

Managing Innovation Ecosystems to Create and Capture Value in ICT Industries

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*“Great discoveries and improvements invariably”
involve the cooperation of many minds.*

Alexander Graham Bell (1847–1922)
Scientist, inventor, and a founder of Nokia Bell Labs

In a new knowledge-intensive economic landscape, firms need to access external knowledge sources due to their inability to generate all necessary knowledge on their own. The interaction with and learning from external knowledge sources implies that firms depend upon decisions and actions made by business partners and external support organizations. This network of linkages can be considered as an ecosystem in which commercial enterprises and non-firm organizations interact with one another and work together to create and capture value. Previous studies have shown that a firm's ability to successfully commercialize a new product depends not only on its own technology strategy but also its capabilities to manage an innovation ecosystem strategy. Dynamic markets, intense competition, and shorter product lifecycles force companies across different industries to create and capture value more rapidly by launching new innovations. Well-defined and executed innovation ecosystem strategies can help companies to develop new markets and business opportunities for the different types of innovations and enable their businesses to grow. This study provides new insight into how an ecosystem strategy can be formed based on the traditional strategy literature and proposes a conceptual framework for senior leaders to form an ecosystem strategy.

Introduction

Capability to create new innovations is important for both large and small companies to enhance growth. In order to achieve this, an organization must have: i) in-depth understanding of innovation dynamics, ii) a well-crafted innovation strategy, and iii) well-designed processes for innovation, with iv) the innovation ecosystem and external collaborators that will enable it to bring in complementary assets to the innovation process (see e.g., Adner, 2006; Teece, 2007; Pellikka, 2014). In order to co-evolve capabilities, to incorporate a new round of innovations, and to satisfy changing customer needs, many companies have started to seek new business opportunities with the other key players. This article focuses on the "innovation ecosystems" that can be defined as a network of interconnected organizations that is organized around a focal firm or a platform, and incorporates both production- and use-side participants, and focuses on the development of new value through innovation (see Autio & Thomas, 2014). This

definition goes beyond the current thinking by addressing the challenges and opportunities emerging via digitalization, new developments in information and communications technologies (ICT) and new resources such as big and small data.

Working cooperatively with other players such as private and public organizations and consumers as a quadruple helix (Arnkil et al., 2010) provides companies new ways to take advantage of other organizations' technologies, processes, and brands. Adding consumers as the fourth type of actor in the helix also introduces a new type of system dynamics to the existing ecosystem models. Research on ecosystems applied to human multi-actor assemblages is only emerging based on, for instance, the observed nature of the different types of ecosystems (Valkokari, 2015) or their different dynamics and network structures (Ali-Vehmas & Casey, 2012). Along with new opportunities, however, the emerging network of dependencies between the different parties of the innovation ecosystems also presents a

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new set of risks and uncertainties that need to be taken into account when managing and developing the desired innovation ecosystems. Systems thinking, ecosystems, and digitalization have become a core element in several industry sectors where firms seek new ways to accelerate growth (Adner, 2006). The capability of a group of companies to adapt to the changes in the market and at the same time maintain a high degree of productivity requires collaborative structures and styles between the organizations that would ultimately determine whether the group is only a group of independent self-driven but cooperating companies or a resilient business ecosystem (Crespo et al., 2014).

In today's dynamic business environment, an organization's capability to catalyze the emergence and guide the development of a business ecosystem offers increasing potential as a powerful source of competitive advantage that underlines the importance of ecosystem strategies and their execution (e.g., Rohrbeck et al., 2009; Williamson & De Meyer, 2012). For example, Adner (2006) highlighted that depending on others in the innovation ecosystem has two important strategic implications: timing of market entry (i.e., getting to market ahead of your rivals is of value only if your partners are ready when you arrive) and resource allocation (i.e., allocating resources externally to the relevant partners can be more effective than allocating resources internally). In addition, Williamson and De Meyer (2012) listed six ways organizations can realize the benefits of the ecosystem: i) pinpointing the added value, ii) structuring differentiated partner roles, iii) stimulating complementary partner investments, iv) reducing transaction costs, v) enabling flexibility and co-learning, and vi) engineering value-capture mechanisms. However, it is not clear how organizations should use these approaches in different types of ecosystems. Moreover, companies must understand the potential impact of digitalization and digital technologies on their strategy to create and capture value both at the organizational and ecosystem levels (Bharadwaj et al., 2013). Therefore, organizations must be able to identify in greater detail the key value-creation elements, drivers, and constraints (Ali-Vehmas & Casey, 2015; Davidson et al., 2015).

Taken together, the perspectives described above led us to formulate the main research question of this study:

What are the key differences between business strategy formulations based on a single company and innovation ecosystem perspective?

This article provides a conceptual setting of a new research project that is designed to answer this research question by identifying an extended set of strategies for innovation ecosystems and their stakeholders, including multiple dependencies. The aim is to complement the large body of research on value creation and capture a single-company perspective. The article is organized as follows. First, we present the key concepts of the study and the relevance of the ecosystem and collaboration strategies. Then, we describe our conceptual analysis and the project's preliminary findings. Finally, we describe key managerial implications and avenues for future research.

Key Concepts

Collaborative models depend on multiple different factors such as the logic of action (Valkokari, 2015). However, if and when ecosystems follow different logic, the collaboration between the ecosystems becomes a new, higher-level challenge of a system of systems, including the fact that companies may be members of different ecosystems at the same time. Therefore, we must first summarize the three key concepts – namely knowledge, benefits, and innovation – that will form the basis of our conceptual analysis of innovation ecosystems.

Knowledge

Knowledge and information have become primary wealth-creating assets of firms; they are essential for innovation management and for developing and maintaining competitiveness. According to the systemic view of innovation, the search for and acquisition of technological knowledge and information should be regarded as a process in which a number of agents interact with each other and their external socio-economic environments (e.g., Lundvall, 1992). In the knowledge-based economy, companies are particularly dependent on the knowledge resources of other firms and organizations. The competitiveness of a firm in a dynamic business environment depends on the competitive quality of its knowledge-based assets and the successful application of these assets in operational activities in order to fulfil its strategic objectives (Teece et al., 1997). Efforts to acquire (and apply) knowledge can be implemented via contributions by universities, research institutes, government agencies, suppliers, clients, and other companies. The success of a company in turbulent markets depends on its ability to further develop, implement, and maintain – as well as exploit – the combination of the internal and external sources of knowledge and data (e.g., Pellikka, 2014).

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Benefits

The potential business benefits for a private company engaging in inter-organizational collaboration can be summarized as follows:

1. *Increased profitability.* Collaboration can enable a firm to obtain necessary skills or resources more quickly than developing them in-house (Harper & Georghiou, 2005). When a dynamic technology market is changing rapidly, firms may want to avoid committing themselves to fixed assets that may rapidly become obsolete, which is a common challenge for instance in the modern pulp and paper industry.
2. *Shortened time to market.* Obtaining some of the required capabilities (e.g., for research and development activities) from the business partners rather than building them in-house can help a firm, for example, to reduce its financial asset commitment and therefore enhance its flexibility. This might be especially important in small technology firms, where financial resources may be limited (Lawton-Smith, 2004; von Hippel & von Krogh, 2006).
3. *Enhanced innovation capability and learning.* Collaboration with partners can be an important source of learning for the firm (Lawton-Smith, 2004). By transferring and pooling their technological know-how and resources, firms may be able to expand their knowledge bases and competences (e.g., Allocca & Kessler, 2006).
4. *Expanded market access.* Firms may also collaborate to facilitate the creation of a new standard (Schilling, 2008) when there is a need for regulation or to address a larger base of customers. Collaboration in the development phase can be a crucial way of ensuring partnering in the commercialization phase of a technology, and such cooperation (e.g., via standardization) may play a highly important role in securing compatibility and reducing market uncertainties.

Innovation

Innovations result from a complex, interactive, and interdependent process involving multiple actors and influences within dynamic systems, rather than arising exclusively from the internal research and development activities of commercial enterprises. Inter-organizational collaboration can provide a strong basis for the generation of innovation, and provide other potential benefits, such as facilitating access to new technology and entry to new markets through licensing

(Chiaroni et al., 2008). Carayannis and Campbell (2009) evaluated the key concepts that have played a role in the formation of the knowledge-based economy and in knowledge creation. They highlight that the conceptual settings have changed in many ways and therefore there is a need to understand the new ways in which knowledge production, utilization, and renewal take place in the knowledge economy. They define a 21st Century innovation ecosystem as "a multi-level, multi-modal, multi-nodal and multi-agent system of systems" and state that "the constituent systems consist of innovation meta-networks (networks of innovation networks and knowledge clusters) and knowledge meta-clusters (clusters of innovation networks and knowledge clusters) as building blocks" (Carayannis & Campbell, 2009). Continuous forming, re-forming, and dissolving are characteristic of the innovation ecosystems due to the fractal interplay of the diverse institutional, political, technological, and socio-economic domains including government, universities, industry, non-governmental organizations, as well as the consumers who are applying the new digital information and communication technologies.

Conceptual Analysis

In order to analyze the linkage between traditional business strategy and the innovation ecosystem perspective specifically, we started our analysis by summarizing the traditional strategy-related literature (see Table 1). Traditionally a corporate strategy can be defined as "a pattern of decisions that determines and reveals its objectives, purposes, or goals, produces the principal policies and plans for achieving those goals, and defines the range of business the company is to pursue, the kind of economic and human organization it is or intends to be, and the nature of the economic and noneconomic contribution it intends to make to its shareholders, employees, customers and communities" (Andrews, 1980). A successful business strategy requires a fit between all the elements discussed in the literature. The same is valid for innovation ecosystems but in a different way. As a practical contribution for senior leaders, Table 1 also lists key questions that complement the traditional strategy literature by highlighting the role of ecosystems, inter-organizational collaboration, and open innovation approaches that have been especially enabled by technological developments and digitalization. Analyses of the collaborative networks based on systems thinking and system dynamics can provide additional projections to the strategic problems related to ecosystems and also to system-level collaboration between the ecosystems.

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Table 1. Questions arising when an innovation-ecosystem strategy perspective is applied to the traditional business-strategy literature

Dimension	Traditional Business Strategy	Innovation Ecosystem Strategy
Vision	<ul style="list-style-type: none"> Does our organization have a vision that is clear, consistent, and understandable? <p>(Davidson, 2005; Mintzberg & Quinn, 1996)</p>	<ul style="list-style-type: none"> Has our organization developed a vision of how an innovation, product, technology, or service could become an essential part of a business ecosystem? What different roles does digitalization play in our business strategy? <p>(Bharadwaj et al., 2013; Gawer & Cusumano, 2014)</p>
Industry & Business Environment	<ul style="list-style-type: none"> What are the key characteristics of our industry and the current business environment including inter-organizational structures? How can we win given the competitors in the potential field available to us? <p>(Christensen, 2002; Mintzberg & Waters, 1985; Porter, 1980)</p>	<ul style="list-style-type: none"> What are the impacts of our actions on our strategic partners in terms of their performance in the ecosystem? What collaboration models exist in the target industries and which one is best aligned with our corporate innovation model? How do the current value systems work and how they may change in the future? <p>(Ali-Vehmas & Casey, 2012; Easley & Kleinberg, 2010; Iansiti & Levien, 2004)</p>
Goal Setting	<ul style="list-style-type: none"> Are all our efforts directed toward clearly understood, decisive, and attainable goals against which we can measure our progress? <p>(Martin, 2010; Mintzberg & Quinn, 1996)</p>	<ul style="list-style-type: none"> What are our key business objectives and key performance indicators that we are trying to achieve via partnerships in our ecosystem? How can we measure value creation and capture in our ecosystem? <p>(Adner, 2006; Teece, 2009)</p>
Resources & Capabilities	<ul style="list-style-type: none"> How should our firm's resources be allocated to create an exploitable advantage? What capabilities are necessary for our firm to build, maintain, and continuously improve competitiveness? <p>(Helfat & Peteraf, 2003; Peteraf, 1993; Teece et al., 1997)</p>	<ul style="list-style-type: none"> Have we identified the key organizations in our ecosystem that can provide us with, for example, technology-related assets, funding, or other complementary assets for our business? Have we agreed upon a configuration and valuation of contributions (i.e., knowledge, products, channel)? What open innovation approaches can we use to combine internal and external assets into effective architectures and systems that will generate innovations? <p>(Dittrich & Duysters, 2007; Doz & Hamel, 1998; Enkel et al., 2009; Laursen & Salter, 2006; Nambisan & Baron, 2012; Williamson & De Meyer, 2012)</p>
Organizations & Systems	<ul style="list-style-type: none"> What kind of organizational structure, management systems, and mechanisms do we need to operate, build, and maintain the key capabilities and create value for our shareholders and customers? <p>(Caves, 1980; Miles et al., 1978; Payne & Frow, 2005)</p>	<ul style="list-style-type: none"> What is the operational scope of inter-organizational collaboration that defines the activities and tasks jointly performed by our partners? How will the ecosystem activities and regular interactions between the organizations be governed? <p>(Doz & Hamel, 1998; Gilsing et al., 2008; Perrons, 2009; Schilling, 2008)</p>

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Conclusions and Managerial Implications

A traditional view of a strategy stresses the external dimension from the point of competition instead of inter-organizational collaboration to seek growth and commercialize innovations. In contrast, the ecosystem view has been relatively neglected in the traditional strategy literature. We suggest that an individual company's business performance and capabilities to capture the value of innovation are increasingly dependent on its capabilities to manage assets and resources outside its direct control and therefore innovation-ecosystem strategy perspectives such as co-creation, networking, and interaction with innovation-ecosystem partners plays a crucial role (see also Iansiti & Levien, 2004; Wu, 2012). We also recommend that increasing collaboration in an ecosystem can provide the early signals of significant technological and industrial reconfiguration or a "technology shock" (i.e., technological and business model changes that affect production outcomes through either different types of new innovations or major improvements of the existing ones) (see also Iansiti & Levien, 2004; Schilling, 2015). Thus, executives should systematically identify the organizations with which the future is most closely intertwined and determine the network of dependencies that will contribute to business growth and renewal.

Our study also highlights the importance of a common vision among the innovation ecosystem participants, which leads to alignments with goal settings and a preferable industry and business environment for the overall innovation. In addition, the decisions related to resource allocations and using shared capabilities via collaboration are also crucial to meet the actual expectations of all the ecosystem participants. For the leading company in an innovation ecosystem to tap into the innovative capabilities of an ecosystem of external firms, it needs to: i) develop a vision for the innovation ecosystem and promote it among potentially key players, ii) build a sufficiently open or modular architecture to facilitate ecosystem-wide innovation, iii) carefully manage innovation ecosystem relationships that are mutually beneficial for participants, and iv) continue evolving the ecosystem to remain competitive as challengers emerge (see also Autio & Thomas, 2014; Gawer & Cusumano, 2014; Iansiti & Levien, 2004). However, it is important to note that the different roles of different types of organizations in the innovation ecosystem – where ambitions of knowledge ecosystems and business ecosystems may conflict – are crucial ecosystem-specific concerns. Strong reactive competition inside an ecosystem represents positive feedback and makes

the ecosystem oscillate whereas internal consensus-seeking coordination is a negative feedback process (i.e., a stabilizing element). The ecosystem leader may, however, want to increase competition among other parties in order to maintain its leading position and further enhance structures to be mutually beneficial for the ecosystem participants (see also Perrons, 2009). Strong control mechanisms are not needed in fully voluntary collaborative ecosystems where all the participants share the common evolutionary views related to all the factors of Table 1, but in disruptive innovation ecosystems, the alignment may not be achieved automatically.

As for further avenues for ecosystem research, there is an obvious need to understand the role of the collaboration networks in more detail where the structure, characteristics, and dynamic changes in the collaboration may happen without any conscious action of any innovation ecosystem participant. The role of the weakest link as a hindering point for growth may be more important than the strength of the leading company. Furthermore, digitalization has shortened the delays in information and knowledge networks and the same is now taking place in business delivery networks. The stability – or deliberate instability – of the ecosystems may also cause concerns. Although single-company strategies can assume the internal networks in a company to be well understood based on the organizational hierarchies, the situation in innovation networks is fundamentally different. In addition, when externally observed, ecosystems need positive network effects, which will increase the dynamic output of the ecosystem. External competition can make the ecosystem internally more coherent and it can motivate large investments and therefore more capabilities for the ecosystem to compete and improve. In addition, since the 1990s, the emergence of open innovation approaches due to, for example, digitalization, market dynamics, and dispersed value chains has also challenged the traditional view of business strategy.

Across many firms spanning different industries and sectors, digital technologies (viewed as combinations of information, computing, communication, and connectivity technologies) are fundamentally transforming business strategies, business processes, firm capabilities, products and services, and the ways in which companies are forming and implementing their ecosystem strategies (see e.g., Easley & Kleinberg, 2010). Therefore, the impact of digitalization on business strategy and further developments is essential to take into account in forthcoming studies (both qualitative and

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quantitative). In addition, the observations of this study can be used to selected use cases, for instance in the area of digitalized healthcare. The analysis uses the digitalized data as the value-creating asset rather than traditional assets of a physical nature such as equipment and labour. The data consists of any data, information, knowledge, and even wisdom collected, developed, and utilized in the use cases by the ecosystem participants. The simple network model based on the data is used to understand the dependencies between the ecosystem stakeholders and to identify the borders of the ecosystems. If there is an actor who traditionally has been part of the value chain but actually neither contributes nor utilizes any digital data, the actor may not be relevant in the digitized projection of the ecosystem.

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Timo Ali-Vehmas is a Nokia Fellow and currently works as Head of Ecosystems Research at Nokia Technologies in Espoo, Finland. In his previous role, he was in charge of Nokia's standardization activities as the Vice President, Compatibility and Industry Collaboration, including Nokia's contributions to forums such as the 3GPP, ETSI, CCSA, ITU, IETF, W3C, OMA, DLNA, IEEE, WFA, BT, and many others. He has been working at Nokia since 1980 in a number of different areas, including R&D manager of the first Nokia GSM mobile phone and later Vice President, WCDMA Product Programs in Nokia Mobile Phones. He was also tasked to establish the Radio Communication Laboratory in the Nokia Research Centre. For several years, he has been also a member of the European Union's Open Innovation Strategy and Policy Group (OISPG). Since 2012, Timo has served as the Chairman of the Board of Nokia Foundation and since 2008 has been a member of the Board of the Walter Ahlström Foundation.

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