that an essential managerial task is to assess the current network position where a firm's alliance portfolio currently stands in terms of sparseness and cohesiveness. Padula (2008) stressed the following practical steps:

- Develop a map of the main industry players, along with identification of their partners and the connections (i.e. alliances) between them;
- Place into one group those network actors that are more densely connected between each other (i.e. with a relatively higher number of common partners), and into distinct groups those network actors that are less densely connected with each other;
- Identify where the firm is located within these network partitions (i.e. densely connected partners and the firm's shortcuts);
- Distinguish the groups of alliances and understand how these compound the firm's alliance portfolio;
- Assess the cohesiveness and sparseness of the firm's alliance portfolios.

Goerzen and Beamish (2005, 335) have defined it as the degree of "variance in partners' resources, capabilities, and industrial backgrounds". According to Goerzen and Beamish (2005), prior research on firm's network diversity has found various and contradictory results (i.e. knowledge diversity in a network may or may not provide a performance benefit).

The ultimate goal of this literature review is to untangle capabilities and alliances in the co-evolutionary approach. It was a search for convergence. This study has identified some limited research carried out on alliance portfolios topic but according to this research there is only few studies related to the capabilities portfolio approach. The existing frameworks and theories are mostly normative and rather limited to definitions. Most of the research is set to single capability development. Therefore this doctoral dissertation agrees that there is a clear necessity to analyse more theory as well as practice regarding the co-evolutionary approach of capabilities' and alliance portfolios.

This is particularly vital because already in their early development phase companies execute many different capabilities simultaneously. But in the case of large corporations one could even identify 30 strategic capabilities required for successful management and excellent performance.

However, the changing needs of customers, increasing competition and environmental conditions change frequently. Thus, firms' resources as well as requirements for alliance partners have to change accordingly. Therefore the scientific goal of the research should be to search in greater detail the evolutionary changes in portfolios in terms of their configuration. This theoretical review concludes that enterprises have to understand impacts of market change dynamics on capabilities' and alliance portfolios. Thus, the case studies in the articles of the dissertation address this gap by providing specific insights into convergence of the portfolios under the flux of markets.

2. METHODOLOGY AND DATA

The current chapter introduces the scientific paradigm this research is based on. The research approach and methodology are adopted and justified with references from the research school in which the study is positioned. Rynes and Gephart (2004, 460) have pointed that especially in a qualitative research “it is extremely common that the methodology is underspecified”. In this research one may find several constructs developed by the author to avoid the trap (Fig. 2.1.). This chapter begins with a review of the research problem and research questions. Discussion of the underlying ontological and epistemological constructs follows.

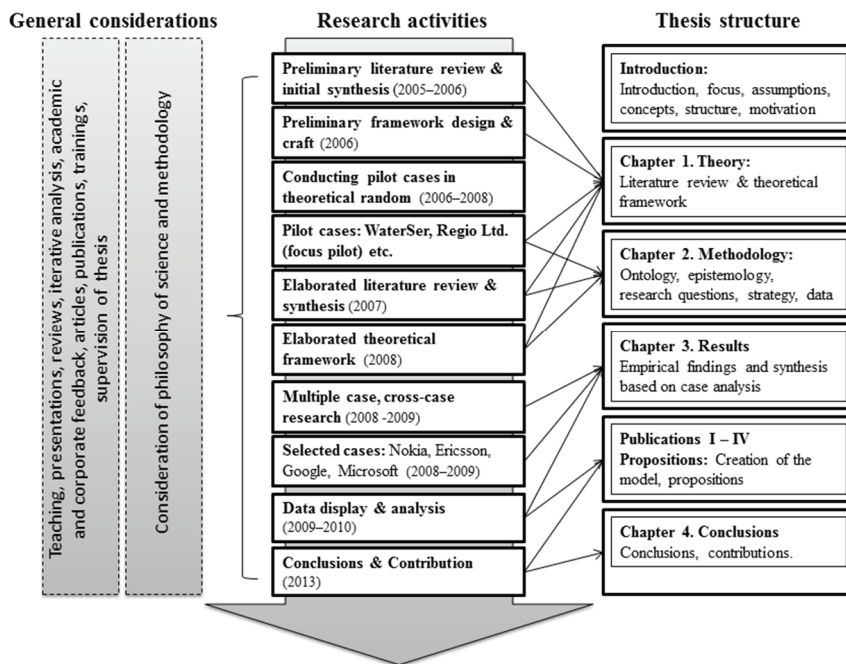


Figure 2.1. Structure and Research Activities of the Thesis

Source: Author’s compilation

Here the author of the thesis presents the methodological strategies for the study. Qualitative multiple-case study is a central scientific instrument applied in the dissertation. The research strategy presents the research questions, the research design, the data collection process, and the data analysis process.

One can argue that the study is by nature a qualitative constructivist abduction with (data, investigator, theory and methodology triangulation) embedded (multiple units of analysis) multiple-case studies.

2.1. Ontology of the Research

Danemark et al. (1997) explain the aim of social sciences as “to explain events and processes” and “describing and conceptualizing the properties and causal mechanisms and then describing how different mechanisms manifest themselves under specific conditions”.

Firstly, the author has defined and explained the research goals and objectives through the research process for various stakeholders. The goals and objectives and specifically the research questions are redefined and carefully improved several times. The objective of the thesis is to contribute to the development of the collaborative capabilities portfolio concept (path and configuration orientation) and provide models for the capabilities development (agility and capability family dynamics).

Most often “research begins with strong grounding in related literature, identifies a research gap, and proposes research questions that address the gap” (Eisenhardt and Graebner 2007, 26). This has been also the practice in the dissertation. The need for the extensive literature review was to mark down evolutionary dynamics of the research rationales in the field of capabilities.

Formulating of research questions is led by the aim of the research – research is either theory-building or theory-driven (Eisenhardt and Graebner 2007, 26). There should be a justification for using “less precise, objective, and rigorous” theory-building or large-scale theory-testing. The research question is also inspired by whether the research is theory-driven (extending “existing theory”) or phenomenon-driven (creating new theory); in the former there is a need to justify why a qualitative deep insight is better than quantitative setting, in the latter there is a need to justify “lack of viable theory and empirical evidence” (Eisenhardt and Graebner 2007, 26).

The thesis provides additional knowledge on the existing theoretical approaches and demonstrates the empirical evidence on management of capability portfolios while developing organisational alliances. This research unites the resource based approach (Barney 1991; Peteraf 1993; Rumelt 1984) and the strategic behaviour literature (Chen and MacMillan 1992; Chen et al. 1992) to search for synergies of the alliances. Competitive responses and predictions (Chen and MacMillan 1992; Chen et al. 1992) have a crucial role in the dissertation, the results of which in terms of capabilities behaviour are described in the Article II.

This thesis aims to address *two research questions*. Firstly, how a focal firm’s portfolio of capabilities evolves over periods of market cycles? Secondly, how a focal firm’s alliance portfolio co-evolves with the firm’s capability portfolio? The questions were divided into sub-questions to research the most relevant theoretical constructs.

Research Question 1: How a focal firm’s portfolio of capabilities evolves over periods of market cycles?

This research question has two sub-questions to deconstruct further search of new knowledge and give focus to research activities. These sub-questions are defined as follows:

Research question 1a: How focal firms develop and manage the portfolio of capabilities (path, families' formation, development agility)?

Research question 1b: How configuration of a capability portfolio change affects the focal firm's strategy?

A distinctive aim of the research here is to identify distinct dynamics, and paths of a focal firm's capability portfolio development over periods of market cycles. The focus is on identifying configuration changes in the capability portfolios inherent to market change. Specifically, the focus is on providing an in-depth capability path evolution pattern explanation from the portfolio's perspective (Article I and III).

To explore these research questions, a literature review is carried out, which presents current theories on capability development and paths (Article II), and how focal firms adapt the capability portfolio to market dynamism. This review is used to design the capability portfolio framework presented later in Article I.

The second research question proposed in this thesis is more phenomenon driven in the area of alliance portfolio configuration. This research particularly sheds light to the alliance portfolio configuration impact on the capability portfolio development (Articles I and III).

Research Question 2: How a focal firm's alliance portfolio co-evolves with the firm's capability portfolio?

The research question 2 has a specific sub-question to deconstruct further search of synergies between the portfolios and to focus on convergence. These sub-questions are defined as follows:

Research question 2a: How a focal firm's alliance portfolio configuration affects development of the capability portfolio (portfolio orientation)?

After defining the goal and research questions the research rationale was designed around the key decision that guided the research in the dissertation. The rationale leaned the research design and supported more coherent result search (Table 2.1.).

Table 2.1. The Key Decisions on the Research Rationale

| Research Issue | Research Rationale |
|------------------------------|---|
| Reality: | Subjective, socially constructed, not mind-independent (constructivism) |
| Research gap: | Co-evolution of capability and alliance portfolios |
| Research question: | <ol style="list-style-type: none"> 1. How a focal firm’s portfolio of capabilities evolves over periods of market cycles? 2. How a focal firm’s alliance portfolio co-evolves with the firm’s capability portfolio? |
| Variables: | Partly from research questions: tie strength, tie diversity, nature of capability (exploration/exploitation); partly emerged from empirics: important/unimportant partners |
| Unit of analysis: | Capability and alliance portfolio, ecosystem |
| Time perspective: | Longitudinal (more than 10 years) |
| Aim: | Theory creation and enhancement |
| Scientific reasoning: | Inductive and abductive, not deductive |

Source: Author’s compilation

Qualitative studies “often fail to state explicit goals, objectives, or research questions that frame the papers and guide data analysis and research outcomes” (Rynes and Gephart 2004, 460). The author of the dissertation has designed a system to avoid this problem and has organised a process around key decisions to rationalise research in the dissertation (Table 2.1.). This process was vital to focus the research and also to develop robust research method.

2.2. Research Methodology and Design

This part presents an overview of the methodological questions and essential decisions on how the research was designed. Rynes and Gephart (2004, 459) note that “the reader needs to know how key decisions were made in the research process”.

This study was a part of long-term research focusing on large multinational firms’ alliance relationships based capabilities development. After carefully reviewing the literature the author conducted many pilot studies. Then the methodological and extensive (each case on approximately 100 pages) descriptions of case studies of the companies in the ICT sector were written.

To begin with, the author of the thesis analysed the focal firms’ business model evolution, financial performance and market growth and divided the focal firm evolution into three specific periods: market emergence, market take-off, and market

growth. Based on the results of these studies, the author designed a special framework for studying capabilities development and its portfolio evolution (capability portfolio matrix in Article I). To analyse emergence of capabilities according to the matrix the author analysed the focal firms' business model evolution over the long-term market cycles. Then the most important development activities were recorded and through in-depth extraction the main capabilities of the focal firm were defined. First, the key focal firm development activities with major impact on the firm's performance were grouped into one development topic. Secondly, all capabilities were coded and mapped on the capabilities matrix.

The primary goal of the research was to analyse how focal firm's capabilities portfolio co-evolves with the focal firm's alliance portfolio. The author of the thesis analysed the alliance portfolio configuration settings more in depth. For this purpose data were mainly extracted from SDC Platinum database (2000 alliances). The focus was mainly on SIC code diversification and tie strength measures, but also on general parameters like tie centrality and compositions of alliance domains.

In the next phase, an even more in-depth market performance review was conducted in focal firms to analyse core products' market share dynamics over the firm's evolution and active competitors. In this phase the aim was to integrate different data layers (business model, alliance portfolio, important ties, and performance analysis) into a research system. It enabled to analyse firms' capabilities development dynamics and alliance portfolio configurations in parallel and correlate these findings to firms' performance over pre-defined market cycles. Thus, there were several data sources for this study. These included interviews, questionnaires, observations, and secondary sources as databases. The triangulation of data from different sources strengthens the robustness of the findings (Jick 1979). Based on the previously described methodology and data sources the main findings on how focal firms develop capabilities based on alliance relationships are presented in the following chapter.

The longitudinal multiple-case review approach was applied because of the complexity and explorative nature of this research. "The case study is a research strategy which focuses on understanding the dynamics present within single settings" (Eisenhardt 1989, 534). It fits very well with the nature of the subject – dynamic capabilities and evolution of the alliance portfolios.

As described earlier, the case descriptions were first developed and provided. Eisenhardt and Graebner (2007, 29) proposed that an effective way to present a case evidence and theory summary is to form a separate table that "summarizes the evidence for each theoretical construct". In within-case analysis activities were described and later formulated as capabilities. Thereafter cross-case analysis was conducted to synthesise cases (Yin 1994); as a result empirical patterns were found (Yin 2003) and then these patterns were compared with propositions from prior theory. A summary of the key decisions in the designing process of the research rationale is presented in the following table (Table 2.2.).

Table 2.2. Research Process in the Dissertation

| Research phases: | Description of research activities |
|--|--|
| Start | Defining research questions about capabilities and alliance portfolio development and co-evolution |
| Selecting pilot cases | Theoretical random sampling |
| Conducting pilot case studies | Three qualitative pilot case studies were conducted. Focus pilot case study was selected and in-depth analyses were carried out in software, telecommunications companies. |
| Selecting final cases | Specified population. Theoretical, not random sampling, focus on focal firms in software and telecommunication industry. Selecting four focal multinational companies. |
| Longitudinal business model analysis | Analysing business model dynamics over different market cycles in 1987–2009: a) market emergence b) market take-off c) market growth. Targeting value proposition change as a focal driver of product innovation. |
| Designing priory framework | Developing exploration and exploitation based capabilities and alliance portfolio framework (matrix). Adding closed/open parameters in terms of tie strength and tie diversification. Crafting alliance portfolio configuration. |
| Crafting & implementing a research strategy | Multiple data collection methods. Qualitative and quantitative data combined: Interviews with open and closed questions, Internet and press research, Annual reports (appr. 100), Industry reports (appr. 15), Press reports (appr. 2000), SDC alliance database from 1987 to 2009 with approximately 2000 alliance records. |
| Acting in the field | Conducting secondary data search. Conducting interviews. |
| Shaping propositions | Iterative tabulation of evidence. Replication of logic across cases. Search evidence for performance relationships. |
| Enfolding literature. discussion | Comparison with conflicting and with similar literature on capabilities and alliance portfolio development and co-evolution. |
| Robustness & validity | Decisions when to stop adding cases. Iteration between theory and data. Triangulation, for example, was used to increase construct validity; multiple iterations and follow-ups were conducted during analyses to increase internal validity. |

Source: Author's compilation

There are many reasons to define precise research process for the study. The most important aspect is related to the robustness of the thesis. The process enables the author to repeat the tests with diverse case companies but also provides clear insights for others to test and validate the results while researching other companies.

2.3. Research Data

The criteria for the selection of cases in this research were to find an industry with high growth rates and clear evolutionary dynamics. Therefore ICT industry was chosen. ICT industry uses also alliancing widely in their daily business. Thus, sampling is one of the most strategic issues in qualitative and quantitative research. For example, sampling problems (e.g. too small sample, too restricted, not appropriate, poor, contaminated, heterogeneous) are most important reasons why research can be considered as failure (Fiske and Fogg 1990, 594).

Semi-structured interviews with open-ended non leading questions were used as the primary data source. In total, some 104 interviews were carried out throughout the research between 2006 and 2011 (Table 2.3.). During the pilot cases, some 43 interviews were taken between 2006 and 2011. The aim of the pilot research was to test and revise (improve) the research protocol for the selected cases. “Pretesting is a good practice to follow” (e.g. Westphal and Khanna 2003, 374).

Table 2.3. Interviewees

| | Software Development | Mobile phones development & manufacturing | Telecommunication infrastructure | Internet Services | Total |
|------------------------|----------------------|---|----------------------------------|-------------------|------------|
| Case firms | 18 | 11 | 6 | 8 | 43 |
| Pilot Cases | 22 | 4 | 5 | 12 | 43 |
| Research Organisations | 2 | 1 | 1 | 1 | 5 |
| MNC consultants | 2 | 2 | 1 | 2 | 7 |
| Executive specialists | 2 | 1 | 1 | 2 | 6 |
| Grand Total | | | | | 104 |

Source: Author's compilation

After pilot case studies, four ICT industry companies – Ericsson, Google, Microsoft, and Nokia – were selected for closer inspection. These case studies were carried out in the same manner, the length of interviews was similar and informants were from similar positions.

Interviews lasted 1 – 1.5 hours depending on the time available for the interviewee, keeping the interviewee and interviewer fresh, and subjects covered. This length of interview is common in the literature as a good practice (see e.g. Graebner 2004; Danis and Parkhe 2002). Most of the interviews were organised in the form of face to face. However, some interviews were carried out over the Skype.

During the interviews and also before the interviews the mapped capabilities' matrixes and alliance portfolio figures were presented to the interviewed persons. During the interviews many capabilities were renamed and reoriented based on the suggestions given by the persons interviewed. The interviewees' jobs varied from specialist and engineer (e.g. software developer) to middle and top level manager (country managers, regional financial managers, directors, vice presidents). More than one person was interviewed in each company, because it might not be enough to involve just one interviewee from one company (Venkatraman and Grant 1986, 82). Snowball sampling was used to find more interviewees from case companies.

The data collection methods of this thesis were mainly qualitative. The following methods were used to collect the additional data: archival data about alliances (SDC Platinum Database), and financial performance data of case companies (DataStream Database). Also previous studies and reports on relevant business fields were collected. SDC Platinum Database provided data about 2000 alliances in the case companies. Identified alliance deals were split into the next groups – marketing, software, Internet services, communication services, (software and marketing) R&D, and (software and marketing) M&A.

The additional data sources, and which topics they were used for, are summarised in the table below (Table 2.4).

Table 2.4. Additional Data Sources

| Topics in the study: | SDC Alliance Platinum Database | Thomson Reuters DataStream Database | Special focus surveys | Corporate managers, specialists interviews | Product segment reviews | Product innovation cases analyses | Case company annual reports | Company Press reports | Corporate thematic homepages | Special industry reports |
|---|--------------------------------|-------------------------------------|-----------------------|--|-------------------------|-----------------------------------|-----------------------------|-----------------------|------------------------------|--------------------------|
| Case firm financial performance. | | XX | | | | | XX | | | X |
| Case firm market performance. | | | | | XX | | XX | | X | X |
| Capabilities portfolio mapping. | | | X | XX | XX | XX | X | | X | X |
| Capabilities matrix configuration. | XX | | | | | | | | | |
| Alliance portfolio configuration & performance. | XX | | | | | | | | | |
| Co-evolution of the portfolios. | XX | | | | X | | XX | XX | X | |

XX - primary source X - additional source

Source: Author's compilation

Each of these areas was analysed depth-wise as the interviews progressed and understanding increased. Most of the cases were worked on in parallel, but some issues needed to be re-addressed by the first few interviewees. When saturation was achieved, no new data appeared from new data sources or from new cases, then data collection was finished (Glaser and Strauss 1967).

Glaser's (2001, 145) well known dictum 'all is data' was followed. The case descriptions were compiled on the basis of various sources. Case studies typically

use multiple sources of data (Yin 2003) to understand more deeply the research phenomena and it allows data triangulation (Yin 2003, 86) with its benefits (e.g. interviewee may have poor recall in retrospective issues or articulation can be inaccurate) (Yin 2003). Therefore it is advisable to use data triangulation (*Ibid* 2003) where some data sources are used to support the primary source.

Secondary data sources such as electronic databases (e.g. DataStream), archival data – press releases, annual reports, and economic and research articles were used to construct the history of the companies more adequately. In some sources, combination and integration of specific search terms was used. Unfortunately, there were certain circumstances where information from different databases did not overlap. Overlapping information was a sign of quality – reliability. In addition, the author participated in several events, including conferences, panels etc.

The dissertation is rest on the longitudinal multiple-case review approach which was the main qualitative data analysis method. The SDC data was analysed by linking the data to the capabilities portfolio matrix. All the major data sources of the thesis and analysis methods are presented in Article 1.

During the research and careful literature review specific methodology was developed by the author of thesis (Kolk 2011). The methodology provides innovative approach to enhancement of fast paced renewal of the firm's capabilities.

3. EVOLUTION OF THE PORTFOLIOS

This is a premier study on long-term evolution of a capability portfolio and management issues related to the portfolio dynamics and configuration. This research investigates further how strategic alliances can be exploited to develop a competitive portfolio of corporate capabilities and shape focal firm behaviour.

The evolution mapping of capabilities' portfolios was essential result in the dissertation research. Case companies developed diverse capabilities (Article I). First time the long term (over 30 years) pattern of portfolio dynamics was demonstrated. The research in the dissertation identified distinct dynamics, and paths of a focal firm's capability portfolio development over periods of market cycles. The portfolio configuration was explained through lenses' of exploration and exploitation function, as well through open and closed feature.

Focal part of the thesis covers capabilities' and alliances' portfolios co-evolution theme through all four articles of the dissertation (Articles I, II, III, IV). The focal firms demonstrated the relevance of the alliance and capability portfolios' convergence under the conditions of market change in multinational corporations. In the following sections a summary of some key results are presented, and how the firms transformed and extended their strategic capabilities beyond the organisational boundaries by managing external resources in the environment of dynamic and complex ecosystems.

Following four major results are synthesised through the two research questions of the thesis and rely on the four research articles of the thesis:

- Capability Development Path Dependence
- Dynamics of Capability Families
- Portfolio Configuration Orientation
- Agility of Capability Development

3.1. Capability Development Path

New capabilities can be developed either a proactive way or adapting with the market changes (Table 3.1.). This dissertation research extends prior findings to ICT industry context and identifies which way is longitudinally more appropriate. Findings are observed from the market emergence phase to the growth phase.

The literature tends to support more proactive capability development (e.g. Cohen and Levinthal 1990; Tushman and Anderson 1986) and first mover advantages (e.g. Draulans et al. 2003; Brown and Eisenhardt 1995). But empirical findings in the dissertation rather support the stand that capabilities development is initiated more by ad hoc and individual competitive actions. Earlier it has been seen that companies are similar in their business models, pioneer advantages are easily copied (Womack et al. 1990), market competition is high (Scott 2008), elimination

of competition not the most important (Penrose 1959) and customer behaviour not predictable.

Thus capability development is a complex and controversial issue, on the one hand, there is no path dependency (Article II), on the other hand, quick response to market changes can happen if a company has a solid base – large prior capability and alliance portfolios (Articles II, III).

Table 3.1. Proactive and adapting prevalence in product areas.

| Product | Smartphone | Mobile OS | Search engine | Maps/LBS |
|------------|------------|-----------|---------------|----------|
| Prevalence | Adapting | Adapting | Adapting | Adapting |

Source: Author’s compilation, Article II.

Therefore results in the thesis demonstrated in-depth capability path evolution pattern and explanation from the portfolio’s perspective (Articles II).

The research in the dissertation resulted in the finding that market growth and focal firm diversification limits capabilities emergence from path, but urges capabilities development from competitive responsive actions. As a result, capability development in the case companies is more adaption with the market rather than proactive action.

Thus, the period of 10+ years was covered by the case studies. In the research proactive capability development was not identified in case companies. Neither ecosystem nor being an explorative pioneer was seen as paths for the capability development. Competition was identified as a source for capability development.

3.2. Dynamics of Capability Families

The study in the dissertation research brought out that firms cluster capabilities into families (Articles III). The case companies formed exploration, exploitation and cooperation capabilities families (Figure 3.1. and Figure 3.2). In this research area prior literature propose either the ambidexterity or punctuated equilibrium approach (Boumgarden et al. 2012; Gupta et al. 2006; Bierly et al. 2009; Gibson and Birkinshaw 2004). The current research findings clearly demonstrate the prevalence of ambidexterity.

These families provided unique recombination opportunities (configuration patterns) and impacted the performance of the case companies.

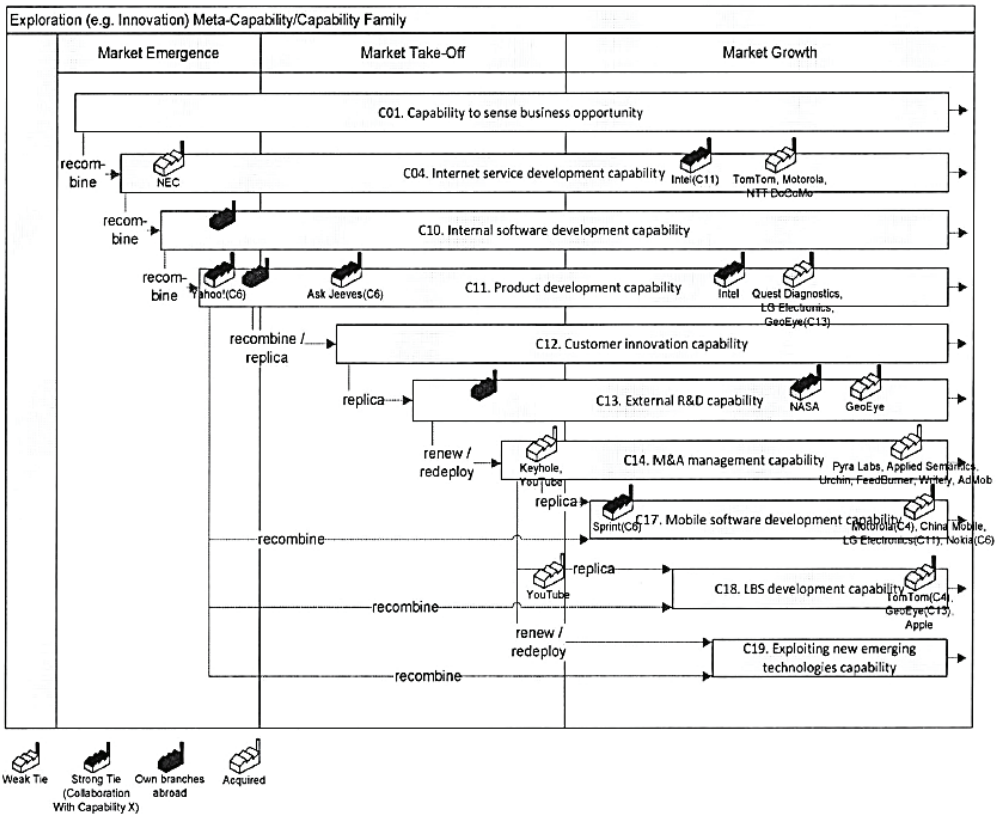


Figure 3.1. Co-evolution of Capabilities in Exploration Family

Source: Author's compilation, Article III

The case study in the Article III demonstrated a sequential pattern where firm develops first internal exploration capabilities and secondly external exploration capabilities. Results evidently indicated that this is essential pre-step to emergence of service diversification capabilities (Article III).

The case discovered that companies use widely recombination technique while building exploration capabilities and rely on important alliance partners.

The case study also brought out clear results about exploitation capabilities' family dynamics (Figure 3.2). The research revealed a sequential pattern where firm develops first internal service excellence capabilities and core service internationalisation follows. Results evidently showed that this is essential pre-step to emergence of focal firms' market diversification capabilities and it has impact to the focal firm performance.

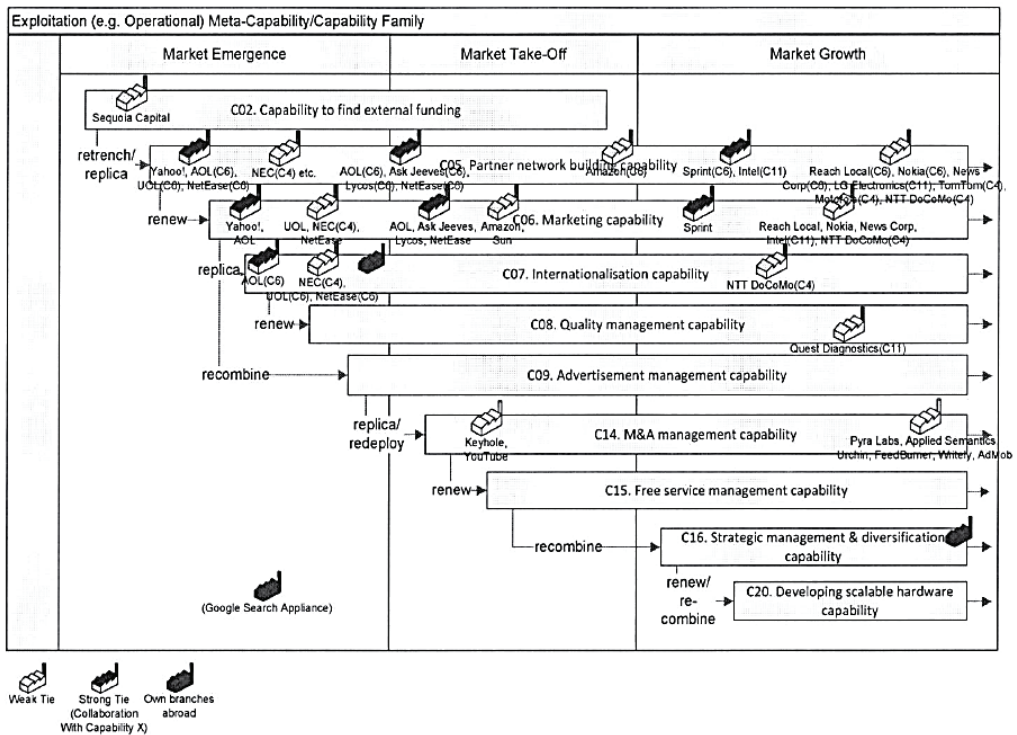


Figure 3.2. Co-evolution of Capabilities in Exploitation Family

Source: Author's compilation, Article III

The study originates that the core service excellence, internationalisation and market diversification is based on renewal and replication techniques and it enhances focal firm's performance through configuration of important alliance partners.

3.3. Portfolios Configuration Orientation

In the thesis Article I demonstrated the viewpoint of exploration and exploitation capability portfolios in the environment of large global ICT companies. As a result some prior findings are confirmed, but some contradictions are also found.

Prior findings emphasized the greater role of exploitation than exploration (Bierly et al. 2009; Regnér 2003). There are also contra examples (Bierly et al. 2009), but these results were not analytically generalized and replicated to ICT industry.

This research reveals that capability development is a more externally oriented exploitive phenomenon than the extant literature presents (Figure 3.3). It appeared that alliance configuration parameters (tie strength and diversity) behaviour is similar in scale to exploration-exploitation and internal-external.

Based on the results of focal firms' capability and alliance portfolios configuration clear pattern appears towards total exploitation. The research brought out that over longer period of the evolution companies tend to focus on open exploitation in terms co-evolution of alliances and capabilities (Article I).

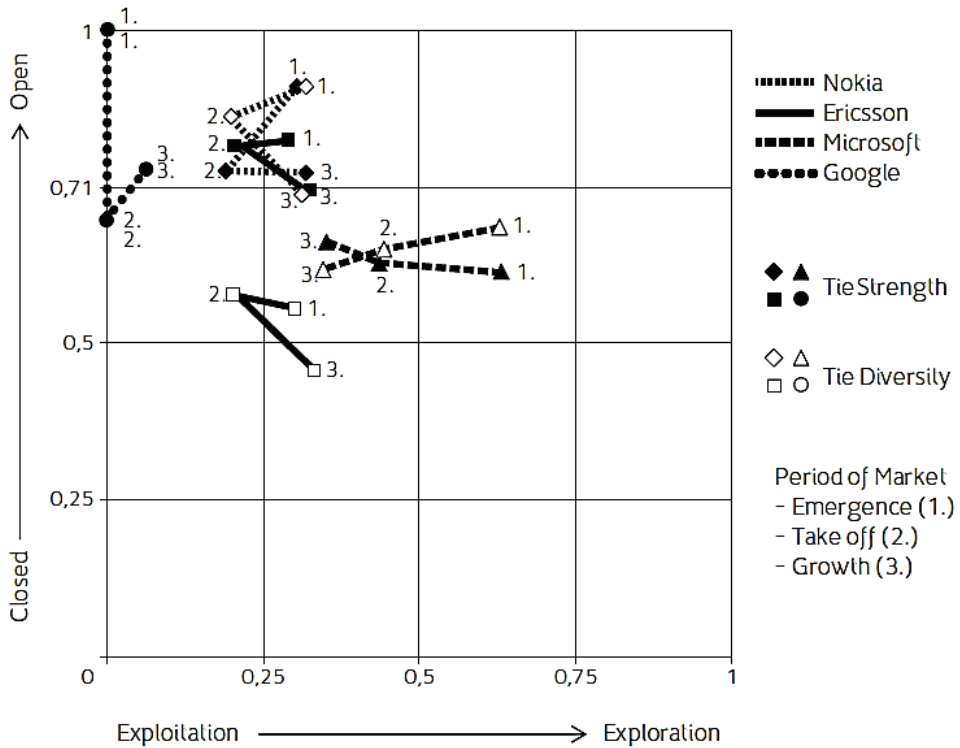


Figure 3.3. Dynamics of capabilities portfolio configuration based on total ties diversity & strength

Source: Author's compilation, Article I

Open exploitation orientation exists in companies, which is known by functional activities such as marketing, retailing and logistics. Companies receive external help from alliances only for the development of transformative capabilities. The development of other types of capabilities is based mostly on internal efforts. Prevailing transformative capabilities are mostly exploitive and do not represent explorative behaviour, as the latter would have been expected from ICT companies. The explorative nature of ICT companies seems to be revealed mostly through the acquisitions of innovative start-up companies.

More precisely two results appeared. Firstly, focal firms have a clear tendency to form open exploitation alliances regardless of market evolution phases and the alliances' ties co-evolve with transformative capabilities' development.

Secondly the research results demonstrated that transformative (open exploitation) capabilities' development is based on the same configuration pattern of tie strength and tie diversity regardless of market phases' evolution.

Thus, in the research empirical proof was given of the use of exploitation also in unstable environments such as ICT. The mechanism as such is based on extensive use of exploitation capabilities and alliances to enhance the firm performance. Both, exploitation and exploration use weak and different SIC ties for better performance (Kauppila 2010; Ozcan and Eisenhardt 2009; Bierly et al. 2009; Lavie and Rosenkopf 2006). Open innovation (Chesbrough et al. 2006; Chesbrough 2003) has shifted to open exploitation and this is the new pattern.

3.4. Agility of Capability Development

The fourth themes of results in this thesis are related to development speed of the capabilities and its relations to the portfolios. In the Article IV the construct of agility factors in the capability development process is presented along with results.

It appeared from the case studies that the alliance management capability is essential, because development of the new capabilities is supremely dependent on the support from the alliances. Novelty of this research is the causal mechanism (Figure 3.4). Larger portfolio of capabilities and alliances in the strong market competition are the true causes for speeding up the development of capabilities. Companies are capable of this if a supportive environment exists in the form of large capabilities and alliance portfolios, which helps to form new capabilities much more easily than acting in isolation.

While prior literature has paid attention to cumulative learning effects and cumulative products (e.g. Wang and Ahmed 2007; Rothaermel and Deeds 2004), then effects of a large capability portfolio have been largely left untouched or have been handled insufficiently (Helfat and Peteraf 2003).

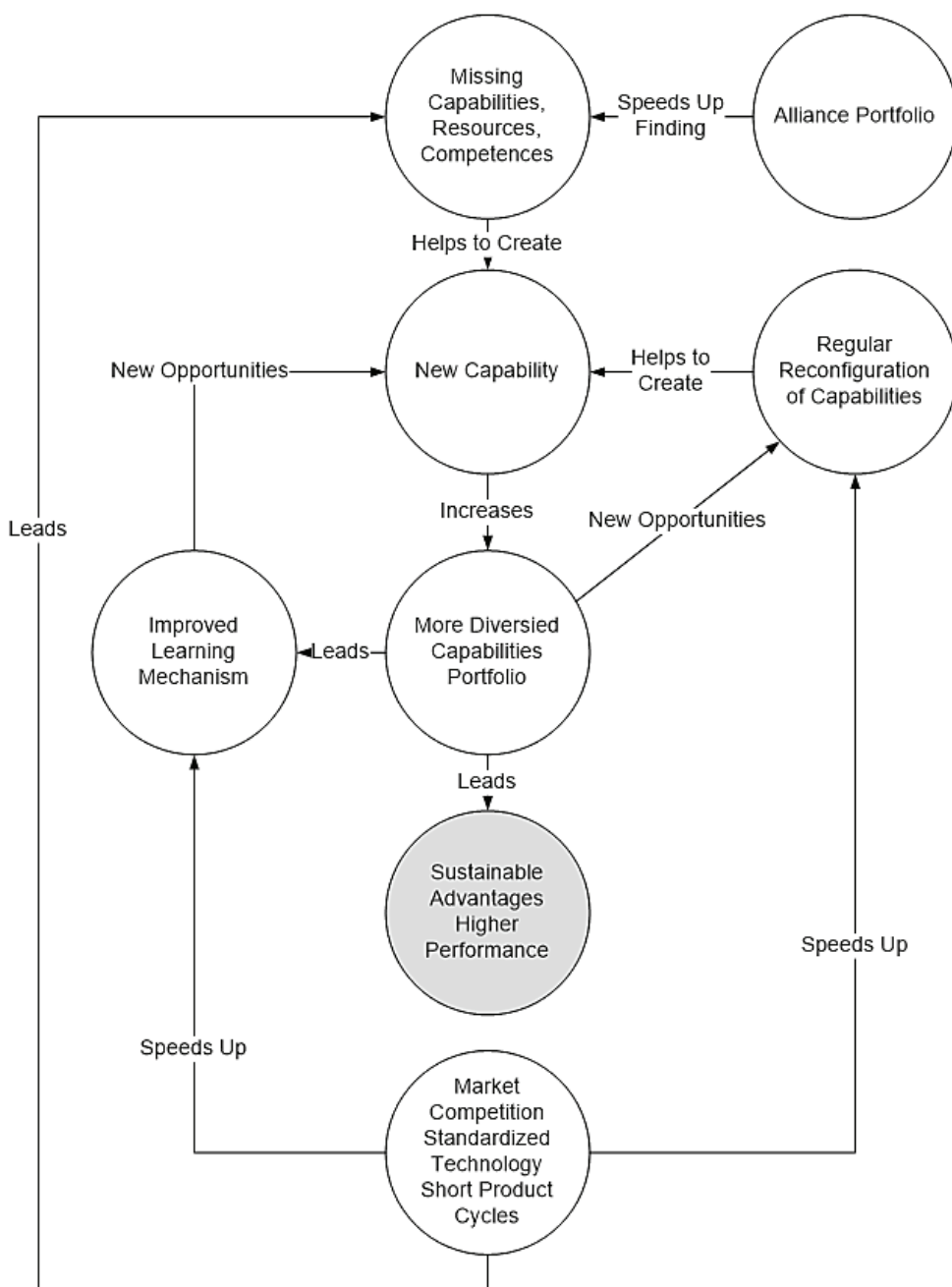


Figure 3.4. Construct of agility factors in the capabilities development process.

Source: Author's compilation, Article IV

More precisely the study of the thesis showed that market and alliance portfolio centrality growth of a focal firm determines capabilities' development speed and affects focal firm performance. All case companies increased significantly alliance centrality at the market emergence and take-off periods where an increase in the number of alliances has caused an increase in the number of capabilities and performance indicators.

At the market growth phase, the number of alliances has decreased, but the number of capabilities and performance indicators has continued to grow.

To respond in a flexible way to the competitors' activities the focal company must be prepared for it. The readiness is guaranteed by the number of the capabilities in the portfolio. Thus, the more capabilities a company possesses, the more urgently the firm is capable of reacting (Article IV).

4. CONCLUSIONS

The objective of the thesis is to contribute to the development of the collaborative capabilities portfolio concept and provide models for the capabilities development. More specifically, this thesis investigates the capability portfolio formations by focusing on the following research questions. Firstly, how capabilities and portfolios are developed and evolve over the market cycles. Secondly, how capabilities' and alliance portfolios co-evolve and provide sustainable advantages.

The thesis builds principally on existing dynamic capabilities' and alliance networking literature and expands those by examining whether the evolution of the portfolios is connected and has impact on each other's configuration patterns.

The research questions are evaluated by using the longitudinal multiple-case review approach because of the complexity and explorative nature of this research. The criteria for the selection of cases in this research were to find an industry with high growth rates and clear evolutionary dynamics. To analyse the life cycle through introduction, growth and maturity, the case companies had to be in rapidly growing industries. Therefore ICT industry was chosen. ICT industry uses also alliancing widely in their daily business.

The following methods were used to collect the data: semi-structured interviews; archival data (SDC Platinum Database), and secondary data (DataStream Database), including previous studies and reports on relevant business fields. SDC Platinum Database provided data about 2000 alliances in the case companies.

The thesis has four major results: Firstly, the thesis demonstrated how capabilities emerge in the formation of capability families. The research discovered that capability development is much more related to competitive responses, and often has no clear historical path (Article II). Secondly, the thesis proposed a distinct pattern for the configuration of the alliance portfolios in the evolvement of capabilities (Article I). Thirdly, a novel model of Open and Closed Capabilities and the research outcome explains how the market evolution cycles have impact on the dynamics of configurations in the portfolios (Article III). Fourthly, the research presented the role a supportive environment in the form of a large capability portfolio and large alliance portfolio as a pre-requirement to speed up capability development in contemporary market circumstances (Article IV).

4.1. Theoretical Contribution

This doctoral study makes novel theoretical and empirical advancements to the literature of capability development and to the portfolio of alliances. After careful research of relevant corporate cases, the study enabled to shed the light to the conundrum of corporate-level capabilities development and its relationships to alliances.

First and foremost, this thesis has developed a novel concept, namely the evolution of capability portfolio, and its configuration patterns. This concept of the portfolio and its configuration contribute to recent capabilities research (Teece et al. 1997; Zollo & Winter 2002) and research on exploration and exploitation (e.g. March 1991) with more established capabilities development techniques (e.g. Helfat & Peteraf 2003).

The first essential findings about capability development are in the field of path dependence (Article II). The literature tend to support more proactive capability development (e.g. Cohen and Levinthal 1990; Tushman and Anderson 1986) and first mover advantages (e.g. Draulans et al. 2003; Brown and Eisenhardt 1995). But empirical findings in the dissertation rather support the stand that capabilities development is initiated more by ad hoc and individual competitive actions. Earlier it has been seen that companies are similar in their business models, pioneer advantages are easily copied (Womack et al. 1990), market competition is high (Scott 2008), elimination of competition not the most important (Penrose 1959) and customer behaviour not predictable.

Secondly, this thesis brought out the importance of the large capability portfolios for new capability evolution (Article I). Since the strong competition (Scott 2008) and new product development cycles are getting shorter (Menon et al. 2002) companies must always be ready to respond to changes. Companies are able to do it if a unique supportive ecosystem exists in the form of synergistic large capability and alliance portfolios. This enables focal firms to form new capabilities much more easily than acting in isolation, without interdependencies with existing capabilities. While prior literature has paid attention to cumulative learning effects and cumulative products (e.g. Wang and Ahmed 2007; Rothaermel and Deeds 2004), then effects of a large capability portfolio have been largely left untouched or have been handled insufficiently (Helfat and Peteraf 2003).

Prior findings emphasized the greater role of exploitation than exploration (Bierly et al. 2009; Regnér 2003). There are also contra examples (Bierly et al. 2009), but these results were not analytically generalized and replicated to ICT industry. Now empirical proof was given of the use of exploitation also in unstable environments such as ICT. The mechanism as such is based on extensive use of exploitation capabilities and alliances to enhance the firm performance. Both, exploitation and exploration use weak and different SIC ties for better performance (Kauppila 2010; Ozcan and Eisenhardt 2009; Bierly et al. 2009; Lavie and Rosenkopf 2006). Open innovation (Chesbrough et al. 2006; Chesbrough 2003) used to be the primary agenda in corporate leadership but based on the empirics of the doctoral thesis, one may find that strong emphasis on open exploitation is the new pattern.

The thesis is strongly focused on the capability family evolution (Article I and III). In this research area prior literature propose either the ambidexterity or punctuated equilibrium approach (Boumgarden et al. 2012; Gupta et al. 2006; Bierly et al. 2009; Gibson and Birkinshaw 2004). The current research findings clearly demonstrate the prevalence of ambidexterity. This ambidexterity focus on focal

firm's collaborative capability development is a key in the market emergence phase. After market evolution and maturation, the focus shifts to open exploitation, which becomes a new centre to initiate and feed further development for collaborative capability portfolio evolution.

Market competition and shorter product cycles require companies to react in an extreme speed. Therefore agile capability development in cooperation with partners is vital. This thesis demonstrated that larger portfolio of capabilities and alliances in the strong market competition are the true causes for speeding up the development of capabilities (Article IV).

4.2. Practical Contribution

This doctoral thesis is a distinctive and most comprehensive empirical analysis of the collaborative capability portfolio development in a multinational focal company. The research results benefit to executives who are responsible for capability development, but also for those managers who are setting up strategic alliances outside the firm's boundaries.

In particular, the doctoral thesis demonstrates that capability portfolio development requires systemic orchestration with alliance portfolio configuration planning over the market evolution cycles. The responsibility of the orchestration to ensure co-evolution between the portfolios of alliances and capabilities lies on the executive management in an organisation.

Management of the collaborative capability development in a focal firm is a complex activity but if organisations develop unique processes, measurement systems, configuration patterns and methods, their execution yields results on many different organisational settings.

This dissertation suggests following critical managerial issues of addressing capability portfolio development and co-evolution of alliance relationships.

Organisations need to proactively identify the capabilities needed and link to the alliances although it is vital to realise that alliance ties may have diverse impact on the evolution of capabilities.

Management of exploration capabilities requires specific configuration patterns in the portfolios. Exploitation capabilities are the path to competitiveness. Focal firms have to acquire an open approach to development of exploitation capabilities. There is increasing influence from alliance partners while building the execution power. Thus, capabilities are forming families in organisations.

Each sub-set of the capability families has a unique role, development patterns and configuration settings. To overcome the challenges in the management of these issues focal firms need specific tools. For capability development in cooperation with partners, companies should create a tool and implement proper methods to deal with their emerging capabilities. It means that each capability has a certain function in the portfolio and therefore it is vital to use appropriate tools.

During the research and careful literature review specific methodology was developed by the author of thesis (Kolk 2011). The methodology provides innovative approach to enhancement of fast paced renewal of the firm's capabilities. The methodology captures the most up-to-date concepts in the field and includes those straightforward models that shed light on the unique role of capabilities and alliances in corporate growth. Corporate managers will find out how to systematically design new valuable capabilities, and involve strategic partners – both inside and outside the company. They will discover how to minimise the risk while building open exploitation business models and alliance networks.

4.3. Limitations

One can distinguish the following limitations in this study. The first one relates to the generalizability of the propositions developed in the thesis. The empirical part of the thesis is based only on four case firms. This approach was deliberately selected to research the conundrum of collaborative capability portfolio evolution based on alliance relationships. The case companies were also well suited to study capability portfolio evolution, given its high velocity information and communication industry environment that offered ample insights to be analysed over many decades of time. Furthermore, the selected case firms provided in depth access to valuable archival data. The data was enriched with data from the interviews with case companies' executives.

Using prior research, the case studies and literature on these topics ensure robustness of the analysis and support propositions developed in the thesis (Articles I – IV) to. This doctoral thesis has reduced the risks in the case study methodology in multiple ways. Multiple methods to test different aspects of the capability portfolio development were used to control the validity of the results. Throughout the study multiple levels of analyses were exploited. The case study sections focused on the entire collaborative capability portfolio development system of a focal firm.

The scientific analysis in the study is based on unprecedented corporate data. The data were obtained by the author of the dissertation by participating in the case companies' projects and during frequent visits to the corporate headquarters in Finland, Sweden and California.

During the doctoral study following specific approaches were used to rationalise these concerns and limitations: interpreter reliability, data reliability and maximise number of test.

Thus, first, the students of the author of the thesis were working in the case companies and conducted several master's thesis based on intimate knowledge of capability development. This supported the long-term case history research and ensured interpreting reliability of general activities in capability development. Also many pilot case studies were carried out. Second, the coded material from interviews

was reviewed by other members of the research team to enhance reliability of the data (joint Articles I–IV). Third, the research was prepared and tested in many smaller research projects and papers written during 2005–2013, but outside the proposition presented in the thesis.

4.4. Future Directions of the Research

This doctoral thesis focused on advancing the knowledge of how organisations develop collaborative capability portfolios and how the portfolio configurations change through the evolutionary market phases. The findings of this research provide several novel perspectives for future research. While the empirical study focused on collaborative capability development in four global and focal ICT corporations, future studies could advance a diverse industrial sector perspective and study how the capabilities behave in the specific business environment. Thus, conducting research outside the ICT industry would enrich corporate knowledge on development of corporate capability portfolios.

It is advisable to conduct the study in a larger sample of focal firms. This would support the validity of current findings and would also add depth to the understanding of collaborative capability portfolio management. This approach would allow companies to enhance corporate competitiveness through the alliances' and capability portfolio convergence.

The frameworks and concepts outlined in the dissertation provide a systemic view on exploration (R&D function in organisation) capability development and therefore suggest also new directions for studying how focal firms shape their total portfolio of exploration alliances, and how the configuration patterns relate to product development in a corporation.

Another stream of research in the dissertation highlighted the new pattern of Open Exploitation. Focal firms' general business models are based on very innovative exploitation models to sustain corporate performance. Therefore, further research should broaden conceptual understanding of Open Innovation (Chesbrough 2004) to Open Exploitation (to extend Article I). Traditionally, the classical exploitation capabilities are viewed as internal activities in an organisation. The research pointed out that there is a need to study more in depth the relationships between collaborative exploitation capabilities portfolio development and corporate performance.

To conclude, the thesis outlined the approach of dynamic capabilities development and its co-evolution with alliances on the portfolio level. This initial system and the propositions concerning market evolution and performance of focal firms should provide a solid base for further study of these complex organisations' development, evolution and dynamics of competitive actions.

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ABSTRACT

Development of capability portfolios has been viewed as a challenging area in the strategic management theory and practice. The portfolio approach has received remarkably less attention in the literature. The existing theories are mostly normative and rather limited to the definitions. There is a rational need to get more knowledge about these portfolios: how to develop and manage, and how to engage alliances into the portfolio, and how to engineer a proper configuration in the portfolio.

This thesis investigates the capability portfolio formation by setting two research questions. Firstly, how capabilities and portfolios are developed? Secondly, how capabilities and alliance portfolios (as a source for external knowledge and resources) co-evolve.

The research questions are evaluated by using a multiple case study method. Several in depth pilot cases were conducted in order to increase the validity and reliability of the research. Around 2000 alliances were analysed to supplement the theory on how alliance ties contribute to the capability development.

The thesis builds principally on existing dynamic capabilities' and alliance networking literature and expands those by examining whether the evolution of portfolios is connected and has impact on each other's configuration patterns. In addition to the theory testing, the study makes major theoretical contributions.

Firstly, the thesis advances the capability development discussion by demonstrating how capabilities emerge in the formation of capability families. The research discovered that capability development is much more related to competitive responses, often has no clear historical path, and is a more externally oriented phenomenon than the extant literature presents (Article II).

Secondly, the thesis makes a theoretical contribution by establishing linkages between the alliances and the capabilities. The study proposed a distinct pattern for the configuration of the alliance portfolios in the evolvement of capabilities. The results demonstrated in this study unexpectedly indicate that the focal firms form open exploitation alliances regardless of the market evolution and sustain tie characteristics (Article I).

Thirdly, a novel model of Open and Closed Capabilities is introduced in the context of exploration and exploitation. The research went beyond the traditional capability classification and proposed a new type of capability and alliance portfolio approach. The research outcome explains how the market evolution cycles have impact on the dynamics of configurations in the portfolios and also demonstrates the sequential nature of the portfolio development. This research contributes to the limited empirical research on how different capability families are developed and how it affects business model innovation (Article III).

Fourthly, the research presented the role a supportive environment in the form of a large capability portfolio and large alliance portfolio as a pre-requirement to speed up capability development in contemporary market circumstances (Article IV).

The practical outcomes of the thesis concern understanding of the significance of the collaborative relationships while developing capability portfolios. During the

study the author developed a specific methodology for the managers who are responsible for the capabilities development and alliance formation in the organisation.

KOKKUVÕTE

Hargmaiste ettevõtete võimekuste ja liitude arendamine globaalses infotehnoloogia tööstuses

Võimekuste arendamine on olnud viimase kümnendi üks olulisemaid teadusuuringute valdkondi strateegilises juhtimises. Nende roll on olnud ülioluline ettevõtte innovatsioonisüsteemide arendamisel.

Mitmed varasemad uuringud on käsitletud võimekuste arendamist ettevõtetes, aga need on olnud liiga üldised ja kirjeldavad. Nende uuringute rõhk on olnud enamasti üksikute võimekuste arendamisel. Samas on suurtes ettevõtetes kasutusel erinevad võimekuste perekonnad, mis moodustavad võimekuste portfelli. Selliste portfelli tasakaalustatud arendamine on ettevõtete jaoks väga oluline. Varasemaid uuringuid ja analüüse, mis süsteemselt käsitlevad võimekuste portfelli arengut läbi ettevõtte pika-ajalise tegevuse, ei ole teostatud.

Olulist tähelepanu vajab võimekuste arendamise kiirus, kuna ettevõtted peavad uusi tooteid ja teenuseid tooma turule iga poole aasta tagant. Samuti ei ole lõpuni selge, milline on võimekuste perekondade moodustamise mudelid ning millised on võimekuste etteplaneerimise süsteemid.

Hargmaiste ettevõtete uute toodete arendamisel ning turule toomisel on peamiseks kasvuteguriks strateegilised liidud. Nende liitude juhtimiseks edendavad ettevõtted võimekuste portfelli. Võimekuste ning strateegiliste liitude ühisarendust on uuritud väga vähe ning see on antud doktoritöö fookus.

Käesoleva doktoritöö eesmärk on võimekuste ja liitude portfelli ühisarendamise võimaluste identifitseerimine (arenduskiirus ja võimekuste perekondade dünaamika) ning teoreetiliste kontseptsioonide uuendamine (portfelli konfiguratsioon ning rajasõltuvus).

Antud doktoritöös on kaks peamist uurimisküsimust. Esiteks, kuidas ettevõtete võimekuste portfelli areneb läbi erinevate turufaaside? Teiseks, kuidas ettevõtete liitude portfelli areneb koos võimekuste portfelliga?

Uurimistö käigus on arendatud uus mudel võimekuste portfelli analüüsimiseks ja juhtimiseks läbi strateegiliste liitude. Uuringute käigus vaadeldi põhjalikumalt ligi 80 võimekuste arendamist 30-aastase perioodi jooksul. Samuti uuriti ligi 2000 strateegilise liidu konfiguratsiooni ning rolli võimekuste edendamisel hargmaistes info- ning kommunikatsiooniettevõtetes nagu Google, Ericsson, Nokia ja Microsoft.

Käesolev doktoritöö koosneb neljast osast. Töö algab sissejuhatusega, mis annab koondülevaate töö sisust ja struktuurist. Esimene peatükk käsitleb olulisi teoreetilisi uuringuid võimekuste ja strateegiliste liitude vallas. Antud töö teine peatükk tutvustab uurimistöös kasutatavaid meetodikaid ning analüüsialuseks olevaid andmeid. Kolmas peatükk esitab peamised tulemused. Töö neljas peatükk tutvustab töös tehtud järeldusi ning kirjeldab antud doktoritöö panust võimekuste ja liitude teooriate arendamisse ja rakenduslike strateegiate edendamisse. Doktoritöö põhiosa lõpeb kokkuvõttega.

Käesolev doktoritöö baseerub lisades I - IV toodud neljal artiklil. Töös leiavad käsitlemist mitmed teemad, mille kohta varasemad uuringud puuduvad (võimekuste

portfelli juhtimine läbi strateegiliste liitude portfelli konfiguratsiooni; võimekuste rajasõltuvus ning nende arendamise seos konkurentide tegevustega; võimekuste ja liitude konfiguratsiooni juhtimine erinevates turuarengu faasides; võimekuste perekondade arengudünaamika; võimekuste arendamise kiirendamise võimalused).

Doktoritöö autor toob välja olulised tulemused võimekuste ja liitude portfelli arendamisel. Antud töös on demonstreeritud kuidas rakenduslikud ning avatud võimekused seotakse vastavate strateegiliste liitudega. Antud uurimuses selgus, et olenemata ettevõtte ja turu arengufaasist loovad ettevõtted enam avatud ja rakenduslikke liite ning need liidud seotaks avatud rakenduslike võimekustega. Töö autor kirjeldab kuidas antud tasakaal püsib uuritud firmades olulise mudelina kõikides arengufaasides.

Käesolevas doktoritöös selgub, et hargmaised ettevõtted on isegi enam orienteeritud rakenduslikele võimekustele, kui seda varasemas teaduskirjanduses on käsitletud (Artikkel I). Samuti näitab antud uurimistöö autor, et ettevõtted kasutavad sarnast mustrit liitude konfiguratsioonis (liitude sidemete tugevus ja diversifitseeritus) oma võimekuste arendamisel suletud süsteemidelt avatule ning arendusvõimekuste üleminekul rakenduslikeks.

Paljud uuringud on käsitlenud üksikute võimekuste ennetavat arendamist. Käesoleva doktoritöö tulemused näitavad, et ettevõtted ei saa enam baseeruda ainult võimekuste planeerimisele, vaid peavad olulisemaks arendada võimekusi lähtuvalt turul toimuvatest muutustest (adapteerimine). Antud uurimistöös leiti, et suurtel ettevõtetel puudub võimekuste arendamisel tihti rajasõltuvus (Artikkel II). Varasem teaduskirjandus toetas selgelt ettevaatavat võimekuste arendamist. Käesolevas doktoritöös selgus, et ettevõtete ärimudelid muutuvad järjest kiiremini sarnaseks ning klientide tarbimiskäitumist on üha raskem ennustada. Antud asjaolu muudab võimekuste arendamise mudeleid oluliselt. Eriti teravalt on antud teema kerkinud üles infotehnoloogiaettevõtetes, kus arendustsüklid ning toodete eluiga on väga lühike. Seega, ettevõtted kasutavad strateegiliste võimekuste arendamisel mudelit, mis võimaldab kiiresti tuvastada muudatused turul ning ümber kujundada olemasolev võimekuste ja liitude portfelli. Seda protsessi toetab avatud võimekuste ning avatud liitude mudeli kujundamine ettevõtte tervikportfellis.

Kirjeldatud tingimustes peavad ettevõtted väga kiiresti arendama võimekusi koostöös teiste partnerettevõtetega. Käesoleva doktoritöö tulemustena on näha, et hargmaised firmad kasutavad oskuslikult suurt võimekuste portfelli, et kiirendada üksikute võimekuste arendamist läbi rekombineerimise (Artikkel IV). Spetsiifiline võimekuste portfelli, kus on oluline osa rakenduslikel ning avatud võimekustel, aitab ettevõttel väliskeskkonna muudatustega kiiresti kohanduda. Antud doktoritöös selgus, et mida suurem on ettevõtte liitude portfelli, seda kiiremini uute võimekuste kohandamine toimub. Liitude portfelli kasv on omakorda seotud ettevõtte ja turu kasvuga. Kiire võimekuste kasutuselevõtt ja arendamine liitude baasil on eriti kohane uue turu tekkimise ja esmase kasvu perioodil. Käesolevas töös selgub, et ettevõtete kasvamisel on võimekuste ja liitude portfellis diversifitseeritus kõrgem ning see annab võimaluse rekombineerida erinevaid võimekusi ja liite, aga ka

erinevaid võimekuste ja liitude elemente. Seega, uue ning strateegiliselt olulise võimekuse arendamine sõltub olemasolevate portfelli suurusest ja kasvust.

Käesolevas doktoritöös selgus, et võimekused koonduvad erinevatesse perekondadesse, mille funktsionaalne ning kronoloogiline areng määratleb ettevõtte kasvustrateegiad turgude ja teenuste diversifitseerimisel. Töös selgub, et ettevõtte arendavad süsteemselt rakendus-, arendus- ning koostöövõimekuste perekondasid. Viimaste perekondade roll on sidustada rakendus- ja arendusvõimekuste perekondasid. Antud uurimistöös selgub, et arendusvõimekuste areng toimub vastavalt spetsiifilisele muustrile. See muster on seotud erinevate turu arenguetappidega. Nendes etappides muutuvad sisemised võimekused avatud võimekusteks, millele järgneb teenuste diversifitseerimine. Samast muustrit järgib ka rakenduslike võimekuste areng. Turu kasvades muutuvad olulisemaks toodete rahvusvahelistumine ning sisenemine uutele turgudele, diversifitseerimine.

Varasemas kirjanduses on toodud välja, et ettevõtte arendavad nii paralleelsete võimekuste süsteeme kui ka rakendavad tasakaalustamise taktikaid. Käesolevas uurimistöös selgus, et domineerivad siiski paralleelsed võimekuste perekonnad, eriti turu arengustaadiumi esimestes etappides. Kasvufaasis muutub uueks keskmeks võimekuste arendamisel avatud ja rakenduslikud võimekused, mida toetatakse erinevate liitude loomisega (Artikkel III).

Autori soovitus on tulevikus senisest enam pöörata tähelepanu kõige olulisematele partneritele võimekuste uurimisel ning vastavate portfelli kujundamisele. Käesolevas töös uuriti peamiselt kogu liitude portfelli mõju.

Tulevikus on plaanis uurida täpsemalt võimekuste portfelli arendamise võimalusi teistes ärivaldkondades ning nende võimekuste arendamise tehnikaid. Antud töös selgus, et ettevõtte panevad kasvamisel suurt rõhku avatud ja rakenduslikele võimekustele. Nende võimekuste uurimist pole varasemalt põhjalikumalt tehtud. Eelnevad uuringud on keskendunud avatud arendusvõimekustele.

Käesoleva doktoritöö käigus uuriti võimekuste arenguid eesmärgiga leida ka arendusmetoodikad, mis sobiksid kasutamiseks nii info- ja kommunikatsioonitehnoloogia valdkonna ettevõttes kui ka teistes äri sektorites. Antud metoodikat kirjeldati koos ettevõtetega ning see aitab ettevõtte juhtidel täpsemalt kujundada firmade võimekuste portfelli ning luua vastavaid strateegilisi liite.

Article I

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Total Exploitation Orientation in Capability Development: The Cross-case of Google, Ericsson, Microsoft and Nokia

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Abstract

The aim of the research is to cover the important aspects of corporate capability portfolio development – its co-evolution and configuration with an alliance portfolio. Capability portfolio management has received less attention than it deserves, and the co-evolution of capability and alliance portfolios is not looked at together. Here a closer look is taken from the perspective of exploration and exploitation capability portfolios in the context of large global ICT companies as cases in the multiple case study. As a result some prior findings are confirmed, but some contradictions are also found. This research reveals that capability development is a more externally oriented exploitive phenomenon than the extant literature presents. Alliance configuration parameters: tie strength and diversity behaviour is similar in scale to exploration-exploitation and internal-external.

JEL classification codes: M10, M13, L1, L25, D74, O321

Keywords: dynamic capabilities development, alliance portfolio, capability portfolio

1. Introduction

While a moderate amount of literature exists about capabilities development (e.g. Helfat & Peteraf, 2003; Winter, 2003; Eisenhardt & Martin, 2000) and an adequate amount for alliances (e.g. Hoffmann, 2007; Chesbrough, 2003; Eisenhardt & Schoonhoven, 1996), little is known about value creation from the perspective of co-evolution of capabilities and alliances, there is a lack of extant empirical sources. Capabilities, as with the majority of other company related issues, belong either to an exploration or exploitation related family (March, 1991), and this division is taken as a basis for this paper. Capability evolvments are viewed through the development of alliance portfolios. Portfolio, as such, is defined “as a firm’s set of direct ties” with other companies, which together construct an “egocentric network” (Das & Teng, 2000; Ozcan & Eisenhardt, 2009, p. 246). Gulati and Singh (1998, p. 781) define an alliance “as any voluntarily initiated cooperative agreement between firms that involves exchange, sharing, or co-development, and it can include contributions by partners of capital, technology, or firm-specific assets”. The exploration-exploitation dimension has been looked at for a while, and mostly in alliances’ (e.g. Hoffmann, 2007) and not in the capabilities’ context and interdependencies among alliance partners (i.e. tie characteristics) – open-close dimension – have not been looked at thoroughly.

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This paper compares and contrasts how four outstanding global information and communication technology (ICT) focal firms get things done. Through applying comparison, similar patterns are found for analytical generalisation (Yin, 2003), and contrasting helps to find differences between companies and explain them. The aim of this work is to give best practices in capability development that other companies could follow to achieve similar results and benefits. This is all done through the lens of dynamic capabilities as a key term in modern strategic management. In detail, for this purpose, the idea is to gain a broader understanding of the evolvments of the capability portfolio and specifically to identify a framework and patterns as to how the capability portfolio evolve together with an alliance portfolio.

In this study, the capability portfolio development and related alliance portfolio co-evolution issues are handled. This co-development of capability and alliance portfolios is looked at from the perspective of exploration-exploitation and in the context of ties configuration. The former is a widely used categorization in organizational learning (March, 1991) and this model has been developed further by many authors. Another aim is to extend prior findings by looking at the prevalence of exploitation or exploration capabilities in alliances of the ICT industry. The main research question of this study with two sub-questions is:

How alliances’ and capabilities’ portfolios co-evolve?

- How capabilities’ portfolio is developed based on exploration-exploitation ties?
- How capabilities are developed based on tie strength and diversity?

On the basis of research questions, the authors’ goal is to construct a research model and test it in practice. Development of propositions are carried out on the basis of prior literature and proved in ICT industry companies. The ICT industry is characterized by a fast growing market, heavy competition, and a highly uncertain and unstable environment with fast changes. Data from Google, Ericsson, Microsoft and Nokia were used to find the patterns and work out propositions. All case companies are multinational ones, having branches and development centres in the Eastern Europe geographic area.

This paper first provides a review of the extant literature regarding capability development, and introduces the research environment – framework for capabilities’ portfolio configuration, and reaches the propositions. Next, the research method and data sources are discussed. The results of the study are then presented and analyzed. Finally, the conclusion and other implications are proposed.

2. Theoretical Framework

In a theoretical framework the research model is constructed, for this purpose, the dimensions of the research model are introduced. First, the exploration-exploitation dimension is described from the perspective of capability development. Second, the open-closed dimension from ties configuration is explained in the context of alliancing. Finally, these dimensions are put together into a two-dimensional research model.

2.1. Exploration-exploitation

Background of exploration and exploitation. In the theory of organizational learning there are two types of activities – exploration and exploitation (March, 1991). Exploration is defined as learning activities: “search, ..., risk taking, experimentation, ..., discovery, innovation” (March, 1991, p. 71). Exploitation is defined as practicing activities: “..., production, efficiency, selection, implementation, execution” (March, 1991, p. 71). Exploration is “to gain knowledge unrelated to their current areas of expertise” (Bierly et al., 2009, p. 484). Exploration’s focus is on “upstream activities of the value chain” (Lavie & Rosenkopf, 2006, p. 799; Kauppila, 2010, p. 284). Innovativeness and fast development are constantly required, but it is not cheap to invest into exploration, as very few ideas reach the product development phase, much less will be brought to the market and one or two may see success. Therefore there is a tendency that only financially successful focal firms can invest better in explorative “innovations because they could better weather a failure” (Bierly et al., 2009, pp. 486–487). Exploitation is to advance existing knowledge (Bierly et al., 2009, p. 484). Exploitation focuses on manufacturing, “commercialization and marketing”, i.e. on downstream activities of the value chain (Lavie & Rosenkopf, 2006, p. 799; Kauppila, 2010, p. 284). Exploitation aims at efficiency and can more easily “take the form of outsourcing” (Kauppila, 2010, p. 287), networking and alliancing provides many ways for this. Merge and acquisition (M&A) is also one of the options that exploitation can use to fulfil its aims.

In real life, a sequence routine of exploration and exploitation happens in a modulated alternating way (Nickerson & Zenger, 2002; Crossan et al., 1999) – learning new knowledge, skills and competences are iteratively changed by practicing learnt knowledge, skills and competences. Some say that exploitation prevails over exploration (Regnér, 2003), and prior literature brings many reasons: exploitation is cheaper than exploration (Bierly et al., 2009), because the exploration process is more clearly illustrated by a funnel, channelling ideas and effort into just one stream. For the same reason, exploitation is less risky (Bierly et al., 2009) and it is easier to outsource (Kauppila, 2010). “The returns to exploiting existing knowledge and capabilities tend to be more certain and immediate than the returns to the exploitation of novel capabilities and opportunities” (Levinthal & Myatt, 1994, p. 47). The complexity is lower in the case of exploitation. On the other hand, some consider the prevalence of

exploitation as a disadvantage and see exploitation's capabilities as short-term zero-level ones (Winter, 2003).

Co-development of exploration and exploitation – separately or together. The choice between exploration and exploitation must be made carefully. Usually, when exploration prevails the company is focused on “long-term viability” and when exploitation prevails the focus is on “short-term profit maximization” (Hoffmann, 2007, p. 840). Cepeda and Vera (2007) see operational capabilities as a source of earning. Operational capabilities are closer to exploitation than exploration.

There is an opinion that exploration and exploitation do not fit together in a single company, a so-called punctuated equilibrium (Gupta et al., 2006, p. 693, 697), two of the reasons are: one crowds out the other (Lavie & Rosenkopf, 2006, p. 801), and there are competition and conflicts for attention (Gupta et al., 2006, pp. 695–696). A company either has to focus on exploration or on exploitation if they want to outperform the other competitors' mixed strategy (Ebben & Johnson, 2005, p. 1249, 1252). There is no clear evidence whether focusing on exploration or exploitation is a better choice (Ebben & Johnson, 2005, p. 1252, 1257).

However, there are ways to balance exploration and exploitation (Lavie & Rosenkopf, 2006), for example, one way is when the integration between them is carried out by the senior management officers (Tushman & O'Reilly, 1996, pp. 27–29; Kauppila, 2010, p. 284) and the second way is if exploration and exploitation are kept structurally separate so they would not interfere as much with each other (Gibson & Birkinshaw, 2004, p. 210; Kauppila, 2010, p. 285). However some say that separation needs to be avoided between exploration and exploitation, instead it is recommended that structural ambidexterity can be used for this (Gibson & Birkinshaw, 2004, p. 222). Some resource problems can still remain after that, such as the strategic role conflict, between keeping current (exploitation) and developing new (exploration) (Floyd & Lane, 2000, pp. 154–155). Ambidexterity deals with the separation issue and ambidextrous companies are good at combining exploration and exploitation efficiently together and “sustain their competitive advantage” (Tushman & O'Reilly, 1997, p. 167). While the companies' middle management has top management abilities, the company can then turn “exploration efforts into new exploitation opportunities” more effectively (Burgelman, 2002, p. 355).

This separation problem of exploration and exploitation is valid at different unit of analysis' levels – e.g. company's general orientation to exploration or exploitation, alliance portfolios orientation, capabilities orientation etc. All these levels need to manage this separation problem and there are solutions for a company's level, for alliance portfolio level, etc. For example, some sources (Hoffmann, 2007, p. 840) show that alliances can be transformed from exploration to exploitation alliances and vice versa, and this also opens up possibilities for reducing separation between them.

2.2. Evolution of Capabilities' Portfolio

It is methodologically reasonable and justified to divide capabilities into exploration or exploitation. Examples of exploration type capabilities are: internal and external R&D capabilities, product development capability in general and ICT capabilities in specific (such as software development capability, mobile software and hardware development capabilities, location based services (LBS) development capability). Examples of exploitation type

capabilities are: manufacturing capability, logistics and supply chain capabilities, quality management capability, internationalization capability, and marketing capability. Only a few of these have received earlier attention in the literature, such as, capability to manage networks – alliance management capability (Anand & Khanna, 2000), both exploration and exploitation type of alliances; and product development and strategic management capability (Eisenhardt & Martin, 2000). Prior empirics have not named and shown the optimum number of capabilities for exploration and exploitation capability families. Only Zook (2007) mentions that in general, a company has “80 to 200 significant capabilities”, but only fewer than 10 are the core capabilities.

In general, theorists have not paid attention to differences between exploration and exploitation capability developments. Most authors (e.g. Helfat & Peteraf, 2003) take capabilities at an abstract level to describe capability developments. There are sources that tie organisational learning and capabilities together (Cohen & Levinthal, 1990; Zollo & Winter, 2002; Helfat & Peteraf, 2003), providing the source for exploration capability development. From the exploitation side, there is a response from descriptions of main earning sources – operational capabilities (e.g. Cepeda & Vera, 2007; Plakoyiannaki & Tzokas, 2002; Helfat & Peteraf, 2003). The difference can be in capability development techniques, the way Helfat and Peteraf (2003) have described the content of certain capability techniques permits to presume that some of them are more suitable for exploration and some for exploitation. For example, Helfat and Peteraf (2003, pp. 1005–1006) define recombination as organisational learning (exploration), redeployment as a product altering technique for another market (exploration), renewal as raising efficiency (exploitation) and replication as internationalisation (exploitation).

The difference between exploration and exploitation oriented capabilities can be searched in organisational learning and innovation (for exploration) and operational management (for exploitation) research streams, which however do not particularly focus on capabilities, but gives some source and base for them. From the list of known capability development techniques (Helfat & Peteraf, 2003) some are more appropriate for exploration and some for exploitation. These development techniques can be extended from the capability level to the capability portfolio level, because capabilities can be aggregated at different levels of activities, from detailed to more generalised.

Capabilities development and market dynamics. New capabilities are often the result of certain techniques (Teece et al., 1997, p. 515), but there is a stance that not all techniques are applicable at the market emergence phase (Adner & Kapoor, 2010). Companies need to have many skills and resources to be successful (Helfat & Peteraf, 2003), but usually there is a lack of them in the first market phases, therefore companies might be stuck to a few capability development techniques. It is advisable to start with the most essential techniques. Only after that companies become ready for other “viable alternatives for capability development” (Helfat & Peteraf, 2003, p. 1001). Capabilities can be derived on the basis of real options’ analysis (Kogut & Kulatilaka, 2001, p. 756). Thus, at the market growth phase companies are mature enough to use a wide variety of techniques. As the portfolio of capabilities is growing larger, the opportunity to exploit diverse techniques is also increasing.

2.3. Evolution of Alliances' Portfolio

There can be exploration and exploitation oriented alliances. Exploration focuses on partners for gaining additional advantages in learning and innovation, and exploitation focuses on partners to increase efficiency and improve manufacturing.

Alliancing and market dynamics. Hoffmann (2007, p. 838) has mentioned that in the market emergence phase “within exploitation strategies, usually only a few alliances are implemented to stabilize the environment and to refine and leverage existing resources” (Hoffmann, 2007, p. 838). It is also known that alliancing takes “20-50% of their assets” (Lin, 2011, p. 331), and this amount of resources might not be available in the market emergence phase. Gulati (1999, p. 413) tested whether entering into “new alliances is influenced by the amount of network resources available to them”. Growing maturity, in the market take-off and growth phases, opens new possibilities for exploitation, “exploitation alliances in mature industries are characterized by high linkage intensity and redundancy because the inter-organizational field is stable and densely connected” (Hoffmann, 2007, p. 835). Tendencies are similar for exploration, being first, in the market emergence phase, internally focused in new product development, and then when becoming mature the open innovation is needed for exploration. Levinthal and Myatt (1994, p. 47) stated that “an established firm may have more incentive to invest in incremental changes in a current technology than in exploring more radical innovation”. It is known that economically prosperous companies can more easily cope with failures from explorative innovations (Bierly et al., 2009, pp. 486–487). Therefore start-ups, built around a certain innovative idea, provide good opportunities for focal firms. The extent to use alliances is also related with a company's wealth, focal firms are “less likely ... invest in radically innovative [exploration] ideas” in order “to avoid costly transitions” and instead of it, “less risky exploitative innovations” are taken for consideration (Bierly et al., 2009, pp. 486–487). Exploitation produces exploitation, and makes it “more attractive due to various sorts of competency learning” (Levinthal & Myatt, 1994, p. 47).

Exploration-exploitation and tie characteristics. Hoffmann (2007, pp. 830–831) proposes the following strategies for managing alliances: (1) adapting, (2) shaping, and (3) stabilizing. According to Hoffmann (2007, p. 831), shaping is characterized by exploration (“to develop new ... capabilities and to explore new ... opportunities”), stabilizing by exploitation (commercializing and leveraging resources, “exploitation of ... competitive advantages”), and adapting by exploration (reactively adapting with environment and delicately “exploring new opportunities”). From an uncertainty point of view, Beckman et al. (2004, p. 262, 263) notes that for firm-specific uncertainty (i.e. exploration), broadening the alliance network “with new partners” is good and for market uncertainty (i.e. exploitation), re-forming the alliances “with existing alliance partners” is good.

Tie strength is one of the oldest traditional measures of alliance portfolios, for example, Granovetter (1973, p. 1361) defined tie strength during the 1970's – “the strength of tie is a ... combination of the amount of time, the emotional intensity, the intimacy ..., and the reciprocal services”. Tie strength has two choices: (1) weak tie – first time partnership and (2) strong tie – more than one time partnerships. The tie diversity among partner domains is another measure, and tie diversity has two options: (1) the same Standard Industrial Classification (SIC) – partner operates in the same business field and (2) different SIC – partner operates in a different business field.

In the tie strength, the strong ties “enable rich and efficient exchange” and weak ties “enable greater flexibility and exploration” (Ozcan & Eisenhardt, 2009, p. 246). Strong ties are exploitations and weak ties are explorations, as even a strong tie in an explorative alliance has an exploitive nature (Lavie & Rosenkopf, 2006, pp. 799–800). In the tie diversity, Baum et al. (2000) found that different SIC alliances offer more information than the same SIC ones. Empirics have shown that different SIC ties are applied more to exploration (Bierly et al., 2009, p. 502). Tie strength and diversity combinations together are also important to consider. Hoffman (2007, p. 834) recommends integration possibilities, “either partially redundant strong ties to similarly positioned alliance partners or non-redundant ... weak ties to partners from different clusters”, Kauppila (2010, p. 295) includes: “weak ties to other explorative actors” and “weak ties with exploitation partners”. From the perspective of separation in a punctuated equilibrium, alliances are good in many ways, but “it is not the network but the firm that balances exploration and exploitation” (Kauppila, 2010, p. 307). A short overview of tie characteristics, i.e. tie strength and diversity, is given for exploration and exploitation in Table 1. Different SIC and weak ties are characterised as a more open strategy, and the same SIC and strong ties as a closed strategy.

Table 1. Tie characteristics in an alliance portfolio

| Exploration | Exploitation |
|---|---|
| Tie Strength | |
| Weak ties for exploration (Lavie & Rosenkopf, 2006; Ozcan & Eisenhardt, 2009; Kauppila, 2010) | Strong ties for exploitation (Lavie & Rosenkopf, 2006) Weak ties are also used for exploitation (Kauppila, 2010) |
| Tie Diversity | |
| Different SIC is applied more to exploration (Bierly et al., 2009: 502) | Not as much information richness needed from different SIC alliances as exploration (Baum et al., 2000) |

Source: Authors’ compilation

Tie characteristics and market dynamics. Development of strong ties takes a longer amount of time (Gulati, 1998) and therefore they cannot be noticed as much in the market emergence phase. There are benefits for waiting, Bierly et al. (2009, p. 488) note that experience of prior strong ties from alliances may help to “overcome exploration barriers”, which means that it is appropriate to start with strong ties. Koka and Prescott (2008, p. 641) recommend to first choose partners among those with the same SIC. Recommendations to start with the same SIC and strong ties mean that exploitation should prevail in the market emergence phase and exploration should be internally oriented in the same phase. After a company has received some maturity, it can focus more on alliancing in exploration as well (Rungi & Kolk, 2011).

Total alliance configuration. Most authors do not specifically name their research focus and unit of analysis to be total alliance. However, most literature about tie strength and diversity in alliances fit with the total alliance portfolio configuration. In total alliance analysis, the strategical, technological and/or financial proportion is not brought out separately as in the case of the important ties alliance portfolio and a less beneficial partner is equal with a more beneficial/important partner. The difference between the total and important alliance configuration can be brought out implicitly, for example, the tie strength dimension can be used for this purpose instead of the total/important configuration. In total

alliance portfolio, both strong and weak ties, and the same and different SIC partners can exist in a portfolio depending on the orientation and aim: either exploration or exploitation, the need for information etc.

2.4. Towards Total Capabilities' Portfolio Management and Configuration

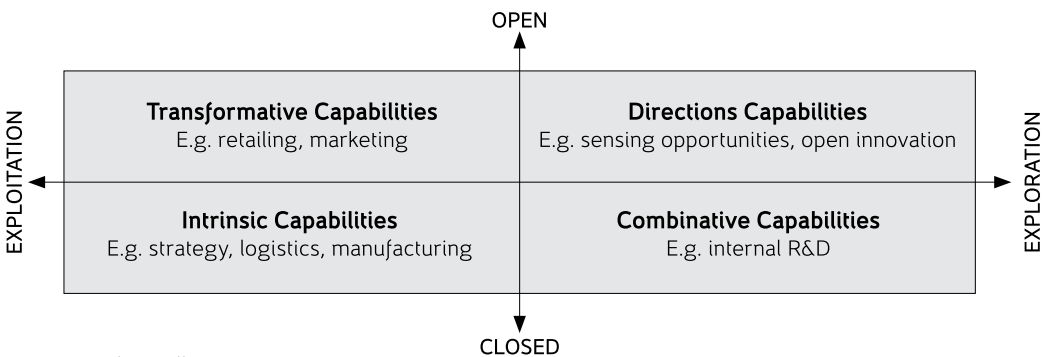
In capability development literature (e.g. Laamanen & Wallin, 2009) it is quite common that matrixes are constructed in order to analyse and observe the development of a capability portfolio. In this research, another simple two-dimensional space was worked out, since one of the interests is the influence from external-internal development an open-close was chosen for the first dimension. This dimension characterises such partnership measures as, tie strength and diversity – weak ties (first time partnership) and different SIC indicate to open, and strong ties and same SIC indicate to close. The second dimension is constructed on the basis of a continuum, where at one end is exploitation and at the other end is exploration. Exploitation and exploration definitions here are consistent with March (1991) definitions. As a result the next two-dimensional space is constructed (Figure 1). Using this matrix all capabilities are placed to a certain quadrant and on the basis of their nature, four quadrants are possible: (1) directions, (2) combinative, (3) transformation, and (4) intrinsic capabilities.

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Direction capabilities have the ability to sense opportunities that emerge from outside of a firm's established boundaries, e.g. start-ups, open innovation etc. In the current classification, direction capabilities represent an ability to adapt its competences and positions to expected future environmental changes. Direction capabilities are true search, innovation and development capabilities to benefit from future opportunities in collaboration with new partners. These capabilities are developed based on weak ties to reduce the risks of technological or market failure. Ecosystem (Moore, 1993) and network based external research and development (R&D) management is an example of modern direction capability.

Combinative capabilities enable companies to systematically combine local search related competences inside of established firm boundaries to efficiently develop new products and services. Combinative capabilities are also innovation and development capabilities similarly to direction capabilities, but its competences and positions rely on strong ties and established routines. Intramural core R&D management is a classical example of a combinative capability.

Figure 1. Configuration of capabilities' portfolio



Source: Authors' illustration

Transformative capabilities exploit firm-specific resources and capabilities inside and outside the boundaries of the firm to transform an established business model while adapting to new market conditions. Transformative capabilities are based on weak partnerships to renew firm's competences, processes and positions in the resource utilisation. Typical transformative capabilities are retailing, servicing or marketing routines.

Intrinsic capabilities lay the foundation for the ability to produce value from efficiency and refinement related processes to the delivery of quality products and services. Intrinsic capabilities are based on strong ties to minimise any negative effect on efficiency based processes, positions or competences in the firm's resources' utilisation. Strategic and quality management, logistics and manufacturing are classical intrinsic capabilities that firms manage strongly internally.

During the within-case analysis the appearance of new capabilities were used through the three evolution phases: market emergence, market take-off and market growth in the landscape of configuration matrix (Figure 1, Table 2). In this way, the full capability portfolio was divided into particular configuration quadrants.

The research model is looked at from the perspective of performance (as one of the most traditional outcome variables in management research). Performance is affected by wellness of dynamic capabilities (Zott, 2003); the exploitation nature – “short-term profit maximization” (Hoffman, 2007, p. 840); increasing total alliance centrality – frequency of entering alliances (Gulati, 1999), number of alliances and tie diversity (Oszcan & Eisenhardt, 2009; Baum et al., 2000). Despite the short-term nature of exploitation, case companies are able to show increasing performance indicators throughout phases; as they are always exploitation oriented – case companies became managing resource leverage companies. Measuring performance in ICT companies and in the case of alliances is problematic (Lavie, 2007, p. 1198). Therefore Lavie (2007, p. 1198) recommends using the market performance measure instead. There is a need to differentiate between portfolio and firm performance (Oszcan & Eisenhardt, 2009, p. 254), where portfolio performance includes “tie diversity”, “tie strength” and “partner importance”.

2.5. Finalising Propositions

For proposition development, the following findings were considered: exploration and exploitation happen in a sequential order (Nickerson & Zenger, 2002), and exploration and exploitation need to be balanced (Lavie & Rosenkopf, 2006; Tushman & O'Reilly, 1996; Kauppila, 2010; Gibson & Birkinshaw, 2004, p. 210; Kauppila, 2010). Exploitation is production (March, 1991) and “short-term profit maximization” (Hoffmann, 2007, p. 840). Stable environments and low uncertainty are suitable for exploitation (Koka & Prescott, 2008). Exploitation prevails over exploration (Regnér, 2003) for several reasons, such as, cheaper, less risky (Bierly et al., 2009), easier to outsource (Kauppila, 2010), and easier to understand. Alliancing is recommended to be used for finding “complementary resources” (Hoffmann, 2007, p. 829), better performance (Gulati, 1999; Rowley et al., 2000, p. 375; Yli-Renko et al., 2001, p. 589); better effectiveness (Anand & Khanna, 2000); better coping with “environmental uncertainty” (Hoffmann, 2007, p. 830; Eisenhardt & Schoonhoven, 1996); and to gain market power (Hagedoorn, 1993). Alliancing helps both exploration's and exploitation's related performance (e.g. Hoffmann, 2007; Gulati, 1999; Rowley et al., 2000; Yli-Renko et al., 2001; Anand & Khanna, 2000; Eisenhardt & Schoonhoven, 1996; Hagedoorn, 1993). Exploitation is characterised by strong ties (closed) (Lavie & Rosenkopf, 2006), and

exploration by weak ties (open) (Lavie & Rosenkopf, 2006; Ozcan & Eisenhardt, 2009; Kauppila, 2010) and more different SIC (open) (Bierly et al., 2009, p. 502). However, there are no clear tendencies to use the same or different SIC for exploitation. Baum et al. (2000) note that different SIC (open) is just a little less used for exploitation than exploration, and “weak ties with exploitation partners” are also recommended for exploitation (Kauppila, 2010, p. 295). Looking at the nature of exploration and exploitation, we can presume that exploration needs a much wider perspective to see all the opportunities that can take the form of many small partners, and exploitation can rely on fewer larger partners in manufacturing and supply. Therefore from an exploration and exploitation analysis weak and diverse ties (open) should prevail. Exploitation orientation consists of transformative and intrinsic capabilities (Figure 1). Most earning-profit focused capabilities are transformative capabilities, such as logistics, retailing, and marketing. Intrinsic capabilities, such as strategy and quality management, are the core activities of every company which cannot be bought in for a long-term perspective. This leads to the next proposition:

Proposition 1: Focal firms have a clear tendency to form open exploitation alliances regardless of market evolution phases and the alliances’ ties co-evolve with transformative capabilities’ development.

The division to exploration-exploitation are strongly tied with tie strength and diversity configurations (Table 1), in this sense tie strength and diversity behave identically, thus:

Proposition 2: Transformative (open exploitation) capabilities development is based on the same configuration pattern of tie strength and tie diversity regardless of market phases’ evolution.

3. Methodology

This study is part of a long-term study focusing on large multinational firms’ alliance relationships’ based capabilities development. Methodological case studies were compiled for four companies from the ICT sector – Google, Ericsson, Microsoft and Nokia. A mixed method (Cresswell, 2003) – qualitative case study in grounded theory setting (Glaser & Strauss, 1967) with supportive quantitative data – was used. At the beginning of the focal firms’ research, focal firms’ business model evolution (Osterwalder, 2004), financial performance and market growth were analysed (Appendix Table 1) and dividing of focal firm evolution into three specific separable periods was made: market emergence, market take-off, and market growth.

A special framework to study capabilities development and its portfolios evolution (capability portfolio matrix) was designed (Figure 1). To analyse capabilities emergence according to the matrix, the focal firm’s business model evolution over long-term market cycles was analysed. Most important development activities of the case companies were identified and recorded into families of capabilities’ activities. Through in depth extraction the strategic capabilities were selected and defined. Defining was done through open coding, where all identified activities from all data sources (incl. interviews) were associated with a certain category of the activities, and where needed a hierarchy of categories were built and

finally turned into capabilities. First, the key development activities having a major impact on the firm's performance were grouped into one development topic. Second, all capabilities were coded (whether they are exploration-exploitation and open-close on the basis of the nature and characteristics of the involved partners) and then these capabilities were mapped on the capabilities matrix. All the capabilities and its development path were presented to the interviewees of the study who made some adjustments and confirmed the capabilities emergence timeline.

As the primary goal of the study was to analyse how focal firm capabilities' portfolio co-evolve with the focal firm alliance portfolio, the research started to analyse focal firms' alliance portfolio configuration settings through three specific periods/phases – how capabilities emerged and evolved in these periods. Two different settings can be analysed throughout these periods: total alliance portfolio (all ties) and important ties configurations. Here, results are only presented for total alliance portfolio (Figure 2).

This research used several data sources (Appendix Table 1) – primary data sources, such as semi-structured interviewing, and secondary data sources. It is advisable to use data triangulation for corroboration reasons (Yin, 2003, pp. 98–99). Secondary data sources, such as electronic databases (e.g. SDC Platinum <http://thomsonreuters.com/>), archival data – press releases, annual reports, and economical and scientific articles – used the construct history of the companies more adequately. For total alliance portfolio configuration analysis (Figure 2), data from the SDC Platinum database were used. For capability developments and mapping to matrix, other data sources were used.

4. Results

Case companies show an expectedly good performance (Appendix Table 2). The capability development path for case companies shows the following portfolio division for market stages (Table 2). Numbers in the table show how many capabilities existed at a certain market phase. Transformative (T) and intrinsic (I) capabilities indicate exploitation, and directions (D) and combinative (C) capabilities represent the exploration type of capabilities (Figure 1). Exploitation capabilities clearly prevail in contrast to exploration capabilities, especially transformative capabilities, as their cumulative numbers outweigh the numbers of other types of capabilities.

Table 2. Cumulative capability portfolio development (for details see Appendix Table 3)

| Company | Market Emergence | | | | Market Take-Off | | | | Market Growth | | | |
|-----------|------------------|------|------|------|-----------------|---|---|---|---------------|---|---|---|
| | T | I | D | C | T | I | D | C | T | I | D | C |
| Ericsson | 3(2) | 3 | 2(1) | 1 | 5 | 3 | 3 | 1 | 5 | 3 | 5 | 1 |
| Google | 6 | 1 | 2 | 2 | 7 | 1 | 5 | 2 | 8 | 2 | 6 | 3 |
| Microsoft | 4(4) | 3(1) | 3(2) | 3(1) | 6 | 4 | 5 | 4 | 10 | 4 | 6 | 4 |
| Nokia | 1 | 5(3) | 1 | 3(2) | 4 | 5 | 3 | 4 | 8 | 5 | 3 | 4 |

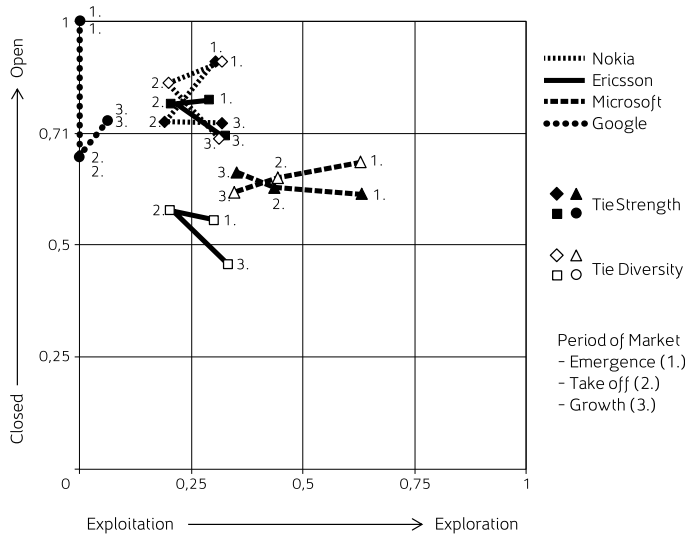
Note: numbers indicate the no. of certain types of capabilities at a certain market stage; T – transformative, I – intrinsic, D – directions, C – combinative capabilities (Figure 1); (x) – no. of historical capabilities before market emergence stage

Source: Authors' compilation

Alliance development results are presented in a capability portfolio configuration model. Developments are calculated on the basis of SDC Platinum. Interestingly, in open-close and exploration-exploitation dimensions (Figure 2) there is a clear pattern for all four companies to be located in the open-exploitation quadrant, not on the exploration's side. Exploration has a tendency to stay at the periphery and exploitation at the centre (Regnér, 2003). In the open-close dimension, companies are more focused on different SIC and weak ties.

Nokia and Ericsson are more oriented to hardware, and Google and Microsoft more to software. This hardware cluster (Nokia and Ericsson) behaves very closely/similarly with each other in the tie strength related questions. In terms of total alliance configuration, focal firms are strongly oriented to exploitation related capabilities with weak and diverse (SIC) ties. Within a prevailing exploitation focus there exist some minor changes through market evolution phases. From the initial position at the market emergence phase, focal firms have a tendency to shift more on exploitation oriented capabilities at the market take-off phase and slightly turn back to exploration related capabilities at the market growth phase. From a tie strength/diversity perspective, companies also share a similar pattern, they become more closed or stay similarly at the same level. At the market growth phase it appears that the case companies did not develop more tie diversity. Companies act mostly in the transformative quadrant (Figure 1), which is typically service and marketing oriented. By the market growth phase, case companies showed good evidence of parallel development of several complex technological capabilities, (e.g. LBS and mobile operating systems), which became possible due to larger capability and alliance portfolios.

Figure 2. Dynamics of capabilities' portfolio configuration based on total ties diversity & ties strength



Note: Tie diversity – diversity of a focal firm SIC code (open = different SIC/closed = same SIC). Tie strength – weak (open)/strong (closed) partnerships of a focal firm

Source: Authors' illustration

Microsoft's starting position was in the innovative directions quadrant (open exploration) and Ericsson's ending position turned to the efficiency oriented intrinsic quadrant (closed exploitation) (Figure 1 and 2), but both these exceptional movements have taken place close to the transformative quadrant (open exploitation). Microsoft was in the market before

others, when the uncertainty was higher and business models not standardised, however, Nokia as a pioneer in the mobile industry didn't follow this Microsoft tendency, since Nokia has been modest when taking into use and marketing its breakthrough technologies (e.g. touchscreen). Ericsson's efficiency behaviour is related with its lower performance indicators than the others (see Appendix Table 2). While others turned back a little towards an explorative direction, Microsoft then turned more exploitive, and the reason may be that Microsoft has behaved sporadically with some of its products, changing and diversifying them in no clear way. Thus, the Microsoft business model was strongly oriented at that stage to capital return generation. The company acted as a classical financial institution, not as a technological innovator. No company has operated in internal innovation (combinative capabilities, closed exploration).

In the beginning, Ericsson put a lot of effort into partnerships with leading companies in the field of mobiles networks/phones and later to the wireless services. The take-off phase resulted in major losses due to various problems (challenges in business and supply problems), and simultaneously the mobile sector repositioned, which lead to the important joint venture Sony Ericsson, plus other strong ties with key partners. In the growth phase, the company started diversification, influenced mostly by the new multimedia unit created. Very soon Ericsson made a very strong focus on decisions and finally sold its handset business stake in Sony Ericsson entirely. Sony became the sole owner.

Google's behaviour can be characterized as the most exploitation oriented, as it is almost pure exploitation. First, Google focused on making its core service excellent and internationalising it. Google was active in exploitation related alliancing and started exploration related partnerships relatively late. External focus was rising even more by expanding diversification, which allowed protecting from competitors' attacks. They have kept their core technology in-house and acquired the rest of the innovations externally, including start-ups from new fields (Rungi & Kolk, 2011), such as LBS, video on demand (YouTube) etc. Google developed new capabilities and initiated alliances at an increased pace. Google had a very high profit margin and also a leading technology innovator image. Thus company investment into different areas was in line with the general corporate business model – to bring more customers into the Internet. The extreme diversification and focus on new partners were preparation to compete with competitors like Microsoft and Apple. During the market growth phase Google built most of its capabilities in the area of mobile communications (smart phones, tablets).

Microsoft first tried to achieve dominance in the market, and after that they targeted wide networking. They networked with partners close to the customers, which permitted vast internationalisation. The certification system used allowed them to find the best partners and an emphasis was on marketing and sales (weak ties). During the market development Microsoft also started product and service diversification, and they increasingly focused on the same SIC partners, which made them a rather closed company. They entered the Internet field after a delay, but not before the market take-off phase and it was still under expectations at market growth.

Nokia developed most of its capabilities internally based on resources from their long corporate business history. When volumes started to grow rapidly and the market became international, then Nokia started stronger collaboration with other companies at the market take-off phase – strong ties with important partners and weak ties with the rest of the majority partners. For example, Nokia cooperated with one of its longest competitors

Ericsson in the field of mobile operating systems (Symbian). For Nokia, the situation and their dominance started to change when competition became stronger with the third-generation (3G) telephony standard. Nokia's product portfolio was expanded at the market growth phase when developing geographical areas – Asia and the Middle East provided a high sales volume, but slow global growth. If new markets emerge, it's most reasonable to develop its capabilities with partners.

Common behavioural keywords are dominance and excellence in core service and home market, internationalisation, diversification, increased networking since the take-off phase, joint-offerings, external innovation, and emphasising efficiency and outsourcing in manufacturing, which have led to an open exploitation prevalence. Thus, all the case companies developed its international growth very strongly based on open exploitation activities.

Based on the data from SDC Platinum and other sources (in Appendix), empirical findings – quantitative (Figure 2) and illustrative descriptions – confirm the propositions. Proposition 1 is confirmed since the majority of dynamics locates on the transformative quadrant (see alliances on Figure 2 and capabilities on Table 2), except Microsoft at market emergence stage and Ericsson's tie diversity at market growth stage. These are minor anomalies, because some of them are close to the transformative quadrant and explanative descriptions are given. Proposition 2 finds support while development paths of companies are cross-compared on Figure 2, where most companies move to exploitation and simultaneously openness is reduced (or at least kept at the same level) from market emergence to take off. At market growth stage companies have a tendency to slightly turn back to exploration. Figure 2 is based on quantitative data (four companies – together approximately two thousands alliances, see Appendix Table 1) and its reliability is high.

5. Discussion and conclusion

This research revealed that in the total alliance configuration clear transformative capabilities (open exploitation) orientation exists in companies, which is known by functional activities such as marketing, retailing and logistics. Companies receive external help from alliances only for the development of transformative capabilities. The development of other types of capabilities is based mostly on internal efforts. Prevailing transformative capabilities are mostly exploitive and do not represent explorative behaviour, as the latter would have been expected from ICT companies. The explorative nature of ICT companies seems to be revealed through the acquisitions of innovative start-up companies. O'Connell (2012) says that while Google and some others still develop innovations on the basis of external competition conflict, then perhaps they should instead provide an environment for innovations. Next, while managing alliance portfolio tie strengths and diversities, their development changes should be managed simultaneously in the same directions in the exploration-exploitation open-close matrix.

This empirical work confirmed many prior findings. Regnér (2003) has found that exploitation prevails over exploration. Empirical findings found it to be true from the perspective of alliancing in four big global ICT companies. The evolution of the ICT sector has led to standardized business models, low uncertainty and stable environments where companies imitate each other (institutional theory - Lieberman et al., 2006) rather than take

proactive actions. Koka and Prescott (2008) have showed that stable environments and low uncertainty seemed to fit for exploitation, as it was also confirmed by the current findings. Exploration and exploitation do not fit together in a single company – punctuated equilibrium (Gupta et al., 2006). As companies clearly focused on only one family – exploitation, it could be proven. Bierly et al. (2009, pp. 486–487) note that focal firms innovate in exploitation rather than in exploration, since the least uncertainty exists there. In practice, innovative ideas are searched through start-ups and imitations.

However, this research also revealed some contradictory findings. Prior theory sees exploration and exploitation happen in sequential order (Nickerson & Zenger, 2002). Hoffmann (2007, pp. 830–831) proposes sequential order for managing alliances: (1) adapting (exploration), (2) shaping (exploitation), and (3) stabilizing (exploration). As a matter of fact, clear exploitation orientation prevailed in case companies through market phases, and only one out of four companies (i.e. Microsoft) indicated a slight tendency for sequential order. Exploration and exploitation need to be balanced – ambidexterity (Lavie & Rosenkopf, 2006; Tushman & O'Reilly, 1996; Kauppila, 2010; Gibson & Birkinshaw, 2004, p. 210; Kauppila, 2010). In practice companies do not try to balance exploration and exploitation, and let exploitation prevail throughout all phases. Exploitation is production (March, 1991) and “short-term profit maximization” (Hoffmann, 2007, p. 840). Empirics show that companies have built long-term plans simultaneously with prevailing exploitation. There is no clear evidence as to whether focusing on exploration or exploitation is a better choice (Ebben & Johnson, 2005, p. 1252, 1257). From the perspective of performance, exploitation was a better choice for the case companies (Appendix Table2). Case companies were rather focused on imitation.

To sum up the most influential theoretical implications, first the novelty of this research is the analytical generalization and replication of prior findings into the ICT industry. Secondly, it provides proof to use exploitation in unstable environments such as ICT. Next, knowledge is acquired that capability and alliance portfolio development is clearly distinct on the basis of exploration-exploitation and open-close dimensions. Fourthly, capability and alliance portfolio co-evolution in open exploitation is discovered. Last but not least, the discovery that ties strength and diversity should be managed in the same directional way (as simultaneous chains).

The qualitative part of this work matches traditional limitations of case study research, for example, research is limited to the ICT industry and the size of sample permits only analytical generalisation; responses are also traditional: triangulation, multiple-case study and longitudinal setting (more than 10 years period covered), theoretical sampling, researchers' reflexivity etc. (Yin, 2003; Silverman, 2002). Findings of the research need to be tested quantitatively in the future.

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Appendix

Table 1. Data sources of the case companies

| Ericsson Case | | |
|-------------------------------------|-------------|-------------------|
| Data Source | Data Period | Periods, Quantity |
| SDC database | 1989-2010 | 200 alliances |
| Theoretical literature and articles | 1989-2010 | |
| Ericsson Inc. Press Releases | 1989-2010 | |
| Ericsson Inc. Annual Reports | 1989-2010 | |
| History of Ericsson Inc. | 1989-2010 | |
| Location Based Services Analysis | 1989-2010 | |
| Interviews | 2009-2011 | 3 top managers |

| Google Case | | |
|----------------------------------|-------------|---|
| Data Source | Data Period | Periods, Quantity |
| SDC database + case firm data | 1994-2010 | 83 acquisitions, 221 alliances |
| Articles | 1980-2010 | 120 articles |
| Google Inc. Press Releases | 1996-2010 | 14 years |
| Google Inc. Annual Reports | 2001-2009 | 8 years |
| History of Google Inc. | 1994-2010 | 16 years |
| Location Based Services Analysis | 1998-2010 | 12 years |
| Pilot Research | 2010 | 18 users |
| Interviews | 2010 | 1 development manager of acquired company |
| Interviews (ecosystem) | 2011 | 4 Android developers |

| Microsoft Case | | |
|---------------------------------------|-------------|----------------------------------|
| Data Source | Data Period | Periods, Quantity |
| SDC database | 1987-2009 | 267 acquisitions, 1043 alliances |
| Microsoft Inc. Press Releases | 1996-2009 | 14 years |
| Microsoft Inc. Annual Reports | 1994-2009 | 16 years |
| Acquisition History of Microsoft Inc. | 1994-2009 | 110 acquisitions |
| History of Microsoft Inc. | 1982-2009 | 28 years |
| Location Based Services Analysis | 1999-2006 | 147 pages |
| Interviews | 2009-2011 | 8 top and middle level managers. |

| Nokia Case | | |
|--------------------------------|-------------|-------------------|
| Data Source | Data Period | Periods, Quantity |
| SDC database | 1992-2009 | 250 alliances |
| Bloomberg Professional Service | 1992-2009 | 17 years |
| Nokia Inc. Press Releases | 1992-2009 | 17 years |
| Nokia Inc. Annual Reports | 1992-2009 | 17 years |
| Interviews | 2009 | 1 top manager. |

Source: Authors' compilation

Table 2. Performance

| Company | Market emergence | Market take-off | Market growth |
|--------------------------|------------------|-----------------|---------------|
| Productivity | | | |
| Google | 304.32 ⬆️⬆️ | 900.45 ⬆️⬆️ | 987.44 ⬆️⬆️ |
| Nokia | 92.83 ⬆️⬆️ | 241.46 ⬆️⬆️ | 527.29 ⬆️⬆️ |
| Ericsson | 106.46 ⬆️⬆️ | 216.79 ⬆️⬆️ | 357.55 ⬆️⬆️ |
| Microsoft | 171.30 ⬆️⬆️ | 333.52 ⬆️⬆️ | 652.26 ⬆️⬆️ |
| CAGR (Revenue, %) | | | |
| Google | 408.54 ⬆️⬆️ | 93.32 ⬆️⬆️ | 27.14 ⬆️⬆️ |
| Nokia | 7.10 ⬆️ | 18.74 ⬆️⬆️ | 11.62 ⬆️ |
| Ericsson | 19.00 ⬆️⬆️ | 21.12 ⬆️⬆️ | 3.26 ⬆️ |
| Microsoft | 42.04 ⬆️⬆️ | 20.02 ⬆️⬆️ | 7.99 ⬆️ |
| CAGR (R&D, %) | | | |
| Google | 92.41 ⬆️⬆️ | 97.60 ⬆️⬆️ | 31.88 ⬆️⬆️ |
| Nokia | 11.94 ⬆️ | 27.29 ⬆️⬆️ | 10.05 ⬆️ |
| Ericsson | 17.02 ⬆️⬆️ | -32.97 | 7.84 ⬆️ |
| Microsoft | 45.77 ⬆️⬆️ | 24.64 ⬆️⬆️ | 7.82 ⬆️ |
| CAGR (ROA, %) | | | |
| Google | 313.80 ⬆️⬆️ | -19.65 ⬇️⬇️ | -7.22 ⬇️ |
| Nokia | | -0.07 ↔️ | -6.13 ⬇️ |
| Ericsson | 78.50 ⬆️⬆️ | -212.22 ⬇️⬇️ | -10.33 ⬇️ |
| Microsoft | -0.81 ↔️ | -7.72 ⬇️ | 0.58 ↔️ |

Note: CAGR (compound annual growth rate), R&D (research and development), ROA (return on assets), significantly up >15%, slightly up 15%, staying same ±2%, slightly down -15%, significantly down <-15%; ⬆️⬆️ - significantly up, ⬆️ - slightly up, ↔️ - staying same, ⬇️ - slightly down, ⬇️⬇️ - significantly down

Source: Authors' compilation

Table 3. Capabilities' development from market emergence to market growth stage

| Stage | Google | Microsoft | Ericsson | Nokia |
|-----------|---|--|---|---|
| Emergence | <ul style="list-style-type: none"> • Capability to sense business opportunity (D) • Capability to search external funding (T) • Collaboration and networking capability (T) • Internet service development capability (T) • Partner network building capability (T) • Marketing capability (T) • Internationalisation capability (T) • Quality management capability (I) • Advertisement management capability (D) • Internal software development capability (C) • Product development capability (C) | <ul style="list-style-type: none"> • Capability to sense business opportunity (D) • Internal software development capability (C) • License management capability (I) • Quality management capability (I) • Product development capability (C) • Internal R&D capability (C) • Internationalisation capability (T) • External software development capability (D) • Collaboration and networking capability (T) • Capability to find external funding (T) • External R&D capability (D) • Marketing and sales capability (T) • Strategic management & diversification capability (I) | <ul style="list-style-type: none"> • Capability to sense business opportunity (D) • Manufacturing capability (I) • Patenting capability (I) • Quality management capability (I) • Internationalisation capability (T) • Product development capability (C) • Collaboration and networking capability (T) • External R&D capability (D) • M&A management capability (T) | <ul style="list-style-type: none"> • Capability to sense business opportunity (D) • Manufacturing capability (I) • Diversification management capability (T) • Product development capability (C) • Marketing & sales capability (I) • Internal R&D capability (C) • Mobile hardware development capability (C) • Strategic management capability (I) • Quality management capability (I) • Logistics management capability (I) |
| Take-Off | <ul style="list-style-type: none"> • Customer innovation capability (D) • External R&D capability (D) • M&A management capability (D) • Free service management capability (T) | <ul style="list-style-type: none"> • Hardware development capability (C) • Exploration new business areas capability (D) • External Internet service development capability (D) • M&A management capability (T) • External Internet service management capability (T) • Capability to manage legal and corporate affairs (I) | <ul style="list-style-type: none"> • Wireless system development capability (D) • Mobile Internet application development capability (T) • LBS development capability (T) | <ul style="list-style-type: none"> • Supply chain management capability (T) • Exploration new business areas capability (D) • Sustainability capability (C) • Branding capability (T) • External R&D capability (D) • Collaboration and networking capability (T) |
| Growth | <ul style="list-style-type: none"> • Strategic management & diversification capability (I) • Mobile software development capability (C) • LBS development capability (D) • Exploiting new emerging technologies capabilities (T) | <ul style="list-style-type: none"> • Mobile software development capability (D) • Online advertisement sales capability (T) • LBS capability (T) • Search engine management capability (T) • Partner ecosystem building capability (T) | <ul style="list-style-type: none"> • Multimedia service development capability (D) • Exploration of new business areas capability (D) | <ul style="list-style-type: none"> • M&A management capability (T) • Wireless network management capability (T) • Internet service management capability (T) • LBS development capability (T) |

Note: T – transformative, I – intrinsic, D – directions, C – combinative capability

Source: Authors' compilation

Article II

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Capability Development – No Path, Response to Competition: The Cross-case of Google, Ericsson, Microsoft and Nokia

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Abstract - This study is about the capability portfolio development and how the market influences capability development in technology companies. New capabilities can be developed either a proactive way or adapting with the market changes. Alliances, which help in new product development, can co-evolve in a similar vein. This study extends prior findings to ICT industry context and identifies which way is longitudinally more appropriate. Findings are observed from the market emergence phase to the growth phase. As a result, capability development is more adaption with the market rather than proactive action.

Keywords - Dynamic capability, technology management

I. INTRODUCTION

In recent decades capability development has taken an important part in technology management literature (e.g. ICT [22]), especially in the literature of strategic management (e.g. [15]) and operational management (e.g. [6]). Capabilities consist of “skills, resources, and ... competences” [35] (p. 515) and cover all functional activities of a company [9] (p. 145). A company usually has “80 to 200” capabilities, where less than ten of them are significant [39]. With a changing environment, a company constantly needs to develop its capabilities. The majority of capability literature concentrates on capabilities themselves and not on capability development. The seminal work of capability development by Helfat and Peteraf [19] is not developed much further. New capabilities can be developed either a proactive way [11] or benchmarking others [38]. The research question is: which capability development approach prevails in large multinational information and communication technologies (ICT) companies? The ICT industry is considered relevant due to its rapidly expanding modern and innovative nature, where changes happen quickly and regularly.

II. METHODOLOGY

This study is part of a long term study focusing on large multinational firms based capabilities’ development. An inductive multiple-case study research setting with quantitative data was chosen [40][12]. Eisenhardt [12] recommends choosing 4-10 cases. Cases were compiled for four companies from the ICT sector. At the beginning of the research, large case descriptions in the form of within-case analysis were compiled for each company.

Within-case analysis is based on the focal firms’ business model evolution, financial performance and market growth analysis. These within-case analyses permitted to divide focal firms’ evolution into three specific separable market periods: 1) emergence, 2) take-off, and 3) growth. To analyze capabilities development, the most important activities were recorded and categorized as capabilities. Exploration-exploitation [25] dimension was constructed to study capabilities development and decide whether companies are paying more attention to proactive explorative activities or not. An additional measurement was used to analyze how capability development co-evolves with the focal firm alliance portfolio.

Some 17 case interviews and secondary data sources were used for data triangulation [40] (pp. 98-99). Secondary data sources, such as electronic database SDC Platinum, press releases, annual reports, and economical and scientific articles were used to construct the case descriptions adequately.

III. THEORY

A. Exploration and exploitation

Both benchmarking and proactive capability developments require organizational learning abilities. Organizational learning theorist – March [25] divides all companies’ related activities into either exploration or exploitation. Exploration types of activities are closer to innovation and all related with it, such as risks and experimenting [25]. Exploitation, on the other hand, is all about exploiting prior knowledge to implement new ideas, i.e. activities such as manufacturing, efficiency and quality [25]. It can be presumed from the definition that proactive capability development requires more exploration than exploitation. Companies also quite often use ecosystems [28], and acquire or alliance with start-ups to find new ideas [36].

B. Market impact

Competition: Global competition has increased and companies fight against each other to gain several advantages (e.g. lower costs) [24] (p. 45, 47). There is competitive uncertainty that “increase[s] with the concentration ratio of the industry” [2] (p. 262). ICT industry is a fast developing industry [32], and the rate of changes is high. In the ICT industry, as a young

engineering field, the whole value chain is full of regular changes. Software developing tools are changing, hardware performance is increasing, quality management is improving, new types of applications are regularly emerging and distributing to every possible branch of life. Software companies are spreading to hardware (e.g. software to mobile and location based service (LBS) industry) and vice versa, plus all other movements to new fields. Capabilities development speed and emergence are much related to market activities [24] (p. 46). In rapidly changing environments where fast innovative responses are required, time-to-market and timing is critical, the rate of technological change is rapid, and the nature of future competition and markets is difficult to determine, as firms need capabilities to adapt and capitalize in such an environment [35]. Even though it is relevant for companies to incorporate an open innovation paradigm and innovate with their business models [7][8] they nevertheless need respective capabilities for such aims.

During the market emergence phase, when uncertainty is high and competition low, the focal firms together with their coevolution alliance¹ partners and competitors benefit, i.e. mutualistic coevolution takes place [30] (p. 12). In the later market phases the competition turns fiercer [32] (p. 27), i.e. coevolution turns competitive [30] (p. 12). Competition is also influenced by shortened new product development (NPD) cycles [26].

The need for diversification: One of the aims of strategic technology management is to cope with industrial diversification [24] (p. 45). While industrial organization theory sees that the choice of industry is most influential [31], Levinthal and Myatt [24] see the capabilities to be more important. There are substantial streams about relationships between diversification and performance (e.g. [4] (p. 223)). Niche strategy does not permit regular growth, and companies need to diversify their product portfolio for growth. Many authors [38][10] see many advantages in the diversification of product line.

Companies use the help from alliances to work out new products, i.e. to expand and diversify their product list. A larger product list also requires ex-ante larger amount of capabilities. When alliance centrality goes up the capabilities portfolio expands to be large as well. The size of the capability and alliance portfolio is an indicator for the level of diversification. If they are larger then it is the sign of a more diversified product portfolio. They are partly closely reciprocal, and if new alliances are formed more frequently, better accumulation of capabilities takes place [16]. High performance is also a sign of high alliance centrality. Alliances also help to cure “environmental uncertainty” [21] (p. 830) emerging from market competition, which in turn increases the need for diversification. Beckman *et al.* [2] (p. 262, 263) note that exploration specific uncertainty leads to broadening the

network partners, while exploitive market uncertainty leads to reusing “existing alliance partners”. Uncertainty and diversification are linked to each other [25] (p. 72).

C. Capability development

The role of diversification for capability development techniques: Development of a diversified product portfolio requires preliminary availability of many capability development techniques [19]. If product portfolio is large and diversified then it requires more development techniques. For example, for expanding an existing product to global market/foreign countries requires replication techniques (internet search engine; European cars overseas expansion), when a product is required to be accustomed with foreign clients’ demands the redeployment technique is needed (support of Cyrillic and hieroglyphic alphabet in search engine; the use of the same chassis in different car models for different geographical areas; left and right-handed models). With an aim to increase efficiency in production the renewal technique is needed and if there has been learning then the recombination technique either for NPD or for imitating competitors’ products. First when uncertainty is high, companies “strive for homogeneity” [20] (p. 133), i.e. to similar business models [29]. In a mature market, business models are similar, competition is high, products are diversified, and this all leads to the adapting strategy.

Capability development and market dynamics: New capabilities can be developed either in a proactive way [11] or adapting to the market changes. At first, in the market emergence phase, the market created demand for certain capabilities, and at some point when companies had enough capacity they started to create new markets on the basis of new technological possibilities and innovations. These innovations pre-required support by capabilities, which were developed in advance. Proactive capability development is recommended [11], but it is not common. “Although technical and market changes can never be fully controlled, proactive product development can influence the competitive success” [3] (p. 344). In practice, proactive product and capability development is much more complicated to implement. On the other hand, when adapting to a new field, a company needs to cope with the barrier of the past. Capability development is “heavily influenced by its prior activities” [24] (p. 47).

Uncertainty (“the extent to which future ... can be ... accurately predicted”) and munificence (“the extent to which the environment can support the growth”) are important environmental variables which increase after the discontinuity [36] (p. 445) – ICT industry is characterized by regular changes. In later phases, when technologies are rather standardized and has an impact to decrease uncertainty, the regular need “to stimulate market demand” [28] (p. 79) was not very effective due to the fast benchmarking of other products/services. Furthermore, proactive capability may not become effective for the same reasons. Companies which exploit both, “induced and autonomous” strategic initiatives, need

¹ In capability development, alliancing is widely used for several purposes [21][7][8][15][36][13][34][23], and also for competitive reasons [18][17].

good strategic context determination “between exploration and exploitation” [5] (p. 355).

Prior path is not important, competition is: In general, capability to develop new capabilities at an increased pace is needed for performance sustainability reasons and at circumstances of a new competition environment, where business models are similar, opportunities are constantly increasing and productivity indicators are decreasing. As a result, when companies get affected by fast changes and growth of market, then they need to respond by a faster development of capabilities. Not necessary in a proactive way, but using benchmarking, i.e. path in the form of existing capabilities is not as important as competition. All companies need to respond quickly to competitors’ new products. Larger market share has “a greater tendency to initiate new relationships” [24] (p. 60). Literature speaks about first mover advantages. Competitive landscape in the ICT industry is characterized by winner-take all behavior [1]. Golder and Tellis’ [14] article leaves opinion that no innovation is needed, simply imitate. Nowadays, imitating happens rather quickly, which diminishes the first mover advantage. If not chosen to be the first mover, then it leaves and leads to the adapting role [21] (p. 832). First mover pioneer advantages are not as large as they used to be.

D. Proposition development – summary

Focal firms at the start-up phase rely on the development of a few independent core capabilities, i.e. companies start with elaborating capabilities for their own business idea, then in circumstances of market increase, at the market growth phase, competing technologies become standardized, strategic uncertainty goes down and firms’ value propositions are becoming similar – the market becomes similar, and as a result, market competition determines a focal firm’s responsive actions through diversification in terms of the required new capabilities. Therefore focal firms develop capabilities as competitive responsive actions to sustain market performance.

Proposition: Market growth and focal firm diversification limits capabilities emergence from path, but urges capabilities development from competitive responsive actions.

The causal mechanism of the proposition is:

- Market growth leads to lower market uncertainty and higher product diversification, these movements increase market competition;
- High market competition diminishes the role of proactive development (prior path);
- Pioneer advantages are easily imitated;
- High market competition leads to adapting strategy.

IV. RESULTS

Existing capabilities and alliances were categorized in exploration-exploitation dimension (Table I). Table shows that non proactive (exploitation) type of capabilities and

alliances prevail in all market periods. Deeper analysis to find out how case companies behaved in key product areas was performed (Table II), and adaption prevails.

In the field of smartphones there are few widely used mobile operating systems (OS), such as Nokia’s Symbian, Apple’s iOS, Microsoft’s Windows Mobile and Google’s Android. Symbian OS is the oldest, as its development has taken decades. Its predecessor was already established in the early nineties and it was finally owned by Nokia in 2008. Being the oldest has not saved it to decline at a fast speed, as its market share was 47% in 2010 and 29% in 2011. The Windows Phone, released a decade ago in 2000, has not been successful either by losing its market share in recent years (20% in 2009, 9% in 2010). This is despite tremendous proactive efforts by Microsoft (e.g. [27]). The history of mobile OS-s shows a couple of great tendencies: own developments (iOS, Windows Phone) and acquisitions (Android, Symbian) are equally in use; companies with strong software ecosystems (Google) are more successful [37] (p. 12); development time of new operating systems have decreased tremendously from a decade to 3-4 years; in-house development (Nokia) has given up to development in alliances (e.g. Google); free platform (Android) has a tendency to be more successful than non-free ones (Symbian, Windows Phone) with the exception of iOS; and ease of use (iOS, Android) has been more important than the number of functions (Symbian).

“MS used to be a software company, but now is classified as a service and devices company. Therefore partnering with hardware companies and will continue to market PC computers and also mobile phones.”

(Country Manager in Estonia, Microsoft)

“Android is a good platform, because it’s for free. So you see what Android created within just two years.”

(Android developer #4)

“Because there are many application makers out there ... That is why we are here, to differentiate, we stand out.”

(Android developer #2)

“I would say that the ecosystem is very friendly to developers.”

(Android developer #1)

In the search engine market some of the same companies have been key competitors in the field (Google, Microsoft). Google was established in 1996 and its main business line has been since beginning the search engine. Google’s success has been outstanding, in 2005 they had a market share of 57%, and already 78% in 2009. Microsoft realized the true importance of the Internet after some delay, despite starting in the early nineties together with the Internet boom they underestimated the importance and started in the late nineties. Microsoft has behaved sporadically and has changed their search engine brand several times throughout history – MSN Search (launched 1998), Windows Live Search (unveiled 2006), Live Search (2007) and Bing (2009). Microsoft market share has declined – 13% (in 2004) and 10% (in 2009).

TABLE I
CAPABILITIES AND ALLIANCES IN EXPLORATION-EXPLOITATION DIVISION

| Comp. | Market emergence | | | Market take-off | | | Market growth | | |
|-----------|---------------------|---------|---------------|---------------------|---------|---------------|---------------------|---------|---------------|
| | No. of capabilities | | Alliances [%] | No. of capabilities | | Alliances [%] | No. of capabilities | | Alliances [%] |
| | Explore | Exploit | Exploit | Explore | Exploit | Exploit | Explore | Exploit | Exploit |
| Ericsson | 3 | 6 | 70 | 4 | 8 | 79 | 6 | 8 | 67 |
| Google | 4 | 7 | 100 | 7 | 8 | 100 | 9 | 10 | 94 |
| Microsoft | 6 | 7 | 37 | 9 | 10 | 56 | 10 | 14 | 65 |
| Nokia | 4 | 6 | 69 | 7 | 9 | 80 | 7 | 13 | 68 |

TABLE II
PROACTIVE-ADAPTING PREVALENCE IN PRODUCT AREAS

| Product | Smartphone | Mobile OS | Search engine | Maps/LBS |
|------------|------------|-----------|---------------|----------|
| Prevalence | Adapting | Adapting | Adapting | Adapting |

One of the biggest competitors Yahoo!, established in 1994-1995, helped both of the case companies in a strange way, Google provided its search engine in Yahoo!'s site around 2000. Since Microsoft's Bing just could not compete with its major competitors Google and Yahoo!, Microsoft made a deal with Yahoo! in 2009, that instead of Yahoo!'s own technology Yahoo! will use Microsoft search technology in their web site. The history of search engines shows such tendencies as: it is easy to fail if you do not have enough development capabilities until the required ones were acquired; partnerships (between key competitors Google and Yahoo!) and acquisitions (Microsoft's deal with Yahoo!) are common.

Maps field is again the field where most of the case companies were key competitors (Google, Microsoft, Nokia). Microsoft maps started in the early mid-nineties by Automap Streets and Expedia, and late-nineties by MapPoint and TerraServer, and now they have reached Bing Maps. In the development of TerraServer, Microsoft used a joint venture together with a couple of other companies, including Compaq. Microsoft's portfolio was even bigger, including MS AutoRoute, Research Maps, MS Streets & Trips, Phosynth, etc. This diversity in names was finally rebranded to Bing. Microsoft's strategy has been to sell their services and products commercially through different channels.

"Microsoft was already good at printing maps to CDs in the 80s, but decided that this was not a priority. Google came in 2004 and made a nice business model from it. And then Microsoft was a little forced to follow."

(General Manager for Strategy and M&A, Microsoft)

Google as a late entrant entered the field of maps around 2004, and the start was made possible by acquisition of Where2Technologies. Google differed from competitors by being a pure Web based solution. Google's map portfolio is also rather large, including services such as Google Maps, Google Earth, Sky, Moon and Mars, Google Ride Finder, Google Transit and many others. Google has used a strategy to provide their services free for non-commercialized use. Nokia's start was around the same time as Google, in 2004. Nokia's start, as a mobile provider, is related to GPS technology,

when it became possible to include it in mobiles. First it became possible for premium models. They started with Nokia Maps and after acquisition of NAVTEQ. Nokia's Ovi Maps (originally Smart2Go) was born in 2009. Microsoft and Nokia (at first) have tried to earn money/commercialize their product, but Google's free services forced them to provide their services free as well. Bing focuses on business clients, Ovi to Nokia mobile users, and Google Maps to everyone. Google's idea is to increase internet traffic and earn more from advertisements. The history of maps shows few tendencies: large product portfolios; development supported largely by acquisitions and alliances; emergent free GPS based possibilities have led the development in the past decade; free services (Google) are more successful than commercial ones (Microsoft and initial version of Nokia).

In the smartphone industry, Nokia has developed the smartphone for a rather long time, but Apple produced iPhone in 12 months. Companies were concerned about the fast development speed for NPD:

"There are broader capabilities around the agility of the organization – how quickly can you take an innovation to the market. Those I would call out first and foremost. ... This is for our large organization like what is your operating model and internal processes by which you can make your decisions quickly, by which your ideas can turn into products and actions quickly."

(Corporate Vice President, Microsoft)

Microsoft's problem in many fields seems to be too inwardly focused:

"... if you look at the value chain from the research to sales, Microsoft is doing the majority of the stuff on research and the other partners tend to be more on sales and distributors."

(General Manager for Strategy and M&A, Microsoft)

V. CONCLUSION

First mover pioneer advantages are not as large as they used to be. Google was not the first search engine inventor or implementer, Yahoo!, Microsoft and many others were in the market before it, but Google is the largest. Nokia one of the pioneers in the mobile industry, is now losing its position to late entrants, such as Apple, HTC, LG and Samsung. Nokia had touchable screens before others and HP had the tablet early this decade, but

due to market un-readiness or bad marketing these products didn't become major breakthrough products. Adaption seems to be a better choice.

The period of 10+ years was covered by the case study. Proactive capability development was not identified in case companies. Neither ecosystem nor being an explorative pioneer was seen as paths for the capability development. Competition was identified as a source for capability development.

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Article III

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Trajectory Evolvments of Capability Families: The Google Case¹

Mait Rungi² and Alar Kolk³

Abstract

Dynamic capabilities are a well-known and useful theory from recent decades. Capability families, their evolvments, and business ecosystems are more contemporary findings. There is little empirical evidence how companies cope with the environmental changes in business ecosystems at capabilities level. It turns out that capabilities clearly form certain families (exploration, exploitation, and cooperation). Evolution of these families in a focal firm over a period of 14 years is examined. Longitudinal perspective, provided by Google Inc., gives evidence for the case. Google is a good example of outstanding company which grew out from a university project. An overview of the dominant families and peculiarities of their evolvments, and co-evolvments is provided. The results of the case study show how capability families evolve through different market situations, what threatens their appearance and development, and what patterns are worth following. The paper describes a business ecosystem where focal firm acts hand-in-hand with other companies and universities.

1. Introduction

Exploration/exploitation, business ecosystems, alliances, portfolios, networking, and dynamic capabilities are seen as mainstream subjects in the contemporary strategic literature. Collis (1994: 145) defines dynamic capabilities simply as “an ability to perform the basic functional activities of the firm” whereas Winter (2003: 991) sees them just as high-level (repeated) routine. The focus of dynamic capabilities is on developing competences through “appropriately adapting, integrating, and reconfiguring internal and external organizational skills, resources, and functional competences” to cope with environmental changes (Teece et al. 1997: 515). Network theory (Kilduff and

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Brass 2010) deals with relationships among actors, for example, among companies and/or alliances. It includes also “structural patterning” (“presence and absence” of ties and block modelling of clusters) (Kilduff and Brass 2010: 320–329). Exploration is defined as: “search, ..., risk taking, experimentation, ..., discovery, innovation”, and exploitation as: “..., production, efficiency, selection, implementation, execution” (March 1991: 71). Exploration and exploitation are the key concepts of organizational learning (March 1991) to happen in real life in a modulated way (Nickerson and Zenger 2002) – learning and practicing. Gulati and Singh (1998: 781) define alliance “as any voluntarily initiated cooperative agreement between firms that involves exchange, sharing, or co-development, and it can include contributions by partners of capital, technology, or firm-specific assets”. Similarly, portfolio, as such, is defined “as a firm’s set of direct ties” with other companies, which together construct an “egocentric network” (Das and Teng 2000; Ozcan and Eisenhardt 2009: 246). The most recent term, business ecosystem is a construct where companies across “a variety of industries” “work cooperatively and competitively to support new products, satisfy customer needs, and eventually incorporate the next round of innovation” (Moore 1993: 76).

Each of these subjects is quite well covered; unfortunately, not enough sources are available that could help practitioners and academics to understand the dynamics of capabilities in such complex environments as global market and business alliances/ecosystems. Companies are engaged in multiple simultaneous alliances and are facing the challenge to manage alliance portfolios (Anand and Khanna 2000; Gulati 1998), research about it started relatively recently (Baum et al. 2000; Rowley et al. 2000), however, they have neglected a synergy issue from capabilities in alliance portfolios.

This paper empirically investigates the limited field of capability evolvments in business ecosystems. The main purpose of the research is to gain a broader understanding of the evolvments that capability families face, and specifically to identify a framework and patterns how capability families evolve. The main research questions (RQ) for this study are:

1. How do capabilities group into families?
2. How do capability families/portfolio evolve over time?
3. How do the strength of ties and tie diversity co-evolve together with the capability families/portfolio?

The unit of analysis in this study is bi-level: capability families and alliances. Trends among important alliance partners are mostly followed; less attention is paid to total alliance centrality. The information and communication technology (ICT) industry provides a good environment where companies maintain alliance portfolios for competition and new product development, and also frequently add new alliances to their portfolios. Interviews, questionnaires, and public data about ICT company Google Inc (NASDAQ: GOOG, hereinafter Google) were used to find the patterns and work out propositions. Google is an example of university spin-off.

2. Methodology

This study was a part of a long-term study focusing on capabilities development of large multinational firms, based on their alliance relationships. After a careful literature review pilot cases were conducted. Next, a case study in grounded theory setting was compiled for a company in the ICT sector. In grounded theory, iterative constant comparative theory development was used (Glaser and Strauss 1967), where propositions were found from empirics (Table 1) and compared against prior literature. It is possible to enter the field without prior knowledge and/or preliminary developed propositions.

At the beginning of research on the focal firm, its business model evolution, financial performance, and market growth were analysed and three specific periods were distinguished in its evolution: market emergence, market take-off, and market growth. These periods match largely the periods proposed by Moore (1993): birth → expansion → leadership.

Based on the results from these studies, a special framework to study capabilities development and its portfolios evolution (capability portfolio matrix) was designed. To analyse capabilities emergence according to the matrix, the focal firm's business model evolution over long-term market cycles was analysed. Most important development activities were recorded and through in-depth extraction the main capabilities were defined. First, the key development activities having a major impact on the firm's performance were grouped into one development topic. Second, all capabilities were coded and then these capabilities were mapped on the capabilities matrix. All capabilities development activities were related to alliance activities of the focal firm.

| Data Source | Data Period | Periods, Quantity |
|-------------------------------|-------------|---|
| SDC database + case firm data | 1994–2010 | 83 acquisitions, 221 alliances |
| Articles | 1980–2010 | 120 articles |
| Google Inc. Press Releases | 1996–2010 | 14 years |
| Google Inc. Annual Reports | 2001–2009 | 8 years |
| History of Google Inc. | 1994–2010 | 16 years |
| LBS Analysis | 1998–2010 | 12 years |
| Pilot Research | 2010 | 18 users |
| Interviews | 2010 | 1 development manager of acquired company |
| Interviews (ecosystem) | 2011 | 4 Android developers |

Table 1: Data Sources of the Study

As the primary goal of the study was to analyse how the focal firm's capabilities portfolio co-evolved with its alliance portfolio, the research started with in-depth analysis of

configuration settings of the alliance portfolio. For this two different settings were analysed: total alliance portfolio (all ties) and important/key ties configurations. First, total alliance portfolio configurations were analysed. Data from SDC Platinum database were mainly used. First and foremost, Standard Industrial Classification (SIC) code diversification (i.e. whether active in the same business areas or not) and tie strength (i.e. whether one or more partnerships) measures, but also general parameters such as tie centrality and compositions of alliance domains were studied. Analyses showed that general data on the configuration of the alliance portfolio did not answer all proposed research questions and some important alliances were not present in the SDC database.

Therefore, a study of the important partners of the focal firm was initiated. All important partners for each market cycle that were defined previously were mapped. Several data sources and methods for the exercise were used. A special search tool to analyse all public relations (PR) announcements of the focal firm from the beginning of its history was programmed. Google's press releases between 1999 and 2009 were read one by one and releases that included information about partnerships were selected. After all releases had been read, the researchers evaluated all selected alliances and the most important ones for every phase were selected. All the firm's annual reports and special studies were examined (see Table 1). All identified important partners were analysed according to the following parameters: tie strength, tie diversification (based on SIC codes), tie domains, exploration and exploitation nature in a given market cycle.

3. Case Description

3.1. Development of Capabilities

Google developed a total of 11 capabilities in the market emergence (ME) phase (1996–2001). These were, in order of emergence: capability to sense business opportunity (C01), capability to find external funding (C02), alliance management capability (C03), internet service development capability (C04), partner network building capability (C05), marketing capability (C06), internationalization capability (C07), quality management capability (C08), advertisement management capability (C09), internal software development capability (C10), and product development capability (C11). Google started to grow fast through advertising and free Internet services in the market take-off (MTO) phase (2002–2005). Four additional capabilities emerged in the Google's capability portfolio in this phase. These were, in order of emergence, customer innovation capability (C12), external research and development (R&D) capability (C13), merge and acquisition (M&A) capability (C14), and free service management capability (C15). The market growth (MG) phase between 2006 and 2009 was

really interesting for Google. Google generated enormous revenue from the advertising business, which was the foundation for creating an IT service provision company. In that phase Google continued to develop the IT services and the search engine, but was also able to reach for totally new sectors, new services, and new technologies. As in the market take-off phase, also five new capabilities emerged in the market growth phase. These were, in order of emergence, strategic management & diversification capability (C16), mobile software development capability (C17), location based services (LBS) development capability (C18), exploiting new emerging technologies capability (C19), and developing scalable hardware capability (C20).

After final combinations of capabilities, exploration and exploitation families clearly stood out with a third one – cooperation, which helped to tie the former two together.

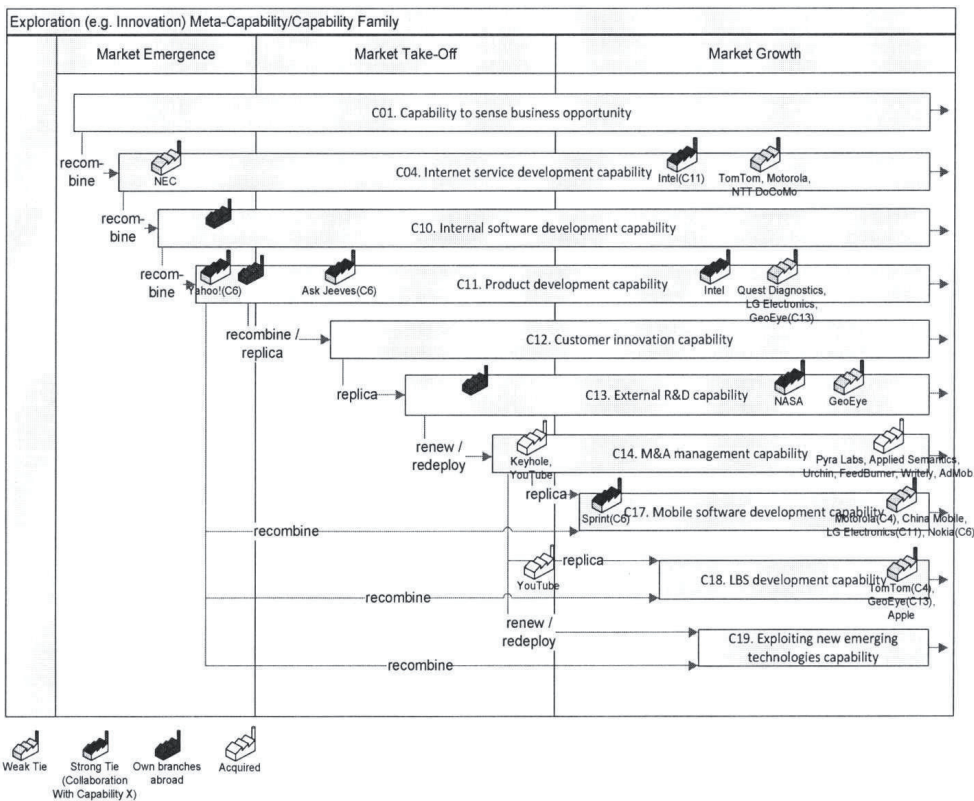


Figure 1: Coevolution of Capabilities in Exploration/Innovation Family (Important Partners)

(Retirement – decline; retrenchment – delayed decline; renewal – raising efficiency; replication – another market/same product; redeployment – another market/related product; recombination – org. learning/combination of two or more capabilities (Helfat and Peteraf, 2003: 1005–1006))

On the basis of ideas and definitions for capability evolvments by Helfat and Peteraf (2003), Google capability family developments are described next. The exploration family (Fig. 1) started with business opportunity sensing, which soon brought about the start of technical internet service development. This causal link was not direct, but more like recombining managerial ability to sense opportunities to co-develop services together with support from just initialised alliance management capability. After that, positive learning experience from external technical capability was used to improve internal technical capability (internal software development) and product development capability, in general. Then, a recombination of prior technical and other skills (e.g. managerial) was used to initiate various technical competitions among out-of-the-house agents to develop further existing and new services. In the same vein, simultaneously several branches/centres were opened to support similar developments in a larger scale. The need to grow larger, together with aiming at new products and better financial efficiency, caused finally an active M&A process. Earlier technical capabilities were then combined with M&A to result in several new technical skills, such as mobile services or LBS, and mostly exploiting new emerging technologies. Google was efficient at buying in new capabilities, despite the view that capabilities “are built rather than bought” (Collis 1994: 146). Presumably, the recombination technique prevails in the exploration family.

In the exploitation capability – external funding (Fig. 2) – declined when the company made an initial public offering (IPO) to get stock finances. Partner network building helped significantly familiarise Google’s search engine to a larger audience through incumbent and known websites. In parallel with the existence of a partner network, the marketing capability started to benefit from it and a better financial situation was achieved – the financial efficiency rose significantly. The capability to get external funding was replicated to earn revenue from internal sources, directly through marketing and via partner networks. Exploitation then continued to replicate the once proved mechanism to other markets – internationalization. A larger market share forced the company to raise its technical efficiency – to improve the quality of the search engine. Advertisement management was a logical continuation of marketing capability – aimed at the AdWords advertisement tool, which was the source responsible for the main revenues. This was learning (i.e. recombination) from an earlier mechanism. The established new marketing model was then exploited in existing and new products that were acquired by M&A. It was decided to make all new and existing products available for free to raise traffic, which increased financial efficiency. Finally, the company became mature enough and started exploitation in new fields – organised by the top management in an improved way. Renewal and replication techniques were rather largely used; however, an even larger extent would have been expected.

Trajectory Evolutions of Capability Families: The Google Case

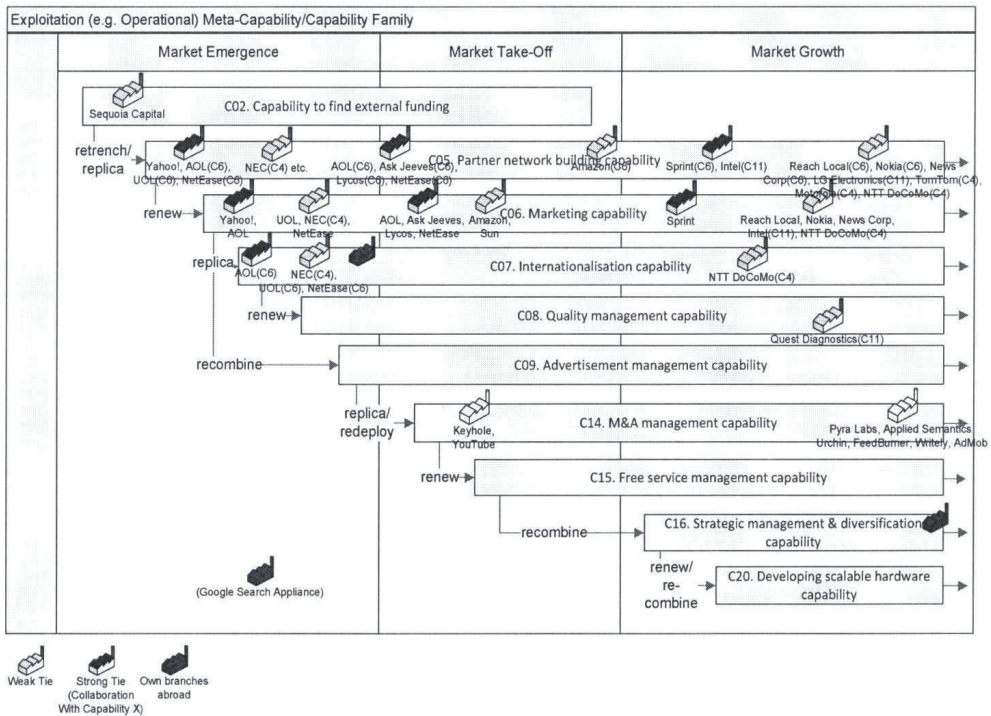


Figure 2: Coevolution of Capabilities in Exploitation/Operational Family (Important Partners)

The cooperation family (Fig. 3) is mainly carried by alliance management. From time-to-time it created sub-branches to outsource external resources to develop existing and new products, which was done either through competitions, research centres or M&A.

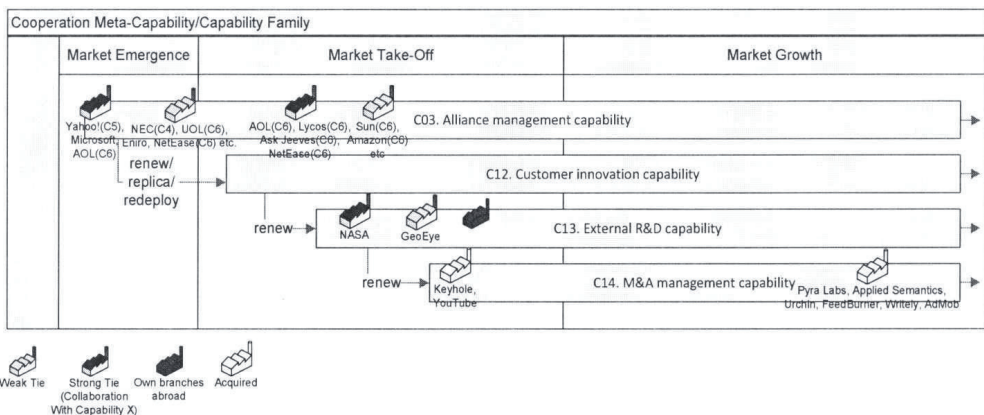


Figure 3: Coevolution of Capabilities in Cooperation Family (Important Partners)

4. Discussion

4.1. Classification of the Capability Families

Some companies claim they do not rely on or develop capabilities at all, but instead use ad hoc solutions (Winter 2003: 993–994). The Google case, on the contrary, gave evidence of the existence of 20 different capabilities. A closer look showed that certain capabilities were responsible for exploring new business and technological possibilities (Fig. 1), while another group of capabilities took care of making them become true (Fig. 2). There was also a third group, which was responsible for keeping and tying the former two groups together (Fig. 3) in a similar way as contingency theory (Miller 1987) sees the fit with internal and external environments. These families form a structure presented in Fig. 4.

Exploration and exploitation build large clusters/cities from the list of all capabilities, and cooperation is like a highway between these cities. The first two families match well with the organizational learning theory with its exploration and exploitation cycles (March 1991). Exploration is defined as learning related activities and exploitation as production related activities (March 1991: 71). From knowledge perspective, exploration is “to gain knowledge unrelated to their current areas of expertise” (different SIC) and exploitation to advance existing knowledge (Bierly et al. 2009: 484). This is no surprise that there is a need to intensively learn in a knowledge-intensive field such as ICT, one single company cannot cope all alone (Powell et al. 1996: 116). However, to be successful, you also need to have capabilities to use the acquired knowledge. Exploration and exploitation sequence routine is required to happen alternately (Crossan et al. 1999).

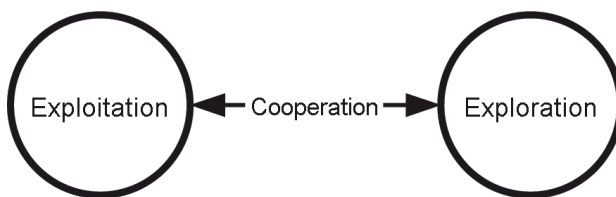


Fig. 4: *Capability Families*

Exploration and exploitation might not be the ends of the same continuum (Gupta et al. 2006: 693, 695–697); there might be space for something else – cooperation. The third component, cooperation family, is related with network theory (Kilduff and Brass 2010). Cooperation is defined as a bridge, link, connection, interconnection, trade-off, and balance. Cooperation is in a transformative role between exploration and exploitation – to take care of transition from one to another and to keep them both in

function when needed. Relatively recently, related with the research stream of business ecosystems, it became possible to reason how these three families can be tied together. Cooperation (and interdependencies) among ecosystem actors gives input to organization learning benefits received from alliances (i.e. exploration) (Kim and Inkpen 2005; Stuart and Podolny 1997, 1996) and a chance to find necessary resources for exploitation (Ding et al. 2009: 19). However, it seems that no prior source has emphasised cooperation in the role of uniting exploration and exploitation – to tie these two families together. The need for cooperation rises from demand for open innovativeness (Chesbrough 2003); there is a need for external partners in innovation (Chesbrough et al. 2006). “Turbulent environments”, such as the operating environment for Google, require explorative networking, “stable environments emphasize the importance of network positions that enable exploitation” (Koka and Prescott 2008: 643). Another reason for cooperation is to balance exploration and exploitation, that is to create an explorative source in exploitation (e.g. R&D with existing partners) and vice versa (Lavie and Rosenkopf 2006: 804–805), like oriental yin-yang. However, this balancing nature of cooperation is addressed in only a few sources (e.g. Lavie and Rosenkopf 2006).

Several categorizations are available for intra-firm capabilities, such as Laamanen and Wallin’s (2009) internal/external location based one. Google’s case showed that there is need to cope with both intra- and inter-firm capabilities (i.e. all available types in alliances) under the name of cooperation. The proposed categorization (Fig. 4) differs from the earlier ones, but is even simpler.

In traditional industries, the majority of efforts are put on exploitation (Regnér 2003) and the minority on R&D and other exploration dependent activities. Here, it is advised that more emphasis be put on exploitation as well, even though some sources consider exploitation as kind of short-term zero-level capability (Winter 2003). In conclusion (Fig. 4), the following proposition is provided:

Proposition 1. Companies should systematically develop the following capability families/divisions: exploration, exploitation, and cooperation.

Hoffmann (2007: 831) proposed something similar – exploitation, exploration, and trade-offs between them, but this is from another perspective where the unit of analysis is alliances, not capabilities. There cooperation is seen as a solution for trade-off: “alliances can help minimize this trade-off and create a balance between exploiting existing competencies and developing new competencies” (Hoffmann 2007: 831).

Some authors say that exploration and exploitation do not fit together well in a single company context – punctuated equilibrium (Gupta et al. 2006: 693, 697): one crowds out the other (Lavie and Rosenkopf 2006: 801), competition and conflicts for attention and organizational routines occur (Gupta et al. 2006: 695–696), which is psychologically hard, a company either has to focus on one or the other if they want to outperform others’ mixed strategy (Ebben and Johnson 2005: 1249, 1252). In the small

firm context, it remains unclear whether concentrating on exploration or exploitation is a better choice (Ebben and Johnson 2005: 1252, 1257).

However, some others (Lavie and Rosenkopf 2006) see possibilities of balancing them, for example, if integration as a change is made by the senior management (Tushman and O'Reilly 1996: 27–29; Kauppila 2010: 284) and if exploration and exploitation are structurally separate with distinctive processes (Gibson and Birkinshaw 2004: 210; Kauppila 2010: 285). Separation needs to be avoided in these structures; instead it is recommended that more structural ambidexterity be used (Gibson and Birkinshaw 2004: 222). Anyway, some resource problems can still remain, such as the strategic role conflict – need to keep current (exploitation) and develop new (exploration) (Floyd and Lane 2000: 154–155). Ambidexterity deals with separation, ambidextrous companies are good at combining exploration and exploitation efficiently and “sustain their competitive advantage” (Tushman and O'Reilly 1997: 167).

4.2. Evolution of the Capability Families

4.2.1. Evolution of the Exploration Family

Next, it would be interesting to show how each family has evolved over time and phases. Among others, dynamic capabilities are mostly “the capacity to renew competences” (Teece et al. 1997: 515), the dynamic nature is its very essence. The dynamic nature of capabilities is also one of the key differences from its counterpart – static resource-based view (Barney 1991). Capability evolution is path dependent, among others it is also influenced by factors such as organizational structure and culture (Collis 1994: 145). Evolution of capabilities is seen through integrations and reconfigurations (Teece et al., 1997: 515). Capability families, sometimes called capability trajectories (Levinthal and Myatt 1994), are kind of meta-capabilities that tie a certain amount of low-level capabilities together with the higher, abstract level. This gives reason to apply the same capability evolution logic at the higher level that is used at the lower level. Social evolutionary theory (Aldrich 1999: 22) sees evolution as happening via the cycle model: variation → selection → retention with struggle. In a similar vein Teece (2007: 1319) proposes the following disaggregation for capability evolution: “capacity ... to sense ... opportunities” → capacity “to seize opportunities” → reconfiguring capacities.

Google's case showed that at first (see the market emergence phase in the exploration family (Fig. 1)) the situation may be characterised by a clear direction towards internal innovation (Fig. 5). Then, in the market take-off phase, orientation was switched to external innovation, which mainly took place. Finally, in the market growth phase, diversification started. The two later phases, take-off and growth are more illustrated by exploration. However, the majority of innovation capabilities reached a product, happened only during growth.

Google has employed alliances widely. Companies used to organise most functions internally, but this is not enough anymore (Powell et al. 1996: 116). Evolution of exploration, in the case of Google, is described by how the number of alliances is growing. Alliances are seen as a link to “complementary resources” (Hoffmann 2007: 829). Inter-firm competition is another reason to build alliance portfolios (Hamel 1991). Google followed a step-by-step process, first knowledge was acquired to manage single and a few alliances, then it became possible to start to manage a portfolio with many alliances (Hoffmann 2007: 828), because single is not enough. An average large company may have 30 ties with partner alliance companies (Reuer and Ragozzino 2006: 27); this indicator was much higher in Google (see Table 1). On the other hand, larger alliances are more complicated to manage (Das and Teng 2000). Also, alliances require a lot of resources, “20–50 % of their assets” (Lin 2011: 331), which might not be available in the beginning. Gulati (1999: 413) also tested whether entering into “new alliances is influenced by the amount of network resources [with prior experience] available to them”. The best origin of portfolios is from the big picture – advocating industry architecture, making “long jumps” to new industries, and using sequential back and forth attention with many ties to reduce key uncertainties; not necessarily developed on the basis of single emerged ties (Ozcan and Eisenhardt 2009: 256–268). Ownership plays its role in alliance creation as well, companies with low “inside ownership ... develop more extensively” joint ventures (Reuer and Ragozzino 2006: 28). Google’s key owners have been involved with the company from the beginning. Alliances are good in many ways, but when it comes to balancing exploration and exploitation, then “it is not the network but the firm that balances” (Kauppila 2010: 307). However, networks and M&A have their own role as a buffer and/or testing external opportunities in relative isolation from the company’s internal environment (Lavie and Rosenkopf 2006: 800).

The number of alliances has a negative (Draulans et al. 2003) and the frequency of entering alliances a positive effect (Gulati 1999) on the outcome of the company – its performance. However, there is experience that a higher number of alliances with weak ties has a positive impact on the performance (Rowley et al. 2000: 375). Besides, for learning there has to be the ability to replicate the knowledge obtained from networking affairs (Tsai 2001). Absorption incentive from learning is greater when “learning is hard” and “firms within an industry are less interdependent in the sense that rivals’ technical advances have less of an effect on the firm’s own profit” (Cohen and Levinthal 1990: 142); the latter is not the case in ICT industry.

In addition, the lack of alliances in the market emergence stage is also explained by the fact that Google applied exploitation in the first phase, then “within exploitation strategies, usually only a few alliances are implemented to stabilize the environment and to refine and leverage existing resources” (Hoffmann 2007: 838). Some sources (Hoffmann 2007: 840) show that alliances can be transformed from exploration to exploitation alliances and vice versa.

Google as a prominent focal firm at first sought partners among those with a similar status, as recommended by Koka and Prescott (2008: 641). Google deployed the real options reasoning approach – small steps at a time (McGrath et al. 2004) – while increasing its alliance portfolio. Here, some authors (Draulans et al. 2003) note that it is still better to learn managing alliances while being in alliance, not completely from scratch alone. Sources describing the selection of alliance partners (e.g. Gulati 1998) suggest also not managing simultaneously many alliances with different partners. Alliances remain very important because new ideas are usually identified by alliance partners, not by companies' own initiative (Gulati 1998: 294).

While above evolution was examined and described by social evolutionary theory (Aldrich 1999) and capabilities (Teece 2007), the ecosystems theory sees the evolution path of alliances in the ecosystem: birth (“defining what customers want”) → expansion (“capturing territory”, stimulating “market demand”) → leadership (“the fight for control”) → self-renewal (Moore 1993: 76, 79, 80).

Hoffmann (2007: 830–831) proposes three strategies for managing alliances: (1) adapting, (2) shaping, and (3) stabilising. Google has had a good position to shape the environment. Depending on the level of uncertainty, Google has used either shaping (uncertainty high) and/or stabilising when uncertainty was low. According to Hoffmann (2007: 831), shaping is characterised by exploration (“to develop new ... capabilities and to explore new ... opportunities”) and stabilising by exploitation (commercialising and leveraging resources, “exploitation of ... competitive advantages”). Exploration tends to stay at the periphery and exploitation at the centre (Regnér 2003: 66), which was partly the case in the first phase of Google's life cycle; later it was rather on the contrary. Exceptionally, Google has moved from exploitation to exploration, usually the path is vice versa, in case of uncertainty exploration is needed to overcome this and start exploitation (Hoffmann 2007: 831). It can be presumed that in the ICT industry uncertainty continues to grow due to constant technological breakthroughs. Usually, when exploration prevails the company is concerned about “long-term viability” and in case of exploitation, about “short-term profit maximization” (Hoffmann 2007: 840). Exploration alliances focus on “upstream activities of the value chain” (Lavie and Rosenkopf 2006: 799; Kauppila 2010: 284); see Fig. 1.

Proposition 2.1. The evolution of exploration (innovation) proceeds as follows: internal innovation related capabilities → external innovation related capabilities → service diversification related capabilities.

Google's case seems to support the standpoint that financially successful focal firms invest better to explorative “innovations because they could better weather a failure”, and not the standpoint that they “less likely ... invest in radically innovative [exploration] ideas” “to avoid costly transitions” and instead “less risky exploitative innovations” are taken for consideration (Bierly et al. 2009: 486–487).

Important partners show different patterns of capability development (tie diversity/strength) compared to total alliance portfolio configuration, because not all the alliances and partners are valuable to the focal firms as any alliance agreement would need significant resources to run. But as in many industries (Gulati and Higgins 2003; Powell et al. 1996), for Google some partner types are more important than others. Therefore in order to provide in depth understanding, most important/key ties were detected and studied carefully and separately.

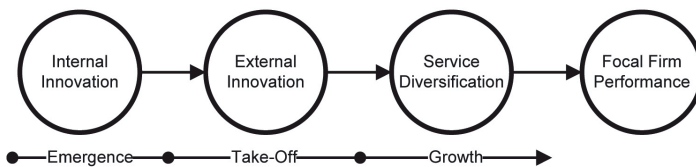


Figure 5: Evolution of the Exploration Family

Strong and weak ties with partners were determined – if the focal firm had only one partnership with a partner in a phase, then it was defined as a weak tie, but if the focal firm had two or more signed deals with a partner, then it was defined as a strong tie. Empirics have shown that different SIC is applied more to exploration (Bierly et al. 2009: 502).

Recombination technique prevails in exploration. In detail this process is characterised by:

Proposition 2.2. External innovation and service diversification based on the recombination technique enhance the focal firm’s performance in the configuration of important alliance partners.

Proposition 2.3. In the configuration of important alliance partners, better performance of capabilities in exploration phases (i.e. internal innovation, external innovation, and service diversification) is achieved without alliancing in the market emergence phase; through weak ties with different SIC partners in the market take-off phase; and through varying tie strength and different SIC partners in the market growth phase.

One of the aims was to find the most critical factors for situations when the company was moving from internal innovation to external innovation and service diversification. Strong ties do not give the necessary diversification. Leonard-Barton (1992: 118–121) gives also a list of problems that may arise at organizational culture level when diversifying, while Cohen and Levinthal (1990) see advantages in diversified knowledge. Service diversification was needed for the company to achieve better performance (in the sense of return on investment (ROI)). Google’s performance is very much dependent on internet traffic: the higher the traffic, the better the chances to sell more advertisements and improve performance.

4.2.2. Evolution of the Exploitation Family

Evolution of the exploitation family (Figs 2 and 6) reflects clearly Google’s development. However, evolution steps do not match exactly with the boundaries of phases and are therefore fuzzier than in the case of the exploration family. In the first phase, Google tried to guarantee core service excellence. The same phase was characterised as the foundation of new capabilities. This is in line with the recommendation that companies should not integrate much in networks during the market emergence, especially if technology has not “reached a stage of maturity” (Adner and Kapoor 2010: 308). Then Google turned to core service internationalization (Fig. 6) with a propensity to use replication and renewal techniques. Internationalization, taking place in the same first – emergence – phase, is very similar to the expansion phase with the aim to increase the market share (Moore 1993: 79), since its focus is on increasing traffic in all internet mediums. For the sake of traffic, the need “to stimulate market demand” (Moore 1993: 79) for search engine services is also very useful. The final part can be characterised as core service strategic management and diversification portfolio management. Diversification in the last phase, in the form of active search ‘pearls’ and ‘cash cows’, may open up also early mover advantages from exploitation. Tushman and Anderson (1986: 461) found that early adopters will receive competitive advantage. Usually exploration refers to being a first mover, not exploitation as a stabilising force – the contrary decision for being a first mover is the role of an adapter (Hoffmann 2007: 832). Google has mostly failed to be a pioneer, in some important and popular products such as search engine and internet video (e.g. YouTube), the company has been a late entrant. Pioneering is in a bad shape in the case of families, exploration as well as exploitation. With market diversification, Google differs from mainstream research, which tends to “ignore interactive elements of the market” (Gulati 1998: 295).

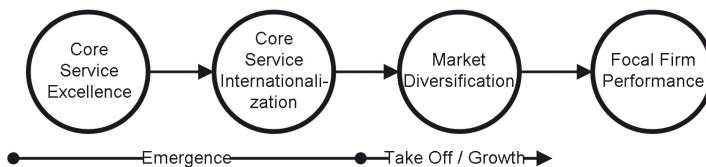


Figure 6: Evolution of the Exploitation Family

Being a pioneer in efficiency related exploitation questions is not necessarily needed, good benchmarking and copying can help out (Womack et al. 1990). All cycles, core service excellence, core service internationalization, and diversification have received earlier attention (Womack et al. 1990), but not clearly in that particular order (Fig. 6).

Proposition 3.1. The evolution of exploitation (operational) proceeds as follows: core service excellence related capabilities → core service internationalization related capabilities → market diversification related capabilities.

Renewal and replication techniques prevail in exploitation. In detail this process is characterised by:

Proposition 3.2. Core service excellence, internationalisation and market diversification based on renewal and replication techniques enhances focal firm's performance in configuration of important alliance partners.

Important partners have different patterns of capability development (SIC/tie strength) compared to total alliance portfolio configuration. A large number of alliances with strong ties among important partners influence positively the performance of a firm (Rowley et al. 2000: 375).

Proposition 3.3. In the configuration of important alliance partners, better performance of capabilities in exploitation phases (i.e. core service excellence, core service internationalization, and market diversification) is achieved through varying tie strength and diverse partners in the market emergence phase; through strong ties with same SIC partners in the market take-off phase; and through weak ties with different SIC partners in market growth phase.

The aim of market diversification is to get a larger market share. Exploitation gives a market share and internal efficiency. Exploitation is related with ROI type of performance. The market share is important for Google's business model to keep and increase internet traffic. Therefore Google is active in new search engine fields, such as the mobile market.

Exploitation alliances focus on manufacturing, "commercialization and marketing", i.e. on downstream activities of the value chain (Lavie and Rosenkopf 2006: 799; Kauppila 2010: 284), see Fig. 2. Efficiency, as an aim of exploitation, can "typically take the form of outsourcing" (Kauppila 2010: 287) or M&A.

In market diversification (e.g. through marketing joint ventures), the learning effects are weakest, not such large effects like in case of research joint ventures (Anand and Khanna 2000: 295). Learning would be nice, but it is not the main aim of exploitation.

Interestingly, exploitation, which is less active in later phases, has more active alliance activities in later take-off and growth phases, in contrast to prevailing exploration. Some explanation is given by Hoffmann's (2007: 835) note, "exploitation alliances in mature industries are characterized by high linkage intensity and redundancy because the interorganizational field is stable and densely connected", except that the ICT industry is not mature and stable.

The exploration side of exploitation is balanced by active acquisitions. "Acquisitions intensity" will grow with the firm's performance (Lin 2011: 334).

4.2.3. Evolution of the Cooperation Family

The cooperation family is much about the ability to find external partners and to put these partner networks work effectively. This skill is called alliance capability (Anand and Khanna 2000; etc.). Experience, which is received from networking, including earlier trials, helps to learn being more effective (Anand and Khanna 2000). Learning benefits are important for the exploration family (Fig. 5).

Google showed an increase in alliances in the market growth phase when extensive diversification started. However, there is a need to be reasonable about the total number of alliances because success is decreasing while the number is going high (Draulans et al. 2003), diversification cannot continue endlessly. Diversified knowledge is important from another perspective: new alliances are formed more frequently, better accumulation of capabilities takes place (Gulati 1999).

During the emergence, Google together with its coevolution partners and competitors all benefited (i.e. mutualistic coevolution (Peltoniemi 2006: 12)), which is probably common for market emergence phases. In the take-off phase the competition turned fiercer (Scott 2008: 27) (i.e. competitive coevolution (Peltoniemi 2006: 12)).

Google is taking an entrepreneurial position in its networks, which sometimes can take also weak forms:

“There is the portion pool model. Sometimes they will pool us and say here is an opportunity, if you’re wanting to work on this you should start now and they give us an idea what we should do.” (Android developer 1 – illustrating the cooperation process with a strong tie).

Entrepreneurial position means benefits from information diversity (Koka and Prescott 2008; Gulati 1998: 296), control (Gulati 1998: 296) over external resources and resource leverage – making the company to be in the focal position. Entrepreneurial position, in contrast to prominence position, fits better for ICT companies (Koka and Prescott 2008: 640), but they “are unlikely to go beyond their existing ties to seek out novel information” (Koka and Prescott 2008: 644), this needs to be balanced. Entrepreneurial stand, called also strategic posture, is especially important for exploration (Bierly et al. 2009: 486, 496).

“I would say that the ecosystem is very friendly to developers.” (Android developer 1 – commenting on non-prominence position of Google).

The focal point is the maximally achievable boundary for Google, because no one can “realistically own the entire ecosystem” (Santos and Eisenhardt 2005: 497).

The “strategic interdependence perspective” sees alliances “with those with whom they share the greatest interdependence” (same SIC) (Gulati 1998: 299), therefore Google allied mostly with firms from all its business lines. Alliances, especially ecosystems, aim mostly to control, not at efficiency/cost (Santos and Eisen-

hardt 2005: 497). Google’s ecosystem seems to be a technology based ecosystem “where both innovation and interdependence are critical” (Santos and Eisenhardt 2005: 499).

Proposition 4. Cooperation starts with few partners and evolves to massive alliancing and extensive M&A.

In the emergence phase, there were only a few alliances (Fig. 7), because the company was unable to integrate more alliances due to shortage of resources (alliance management is very resource consuming). Alliance centrality increases throughout the process.

Interestingly, in the market emergence phase, when Google had a weak shaping potential, it still did not apply any adapting strategy (i.e. reactive adaption with changing environment) (Hoffmann 2007: 830, 838) or perhaps only to some extent by creating social capital (e.g. with Yahoo) and new competences (Hoffmann 2007: 839).

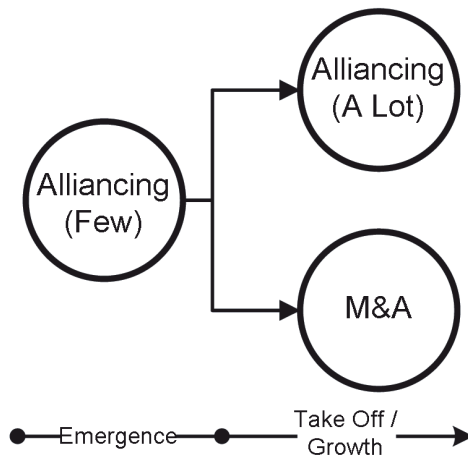


Figure 7: Evolution of the Cooperation Family

4.3. Performance Formation by Families

In terms of total alliance, Google’s performance had an increase at market emergence, a significant increase at market take-off, and continued to grow in the market growth phase. In 2001, in the market emergence phase, Google had 284 employees and its revenue was \$86 million. In the market take-off phase (2005), there were 5,680 employees and the revenue was \$6,139 billion. In 2009, in the market growth phase, the number of employees was 20,222 and the revenue amounted to \$21,796 billion. The pace accelerated phase-by-phase together with growing alliancing. Extensive use of

“alliances would represent over 40 percent of the firm’s value in 5 years’ time” (Reuer and Ragozzino 2006: 27). The tie strength has its influence here: Rowley et al. (2000: 369) found that “strong ties in a highly interconnected strategic alliance network negatively impact firm performance”. First of all, performance is influenced by how well company manages dynamic capabilities (Zott 2003). In the same vein, knowledge integration ability has a positive impact on research productivity (Henderson and Cockburn 1994).

Google’s case showed exploitation to be the main source for performance (Fig. 8). This partly confirms findings by Cepeda and Vera’s (2007) division, who see operational capabilities as a source of earning and dynamics as managerial activities to change operational ones. Total alliance centrality showed a clear prevalence of exploitation activities. Since exploitation lasts through phases, in the case of Google, exploration capabilities together with cooperation led the company to better performance and results.

Proposition 5. Exploitation (operational) capabilities are the base for performance/earnings.

4.4. Evolution of Capability – Recombination Strategy

Amit and Schoemaker (1993) mention that capabilities are developed through complex interactions among company’s resources. In theory, it is recommended that proactive capability development be used (Draulans et al. 2003; etc.). “Although technical and market changes can never be fully controlled, proactive product development can influence the competitive success” (Brown and Eisenhardt 1995: 344). In practice proactive development is much harder to implement, and mostly practical experience and orientation prevails – learning-by-doing (Draulans et al. 2003). Evolution of exploration and exploitation, taking place in all three phases, is represented by changes at the capability level. Capabilities do not emerge/pop up from nothing, new capabilities are often a result of recombination, thus instead of proactive capability development firms integrate and reconfigure (Teece et al. 1997: 515). Recombination is useful for considering experience in exploratory innovations (Bierly et al. 2009: 488). The ability to recombine is essential since it takes advantage of the existing capabilities and it is long known as a source for organizational learning and innovation (Henderson and Clark 1990). Relatively less is known that it happens in combining existing core capabilities with market capabilities, such as sensing and using new marketing perspectives (Fig. 9). Market capability is seen here as market-oriented actions “that took place by interfacing with external constituencies” (Laamanen and Wallin 2009: 962). Recombination is not the only proposed approach for developing, some other are a resource-picking or capability building (Makadok 2001).

Earlier findings (see Figures 1, 2 and 3) show that in Google only one capability out of 20 declined, all others remained alive; this contradicts partly Helfat and Peteraf (2003: 1004) who claim that “not all capabilities may reach the maturity stage”.

Proposition 6.1. In market growth circumstances the capabilities start to cumulate. Earlier capabilities tend to stay alive and neither disappear nor get killed.

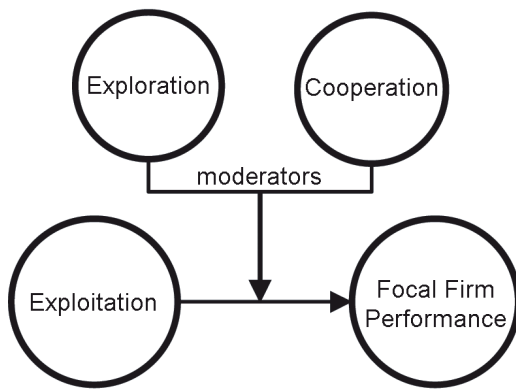


Figure 8: Performance

Proposition 6.2. Earlier capabilities coevolve and create new capabilities. Sustainable corporate growth relies largely on the recombination of the existing internal core capability and market capability. New capabilities are not much formed by resource-picking (i.e. raising efficiency).

There is also a tendency that new capability development is sped up if there are more capabilities in the portfolio, since new knowledge is built on the basis of the existing knowledge portfolio (Bierly et al. 2009: 483).

Proposition 6.3. In spite of the market phase, the focal firms use capability re-combinations to develop new capabilities and ensure fast growth and high performance.

Proposition 6.4. If re-combinations are started during the market emergence phase, growth will follow in the next market phases.

Proposition 6.5. The earlier the recombination with market interfacing capabilities starts, the faster growth is achieved in the next phases.

There are a plurality of prior viewpoints on how capabilities evolve and on their origin, starting from that capabilities are “born, not made” (Winter 2003: 991) or built, not bought (Collis 1994: 146), and finishing with more complex explanations. Google’s case showed in many cases quite a different behaviour: they made new capabilities by combining existing ones and bought in many capabilities through M&A.

Strategies typically evolve “from adapting to shaping and to exploiting (stabilizing)” (Hoffmann 2007: 827). Google’s case is different.

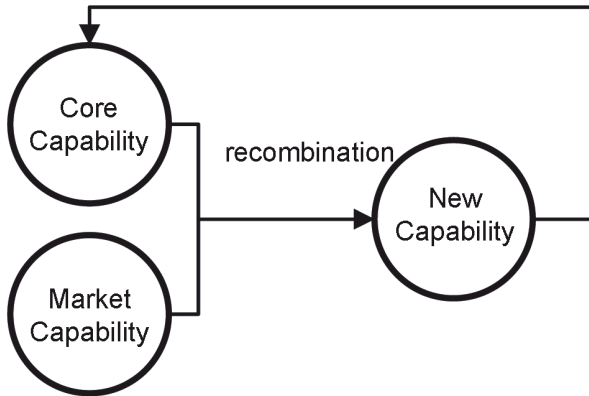


Figure 9: Evolution of Capabilities by Recombination

4.5. Evolution of Ties

In exploration, extensive alliancing started by the diversification in the market growth phase when the focal firm initiated search for important partners at a larger extent, mostly from non-same fields. During the emergence in exploitation, Google dealt with core service development and internationalization in a win-win way. This phase was characterised by a few strong and weak ties. During the take-off, when cooperation became more active, both strong and weak ties (in the form of internationalization channels, R&D, and alliance management development capability) tended to turn into stronger ties due to competition. During the growth, weak ties could be noticed; the context for this was set by R&D in alliances and fierce competition. Google’s case (emergence – exploitation, take-off – exploitation/exploration, growth – exploration) matches partly with Koka and Prescott (2008: 643) – strong ties are common for exploitation and weak ties for exploration.

In the market emergence phase, weak and strong ties are rather balanced (Fig. 10). At take-off strong ties prevail and in the final growth phase weak ties do. In the growth phase merge and acquisitions are kind of representatives of strong ties (Fig. 7).

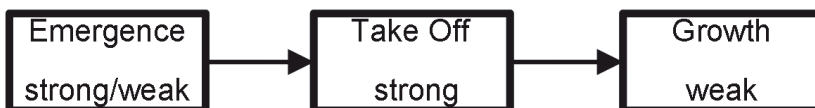


Figure 10: Evolution of Ties through Phases (Important Partners)
(Weak – first partnership, strong – repeated partnership)

Proposition 7. During emergence attention should/must be paid to a few strong/weak ties by the focal firm, during take-off more to strong ties, and during growth more to weak ties.

Strong ties fit for stable environments and weak ties for turbulent environments with high uncertainty (Rowley et al. 2000: 370). Strong ties “enable rich and efficient exchange” and weak ties “enable greater flexibility and exploration” (Ozcan and Eisenhardt 2009: 246). Strong ties, even those in explorative alliances are kind of exploitations and weak ties are explorations (Lavie and Rosenkopf 2006: 799–800). Bierly et al. (2009: 488) note that experience of prior strong ties from alliances may help to “overcome exploration barriers”. “Only strong ties ... enable a sufficiently close and trustful collaboration ..., [but strong ties also reduce] their flexibility and can lead to interorganizational inertia” (Hoffmann 2007: 834). Google showed that strong ties were not necessarily developed over a longer period of time, like proposed by Gulati (1998). Google rather tended to have weak ties with new fields (different SIC) and strong ties with existing fields (same SIC) (Fig. 11), which is partly opposite to the standpoint of Baum et al. (2000) that alliances of the same type offer less information. However, it matches well with Hoffmann (2007: 834): there can be “either partially redundant strong ties to similarly positioned alliance partners or nonredundant and predominantly weak ties to partners from different clusters”. Bierly et al. (2009: 481, 487, 489) emphasised exploration’s peculiarity to rely less on technologically related fields (same SIC) in the process of innovation, even if it helps to learn quicker, because exploration aims for new. In greater detail, tie characteristics are also important to make exploration and exploitation work together within a single company, the key integration mechanisms are: “strong ties with strategic exploration partners”, “weak ties to other explorative actors”, and “weak ties with exploitation partners” (Kauppila 2010: 295). When the strategy is to be innovative then more alliancing is used. However, another article (Cohen and Levinthal 1990) argues somewhat controversially that absorptive capacity helps to be more innovative. In car industry, keeping integration in-house reduces “technological progress” (Cusumano and Takeishi 1991: 566). Google was able to efficiently combine exploration and exploitation on that basis; it started with weak exploitive ties and turned to explorative phases with both strong and weak ties.

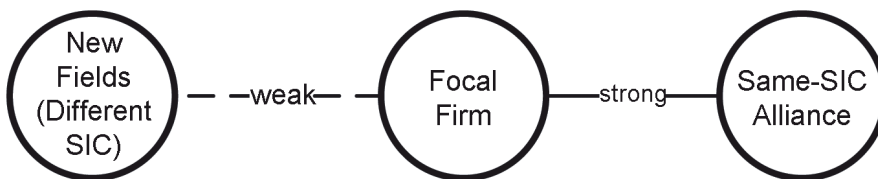


Figure 11: Tie Diversity Evolution through Phases (SIC Based) (Important Partners)

Proposition 8. Form weak ties with new fields (different SIC), strong ties with alliances of the same SIC type.

“Acquisitions and mergers often provide a more efficient organizational long-term form for utilizing synergies among firms than alliances because of lower transaction costs” (Hoffmann 2007: 835).

Tie strength and tie diversity differed in the case of total alliance from trends found for important partners (see above). Total alliance was clearly exploitation oriented. It is unexpected since in “turbulent environments” the exploration orientation prevails (Bierly et al. 2009: 501). Weak ties together with different SIC prevailed at market emergence. A few stronger ties and some ties with partners from the same SIC came into play at market take-off; finally they slightly turned back to the original state in the market growth phase.

5. Conclusions

In the contemporary world it is not enough to have an idea, there has to be also capability to implement it. These are the two sides of the same coin, you need to have one for the other; one cannot survive without the other. In academic strategic terminology these sides of the coin are called exploration and exploitation. The speed of technological breakthroughs and globalized world market has significantly raised the requirements for survival. It is not any more enough to face and tackle all the problems alone, the complexity and stakes are just too high for that, you need to get involved with networks to boost both exploration and exploitation. This is a third component of the coin, which helps to cope equally with both former sides (exploration and exploitation). The third component is called cooperation and by its nature it is alliance management capability with other relevant counterparts (1st RQ).

The neutral stand taken in this case showed independently similar tendencies. Activities observed in Google clearly formed the following capability families: exploration, exploitation, and cooperation. The data gave an opportunity to look at the tendencies longitudinally, through a period of one and half decades. Exploration developed from inward orientation to outward external orientation, which at last turned to diversification. Exploitation first paid attention to the core service; then expanded it globally without major modifications and finally turned to the diversification route (2nd RQ). In both cases alliances came into the game with a short delay, alliancing started earlier in exploitation than in exploration. Later Google skilfully selected some companies as its important alliance partners, with whom it had several alliances (strong ties) while with some others this did not happen (weak ties). In later phases, where diversification was in the focus, weak ties prevailed (3rd RQ). Today, Google has become a company in an entrepreneurial position in its business ecosystem, with the

main aim to provide resource management and leverage through its partners to grow bigger and more successful. The case also revealed threats that may occur if alliances are formed too late.

The authors' contribution was to give answer to all RQs by working out several propositions on the basis of comparing empirics (Table 1) with prior literature. Propositions need to be tested quantitatively in future.

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Article IV

Kolk, A and Rungi, M. (2013). Agility of Capability Development: The Multiple-Case Study of Ericsson, Google, Microsoft and Nokia. - *The IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*, Bangkok, Thailand, December 10-13, 2013. Thailand: IEEE, 2013.

Agility of Capability Development: The Multiple-Case Study of Ericsson, Google, Microsoft and Nokia

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Abstract – Dynamic capabilities are meant to cope with environmental changes, and since the changes happen more often and speed to market is increasing, then the ability to identify corresponding capabilities quickly is becoming extremely important. This study investigates the agility aspect of capability development in a qualitative setting on the basis of four large information and communication technology companies. Findings support that the existence of a supportive environment in the form of a large capability portfolio and large alliance portfolio are pre-requirements to speed up capability development in contemporary market circumstances.

Keywords - Dynamic capability, technology management

I. INTRODUCTION

This study is about the capability and alliance portfolios development and related issues, more specifically capability development speed. The capabilities development model is based on the organizational learning theory [25], resource-based view (RBV) [4], resource dependence theory (RDT) [31], networking and alliance management theory [32][19] and the dynamic capabilities theory [40][17]. This study combines insights from these models and extends the existing model in the perspective of capabilities development speed.

The research question is: how to speed up capability development in large multinational information and communication technologies (ICT) companies? The ICT industry is interesting due to its rapidly changing business environment.

II. METHODOLOGY

This study is part of a long term study focusing on large multinational ICT companies' capability development. For further details, refer also to earlier publications [35]. Four case companies were selected in accordance with multiple-case study recommendations [14]. The first case company, Ericsson is a Swedish telecommunication provider, which was founded in 1876 and had \$28 billion of revenue in 2009. The second case company, Google is an American Internet search provider, which was founded 1998 and had \$24 billion of revenue in 2009. Third, Microsoft is an American software and device provider, which was founded 1975 and had \$60 billion of revenue in 2009. Fourth, Nokia is a Finnish mobile devices provider, which was founded 1865/1871 and had \$41 billion of revenue in 2009. Empirical data was gathered from different sources to receive the triangulation effect

[45](pp. 98-99), such as interviews, press releases, annual reports, and economical and scientific articles.

For each case company, first, within-case analyses was prepared [45]. Within-case analyses provided the foundation to separate the evolution into three market periods: 1) emergence, 2) take-off, and 3) growth. For finding capability portfolios, all identified activities were categorized as capabilities for later analyses. For alliance portfolio, a secondary data source, electronic database SDC Platinum [36] was used.

III. THEORY – DEVELOPMENT OF THEORETICAL PROPOSITION

Growing market size and competition require higher capabilities development speed, and the current environment is illustrated as turbulent. In turbulent environments the R&D and innovation (exploration) orientation is dominating [8], in contrast to exploitation type of activities (e.g. production and logistics), which is suitable for stable environments and low uncertainty [22]. New product development cycles are becoming shorter [26][28][7](p. 8), “concluding in a virtuous ... cycle of continuously faster innovation” [7](p. 8) and established companies fight for radical and fast technological changes, and may surprisingly fail while listening “too carefully” to customers [10](pp. 197, 198, 205). Radical changes are difficult to adopt [43](p. 84), competition is changing [7](p. 17), e.g. there are continuous changes instead of rare radical changes [9](p. 1). The speed of “technological change” is increasing [7](p. 8), higher speed rate is a prerequisite to outperform others through a competitive advantage [13](p. 423). An early adopter may receive a competitive advantage [42](e.g. if “market share increases” “production costs fall”, company is “gaining more experience” [3](pp. 83-84)). “More people adopt a technology, the more it improves and the more attractive it is for further adoption” (positive feedback loop) [3](p. 92). On the other hand, being a pioneer is not effective, as fast imitation diminishes it [44]. For example, patents are only effective in a few industries and they are imitated quickly [7](p. 9). In any cases, it is hard for companies “to repeat their success when ... markets change” [10](p. 197). The options are selected between imitating and/or innovating [29], turbulence increases imitation [46].

From the lifecycle point of view, when uncertainty is high in the market emergence phase (Figure 1), there is demand for more active (shaping) involvement. In the later phases when uncertainty has decreased a more stabilising involvement is appropriate [19]. In case of a stabilized market with similar business models, companies are

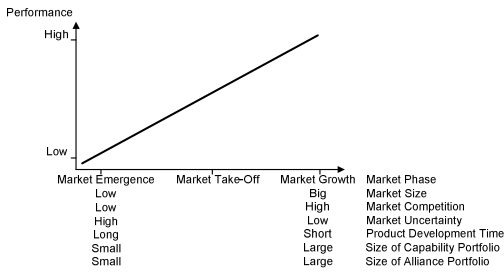


Fig. 1. Dynamics of key variables through different market phases.

strongly affected by fast growth of the market then they need to respond with faster development of capabilities for developing new capabilities and it is about benchmarking and copying others' capabilities.

Companies need to have good capabilities (skilful and competent resources) to face the competition. For skilful and competent resources companies can develop existing resources (organizational learning), choose competitively advantageous resources [4] or find them externally by controlling "critical resources" and gaining power by having them [41](p. 1659). Dynamic capabilities deals with developing "internal and external organizational skills, resources, and functional competences" to cope with them along with changing environmental needs [40](p. 515).

Capability development is related with organizational learning. From a resource development perspective, the organizational learning is important. There are two types of learning: adaptive and proactive/generative learning [37]. Intuitively, the learning is about acquiring new knowledge, skills and competences. New knowledge is built on the basis of an existing knowledge portfolio [8](p. 483). Ability to recombine the existing and new is a source for learning and innovation [18]. There are six capability development techniques: retirement, retrenchment, renewal, replication, redeployment or recombination [17](p. 1005), where especially recombination allows perspectives to achieve new knowledge [1](p. 200). In the case of a capability portfolio, it is reasonable to divide capabilities into exploration and exploitation portfolios [25], or into dynamic and operative capability portfolios [17]. Aspects for a total portfolio then need to be considered also for sub-portfolios, with following system theory approaches [6].

Path-dependency together with time emphasis is brought out by Schreyögg and Kliesch-Eberl [38](p. 916). Larger capabilities portfolio helps to increase development speed, at least it is seen as function of its development [11](p. 128). Regular reconfiguration and integration of capabilities helps to develop new capabilities in rapidly changing environments [40] and learn this way. Capabilities development is cumulative [21](p. 314)[8][46](p. 838), intuitively, there are more options for reconfiguration and integration if the capability portfolio is bigger. If the capabilities portfolio is bigger there are more integration and recombination opportunities [21]. Furthermore, research [34](pp. 824, 829)[47](p. 826) sees

raising benefits from combining capabilities. As a con, a large prior knowledge base may also negatively influence further performance [1](p. 201).

Alliance is defined "as any voluntarily initiated cooperative agreement between firms that involves exchange, sharing, or co-development, and it can include contributions by partners of capital, technology, or firm-specific assets" [16](p. 781). Companies with an exploitation orientation in particular have a large portfolio of alliances [19]. Larger alliance portfolio favours the increase of development speed. There could be missing parts in a capability portfolio, as one single company cannot cope totally alone [33], which needs to be learned. Hoffmann [19](p. 832) recommends alliances to overcome such problems quickly, because internal development takes more time. Podolny and Page [32](p. 57) say that alliancing helps to "foster learning". Missing parts can be quickly acquired through M&A [39] and alliancing. M&A and alliances are equally used (see [1](p. 198)[19][15]). Quick adoption is good for learning [21](p. 313). This depends on tie characteristics (e.g. [8][30][23]). However, transfer of capabilities might not be easily possible from company to company [24](p. 388), i.e. capabilities are built, not bought [12](p. 146). Another option to acquire required resources would be resource picking [24] in a way the resource-dependence theory sees it [31][41], but this is more appropriate for resources "close to each other" [24](p. 394). A sound ability for inter-firm knowledge transfer from existing alliance partners is important [21](p. 318)[28](p. 77). Frequency of entering alliances positively influences the performance [15]. Networking experience helps to learn to be more effective [2]. Hoffmann [19](p. 830) recommends alliances as a cure for "environmental uncertainty". Beckman et al. [5](p. 262, 263) note that for firm-specific uncertainty (exploration), the broadening alliance network "with new partners" is a positive and for market uncertainty (exploitation)(Figure 1), the re-forming of alliances "with existing alliance partners" is good. Portfolios are better originated from a big picture/ecosystem, not developed on the basis of single emerged ties [30].

A. Proposition development – summary

New product development cycles are getting shorter [26]. Regular reconfiguration and integration helps "to renew competences" [40](p. 515). New knowledge is built on the basis of existing knowledge portfolio, as it is cumulative [8](p. 483)[11]. Alliancing assists with competing more quickly [19](p. 831). Frequency of entering alliances positively influences the performance [15]. Companies (especially exploitation) have a large portfolio of alliances [19]. "Accumulated experience via alliances" assists with learning new capabilities [21](p. 313). Pre-alliance level of knowledge is important [28](p. 81), thus:

Proposition: Market and alliance portfolio centrality growth determines capabilities' development speed and affects focal firm performance.

The causal mechanism of the proposition is (Fig. 2):

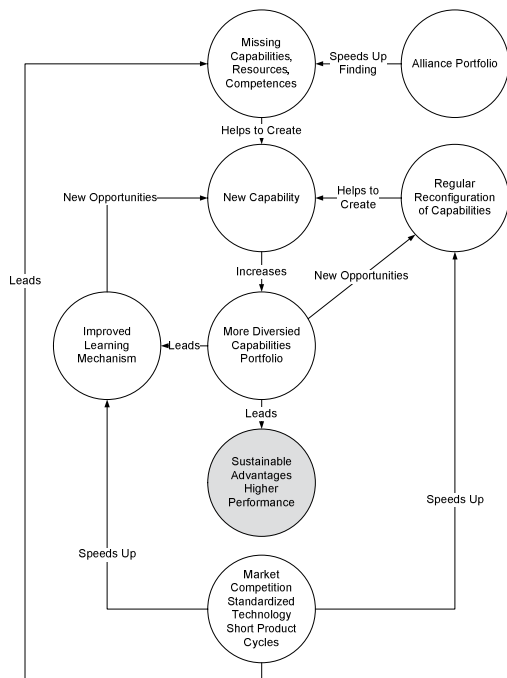


Fig. 2. Construct of agility factors in the capabilities development process.

- At the market emergence phase, when market size is small, learning is slow, NPD time is long, and uncertainty is high. In later market phases, the market size and learning are growing, uncertainty is becoming lower and NPD time is becoming shorter (Figure 1). New market characteristics require faster capability development and learning speed.
- Large capability portfolio speeds up learning from existing capabilities and through regular reconfiguring existing capabilities. The larger the capability portfolio, the better the opportunity to create new capabilities.
- Large alliance portfolio helps speeds up the process of finding missing capabilities and resources from an alliance. The larger the alliance portfolio, the better the opportunity to find missing parts.

IV. RESULTS – SUPPORTIVE FINDINGS

Quantitative data given in Table I moderately supports the proposition, because some key variables were unavailable such as market growth and capabilities development speed. Quantitative data for important alliances¹ shows that the tendency is only supported in the first two

¹ Important alliance: strong ties (i.e. repeated partnership) and no clear prevalence in tie diversity (i.e. same/different business field) (e.g. [19][30]).

phases – market emergence and take-off, where an increase in the number of alliances has caused an increase in the number of capabilities and performance indicators. At the market growth phase, the number of alliances has decreased, but the number of capabilities and performance indicators has continued to grow. Exploration is seen as a source for new partners and exploitation as a source for existing partners [5], however, opposite to this, the number of alliance partners grew throughout the phases in both subfields despite the fact that exploitation prevailed in later phases [23].

The speed of development and competition among key products was separately analysed (such as search engine, map and mobile OS). Rungi and Kolk [35] found that adaption dominates over proactive behaviour, and where partnerships and open innovation together with free platforms are widely used, this all happens in circumstances of large product portfolios, heavy competition and significantly decreased development times, which all partly supports the proposition.

Due to the incompleteness of the quantitative model, some tendencies were analysed qualitatively. These tendencies are case companies’ managers’ opinions about alliances and business ecosystems, which are discussed next.

A. Empirics for alliancing and ecosystem

Case companies identified many possibilities in alliancing and M&A and they were interested in increasing the number of alliances, joint ventures and M&A in order to achieve better performance. For example, MS used to have 38,338 vendors [20](p. 66):

“Microsoft has always sold through partners and has built a strong partner ecosystem around them. If MS gets \$1 then partners will make \$7-14 themselves.”

(Country Manager, MS, commenting on mutual benefits from partnerships, 2011)

Companies are regularly searching for new opportunities to increase the performance:

“There are 1.3 billion computer users and almost 4 billion mobile phone users so the focus has to turn to the mobile market which was now done with Nokia.”

(Country Manager, MS, explaining opportunities from joint activities, 2011)

However, there was also an indication not to go too far with this acquisition process:

“Around the year 2000 the dot-com boom resulted in a huge number of acquisitions. Now the situation has shifted to being more effective.”

(Country Manager, MS, commenting on slowing down M&A, 2011)

“What we have identified that if we buy for medium size opportunities it slows you down more than it accelerates you. Therefore you buy only for large, locomotive type opportunities or you buy very intellectual property that you can ingest very quickly – those

TABLE I
IMPORTANT ALLIANCES, CAPABILITIES AND PERFORMANCE

| Comp. | Market emergence | | | Market take-off | | | Market growth | | |
|-----------|---------------------------|---------------------|--------------|---------------------------|---------------------|--------------|---------------------------|---------------------|--------------|
| | No. of included alliances | No. of capabilities | Productivity | No. of included alliances | No. of capabilities | Productivity | No. of included alliances | No. of capabilities | Productivity |
| Ericsson | 99 | 9 | 304,32 | 182 | 12(3) | 900,45 | 26 | 14(2) | 987,44 |
| Google | 2 | 11 | 92,83 | 10 | 15(4) | 241,46 | 32 | 20(5) | 527,29 |
| Microsoft | 171 | 13 | 106,46 | 727 | 19(6) | 216,79 | 141 | 23(4) | 357,55 |
| Nokia | 50 | 10 | 171,30 | 128 | 16(6) | 333,52 | 60 | 20(4) | 652,26 |

(x) – no. of included capabilities; capabilities were identified, categorized and counted on the basis of case data

are more engineering acquisitions.

(Vice President (VP), MS, commenting on M&A threats when buying medium size opportunities, 2010)

As a next step from alliancing, companies build business ecosystems, where companies across “a variety of industries” “work cooperatively and competitively to support new products, satisfy customer needs, and eventually incorporate the next round of innovation” [27](p. 76).

“Partner ecosystem is for developing partner capabilities to be able to sell Microsoft’s products and solutions to Microsoft’s platform. Partners are evaluated and to get certifications certain exams need to be passed that give a guaranty about the quality.”

(Financial Manager, MS, commenting on selling in an ecosystem, 2011)

“Microsoft has always been about developing an ecosystem, build a platform. That gives you a great advantage, you keep entrepreneurial people in their own environments, you continue to give them the control and you make sure you link those light integrations through APIs. So they have to be stronger partnerships that are really built on a joint view of the future and about a partnership that is not just about extending or connecting a couple of technologies today, but they look at what can they jointly achieve in the marketplace of tomorrow.”

(VP, MS, commenting on Microsoft’s ecosystem, 2010)

“The two things that are super important to maintain are your external connection points with the industry which happens through venture capital, so we spend far more time with the large venture capital firms than we used to, in order to make sure we are constantly connected.”

(VP, MS, commenting on the role of business ecosystem, 2010)

For ventures and other types see Mowery et al. [28](p. 80), there are also a wide stream of cluster literature.

“The benefit that we get is that the ecosystem is now coming to us, because they tend to see the other large guy as a threat in any way and that is something that we are trying to take advantage of by building up sort of partnerships and fundamentally opening up what our technologies are to others. Therefore you can talk about the partner friendly approach, but making sure that you are actually opening up your capabilities to the ecosystem to take advantage, that’s the proof

points that you actually need in order for them to connect.”

(VP, MS, commenting on recent trends in an ecosystem, 2010)

Prior qualitative empirical evidence about large usage of alliances is in accordance with the proposition.

V. CONCLUSION

Capability development is a complex and controversial issue, on the one hand, there is no path dependency – imitation prevails [35], on the other hand, quick response to market changes can happen if a company has a solid base – large prior capability and alliance portfolios (i.e. path dependency).

To respond in a flexible way to the competitors’ activities the focal company must be prepared for it. The readiness is guaranteed by the number of the capabilities in the portfolio. Thus, the more capabilities a company possesses, the more urgently the firm is capable of reacting. The alliance management capability is essential, because development of the new capabilities is supremely dependent on the support from the alliances.

General managerial recommendations are given to put an emphasis on pre-requirements for fast adaption – large capability and alliance portfolios.

Novelty of this research is the causal mechanism (Figure 2). Larger portfolio of capabilities and alliances in the strong market competition are the true causes for speeding up the development of capabilities. Market competition and shorter product cycles force companies to react more quickly. Companies are capable of this if a supportive environment exists in the form of large capabilities and alliance portfolios, which helps to form new capabilities much more easily than acting in isolation.

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CURRICILUM VITAE

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| Tallinn University of Technology | Expected 2014 | PHD |
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3. Language competence/skills (fluent; average, basic skills)

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| Estonian | Mother language |
| English | Excellent |
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| 2013 - | European Innovation Academy | President |
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5. Research Activities

Research Articles

Kolk, A and Rungi, M. (2013). Agility of Capability Development: The Multiple-Case Study of Ericsson, Google, Microsoft and Nokia. - *The IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*, Bangkok, Thailand, December 10-13, 2013. Thailand: IEEE, 2013.

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Current research topics

Innovation management. Opportunity recognition and entrepreneurship process. Business model design and execution. New venture financing.

6. Defended Theses

Master's Degree:

Adapting Balanced Scorecard: Developing Strategic Management in Business Support Agency. Supervisor professor Jaak Leimann. Tallinn University of Technology, 2004.

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| Elva Keskkool | 1992 | Keskharidus |

3. Keelteoskus (alg-, kesk- või kõrgtase)

| Keel | Tase |
|----------------|-------------|
| Eesti keel | Emakeel |
| Inglise keel | Suurepärane |
| Vene keel | Keskase |
| Prantsuse keel | Algtase |

4. Teenistuskäik

| Töötamise aeg | Tööandja nimetus | Ametikoht |
|--------------------------|---------------------------------------|-------------------------------------|
| 2013 - | Euroopa Innovatsooniakadeemia | Nõukogu esimees |
| 2011 – 2013 | Tallinna Tehnikaülikool | Prorektor |
| 2006 – 2011 | EV Rahandusministeerium | Nõunik |
| 2002 – 2006 | EAS | Juhatuse esimees, juhatuse liige |
| 2001 – 2002 | Eesti Tehnoloogiaagentuur | Peadirektor |
| 2000 – 2001 | Sihtasutus Eesti Innovatsioonifond | Juhataja |
| 1999 – 2000 | EV Majandusministeerium | Peaspetsialist |
| 1994 – 1999 | Erakonsultant | Konsultant |
| 1993 – 1994 | EVEA | Lõuna-Eesti esinduse juhataja |

5. Teadustegevus

Teaduspublikatsioonid

Kolk, A and Rungi, M. (2013). Agility of Capability Development: The Multiple-Case Study of Ericsson, Google, Microsoft and Nokia. - *The IEEE International Conference on Industrial Engineering and Engineering Management (IEEM), Bangkok, Thailand, December 10-13, 2013. Thailand: IEEE, 2013.*

Kolk, A. and Rungi, M. (2012). Total Exploitation Orientation in Capability Development: The Cross-case of Google, Ericsson, Microsoft and Nokia. *Research in Economics and Business: Central and Eastern Europe*, 4(2), 5 - 25.

Rungi, M. and Kolk, A. (2012). Capability Development - No Path, Response to Competition: The Cross-case of Google, Ericsson, Microsoft and Nokia. *The IEEE International Conference on Industrial Engineering and Engineering Management (IEEM), Hong Kong, China, December 10-13, 2012. China: IEEE, 2012, 689 - 693.*

Rungi, M. and Kolk, A. (2011). Trajectory Evolvments of Capability Families: The Google Case. *University-Business Cooperation Tallinn 2011 (214 - 239)*. Germany: Berliner Wissenschafts-Verlag

Kolk, A. and Võõras, M. (2009). Estonian space policy and governance in the international space community. *Space Policy*, 25(4), 218 - 223.

Teadustöö põhisuunad

Innovation management. Opportunity recognition and entrepreneurship process. Business model design and execution. New venture financing.

6. Kaitstud lõputööd

Magistritöö:

Adapting Balanced Scorecard: Developing Strategic Management in Business Support Agency. Juhendaja professor Jaak Leimann. Tallinna Tehnikaülikool, 2004.

Bakalaureusetöö:

Managing Complex Organisations. Juhendaja professor Maaja Vadi. Tartu Ülikool, 1999.

**DISSERTATIONS DEFENDED AT
TALLINN UNIVERSITY OF TECHNOLOGY ON
*ECONOMICS***

1. **August Aarma.** Segmented Analysis of Bank Customers and Banking Information: Estonian Case. 2001.
2. **Enn Listra.** The Development and Structure of Banking Sector: Retail Banking in Estonia. 2001.
3. **Tatyana Põlajeva.** The Comparative Analysis of Market's Attractiveness. 2001.
4. **Tuuli Tammeraid.** Modeling Flow of Funds for Estonia. 2002.
5. **Ivo Karilaid.** The Choice in General Method for Investment and Performance Evaluation. 2002.
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9. **Ly Kirikal.** Productivity, the Malmquist Index and the Empirical Study of Banks in Estonia. 2005.
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