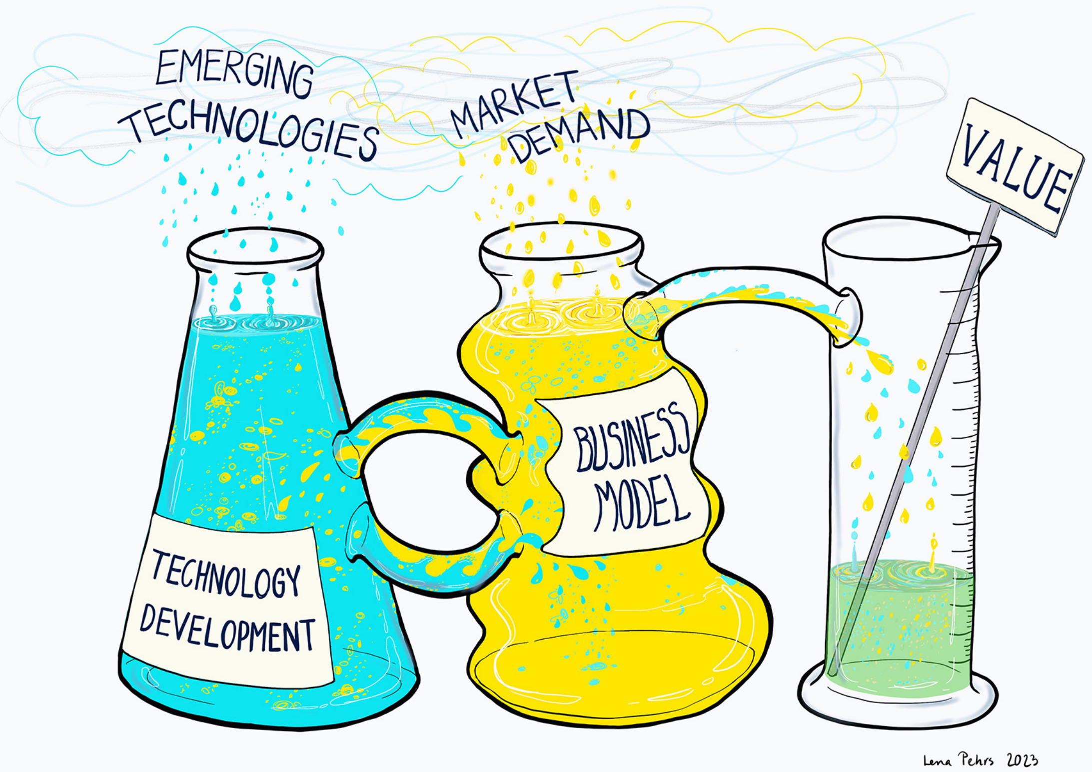
Mats O. Pettersson

CHARTING THE UNCHARTED

HOW AN INDUSTRIAL FIRM USES BUSINESS MODEL INNOVATION TO CAPTURE VALUE FROM EMERGING TECHNOLOGIES



STOCKHOLM SCHOOL OF ECONOMICS

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The modern business landscape is rapidly evolving, driven by breakthroughs in technology. This thesis investigates how a traditional, established firm, Ericsson – a leader in telecommunications – navigates and adapts to these changes. Specifically, it examines how the firm transforms its business models to leverage emerging technologies, such as artificial intelligence (AI) and 5G mobile networks.

The thesis delves into the challenges and strategies of integrating these emerging technologies into an existing firm, emphasizing the need for business model innovation. It highlights the business model innovation process for two variants of service-based business models: performance-based and software-as-a-service (SaaS)-based models, where the firms sell an outcome or a result rather than products. The thesis also explores how the firm prepares for multi-actor business models that foster collaborative innovation ecosystems. These strategies enable firms to access new markets and customer segments, enhancing their ability to create and capture value in a rapidly changing technological landscape.

Through detailed case studies and comprehensive research, the thesis provides valuable insights for both academic scholars and industry practitioners. It illuminates the business model innovation process and its critical role in ensuring that firms stay competitive and profitable in the face of emerging technologies. Hence, this thesis serves as initial coordinates to chart what remains uncharted in this rapidly evolving field.

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To
Ulrika & Gustav

Foreword

This volume is the result of a research project carried out at the Department of Entrepreneurship, Innovation and Technology at the Stockholm School of Economics (SSE).

The volume is submitted as a doctoral thesis at SSE. In keeping with the policies of SSE, the author has been entirely free to conduct and present his research in the manner of his choosing as an expression of his own ideas.

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Solna, November 27, 2023

Mats O. Pettersson

Contents

Chapter 1

Introduction

The background of this thesis lies at the intersection of two worlds: the industry world of practitioners and the scholarly world of academia. My journey began in the industry world, where I worked for a long time at Ericsson, a world-leading telecommunications firm. For more than a decade before my PhD journey, I was deeply engaged in business models and business model innovation at Ericsson. Initially, I participated in practical business model changes, and later I began conceptualizing, educating, and consulting different business model innovation engagements at the firm. Reflecting on these engagements, I observed a recurring theme: while the business model innovation often created value for our customers, the firm's ability to capture that value was not straight forward.

After driving a corporate initiative – the Ericsson Business Model Transformation Program – I had the opportunity to take a course with Clayton Christensen at Harvard Business School. The course, which covered business model challenges in incumbent firms and combined industry case studies with academic theory, resonated very well with my perspective on the challenges incumbent industrial firms face when trying to capture value from emerging technologies, but also highlighted areas that continued to puzzle me. This curiosity led to an epiphany, and I realized that my 15 years of hands-on insights into business model innovation could be valuable to academia and that I could contribute to both worlds. Encouraged by this realization and backed by the support of my manager, I leaped into the scholarly world in 2018, embarking on an industry-PhD journey. It was precisely at this junction – where my industry-based insights into business model innovation underwent academic scrutiny – that the central themes of this thesis found fertile ground for exploration.

The competitive environment of *incumbent industrial firms*[1] is affected by acceleration in the innovation of information and communication technologies, often spurred by *emerging technologies*[2], such as mobile technologies and artificial intelligence (AI). This (paper-based) thesis addresses how emerging technologies influence an incumbent industrial firm's business model innovation process as they strive to capture value from such technologies. The thesis provides a detailed illustration of the strategies, challenges, and critical factors shaping the firm's business model innovation process. It contributes to the academic discourse on business model innovation while providing practical guidance for firms on a similar transformative journey. The central research questions being addressed are:

In the context of an incumbent industrial firm:

How do emerging technologies impact the business model innovation process, and how does value capture unfold within this process for specific business models?

The introduction of emerging technologies requires that incumbent industrial firms explore new approaches to utilizing these technologies to both create and capture value (Amit and Zott, 2020). The initial response from many incumbent firms is to integrate emerging technology into their existing operations to improve efficiency and lower costs; however, the shift prompted by these technologies is far more fundamental, affecting the very core of the firm (Amit and Zott, 2020), presenting both opportunities

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[1] An incumbent industrial firm is here understood as an established firm in an industrial sector, one that likely holds a significant market share, resources, or capabilities. These firms often face different challenges and opportunities compared to newer entrants or smaller competitors, particularly in terms of innovation, adaptability, and response to market changes.

[2] Emerging technologies are new technologies treated as "emerging" 'because their uses and effects are still varied and have yet to stabilize around a recognizable set of patterns and because the technologies themselves are, by design, constantly changing and adapting' (Bailey et al., 2022 p. 1).

and challenges for incumbent industrial firms. At the same time, it is challenging for many incumbent firms to appropriate the value of emerging technologies (Zott and Amit, 2020; Gambardella and McGahan, 2010; Rotolo et al., 2015; Teece, 2018). To stay competitive, these firms urgently need to innovate their business models (Amit and Zott, 2020; Teece, 2018). Yet, the ADL Global Innovation Excellence Benchmark survey (based on 500 international technology and innovation management practices) reveals that only a fraction of firms adequately invest in business model innovation, and even fewer report success in this area (Arthur D. Little, 2023). These facts underscore the urgent need for deeper insights into the business model innovation process.

The impact of emerging technologies on incumbent industrial firms brings the terms of business models and business model innovation to the top of executives' agendas (Zott et al., 2011; Christensen et al., 2003). Neatly articulated by one of Ericsson's prominent customers, Chairman Wang Jianzhou of China Mobile, "It is not only about the technology but also the business model" (Mobile World Live, 2009). Although the relationship between technology development and business model innovation has been explored in the literature, there remain unexplored intricacies in the relationship (Baden-Fuller and Haefliger, 2013), especially concerning emerging technologies. The existing literature has also established the need for a more granular and holistic view of the interdependencies among internal and external activities that link value creation and value capturing (Lanzolla and Markides, 2020). Additionally, there is a need for further research on the business model design process and its impact on the performance outcome of business model innovation (Snihur et al., 2021). These existing research gaps create an opportunity to delve deeper into how emerging technologies influence an incumbent industrial firm's business model innovation process as it seeks to capture value.

The literature on business model innovation identifies various transitions that industrial firms use to capture the value of emerging technologies. One common transition is the move from transactional to service-based business models (Björkdahl 2020; Ibarra et al., 2018). A service-based business model enables a firm to move downstream in the value chain, thereby capturing value from emerging technologies more effectively

(Teece, 2018). Moving downstream transitions the firm from an enabler delivering products and services, to a service provider delivering an outcome (Lightfoot and Baines, 2013; Björkdahl and Holmen, 2019). A transition to a service-based business model can take different directions; one type is the performance-based business model, and a second is the software-as-a-service business model. In the performance-based business model, the firm shifts from selling products and services to delivering performance as a service, often bundled with an outsourcing agreement where the firm assumes operational and maintenance responsibilities. The performance-based business model allows firms to stand out from competitors and offers new avenues for cost-reduction and improved customer satisfaction, thus potentially increasing the value capture (Visnjic et al., 2017). On the other hand, the software-as-a-service business model also aims to deliver outcomes, but it provides software-based, on-demand services via the cloud. The software-as-a-service business model allows for both subscription- and usage-based pricing and offers scalability advantages as well as a cost-efficient approach to targeting new customer segments (Sääksjärvi, 2005). The two service-based business model variants are distinctly different and require significant changes in an incumbent industrial firm's business models; however, the success rate for these firms to transform is low (Haftor et al., 2023; Arthur D. Little, 2023). Understanding the intricacies of these service-based business model innovation transitions may be crucial for incumbent industrial firms aiming to effectively capture value from emerging technologies.

An incumbent industrial firm cannot solely rely on its existing firm-centric business model to promote and capture value on its emerging technologies. It is also vital for the firm to expand the reach of its emerging technology and promote it beyond its existing industry (Venkatraman, 2017; Snihur and Wiklund, 2019). To achieve this expansion and reach its full potential, the firm must actively engage and collaborate with various stakeholders within and outside its industry domain (Amit and Zott, 2020; Venkatraman, 2017). Creating an innovation ecosystem is one way for the firm to expand its reach. An innovation ecosystem fosters collaboration among stakeholders, including manufacturers, suppliers, customers, and researchers (Adner, 2006; Autio and Thomas, 2014; Kolagar et al., 2022).

These new collaborations require a shift from the existing firm-centric business models to multi-actor ones; hence a business model innovation is required. A deeper understanding of how an incumbent industrial firm can use business model innovation to achieve a multi-actor business model and thus foster innovation ecosystems is an under-researched area that deserves attention (Snihur and Markman, 2023).

This thesis focuses on how the case firm, Ericsson, navigates the business model innovation process with the primary objective of capturing value from emerging technologies. The four papers comprising this thesis shed light on different aspects of the business model innovation process and its implications for value capture using emerging technologies. The papers are based on three studies, each with detailed datasets: one longitudinal case study and two exploratory case studies. The first two papers unpack the business model innovation process when Ericsson moves from a product-oriented approach to a service-based approach by implementing a performance-based business model. In *paper I*, I examine how value creation and capture activities change over time as the firm actively seeks a viable performance-based business model. The paper explores how internal and external factors influence the business model innovation process. In *paper II*, I dig deeper into the challenges faced by the firm in managing the triadic interplay among emerging technologies, business models, and shifting customer behaviors. Next, *paper III*, focuses on how the firm integrates emerging technologies into its operations, aiming to enhance value capture through top-line growth by introducing a software-as-a-service business model. Lastly, paper IV investigates the importance of a multi-actor business model approach when a firm aims to design and manage an innovation ecosystem. Such an ecosystem supports the firm in reaching previously untapped customer segments and creates a foundation for value capture from its emerging technology. All four papers are summarized in Chapter 4.

The four papers together have four research purposes that have been synthesized into the central research questions that forms the basis of this thesis (refer to Table 1). In this thesis, I explore three distinct transitions of business model innovation: performance-based business models, software-as-a-service business models, and multi-actor business models, all relevant for industry firms when they introduce emerging technologies (Ibarra, 2018). The contributions from the four papers and this thesis will enhance our understanding of the challenges and opportunities of incumbent industrial firms as they use business model innovation to build new business models in order to effectively capture value from emerging technologies. By doing so, I contribute to advancing the business model innovation process literature by empirically demonstrating that each business model type requires different business model innovation activities for effective value capture. I further contribute by expanding our understanding of the relationship between business models and technologies. In addition, this thesis seeks to provide valuable insights and recommendations for practitioners and scholars interested in practical business model innovation and the capture of value from emerging technologies.

Table 1. Research purposes of the four papers and the aggregated research questions of the thesis.

	Paper	Research purpose/question	Abstraction	Questions for kappa
I	Right Technology, Wrong Business Model: Evidence of How and Why Ericsson Struggled with Substituting Products for Services	How do the value creation and value capture activities of a manufacturing firm change over time as they search for a viable service-based business model?	Value Creation/ Value Capture Business Model Innovation Process Incumbent Industrial Firm Emerging Technologies Service Business Models	How do emerging technologies impact the business model innovation process, and how does value capture unfold within this process for specific business models?
II	Technological Development and Business Model Dynamics: Exploring the Triadic Interplay among Servitization Business Models	To unpack and elucidate the interplay among technology, business models, and customer behavior by advancing the theoretical perspective from a dyadic to a triadic process model.	Business Model Innovation Process Technology Innovation Incumbent Industrial Firm Emerging Technologies Service Business Models	
III	Profiting From AI: Evidence from Ericsson's Quest to Capture Value	To explore how an incumbent industry firm captures value from AI technology.	Value Capture Emerging Technologies Service Business Model Incumbent Industrial Firm	
IV	Generative Innovation Ecosystem: The Formation and Layered Combinatorial Innovations	What are the generative levers that enable ecosystem architects to orchestrate the formation and evolution of generative innovation ecosystems that consistently produce combinatorial innovations?	Innovation Ecosystems Emerging Technologies Incumbent Industrial Firm Generativity Combinatorial Innovation	

Chapter 2

Theoretical background

The relationship between business models and strategy

The term 'business model' has been extensively used over the past decade, mainly by practitioners but also by scholars. The literature sometimes points out that it is difficult to distinguish business models from conventional strategy. To distinguish and relate the concepts of strategy, business model, and tactic, Casadesus-Masanell and Ricart (2010) introduced a generic two-stage competitive process framework, where 'strategy' refers to the business model the firm chooses to compete with, and 'business model' describes "the logic of the firm, the way it operates and how it creates value for its stakeholders" (p. 204); thus the business model is a reflection of the firm's realized strategy. It is important to note the significant difference between strategy and business models first appear when changes occur, such as when emerging technologies are introduced (Casadesus-Masanell and Ricart, 2010). Further, the business model sets the boundaries for the tactics available to the firm, which include more detailed plans of action within those boundaries.

In a more recent debate on the distinction between the business model concept and the strategy concept, Bigelow and Barney (2021) argue that strategy covers most parts of business models; however, they acknowledge that strategy areas could be enlightened by using a business model lens to provide a more granular view of a firm's value creation and value capture dimensions. This view is further strengthened by Lanzolla and Markides (2020), who argue that the business model construct can offer new insights, particularly by focusing on the internal and external interdependencies between the firm's activities that link value creation to value capturing. The business model guides how a firm operates and creates value for its stakeholders, detailing the tactics that can be applied. Understanding the details and the boundaries set by the business model is critical when investigating its relationship to the research questions of this thesis: *How do emerging technologies impact the business model innovation process, and how does value capture unfold within this process for specific business models?*

In this thesis, a business model can be understood as a system of interdependent activities that a firm undertakes to create and capture value (Afuah, 2003; Snihur and Eisenhardt, 2022; Björkdahl, 2009). Here, the firm's value creation is defined as the way that the firm creates value along its value chain by converting its resources, capabilities, and intra- and inter-organizational processes into value propositions and solutions delivered for customers (Achtenhagen et al., 2013; Clauss, 2017; McDonald and Eisenhardt, 2020). The firm's value capture domain is the architecture of revenue and costs that capture profits associated with creating value for customers (Teece, 2010). The value capture is often associated with monetization and pricing models, which downplay essential issues such as the operational effectiveness that plays a paramount role in value capture for a firm (Baden-Fuller and Haefliger, 2013). By understanding the details and the boundaries set by the business model, we will better understand how value capture is affected by the business model innovation process in an incumbent industrial firm.

The interplay between business models and emerging technologies

Emerging technologies, such as the fourth- and fifth-generation mobile technologies (4G and 5G) and AI, undoubtedly have a disruptive impact on incumbent industrial firms' business models. As these examples possess all the characteristics defining emerging technologies – radical novelty, relatively fast growth, coherence, prominent impact, and uncertainty and ambiguity (Rotolo et al., 2015) – they could also be seen as disruptive. We have yet to arrive at a full understanding of 4G/5G and AI emerging technologies' usage and applications, and their usage will affect multiple industries, often outside the firm's industry sector (Adner and Levinthal, 2002; Baines et al., 2020; Amit and Zott, 2020). The adoption of emerging technologies can introduce new ways of value creation while requiring changes in the existing business model of the firms to capture that value (Chesbrough, 2007; Zott and Amit, 2011). Nonetheless, there is a high degree of uncertainty regarding value capture from such technologies (Gambardella and McGahan, 2010; Teece, 2018), and understanding an incumbent industrial firm's business model innovation process to achieve value capture still requires exploration.

Business models and technological development – Different perspectives

The characteristics of emerging technologies, especially their rapid development pace and uncertain applications, make the interplay between business models and technological innovation an important aspect to consider when examining the value captured from such technologies. The existing literature presents various views on the relationship between the two domains. One view suggests that technological change leads to new or changed business models, suggesting that technological innovation provides the opportunity for new methods of value creation and capture (Teece, 2010; Chesbrough, 2010; Björkdahl, 2009; Zott and Amit, 2011). A related view emphasizes the business model's role in capturing the economic value of technology and that the economic value of a technology remains latent until it is commercialized through an appropriate business model (Chesbrough, 2010). A third view proposes that business models can determine the direction of technology development. For instance, Baden-Fuller and Haefliger (2013) suggest that business models are cognitive devices held in the minds of managers and developers, influencing technological development. Tripsas and Gavetti (2000) further argue that inertia influences technology development, as incumbent firms tend to continue developing technologies compatible with their existing business models rather than pursue new opportunities. Yet, the literature often presents only one direction of the relationship: either how technology development influences business models or how business models influence technology development. The rapid evolution of emerging technologies requires a more detailed understanding of this two-way interplay, which constitutes an interesting research gap to investigate. This research gap aligns with the proposed research direction called for by Baden-Fuller and Haefliger (2013), where they propose to untangle the interconnection among business models, technology development, and successful value capture. Specifically, they call for "including the factors that influence business model change in a dynamic manner, [which] will lead to a better understanding of the fundamentals of the relationship between technology development and business models" (p. 423). Hence, a process study is a fitting approach to further understand how emerging technologies interplay with business models.

Business model innovation in incumbent industrial firms

The balance between technological development and the business model is critical for the economic outcome of the firm, and if disrupted, the balance between value creation and value capture is also affected (Teece, 2007, 2010). A firm that maintains a balance between value creation and value capture is likely to succeed (McDonald and Eisenhardt, 2020), even in a fast-changing environment spurred by emerging technologies.

This can be a challenge for incumbent industrial firms since they often cannot capture enough value from emerging (disruptive) technologies when using their existing business models (Christensen, 1997; 2003). To remain competitive over time, incumbent industrial firms must adapt their business model (Amit and Zott, 2020; Chesbrough and Rosenbloom, 2002; Chesbrough, 2010; Doz and Kosonen, 2010). Consequently, a better understanding of the business model innovation process to capture value from emerging technologies is vital for incumbent industrial firms.

A business model innovation is considered a business model new to the firm and is established when a firm changes the way it does business, i.e., makes changes in the value creation and value capture architecture (Björkdahl and Holmén, 2019; Casadesus-Masanell and Zhu, 2013; Teece, 2018). To maintain their competitive edge and ensure sustained growth, incumbent industrial firms must proactively reshape their operations, organizational structures, and strategic focus in response to technological advancements (Zott and Amit, 2011). The business model innovation process, which includes recognizing change triggers, developing innovative business models, implementing them, and evaluating subsequent performance (Teece, 2010), is enabled by emerging technologies. These emerging technologies both threaten established business models and act as a source of innovative methods that could be incorporated into new business models. Emerging technologies, for instance, can challenge established value propositions and create new ones, initiating the need for business model innovation (Chesbrough, 2010). However, incumbent industrial firms frequently encounter challenges during the business model innovation process (Haftor et al., 2023), particularly during implementation. These challenges can significantly hinder the firm's capacity to capture value from emerging technologies. The existing literature highlights a range of such challenges. For instance, organizational inertia and resistance to change – often found in incumbent firms – can hinder significant modifications to familiar processes, roles, and power dynamics (Markides, 2006; Massa and Tucci, 2013). Legacy systems and established processes may prove incompatible with new ways of working, proving costly and complicated to modernize or replace, thereby restricting the progress of the business model innovation process (Chesbrough and Rosenbloom, 2002). Despite these many hurdles, incumbent industrial firms must navigate the business model innovation process to capture value from emerging technologies.

Views on the Business Model Innovation Process

The literature on business model innovation processes is scarce, and the existing discourse offers a spectrum of views, ranging from linear, linear stage-based with recursive processes at each stage, to more non-linear and iterative processes or frameworks. For instance, Frankenberger, Weiblen, Csik, and Gassmann (2013) propose a linear 4I-business model innovation framework (initiation, ideation, integration, and implementation); each phase is adapted from the innovation design literature to fit business model innovation and is based on learnings from multiple case studies. The framework is linear but recognizes the need for iterations between steps back and forth and includes iterative loops (Frankenberger et al., 2013). Another linear view is the Servitization Progression Model (Bains et al., 2020), which describes the business model innovation process for performance-based business models as four stages of organizational maturity (exploration, engagement, expansion, and exploitation). In each stage, the organization is affected by five principal forces or contextual factors (customer pull, technology push, value network positioning, organizational readiness, and organizational commitment). At the macro level, the progression between the stages appears linear and unidirectional; however, there are also iterative activities within each stage (Bains et al., 2020). A third linear business model innovation process is the five-phase transition process for a cloud business model (Khanagha et al., 2014). The phases include screening and speculation, embedded experimentation, independent organization, small independent organization, dissolution of the independent organization, and full integration of exploratory activities. Although a linear model, it emphasizes incremental experimentation with the new business model. The process includes a feedback loop where experimental findings from the new business model are fed back to structural adaptations or collected in a knowledge base (Khanagha et al., 2014); however, it is worth noting that the end of the process is full integration to the regular business of the firm.

Contrasting the linear business model innovation processes is, for instance, the non-linear Trial-and-Error Learning (Sosna et al., 2010), a high-level business model innovation process characterized by a more dynamic and iterative approach. The process emphasizes two phases, exploration and exploitation, which are continuously repeated. The exploration phase consists of initial business model design and testing, and in the exploitation phase, the business model is scaled and learnings are spread through the organization. These phases are then repeated with continuous exploitation and exploration – the business model development process can be described as an initial experiment followed by constant fine-tuning (Sosna et al., 2010). Similarly, McGrath (2010) suggests a discovery-driven high-level process, sometimes with a chaotic start, followed by experimentation with learnings to discover and exploit new business models.

A third view of the business model innovation process is staged-based, with distinct linear stages (or phases) and recursive processes at each stage. One example is Muhic and Bengtsson's (2021) stage-based process view on cloud adaptation, which emphasizes how capabilities evolve in stages during the business model innovation process when firms exploit cloud sourcing from a customer perspective. The model has three stages, each with a dynamic juncture characterized by substantial changes in the firm's capabilities. For example, in the first dynamic juncture, capabilities for internal processes and organization innovations are changed to support the new business model (Muhic and Bengtsson, 2021). An iterative variant of the business model innovation process is presented by Amit and Zott (2020), who emphasize an iterative process with three design phases: business model-ideate, business model-iterate, and business model-implement. The above process views all present high-level abstractions of how the process works, and they undoubtedly add to our understanding of business model innovation; however, while these frameworks or models offer a broad overview of how business model innovation functions, they often lack specific, actionable insights, particularly into how the value capture mechanism works. This gap in the literature highlights the need for more detailed exploration in this area to guide academic research and offer practical advice to practitioners in the field.

There are a few examples of frameworks detailing the value creation and value capture parts of the business model innovation process. The Process Framework of Value Creation and Value Capture Alignment (Sjödin et al., 2020) presents a process for performance-based (outcome-based) business models which emphasize the alignment between value creation and value capture and their collaboration and interdependence between provider and customer (Sjödin et al., 2020). The framework demonstrates that the provider and customer engage in a three-stage process comprising value proposition definition, value proposition design, and value-in-use delivery. Each step includes iterative cycles with value creation and value capture activities to secure a smooth transition to the subsequent phase. The next phase cannot be reached if any activities fail or are insufficient (Sjödin et al., 2020). Another example is the Framework for designing revenue models for digital services (Linde et al., 2021), a business model framework focusing on the value capture component of the business model innovation process, specifically from performance-based (digital services models) business models. The framework emphasizes the revenue model design part of the value capture and offers advice for firms wanting a specific process focused on value capture. It is a phase-based process comprising three phases: small-scale experiments, medium-scale development, and large-scale market growth. The process sheds light on the complex relationship between provider and customer, focusing on the revenue model's impact on the value capture; however, it does not cover the role of operational effectiveness in value capture.

Although the detailed frameworks outlined above help us better understand the value capture process of the business model innovation, they do not fully address the operational effectiveness of value capture. This oversight is critical, as capturing value remains challenging for incumbent industrial firms (Sjödin et al., 2020) despite their excellence in creating customer value. This makes it crucial for academic research and practical applications to dig deeper into the specifics of value capture components of the business model innovation process, focusing specifically on value capture in the business model innovation process. Such detailed exploration would enrich theoretical understanding and provide incumbent industrial firms with actionable insights and strategies to leverage emerging technologies for better value capture.

Three business model types in incumbent industrial firms

This thesis focuses on the business model types prevalent in incumbent industrial firms when aiming to capture value from emerging technologies, namely service-based and multi-actor-based business models (Ibarra et al., 2018). Service-based business models, which focus on delivering an outcome or performance beneficial for the customer rather than merely selling products and services, emerged in two variants: performance-based and software-as-a-service-based business models. Baden-Fuller and Haefliger (2013) provide an analogy with taxi and bus to distinguish between the business models. The taxi – the performance-based business model – offers a customized route to reach the destination (or a guaranteed performance) and requires a close relationship between the provider and the customer, often with complex contractual arrangements. The performance-based business model is often associated with outsourcing, where the firm assumes operational and maintenance tasks. This moves the firm down the value chain and enables differentiation from competitors, cost reductions, and higher customer satisfaction, potentially improving value capture (Visnjic et al., 2017). As described above, the literature presents frameworks for the value creation and value capture process for performance-based business models and provides an understanding of essential aspects in the transition of industrial firms to performance-based business models (Baines et al., 2020; Sjödin et al., 2020; Linde et al., 2021); however, they lack the details of the transition to achieve value capture, especially from emerging technologies.

The second service-based business model type – the bus (the software-as-a-service business model) – operates on a predefined route and a "one-size-fits-all" software-based offering with an on-demand service approach via the cloud (Baden-Fuller and Haefliger, 2013). This business model facilitates subscription and usage-based pricing, scalability advantages, and a cost-efficient way of reaching new customer segments (Sääksjärvi, 2005; Khanagha et al., 2014). The literature on business model innovation processes for software-as-a-service business models is scarce. One example is Muhic and Bengtsson's (2021) stage-based process view on cloud adaptation, which emphasizes how capabilities evolve in the business model innovation process when firms exploit cloud sourcing from a customer perspective. From the provider's perspective, a more detailed understanding of the business model innovation process towards a software-as-a-service will further sharpen our understanding of how incumbent industrial firms capture value from emerging technologies.

The third type is the multi-actor-based business model: it is not a bus or a taxi but a caravan of many vehicles, each driven by different stakeholders such as manufacturers, suppliers, customers, and researchers. Within this caravan, understanding how to configure each vehicle to connect with other parts becomes crucial, as it not only enables collaboration but also impacts the overall direction of the caravan. The stakeholders are all part of an innovation ecosystem that fosters collaboration and relies on its multiple participants' strengths and contributions to deliver a result (Adner, 2006; Autio and Thomas, 2014; Kolagar et al., 2022). An incumbent industrial firm wishing to promote and expand the reach of its emerging technology must be part of and set the direction of the innovation ecosystem (Venkatraman, 2017; Snihur and Wiklund, 2019). These new collaborations require the incumbent industrial firm to transform its business model into a multi-actor business model with several multilateral partners, and by combining external resources and capabilities, it can create and capture new value enabled by technological advancements such as emerging technologies (Gassmann, 2023). This thesis takes a single firm perspective on the multi-actor-based business model and focuses on the business model innovation a firm needs in order to be part of and influence the innovation ecosystem and subsequently expand the reach of its emerging technologies.

Investigating these three distinct business model innovation types for incumbent industrial firms enriches our understanding of the subject matter. Although the existing literature offers some insights into these transitions, it fails to explain the detailed mechanisms of the business model innovation processes essential for effective value capture. Building on the research gaps noted by Snihur, Zott, and Amit (2021) – mainly to better understand the "process from antecedent identification to resulting business model design" (p. 34) – this thesis contributes to the discussion. It does so by revealing detailed empirical findings that shed light on how an incumbent industrial firm can leverage the business model innovation process to capture value from implementing emerging technologies.

Understanding emerging technologies' influence on business model innovation – gaps and directions

The existing business model innovation literature offers valuable insights into the relationship among business models, emerging technologies, and value capture. Despite these insights, however, the literature also includes uncharted avenues that directly align with the research questions of this thesis: *How do emerging technologies impact the business model innovation process, and how does value capture unfold within this process for specific business models?*

Although the literature presents how emerging technologies can disrupt or enrich existing business models, it does not describe the business model innovation process required to better understand the value capture mechanisms. The literature further offers a one-way view of how technology development influences business models and vice versa; however, the emerging technologies' rapid development pace makes understanding the two-way interaction between the domains a topic of interest. Further research should explore these aspects to better understand the business model implementation challenges of the business model types relevant to incumbent industrial firms.

This thesis addresses these gaps by presenting a more nuanced understanding of the two-way interplay between emerging technologies and business models. Additionally, it provides a more granular view of the details involved in the business model innovation process for an incumbent firm striving to capture value from emerging technologies. By examining the firm's boundaries when transitioning to the three business model types, this thesis reveals the factors that shape the tactical actions available within these boundaries. Doing so offers actionable insights for firms seeking to navigate the turbulent seascape of emerging technologies. Hence, this thesis serves as an initial coordinate to chart what remains uncharted in this rapidly evolving field.

Chapter 3

Research setting and methodology

This chapter presents both the research setting and methodology used in this study. I begin with an overview of Ericsson – the case study firm at the heart of this thesis – presenting the firm's background and context and exploring the business model innovation processes undertaken by the firm. Within these parameters, I discuss my role as an insider and someone transitioning into a researcher. The chapter concludes with a presentation of the methodology used to collect and analyze data for my research papers and addresses the limitations of the research.

Ericsson – the firm

Ericsson, a leading global telecommunications and network equipment firm headquartered in Stockholm, Sweden, has a rich history dating back to 1876, when it was founded as a telegraph equipment repair shop by Lars Magnus Ericsson. Throughout the twentieth century, the company was pivotal in advancing telecommunications technology, introducing innovations such as mobile and digital telephony systems. By the twenty-first century, Ericsson had emerged as one of the world's largest telecommunications equipment and services providers, serving mobile and fixed communications service providers globally. With a presence in 180 countries, Ericsson offers a comprehensive range of products and services, including network infrastructure, digital services, and managed services, catering to the needs of communications service providers, enterprises, and governments (Ericsson, 2023).

Business Model Transformation Project

Ericsson's primary business model for more than 100 years was a transactional product-based business model, with the firm selling products and receiving payment upon delivery. Alongside the products, Ericsson also offered services, with payment usually based on an hourly rate. As Ericsson's service side expanded in early 2000, performance-based business models emerged, particularly when managing customers' networks in outsourcing engagements aimed at reducing the operational cost for Ericsson's customers. As the competition increased from players within the telecom industry and the IT industry, Ericsson's transactional product-based business model was challenged. In response, several of Ericsson's business units initiated business model innovation activities, exploring service-oriented business models and how to expand the market reach via innovation ecosystems.

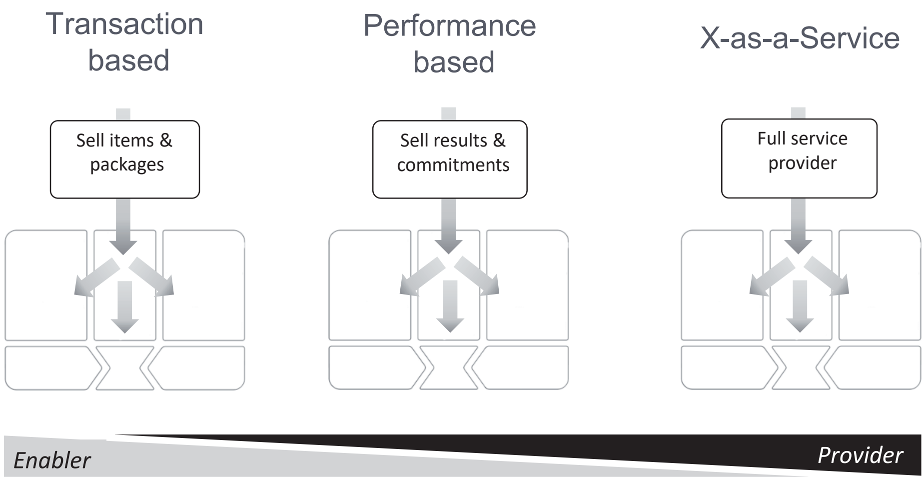
The service-based business model emerged in two distinct variants: performance-based and software-as-a-service. The analogy of taxi and bus is sometimes used to distinguish between these variants of service-based business models (Baden-Fuller and Haefliger, 2013). Both variants focus on delivering specific results or performance to the customer instead of merely selling products and services. The performance-based model – the taxi – is customized to the specific customer's route to reach the destination and has a more complex set-up that requires aligned interests between the provider and the customer. On the other hand, the software-as-a-service business model – the bus – operates on a predetermined route and a "one-size-fits-all" offering that focuses on automation, flexibility, scalability, and cost-efficiency. The software-as-a-service business model delivers services on-demand via the cloud, enabling customers to pay for their actual consumption or via subscriptions. The perceived benefits of the as-a-service business model are that it is easily scalable, simplifies the introduction of new services, and can reach out to new customer segments cost-efficiently.

In addition to developing the two service-business model variants, the business units also believed that the fifth generation of mobile technology (5G) could benefit customer segments across various industries outside the traditional telecom sector. Establishing innovation ecosystems thus became a priority in order to extend their reach beyond the firm's own sector. Introducing an innovation ecosystem entailed a shift in the firm's approach to business model innovation – from being independent to being part of a caravan – as it requires collaboration and co-innovation with new entities to promote the firm's emerging technology. Ericsson subsequently made a strategic decision to extend its market reach beyond its traditional industry segment by pursuing the multi-actor business model, as further emphasized by the CEO: "We can broaden ourselves as a company with the legitimacy of our technology leadership on 5G into the enterprise field" (Telecom Review, 2023).

In 2016, most business units and product segments looked at business models to improve their competitiveness and value capture. Ericsson's Networks business unit recognizes the potential for service-led network performance partnerships and disruptive 5G business models using software-based radio networks. Although the transaction-based model dominated, new business models were emerging, such as performance-based and as-a-service. In the Digital Services business unit, the transaction-based model was prevalent but under price pressure, prompting demand for performance-based models. The adoption of as-a-service business models was also on the rise, and Core Network and Operation Support Systems/Business Support Systems realized that an as-a-service business was needed to maintain competitiveness in the segment. At the same time, the newly launched Emerging Business unit explored innovative approaches to extend its market reach into new industry segments and advocate for the adoption of 'Network-as-a-Service' and specialized private 5G network deployment solutions tailored to enterprises. To achieve this objective, an innovation ecosystem was needed to foster a collaborative environment wherein various firms integrate their distinct offerings to create joint customer solutions (Adner, 2006). Consequently, the above initiatives resulted in several business model innovation activities across the firm.

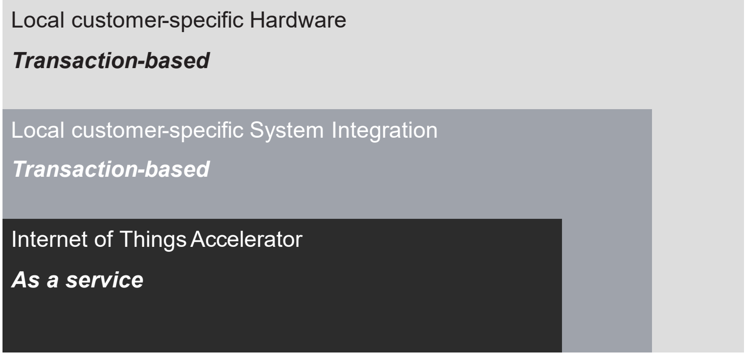
The many variants in business model types in different parts of the Ericsson organization led to management recognizing the need to take a consolidated view of the firm's business model innovation activities. They formed a business model transformation project to analyze the situation and consolidate the view of which business models the firm needed. The project investigated all business model innovation activities at the firm and identified three archetypes of business models used in the firm: transaction-based, performance-based, and x-as-a-service-based (see Figure 1).

Figure 1. Ericsson's business models 2017 (Ericsson).



In its simplest form, an offering to a customer is typically based on one business model type. However, many of Ericsson's offerings are more complex and can be a combination of multiple business model types to create a customized and specific customer value proposition. An example of how a complex offering could look is illustrated in Figure 2. Here, the base of the offering is a software-as-a-service-based offering, an IOT Accelerator service. System integration and equipment are required to integrate this service for a specific customer, and both parts are sold as a transactional business model. In this case, the total offering draws on two business model types, which the firm must support to secure value capture.

Figure 2. Illustration of a complex offering consisting of combinations of two business model types (Ericsson).



The business model transformation project's investigation further revealed that as of 2016, Ericsson's revenue was dominated by transactional product-based business models (77%), compared to performance-based business models (11%) and as-a-service business models (1%), the remainder comprising other types of models, such as patents, etc. The gross margin showed a similar distribution. However, the situation analysis identified that many offerings under exploration across various business segments would require different business models to secure future value capture (see Figure 3). Ericsson's journey through business model innovation forms the background of my research, which investigates the challenges, strategies, and critical factors associated with the firm's use of business model innovation to capture value from emerging technologies.

Figure 3. Ericsson's business models and new business models being explored at Ericsson 2017.

	Transaction based	Performance based	X-as-a-Service
Radio	Hardware, Software, Network Roll-out, Design & Tuning	Optimization and Customer Support Best performing networks	Network Design & Optimization Ericsson Engineering Dashboard NDO EDOS
Managed Services		Field Maintenance Operational Readiness Multivendor Hardware support	
Telecom Core	Hardware, Software, System integration and consulting services	Customer Support	Core and OSS/BSS aaS IP Multimedia System and Overlay-aaS
OSS/BSS	Hardware, Software, System integration and consulting services	Customer Support Managed Services-IT	OSS/BSS-aaS Revenue manager-aaS
Cloud	Hardware, Software, System integration and consulting services	Customer Support Managed Services -IT	
Media	Media Room, Hardware and System Integration	Customer Support	Media First, Unified Delivery Network-aaS TV-aaS, MDI, Advertising-aaS, ...
Industry &Society	Product related services, Enterprise & Cloud Billing	Customer Support	Device Connection Platform IoT Accelerator, CVCaaS, ...

Current business model(s)
New business model(s) being explored

Source: Ericsson, 2017

Being an insider and becoming an industry PhD student

Becoming an industry PhD student meant that I brought my experiences working at Ericsson as input to the PhD journey. I have been working at Ericsson in several capacities, and since 2010, I have specifically been working with different aspects of business models and business model innovation, reflecting on my research interests. This background is suitable for an engaged scholar (Van de Ven, 2007), which I find clearly describes my research into the business model transformation that Ericsson is undergoing. Taking the leap from Mercury to Minerva (Engwall, 1986), from industry to academia, was the first step in my journey to becoming an engaged scholar.

At Ericsson, I had the opportunity to follow the business model innovation process from the inside. Between 2003 and 2009, I was responsible for decisions regarding sales to the case customer in *papers I and II*. Between

2010 and 2017, I supported business model innovation activities for all of Ericsson's customer engagements as Director of Business Model Management and driver of Ericsson's central Business Model Transformation project. In 2018, before starting my PhD journey, I became principal researcher of business models at Ericsson Research, where I conducted the research for *papers III and IV*. These various positions gave me access to empirical material comprising my own notes from business meetings, access to emails related to the cases, internal official documents (such as customer contracts, memos, reports, and presentations), and unofficial documents such as working drafts on contracts and draft reports.

Being an insider entails a risk of bias. To mitigate this and maintain rigor and objectivity in my research, I collaborated with at least one co-author who remained outside the process while I developed each of my papers. The co-author could provide a critical outsider perspective during the entire research process. From a practical perspective, this included double coding and analysis, where the co-author and I independently coded and analyzed the data and compared our interpretations of the findings. This process ensured that my position at Ericsson did not influence my insights and conclusions.

Pre-understanding is often considered a source of bias, but there are ways to use it positively. Alvesson and Sandberg (2022) presented a framework for using pre-understanding in research to enhance one's understanding of the empirical material. The collaboration with co-authors contributed to this understanding through a dialogic conversation between data and theory, allowing us to broaden our view of the phenomenon (Risser, 2010). The pre-understanding was also helpful when I conducted interviews for my research. During the interviews, my pre-understanding helped me draw out perspectives on the phenomenon that the respondents did not spontaneously raise by asking follow-up questions to better understand how the processes had unfolded.

Research design

This thesis includes four papers based on three different datasets: one longitudinal case study and two exploratory case studies. In this section, I explain the data collection, analysis, and research design I used for each data set. All papers use a single case study research design, as this approach enables in-depth, comprehensive analysis and insights that are particularly useful for the research purposes of these papers (Yin, 2009). The case study method is suitable for understanding complex social phenomena in real-life contexts (Yin, 2009) and is especially helpful when exploring how the business model innovation process in incumbent industrial firms is affected by emerging technologies. Due to the complicated nature of this transformation, a single case study offers an opportunity to explore and untangle the business model innovation process, revealing details and process dynamics other methods often bypass. The methods, level of analysis, research design, sample and data sources for the papers are summarized in Table 2.

Table 2. Overview of papers.

	Paper I	*Paper II*	*Paper III*	*Paper IV*
Research purpose	To explore how the search for a service-based business model influences the value creation and value capture activities over time.	To unpack the interplay between technology and business models by expanding theory from a dyadic to a triadic perspective.	To explore how an incumbent industry firm captures value from AI technology.	What are the generative levers that enable ecosystem architects to orchestrate the formation and evolution of generative innovation ecosystems that consistently produce combinatorial innovations?
Level of analysis	Two business units and one customer unit at the firm	Two business units and one customer unit at the firm	Business unit	Business unit
Research design	Longitudinal case-study Process study	Longitudinal case-study Process study	Exploratory case-study	Exploratory case-study
Sample	Single firm, three geographical markets	Single firm	Single firm, globally distributed	Single firm, globally distributed
Data sources	40 semi-structured interviews Participant observations, 232 business meetings 1,494 emails Secondary data: 578 internal documents 49 publicly available documents	46 semi-structured interviews Participant observations, 232 business meetings 1,494 emails Secondary data: 578 internal documents 49 publicly available documents	34 semi-structured interviews Secondary data: 150 internal documents 2 external webinars	54 semi-structured interviews Participant observations, 80 business meetings Secondary data: 19 Knowledge-sharing sessions 18 Webinars 95 Internal documents

Papers I and II – Longitudinal Case Studies

The empirics for *papers I* and *II* are based on a longitudinal case study followed from 2003 to 2014. My interest in exploring how an evolving process ultimately results in a specific outcome – the transformation from a transactional business model to a viable performance-based one – shaped the research design for *paper I*. I found a process research design fitting, given the need to clarify explanations regarding sequences of events leading to the outcome (Elsbach and Sutton, 1992; Langley, 1999; Van de Ven, 2007). In process research, an event is a concrete fact and a moment in time in which the activities and their organization are tangible (Hussenot and Missonier, 2016). Concentrating on the interpretation of events and activities to illuminate and comprehend a process offers a more dynamic approach to understanding phenomena while acknowledging the connections across time and space (Langley and Tsoukas, 2017; Pettigrew, 1992; Poole et al., 2017; Van den Ven, 1992).

I use the same longitudinal case study in *paper II* to study the interplay between business models and technology development. Here, the case-study approach to uncover details of the interplay process and to better understand the interactions between business model design and technology development (Langley, 1999; Van den Ven, 2007).

In this context, Cloutier and Langley's (2020) perspective on process theories offers a deeper layer of theoretical understanding. Their distinction between 'weak' and 'strong' process theories provides a nuanced perspective relevant to the case. From a 'weak' process theory perspective, entities are seen as relatively stable, undergoing changes or processes over time while maintaining their distinct identities. (Cloutier and Langley, 2020). This view aligns with the approach used in *papers I and II*, which focuses on the process that influences the relatively constant structures of business models and technologies. Thus, the methodology in these papers, emphasizing detailed observations of events over time, reflects the essence of the 'weak' process theory as described by Cloutier and Langley (2020). The alignment of this theoretical perspective enhances the methodological choices made in *papers I and II*, placing them within a broader discourse on process theory.

Papers III and IV – Exploratory case studies

Exploratory case studies are fitting when seeking to investigate a relatively unexplored or poorly understood phenomenon and to assemble many observations on complex real-life processes, particularly in situations where the boundaries of the phenomenon and its context are unclear (Yin, 2018). I considered the exploratory case study a fitting approach for *paper III* since the research purpose was to explore how an incumbent industry firm captures value from AI technology, given that we still have a limited theoretical understanding of the activities required to successfully implement emerging AI technology. Likewise, for *paper IV*, the research aim was to unpack how an incumbent firm can design a generative innovation ecosystem for combinatorial innovations in order to foster industry-wide adoption of emerging technologies. Given that innovation ecosystems are a relatively new area of study, an exploratory case study was deemed fitting for *paper IV* (Yin, 2018).

Data collection

The data collection for *papers I and II* was supported by my background as sales director, overseeing the business decisions for the case from 2003 to 2009, and my position as Director of Business Model Management from 2009 to 2014. These positions provided me with extensive and unique data access; for instance, I participated in over 200 business meetings related to the case and kept extensive notes from these meetings. Moreover, I had access to emails and internal documentation providing detailed information on the technical and business model changes during the entire period from 2003 to 2014. The data material for *paper II* is summarized in Table 3.

Table 3: Data material (table from paper II).

Sources	*Description*	*Dataset*	*Purpose*
Semi-structured interviews	Semi-structured in-depth interviews with different hierarchical levels and in different functional positions at Ericsson and WindTel, e.g., chief financial officer, head of Ericsson India, head of Business Unit Services, head of Business Unit Networks, key account managers, account managers, contract managers, sales directors in different business units, pricing managers, commercial managers, technical experts and head of product units.	40 transcribed interviews	To add depth and details to the events that unfolded during the transition to a performance-based business model.
	Additional semi-structured in-depth interviews with technical and commercial specialists at Ericsson.	6 transcribed interviews	To deepen the understanding of the technical and commercial decisions during the technology shift from 2G to 3G and its impact on the performance-based business model.
Participant observations	Participation and notes from business meetings regarding the operation of the business model from 2003 to 2009.	Notes from 232 business meetings	To identify respondents, discussion points, and decisions made during the transition to a performance-based business model.
Emails	Emails written and received by researcher one when he was responsible for the WindTel business and his successive emails for the remaining period of interest. Emails were exchanged both within Ericsson and between Ericsson and customers and were related to the business models in India.	1,494 emails	To provide a good understanding of events and activities and allow triangulation with interview and archival data and participant observations.
Internal documentation from Ericsson	Customer correspondence and presentations Contracts, MoM on contracts, and contract reviews Descriptions, analysis, and improvements on contracts Minutes of meetings from the steering group and decision meetings Key account reports and presentations Financial numbers and reports	578 documents (7,616 pages)	To provide detailed information about the technology and business model changes that occurred during the operation of the new business model.
Publicly available material	Trade press articles Teaching cases (e.g., Harvard Business School) Ericsson Annual Reports 2004-2014 Customer Annual Reports 2003-2014	49 documents	To obtain an outside perspective on the introduction of a performance-based business model.

To add details and depth to the existing data, I conducted semi-structured interviews with individuals involved in and responsible for the business operations and implementing the performance-based business model. The respondents included personnel from different hierarchical levels and functional positions at Ericsson, as detailed in Table 3. The semi-structured interviews aimed to gather detailed insights into events and activities throughout the business model innovation process when Ericsson implemented the performance-based business model (Alvesson and Sandberg, 2022). The semi-structured format allowed for flexibility, letting me probe deeper into topics based on the respondents' initial answers (Kvale and Brinkmann, 2009). My initial approach was to identify a set of respondents with extensive experience in the business model innovation process to gain an overall view of the phenomenon. I subsequently expanded the number of relevant respondents through snowball sampling (Patton, 2014), identifying relevant individuals through documents and emails. For *paper I*, I carried out 36 semi-structured interviews at Ericsson between 2018 and 2020, supplemented by four semi-structured interviews with the customer, including the former managing director for India and Africa, the former executive director, and former group chief technical officers. Additionally, six semi-structured interviews with technical and commercial experts at Ericsson were conducted for *paper II* in 2022 and 2023. The semi-structured interviews included open-ended questions, many of them tailored to the respondent's specific role, and my insider background enabled me to ask relevant follow-up questions when situational details were provided (Alvesson and Sandberg, 2022). I sought to explore how the firm adjusted its business behavior over time, the impact of contextual factors, changes in the methods of value creation and capture, and the impact of business models and technological changes. Each interview lasted 30-120 minutes, and to ensure the collected data's accuracy, the interviews were recorded and transcribed (Bryman, 2016).

I also collected archival data on events, actions, and outcomes related to the case, amounting to several thousand pages (Hill, 1993). These archival data provided a historical backdrop that helped contextualize the insights gathered from the semi-structured interviews (Scott, 2014). The data set included internal official documents such as contracts, reports, presentations, and unofficial documents such as working drafts of contracts and reports on investigations related to the case. Cross-referencing the archival data with interview responses allowed me to understand the case more comprehensively (Hill, 1993). I also collected publicly available data on the case, including articles in the trade press, teaching cases, and annual reports. This publicly available data triangulated and validated the findings from the interviews and archival data (Hill, 1993).

The data collection for *paper IV* spanned May 2019 to February 2022, and *paper III's* data collection was conducted from January 2020 to March 2022. In the case of *paper IV*, I used three methods for data collection. First, semi-structured interviews were conducted with informants at the firm to understand the innovation ecosystem the firm was aiming to create. I conducted initial exploratory interviews in 2019, followed by 50 semi-structured interviews with respondents at senior positions within the firm from 2020 to 2022. I invited the co-authors to some of the interviews and most interviews were transcribed; however, some were not due to confidentiality. Some interviews were repeated to cross-check and verify findings. Second, as I participated in over 80 business meetings, both internal and external, with customers and potential partners, I took notes on the insights from the engagement partner process that I subsequently shared with my co-authors. Third, secondary data consisting of internal and externally published documentation, industry reports, white papers, news articles, and the firm's Ecosystem Operating model were also shared with my co-authors and used to complement and verify interview data.

In the case of *paper III*, I used the same three data collection methods as in *paper IV*. For this case, 34 semi-structured interviews with key informants from various positions – including, e.g., the strategy director, service portfolio director, head of capability development, head of commercial management, and data scientists – were carried out. I also collected observations from my participation in internal meetings and seminars, as well as secondary data based on internal documents and websites. All interviews were transcribed and shared with the co-authors, together with secondary data.

Data analysis

To manage the extensive data material collected for *papers I and II*, I utilized a search module plugin[3] for emails to process the large volume of emails, allowing me to search for keywords in the email as well as attachments and filter on time and email recipients/senders. I also categorized the documents by content and dates – contract-related, customer correspondence, key account reports, business model descriptions/analyses, steering committee meetings, and technical documentation – and created an Excel database to search for documents for specific periods and content. In the following data analysis, I created an initial timeline for the case period from 2002 to 2014. The timeline presented key events and activities for introducing the performance-based business model, such as contract signing, the introduction of new technologies, etc. (as shown in Figure 4). The timeline served two purposes. First, as a tool during the interviews, I could ask the respondents about related details regarding the events and activities on the timeline and obtain additional events for the timeline and details from the respondents. Second, I used the timeline to create the case history, adding other data sources, such as interview transcripts, emails, and documents. The case history and timeline presented an overview of events and activities related to the launch of the new business model and the impact of technology changes and market activities. I subsequently triangulated all the data sources to obtain a rich and reliable timeline of the events and activities of the transformation from business model to performance-based business model (Jick, 1979). Using the document database and the emails in the triangulation further established construct validity (Yin, 2003) and addressed any gaps or inconsistencies in the events and activities. Follow-up interviews were then conducted.

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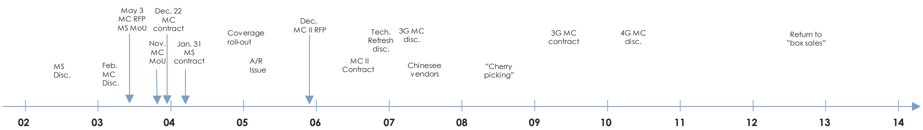
[3] KuTools for Windows

Figure 4. Initial timeline.



Based on the case history created from the data, I constructed a sequence of significant events and activities and named them Episodes (Van den Ven and Poole, 2005). In doing so, I could identify distinct episodes in the case history, which supported the process analysis (Berends et al., 2014; Langley, 1999). The episodes were a coherent set of actions, an analysis, and reflections based on the increased understanding of the business model innovation process to create a business based on a performance-based business model (Berends et al., 2014). The episodes were significant since they affected the direction and progress of the trajectory of the process. The resulting sequence of events and activities is presented in *paper I* and includes between three and nine episodes for respective cases, where I mapped the evolution of the business. The respondents were allowed to review the case description to ensure I understood the events and activities comprising each episode.

For *paper I*, the consequent data analysis consisted of cycles of inductive and deductive reasoning (Walsh and Bartunek, 2011; Gavetti and Rivkin, 2007). To create a list of first-order codes from the data underlying the case histories, I followed the procedures recommended by Strauss and Corbin (1998) and Gioia et al. (2013) by using informant-centric terms and codes. The first-order codes highlighted business-related problems that had been handled during the different episodes of introducing a performance-based business model. Next, I applied deductive reasoning by searching the existing literature for concepts and frameworks that could help to address what emerged from the data. This process allowed for second-order theoretical categorization. The extensive use of business-related problems made me review research on business models (Björkdahl, 2009; Chesbrough and

Rosenbloom, 2002; Clauss, 2017; Teece, 2010). Drawing on this literature stream, I grouped the first-order codes related to specific business-related problems into mechanisms according to the type of change they related to in a firm's business model (Chesbrough and Rosenbloom, 2002; Björkdahl, 2009). The second-order codes represented changes over time to find a new viable business model and whether these changes were related to key activities and processes, key resources, value propositions, customer relationships, revenue streams, or cost structure. Following Corley and Gioia (2004), the second-order theoretical categories were organized into aggregated theoretical dimensions – value creation and value capture – to structure the data. The first-order codes, the second-order theoretical categories, and the aggregated theoretical dimension are presented in Table 4.

Table 4: Coding scheme for the business model from paper I.

First-order codes	***Theoretical categories***	***Aggregate theoretical dimensions***
Statements of changes in - Education of performance-based contracts - Organizational structure to coordinate activities - Network operation and maintenance - Network deployment - Network planning - Network design - Capacity management processes - Governance processes - Revenue recognition processes	Processes	Value creation
Statements of changes in - Network ownership - Head of responsibility - Network planning competencies - Contract management competencies - Delivery resources - Sales resources - Business control resources	Resources and competencies	
Statements of changes in - Customer offering - Benefit to customers - Solving of customer problems	Value proposition	
Statements of changes in - Revenue model - Price parameters - Payment terms and conditions - Measurement and control of revenues (e.g., financial reporting and accounting principles)	Revenue streams	Value capture
Statements of changes in - Volume and structure of costs - Business margins - Use of technology advantage to reduce costs	Cost structure	

In the fourth step of the data analysis, I used the first-order codes to identify changes made to the theoretical categories and to evaluate whether these changes were related to value creation or value capture. This analysis helped me analyze how the process shaped the content of the performance-based business model. The analysis further supported me in sorting out how various internal and external factors influenced the process and changed the content of the performance-based business model, and to identify patterns within and across geographical markets. Figure 5 shows examples of the patterns identified from *paper I*.

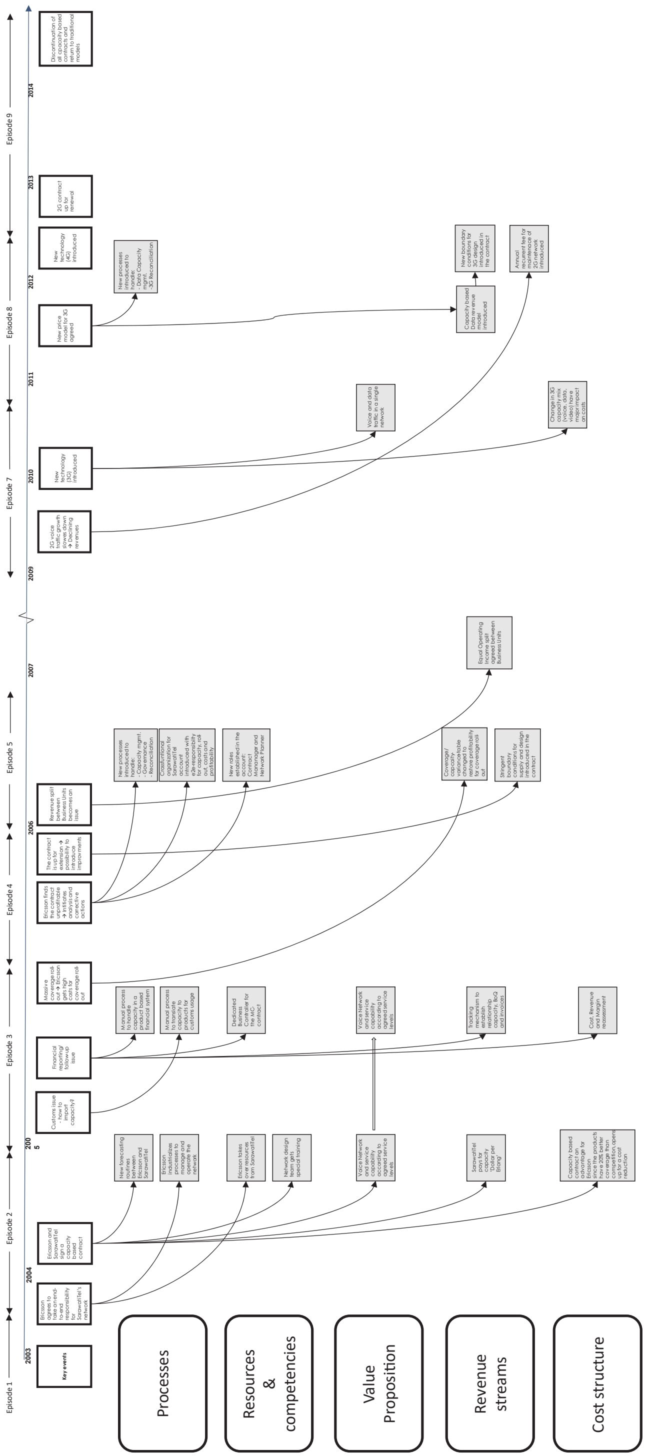


Figure 5. Patterns identified from paper I.

The data analysis for *paper II* was similar to the first steps of the analysis of *paper I*. In *paper II*, the objective was to construct a sequence of events and activities to better understand how the performance-based business model and technology interacted during the new business model's operation, considering factors such as customer and market influence and technology shifts. This approach allowed me to conceptualize the development and adaptations of the performance-based business model and the technological changes over time (Langley, 1999; van de Ven and Poole, 2005). To carry out the data analysis, I draw inspiration from Chesbrough and Rosenbloom's (2002) framework, where the business model serves as a mediator between the technical and social domains – it translates technological advancements into marketable and economically viable products or services, thereby bridging the gap between technical feasibility and commercial success (Chesbrough and Rosenbloom, 2002).

I divided the technical domain into two primary categories of changes: technological characteristics of existing products and exogenous technological development. The first category involved technical characteristics of the products, technical feasibility studies, and product development decisions. The second category covered exogenous technological advancements in 2G, 3G, and 4G standards and features obtained from the firm's technological roadmaps for each radio standard. The social domain encompassed customer activities and market events influencing the technical domain or the business model. The business model components of the analysis included changes in the business model description, value proposition, price models, and contractual terms and conditions. In the analysis, I used a process flowchart, suggested by Langley and Truax (1994), to present the event chronology coded in multiple ways. Throughout the analysis, I used different labels for various activities and events: events, decisions made by the firm or the client, technology characteristics (enabler or constrainer for the business model), exogenous technology development, and activities within the firm. The process flowchart from *paper II* is shown in Figure 6.

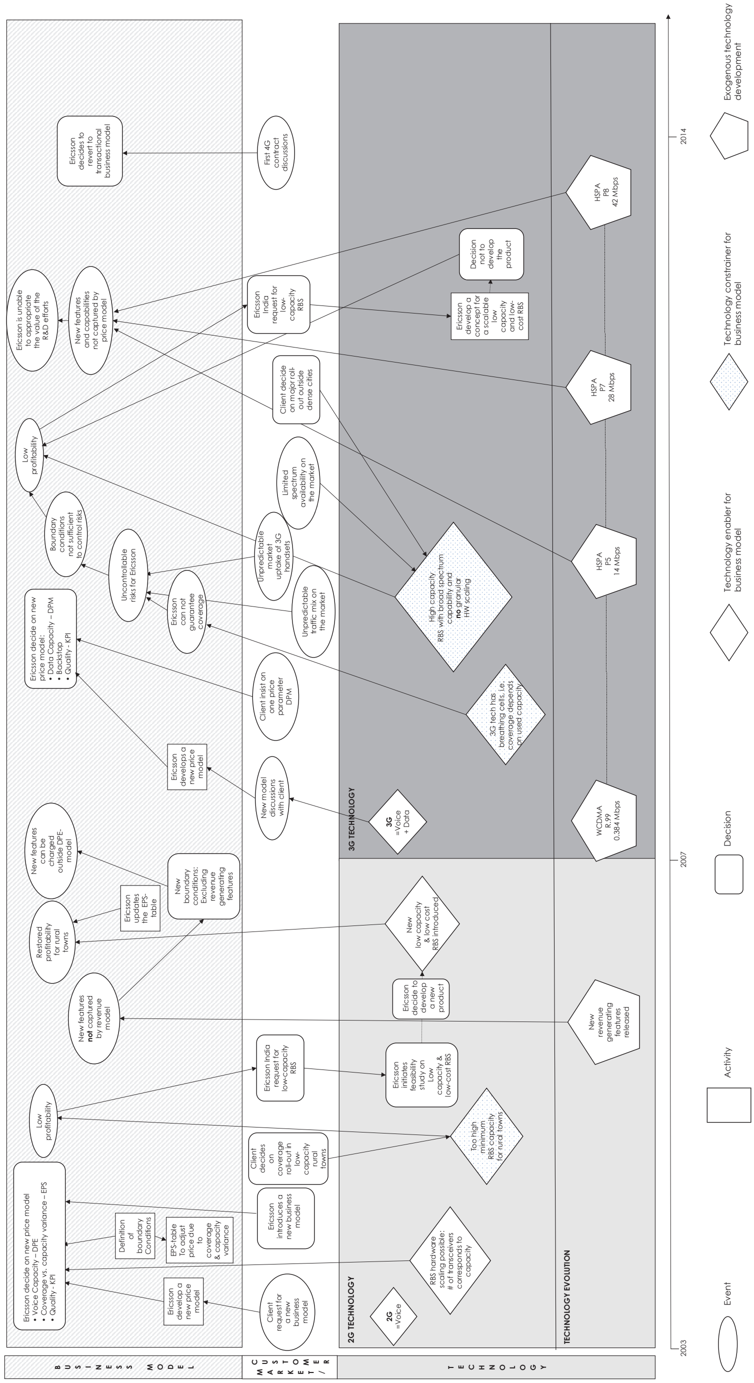
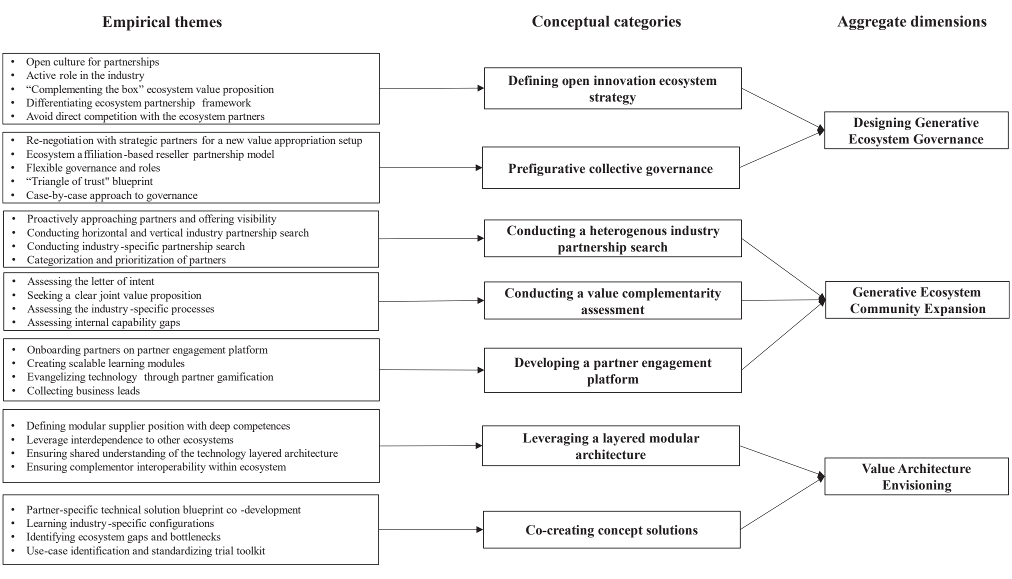


Figure 6. Process flowchart from paper II.

I conducted the data analysis of *paper IV* in collaboration with the co-authors using iterative rounds of analysis and evaluation (Glaser and Strauss, 2017). Interview transcripts were coded using constant comparative analysis, and the process was repeated until no new categories emerged and theoretical saturation was reached (Corbin and Strauss, 1990; Glaser and Strauss, 2017). I also ensured the validity of the data, for instance, from the semi-structured interviews, by cross-checking the findings with multiple sources and comparing them to secondary data. When an interviewee highlighted a particular strategy for collaborating with other stakeholders, I drew on other complementary data sources, such as internal reports or websites, to legitimize these findings. The structure of this analysis is shown in Figure 7.

Figure 7. Data structure example from paper IV.



Limitations

In reflecting upon the limitations of my four papers, I recognize that research design and bias might influence the validity and reliability of my research. One fundamental limitation of my four papers is that they are all based on three single-case studies, as described in section *Research design*. While the single-case studies based on Ericsson offer a unique opportunity to obtain detailed insights into the business model innovation process of a large multinational, multidivisional incumbent industrial firm, they also limit the generalizability of the findings. The uniqueness of Ericsson's context of the business model innovation process might not be directly applicable to other industries. This limitation is common for all single-case studies (Yin, 2003) and calls for caution in extending their findings and conclusions beyond the studied context.

My position as an insider within Ericsson remains a potential source of bias that must be acknowledged and addressed. As described in section *Being an insider and becoming an industry PhD-student*, being an insider allowed me to access vast amounts of data and draw upon my own experiences and observations, thereby providing a unique perspective on the firm's business model transformation process. This insider position comes with the drawback of questions about the objectivity of my research (Brannick and Coghlan, 2007). To address these concerns and enhance the validity and reliability of my research, I implemented several measures in the research process for the three cases. To balance my insider perspective, I made sure that the composition of the research teams always included outsiders, external co-authors, in addition to myself as the insider. Collaborating with co-authors with an outsider perspective facilitated a critical examination of data and findings, thereby reducing bias. To strengthen the rigor of the research, we independently coded and analyzed the data, subsequently comparing our interpretations to draw conclusions and insights from the research. Furthermore, several measures to secure the validity of the data were implemented during the research process, as described in section *Data analysis*; e.g., all findings were cross-checked with multiple sources, including external documentation. Although during the research process, I used the measures described above and in earlier parts of this chapter to maintain validity and reliability, it is nonetheless essential to acknowledge that bias cannot be entirely eliminated.

Chapter 4

Overview of Papers

This chapter provides an overview of the individual papers that form the core of this thesis. Each paper focuses on a different aspect of the business model innovation transitions Ericsson undertakes to capture value from emerging technologies. In addition to a summary of each paper, the following sub-sections present the authors and their contributions, the research setting, and the research purpose. The last section summarizes the findings from all papers.

Paper I: Right Technology, Wrong Business Model: Evidence from Ericsson on Why and How Firms Struggle to Substitute Products with Services

The research purpose of *Paper I* is to explore how an incumbent industrial firm's search for a service-based business model influences the value creation and value capture activities over time, and to reveal how internal and external context influence the business model innovation process. The research setting is a business model change initiated by a discussion between Ericsson and one if it's global customers. In response, two business units and one customer unit at Ericsson embarked on developing and implementing a performance-based (servitization) business model. This paper explores how the value creation and value capture activities evolve over time at Ericsson as the firm rolls out this new business model. Table 5 presents the status of *paper I*.

Table 5. Status of paper I.

Paper I	
Full title	Right Technology, Wrong Business Model: Evidence from Ericsson on Why and How Firms Struggle to Substitute Products with Services
Authors	Joakim Björkdahl and Mats O. Pettersson
Authors' contribution	The author of this thesis obtained access to the data from Ericsson, served as the primary investigator, and collected the data. The author and Björkdahl jointly developed the idea of the paper and the theoretical reasoning; both contributed to writing all sections of the paper.
Status	Under review at international academic journal

Paper I: Abstract

The shift from selling products to selling services is a strategic challenge for many manufacturing firms, and there is a need to better understand how firms can create and capture value from this shift. Prior research has paid little attention to the dynamic changes in manufacturing firms that undergo a shift from selling products to selling services, the underlying reconfiguration and redesign needed to support a service-based business model.

This article fills this gap by examining the strategy adopted by Ericsson, a leading supplier of high-technology capital goods in the telecommunications industry, in its attempt to create and capture value via the change from selling telecommunications networks to selling network capacity across different geographical markets and shifts in technology standards. The paper provides insights into the key factors that enable the firm to successfully transition to a service-based business model. The paper uses a process study, based on data from 578 internal documents, 1,494 emails, 40 semi-structured interviews, and observations from 232 meetings. The paper show that designing a successful service-based business model for high-technology capital goods is challenging due to the many interdependent value creation and value capture activities in the firm's business model, which must be considered and changed. We also show that scalability is problematic because geographical dependencies make it difficult to apply a single service-based business model to different markets and customers and to transfer capabilities from one market to another.

Paper II: Technological Development and Business Model Dynamics: Exploring the Triadic Interplay among Servitization Business Models

The research purpose of *paper II* is to unpack the interplay between technology and business models by expanding theory from a dyadic to a triadic perspective. The paper is based on the same research setting as paper I, but the focus here is on examining the challenges faced by Ericsson when technological advancements and shifting customer behavior affect the performance-based (servitization) business model. Table 6 presents the status of *paper II*.

Table 6. Status of paper II.

Status of Paper II	
Full title	Technological Development and Business Model Dynamics: Exploring the Triadic Interplay among Servitization Business Models
Authors	Mats O. Pettersson, Stefan Arora-Jonsson, and Joakim Björkdahl
Authors' contribution	The author of this thesis developed the initial idea, the paper's theoretical positioning, and carried out data collection. The author also wrote all sections with contributions from Arora-Jonsson and Björkdahl.
Status	Still under development

Paper II: Abstract

As firms strive to remain competitive in the face of rapid technological change, the adaptation and utilization of technology to enhance their business models become crucial. A firm's business model, interdependent activities to create and capture value, plays a central role. Managing the interplay between the evolving technology landscape and the dynamic nature of business models poses a significant challenge for firms. This paper investigates the complexity of the technology-business model interplay by expanding the conventional dyadic perspective to a triadic framework that incorporates the behavior of the customer. Through a case study of Ericsson's transition from a transaction-based to a servitization business model in the Indian market, we examine the firm's struggles in managing the new business model amidst technological advancements from 2G to 4G. Our findings shed light on the challenges associated with coordinating the actions of the seller and buyer in servitization models, emphasizing the importance of addressing divergent expectations, communication issues, power dynamics, and building internal organizational coalitions. This research contributes to a deeper understanding of the dynamics between technology and business models, emphasizing the need to consider the triadic interplay and the complexities arising from the customer's role in shaping business model success.

Paper III: Profiting From AI: Evidence from Ericsson's Quest to Capture Value

The research purpose of *paper III* is to explore how an incumbent industry firm captures value from AI technology. The research setting is one of Ericsson's business units, Managed Services, which manages and operates its customer's mobile networks. The business unit introduces an emerging technology, AI, to improve internal operations and grow the business. The paper explores two major profitability challenges: enhancing the bottom line and driving top-line growth when using AI. To expand the business to new customers, Ericsson introduced an AI-as-a-service offering. Table 7 presents the status of *paper III*.

Table 7. Status of paper III.

Status of Paper III	
Full title	Profiting From AI: Evidence from Ericsson's Quest to Capture Value
Authors	Mats O. Pettersson, Joakim Björkdahl, and Marcus Holgersson
Authors' contribution	The author of this thesis served as a primary investigator, collected the data, developed the initial idea, and the paper's theoretical positioning. The author also wrote all sections jointly with Björkdahl and Holgersson.
Status	Under review at international academic journal

Paper III: Abstract

This article delves into the strategic challenges and opportunities for firms seeking to profit from artificial intelligence (AI), with a detailed examination of Ericsson's methods and experiences. It reveals the complex landscape of translating AI's transformative potential into measurable business gains. The focus is on Ericsson's strategies for capturing value from AI, particularly in driving top-line growth. The paper highlights the critical need for understanding customer requirements, effectively utilizing complementary assets, and building dynamic capabilities within an AI-focused business framework. The narrative of Ericsson's transformation into an AI-centric organization is central, illustrating the importance of complementary assets and addressing the distinct challenges presented by technological complementarities in the current digital and AI-dominated economy. Further, the research discusses the imperatives of overcoming data challenges, advancing organizational capabilities, and clearly articulating value in the context of AI transformations, especially when targeting top-line growth. By presenting Ericsson's case, the study provides actionable insights for large established firms and new entrants in the AI arena, contributing to a richer understanding of how innovation in AI can be harnessed for profitability.

Paper IV: Generative Innovation Ecosystem: The Formation and Layered Combinatorial Innovations

The research question of *paper IV* is: What are the generative levers that enable ecosystem architects to orchestrate the formation and evolution of generative innovation ecosystems that consistently produce combinatorial innovations? The research setting is a business unit of a world-leading telecommunications equipment provider intricately involved in forming an innovation ecosystem surrounding 5G technology; the business unit's ambition is to broaden the usage of 5G by offering private networks for enterprises and industries. The paper explores how the unit builds an innovation ecosystem to broaden the use of the firm's emerging technologies. Table 8 presents the status of *paper IV*.

Table 8. Status of paper IV.

Status of Paper IV	
Full title	Generative Innovation Ecosystem: The Formation and Layered Combinatorial Innovations
Authors	Marin Jovanovic, Mats O. Pettersson, Vinit Parida, and David Sjödin
Authors' contribution	The author of this thesis and Jovanovic jointly developed the initial idea and research design. Pettersson collected all data and collaborated with Jovanovic to conduct the data analysis and theoretical positioning, and to write the paper. Parida and Sjödin contributed insights throughout the writing phase.
Status	Resubmit to the Journal of Management Studies

Paper IV: Abstract

In the contemporary digital era, the prominence of innovation ecosystems in industrial B2B settings is undeniable, with generativity playing a crucial role. This generativity may originate from a generative community, architecture, and governance. Yet, despite its significance, our understand-

ing of how industrial firms invoke generativity within innovation ecosystems remains in its infancy. Consequently, this study delves into the formation of a generative innovation ecosystem and its impact on producing combinatorial innovation. Using an in-depth case study of a world-leading telecommunications equipment provider of 5G technology, informed by 54 interviews and document study, we pinpoint the generative levers essential for the generative innovation ecosystem's formation, namely, designing generative ecosystem governance, generative ecosystem community expansion, and value architecture envisioning. Additionally, we demarcate two orchestration modes of converging and diverging, rendering different forms of combinatorial innovations, respectively, viable innovations and emergent innovations. To further detail the temporal progression of generativity, viable innovation possesses inherent generative potential that subsequently promotes generativity in emergent innovations. By merging these insights, this research aims to enrich both theoretical perspectives and practical implementations concerning the innovation ecosystems and their generative capacities.

Findings of the appended papers

The findings of the four appended papers are summarized in Table 9 and elaborated in Chapter 5, in the context of this thesis's research questions: *How do emerging technologies impact the business model innovation process, and how does value capture unfold within this process for specific business models?*

Table 9. Findings of the appended papers.

Paper I	*Paper II*	*Paper III*	*Paper IV*
Highlights the difficulty and challenges in reconfiguring a manufacturing firm's business model from product-based to service-based. Emphasizes the importance of dynamic capabilities and flexibility in successfully navigating the transition and achieving value creation. Identifies the critical role of aligning the business model with physical technologies for effective value creation and capture. Emphasizes the significance of contracts in complex relationships, particularly performance-based contracts for service-based business models. Reveals the difficulties in scaling a service-based business model to new geographical markets, including the need for knowledge transfer and adaptation. Challenges the received wisdom that manufacturing firms should necessarily move towards providing services and highlights the complexities and uncertainties involved in such transitions.	Examines the interplay between technology and business models in the context of firms adapting to rapidly changing emerging technologies. Demonstrates the continuous reciprocal interaction between business model innovation and technological innovation, showcasing the influence of market changes and exogenous technological developments on the business model. Expands the traditional dyadic perspective on technology-business model interaction to a triad by including the perspective of the customer as a key player. Highlights the challenges firms face in adapting their business models to technological developments, emphasizing the need for coordination, balance of power, and communication between the firm and its customers. The research emphasizes the importance of building and managing internal organizational coalitions to ensure alignment and successful business model implementation. Highlights the role of organizational capabilities, such as R&D resources, contractual terms, and risk management as moderating variables in maintaining the balance between technology and the business model.	Shows that profiting from AI is challenging and requires firms to develop a deep understanding of customer needs, restructure internal operations, and enhance skills and resources. Presents two main strategies for profiting from AI: Focus on bottom-line improvements through internal efficiency and top-line growth through new businesses enabled by AI. Value capture from AI is more problematic when it relies on top-line growth through business model innovation rather than bottom-line improvements through efficiency gains. The complexity of AI technology and its interdependencies with customer data make capturing value from AI investments difficult. Ericsson's AI transformation faced challenges in articulating the value of AI solutions, scaling them cost-effectively, and pricing them appropriately. Challenges in profiting from AI include data, capability, and value challenges, which vary depending on the chosen strategy. Bottom-line improvement strategies rely on internal data and capabilities, while top-line growth strategies require access to and integration with customer data and technologies. Successful AI strategies for top-line growth necessitate careful analysis of complementarities, significant investments in competence, technology, data, and dynamic capabilities, and value articulation and capture.	Focuses on the emergence and evolution of generative innovation ecosystems in industrial B2B settings. Identifies the foundational generative levers pivotal to the formation of generative innovation ecosystems. Provides a framework for understanding the temporal progression of generative innovation ecosystems, from convergence to divergence. Highlights the importance of governance, community expansion, and architecture in fostering generativity. It provides a more granular understanding of the levers that can be controlled to foster generativity, emphasizing the nuances of governance, community expansion, and architecture. Offers ecosystem architects a blueprint for fostering generativity, emphasizing the importance of flexible governance, community engagement, and adaptive value architectures.

Chapter 5

Findings

This chapter presents a synthesis of the findings of my four papers, offering insights into the impact of emerging technologies on the business model innovation process within an incumbent industrial firm. The papers examine Ericsson's business model transition from a transactional product-based business model to two variants of service-based business models and a multi-actor business model. By doing so, they offer details on the complexities, challenges, and potential solutions encountered when trying to capture value throughout the business model innovation process. These findings align with the research questions: *How do emerging technologies impact the business model innovation process, and how does value capture unfold within this process for specific business models?*

The synthesized findings highlight the strong interaction between emerging technologies and business models, emphasizing the necessity of business model innovation where the introduction of emerging technologies creates a misalignment, prompting the incumbent industrial firm to undergo a business model innovation process. This business model innovation process involves restructuring internal operations, organizational structures, and introducing new roles, skills, and resources. All are crucial for effectively capturing the value from emerging technologies. The findings further emphasize the ongoing nature of the adaption process even after implementing a new business model. Continuous adjustments are necessary to address the evolving nature of emerging technologies; furthermore, scaling the new business model presents a significant challenge for the firm.

The four papers present the business model innovation processes for three distinct business model types. The first two business model processes focus on establishing two types of service-based business models: performance-based and software-as-a-service-based. Service-based business models (the taxi) involve a shift in the firm's role from being an enabler to becoming a provider committed to delivering results. The performance-based service business model requires a closer relationship between the firm and the customer, often involving the firm taking over specific customer tasks through outsourcing arrangements. In the case of Ericsson, this involved building and operating the customer's mobile network, and charging the customer based on the voice capacity utilized in the network rather than the on delivered equipment and services (further described in *papers I and II*). On the other hand, the software-as-a-service business model (the bus) aims to efficiently deliver standardized offerings to a broad customer base, in Ericsson's case the delivery of AI-as-a-service to new customers (*paper III*). The papers examine the nuances of these service-based business models, providing insights into their implementation, challenges, and remedies when capturing value. The third transition focuses on the business model innovation process in the context of designing and managing multi-actor business models, the caravan (*paper IV*). The firms see the need to expand their 5G offering outside the traditional industry boundaries and recognize the importance of innovation ecosystems to achieve this. Expanding the firm's reach beyond its established customer base opens opportunities for value capture. Establishing a multi-actor business model serves as a base for promoting partnerships, driving joint innovation, and broadening the usage of the firm's emerging technologies in other industry sectors. The connection between the four papers and business model innovation processes for three distinct business model types is summarized in Table 10.

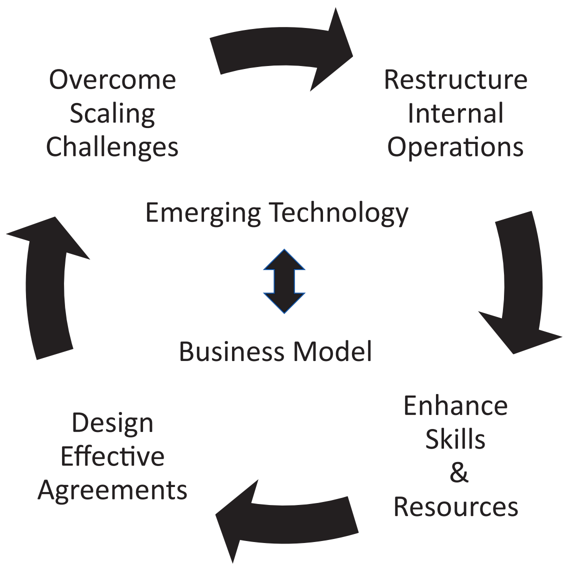
Table 10. The research papers connection to the business model types and their business model processes.

	Research papers	***Business model innovation processes***
I	Examines the process of transformation from product-centric to service-centric business models in an industry firm and explores the interplay among the business model changes, value creation, value capture, and contextual factors.	Implementing a performance-based business model
II	Examines the interplay among technology, business models, and customer behavior in the context of servitization business models.	
III	Explores the value capture challenges and remedies when introducing an emerging technology in an incumbent firm.	Implementing a software-as-a-service business model
IV	Explores how an industrial technology provider orchestrates the formation of a generative innovation ecosystem.	Implementing a multi-actor business model

In the following sections, I explore the details of Ericsson's business model innovation process, examining how it is shaped by the influence of emerging technologies and the strategies employed to effectively capture value from these advancements. *Papers I and II* provide insights into implementing a performance-based service business model. *Paper III* explores the impact on value capture when implementing an emerging technology, both in improving existing business and expanding it using a software-as-a-service business model. Lastly, *paper IV* examines the design of a multi-actor business model to engage with new players and expand market reach for emerging technologies by building an innovation ecosystem.

When I synthesize the insights from the four papers, a clear pattern emerges, highlighting the strong interplay between business models and emerging technologies. The initial misalignment between the emerging technology and existing business models creates a significant barrier to effectively capturing the value. As a result, the incumbent industrial firm is pressed to initiate a business model innovation process. A starting point for the business model innovation process is restructuring internal operations and enhancing skills and resources within their internal organization. Furthermore, activities such as designing effective agreements with customers and new partners within innovation ecosystems becomes crucial for successful value capture. Additionally, the scaling of the new business model must be carefully handled. A conceptual business model innovation process is illustrated in Figure 8.

Figure 8. A conceptual business model innovation process to capture value from emerging technologies.



The driving force behind the need for business model innovation is the lack of fit between the emerging technologies and business models. The synthesized findings, in *papers I and II*, shed light on the process required to align the performance-based service business models with the emerging technology, highlighting the necessity of continuous adjustments to secure continuous value capture. The findings further provide insights into the integration of an emerging technology, AI, into a business unit and its impact on the existing business models, as described in *paper III*. Lastly, the findings from *paper IV* illustrate how a multi-actor business model supports the creation of an innovation ecosystem and extends the reach of the firm's emerging technology to other industry sectors. The following paragraphs will present details of the findings of each paper, providing a deeper understanding of the complexities and strategies involved in aligning emerging technologies with business models to capturing value effectively.

The strong relationship between the emerging technology and the business model is revealed in the case study of Ericsson's transition to a performance-based service business model (discussed in *papers I and II*). The case emphasizes the importance of aligning the characteristics of the emerging technology with the characteristics of the business model. In the case study, the development of the performance-based business model was closely aligned with the characteristics of the second generation of mobile technology (2G). The 2G technology provided voice capacity to cover specific areas, and the technology's characteristics aligned with the revenue parameters of the performance-based business model, which were tied to voice capacity and coverage commitments. When the 2G technology evolved and new services were added, the performance-based business model was not able to value capture of the new and evolved services. To overcome these challenges, Ericsson had to continuously adjust and adopt the value capture mechanism during the operation of the business model. The findings from *papers I and II* highlights how evolving technologies affects the business models, underscoring the importance of making continuous adjustments to ensure the fit with emerging technologies.

The introduction of the third generation of mobile technology (3G) presented significant challenges in aligning the technology's characteristics with the performance-based business model, as explored in *paper II*. Moving from 2G to 3G technology was a fundamental technological leap, expanding the scope from voice-only to voice and data services, which created a misalignment with the existing performance-based service business model. Despite Ericsson's attempts to restructure the performance-based business model to capture value from the data traffic by introducing a new price parameter and new boundary conditions, the value capture was unsatisfactory. The technical characteristics of the 3G technology simply resulted in too high costs for service delivery when using a performance-based service business model. The value capture challenges from the 3G technology were further complicated by the rapid development and constant improvements in 3G technology. For instance, during the operational phase of the 3G performance-based service business model, the data speed offered by the 3G radio base stations increased more than 100 times; however, the performance-based service business model did not evolve at the same pace and the misalignment hindered the value capture of these enhancements. These findings underscore the difficulties in achieving a fit between performance-based business models and rapidly evolving emerging technologies.

The case in *papers I and II* further highlights another example where the importance of aligning the technology's characteristics with the business model's characteristics comes to light. The performance-based service business model was initially designed for 2G technology to deliver and capture value from voice capacity. Although the firm's 2G radio base stations had a scalability for capacity, they were designed for densely populated areas, making them start at a rather high capacity. When the demand for rural coverage (i.e., low-capacity needs) increased the existing radio base stations proved unsuitable due to their high capacity and cost, a misalignment occurred. To address this challenge, the firm developed new low-capacity and low-cost radio base stations to align with the performance-based business model. The value capture from the performance-based business model was restored when the low-capacity and low-cost radio base stations were developed and deployed. A similar challenge arose during the 3G phase of the performance-based business model. The design of the 3G radio base stations focused on delivering high capacity, a characteristic suitable for the traditional product-based business model. This made the 3G radio base stations too costly and unsuitable for rural areas with low-capacity needs, especially in the context a performance-based business model. A similar misalignment between the technology and the business model occurred here as well. Unlike in the 2G case, where products were developed to fit the business model, the lack fit for 3G stressed the importance of aligning business model development with the research and development priorities of the firm.

A 'software-as-a-service'-based business model may also require alignment with the physical technology, as discussed in *paper III*. The findings show that introducing AI technology significantly changed the existing business model, mainly when targeting new customers with an AI-as-a-service offering. In addition to the various changes discussed in subsequent sections, specific challenges arose concerning physical technology. The software-based AI algorithms require access to customers' management systems to receive feedback on the algorithm outcome, thereby preventing model drift. Model drift refers to the deterioration of an AI model's accuracy when it lacks information on the outcome of a specific operation. Ericsson's challenge was to secure access to the data from the customers' management system cost-efficiently while upholding data sovereignty. To tackle this challenge, Ericsson implemented a feedback loop setup that upheld customer data sovereignty and ensured cost-efficient implementation for the firm (elaborated in section *Overcoming Scaling Challenges*). Additionally, the software-based nature of AI algorithms allowed centralized control over upgrades and improvements, but this imposed a challenge until a solution to maintain the integrity of customer data was implemented (as further described in section *Overcoming Scaling Challenges*). Emerging technologies triggers business model innovation and activities found in the papers for the two service-based business models are summarized in Table 11.

Table 11. Findings related to securing fit between emerging technologies and business models.

Business Model Innovation process	*Securing fit between emerging technologies and business models*
Implementing a performance-based business model (Papers I and II)	Continuous adaptions required. Business model high dependence on emerging technologies' hardware characteristics. Research & development alignment with business model required.
Implementing a software-as-a-service business model (Paper III)	Feedback loops to improve emerging technologies' software required. Software-based emerging technologies dependent on hardware integration.

Building upon the insights of how emerging technologies impact business models, the following sections will present the subsequent steps of Ericsson's business model innovation process to effectively capture value from emerging technologies.

Restructuring internal operations

This section explores the restructuring of internal operations during the business model innovation process, highlighting the shift the firm must undergo when introducing emerging technologies. The synthesized findings emphasize the need for profound internal changes to secure value capture. To successfully transition to a performance-based business model, as presented in *papers I and II*, a complete reconfiguration of internal processes was needed, and establishing a dedicated organizational unit became a prerequisite to manage the value capture. Similarly, introducing an AI-as-a-service business model (as described in *paper III*) required an extensive overhaul of internal processes to achieve efficiency and integrate external processes. Additionally, initiating new processes for effective external engagements becomes vital to support the dedicated organization when managing a multi-actor business model (as described in *paper IV*). These synthesized findings collectively underscore the need for continuous adjustment of internal operations due to the introduction of emerging technologies and the creation of dedicated organizations to secure value capture. To illustrate these findings, the following paragraphs dig deeper into the specific instances drawn from the papers and untangle the details of these changes.

The transition to a performance-based service business model, as explored in *paper I*, required a restructuring of internal operations to effectively capture value. This transition changed the firm's role, from being a provider of products and services to becoming a provider of specific and measurable outcomes. Hence, the firm's responsibilities expanded significantly, and to secure the value capture of the performance-based business model, the firm had to develop and implement new processes, such as capacity management and financial control processes and procedures. After an extensive overhaul of these processes and procedures, the firm successfully addressed the value capture challenges. The changes included the enhancement of capacity management processes, which aimed to optimize capacity delivered while simultaneously minimizing equipment usage. Additionally, a closer collaboration and interaction with the customers' processes became necessary, given the introduction of multiple new interfaces required by the service-based business model. Furthermore, the roles of the sales team and the customer support staff had to be redefined to accommodate the new processes and procedures. Implementation was hindered by routinized ways of working, resulting in value capture declining. However, after establishing a separate organization to manage the new service-based business model, the firm managed the implementation and operation of the new processes, and the value capture was improved.

The introduction of the emerging technology AI supported Ericsson's managed services business to operate customers' networks but required a reengineering and automation of manual processes, leading to a complete overhaul of the process architecture, as described in *paper III*. To deliver the AI-supported offerings efficiently, several of the firm's organization's processes had to be re-engineered. These re-engineered processes formed the basis of the Ericsson Operations Engine platform and enabled the efficient delivery of both base and value packages. The base packages are aimed at improving internal efficiency in ongoing engagements, and the value packages are aimed at improving customers' top-line growth. Furthermore, the firm was planning to extend its customer base by offering value packages to new customers through an AI-as-a-service business model. Here, restructuring internal operations was instrumental for effective value delivery to the extended customer base.

When creating multi-actor business models, restructuring internal processes and organizations played a crucial role, as described in *paper IV*. The transition from a closed partnership approach to an open innovation ecosystem required modifying existing processes and introducing new processes. Establishing a specific organization to effectively engage with a broader industry segment, implement new strategies, and develop onboarding processes became important. The findings highlight the significant effort required to construct these onboarding processes and reconfigure existing processes for sales and marketing in order to engage with new industry players beyond the firm's traditional customer base.

In conclusion, the consolidated findings from the four papers underscore the crucial role of continuous reconfiguring processes, procedures, and organizational structures when capturing the value from emerging technologies through business model innovation. As the reconfiguration grows more complex with the participation of external stakeholders and the formation of innovation ecosystems, the task of restructuring internal operations becomes increasingly complex. A summary of the restructuring activities found for the business model innovation processes in the papers are presented in Table 12. Restructuring internal operations is an important first step when incumbent firms realign their business model with emerging technologies, providing a base for the next step of enhancing skills and resources.

Table 12. Summary of the restructuring activities found for the business model innovation processes.

Business Model Innovation process	*Restructuring internal operations*
Implementing a performance-based business model (Papers I and II)	Internal process reconfiguration. Dedicated organization for new business model needed. Continuous adjustments required
Implementing a software-as-a-service business model (Paper III)	Complete rework of internal processes to achieve efficiency needed. Integration of external processes required. Dedicated organization for new business model required.
Implementing a multi-actor business model (Paper IV)	Requires new processes to reach out to external parties. Dedicated organization for new business model needed.

Enhancing skills and resources

This section explores enhancing skills and resources in incumbent industrial firms' business model innovation process. Drawing upon Ericsson's transformative journey, enhancing skills and resources becomes apparent across the four papers with varying business model innovation goals. For instance, in the performance-based business model (*papers I and II*), mastering the new model's logic requires new skills. Transitioning to a software-as-a-service business model (*paper III*) requires a complete internal competence uplift. The introduction of a multi-actor business model, as described in *paper IV*, further emphasizes the importance of managing external resources and competencies, and the need for new skills to navigate the new partner engagements. Each paper uncovers specific challenges and prerequisites, underscoring the complexity of integrating enhanced skills and resources in the business model innovation process. The following paragraphs provide a deeper examination of the papers' findings.

Introducing performance-based business models requires enhanced skills and resources, as exemplified in *paper I*, where the introduction of new skills and resources was instrumental for effective value capture. In the initial stages of the performance-based business model operation, Ericsson faced value leakage due to a lack of expertise in executing the model's new logic. After an extensive analysis, the firm identified the need to introduce new skills, such as contract managers and specially trained network planners, to restore the value capture. The logic of the performance-based business model is to maximize capacity outcomes with minimal product usage. This new logic presented challenges for staff used to the product-based business model that prioritized product delivery. To address this challenge, Ericsson appointed contract managers skilled in service-based logic to optimize deliveries according to the logic of the new business model. Furthermore, network planners and delivery staff received special training to foster an understanding of the new logic, thereby optimizing the design and delivery of the network in line with the performance-based model's principles. The implementation of these new skills resulted in improved value capture.

Investments in skills and resources were required to fully capture the potential of the emerging technology, AI, when operating customer networks, as demonstrated in *paper III*. Ericsson invested significantly in AI expertise and employee training to enable the transition to an AI-driven organization, an investment that resulted in enhanced operational efficiency and bottom-line improvements. Achieving top-line growth became more complex and required skills development across a broader area of the organization. For instance, the sales organizations needed tools to better convey the value of the AI offerings. To address this need, Ericsson introduced a Total Cost of Ownership (TCO) calculator, which supported the sales teams in articulating the value of the AI offerings. The TCO-calculators proved instrumental in assisting the sales teams in introducing potential savings in operational costs made by the AI-as-a-service offerings. For example, the TCO-calculator could articulate how a 'power-saving value package' could reduce cost by presenting how battery life would be extended, thereby reducing the battery replacement cycle. The sales team's usage of the TCO-tools contributed to the value capture of the firm's AI-driven organization.

Ericsson also had to introduce new skills and resources to address the data challenge when expanding the customer base through an AI-as-a-service business model. To enhance the AI algorithms, Ericsson needed data from multiple customer networks; however, such data are sensitive from a competitive standpoint. To solve this issue, Ericsson invested in resources to anonymize the data. Furthermore, compliance with data integrity regulations complicated Ericsson's access and storage of customer data. This challenge was addressed by anonymizing data and storing it on customer premises or within their respective countries (further elaborated in section *Overcoming Scaling Challenges*). The investments undertaken by Ericsson to overcome the data challenge emphasize the importance of incorporating the right skills and resources to capture value from emerging technologies.

Incorporating additional skills and resources also proved crucial when building and managing a multi-actor business model, as presented in *paper IV*. The primary objective of establishing a multi-actor business model is to facilitate an innovation ecosystem that promotes the adoption and utilization of the firm's emerging technology. The firm needed to create new partnerships to extend the use of 5G across new industry sectors. These partnerships involved actors such as software developers, device manufacturers, original equipment manufacturers, consulting firms, and system integrators. The establishment of an innovation ecosystem with these actors served two purposes. First, the innovation ecosystem provided the firm with access to skills and resources from other firms. Second, the innovation ecosystem promoted the usage of 5G technology and made it relevant for the partners when they developed offerings for other industry sectors. To create the innovation ecosystem, the firm had to invest in resources with the skills to understand the partners' offerings and identify potential joint value propositions. Special skills were also needed to manage the partner engagement process, and to further support the engagement process, the firm introduced a digital engagement platform. Partners could connect, share expertise, and collectively develop joint offerings through the digital engagement platform. The platform also provided learning modules on 5G technology to educate industry partners outside the telecom sector. The digital platform was instrumental in helping the firm to effectively engage with over 900 partners. The insights from the firm's experiences of creating a multi-actor business model reveal the increasing complexity of integrating new skills and resources when external assets come into play. A summary of the activities to enhance skills and resources for the business model innovation processes in the papers is presented in Table 13.

Table 13. Summary of the activities to enhance skills and resources for the business model innovation processes.

Business Model Innovation process	*Enhancing skills and resources*
Implementing a performance-based business model (Papers I and II)	New skills to manage new business model logic required.
Implementing a software-as-a-service business model (Paper III)	New internal skills required due to introduction of an emerging technology. New tools/resources required due to introduction of an emerging technology. Access to external resources needed. Managing external resources required.
Implementing a multi-actor business model (Paper IV)	New skills required to manage new business model partners. Access to external resources & skills needed. Managing external resources and skills required. New tools needed for partner management.

Designing effective agreements

This section investigates the role of designing agreements tailored for specific business models in the business model innovation process. Specifically, it highlights how the alignment of contractual design with the characteristics of different business model types affects value capture from emerging technologies. Insights gathered from the four papers distinctly illustrate the diversity of contractual agreements needed to support the various business model types. For instance, the differences in contractual set-up are visible for the two service-based business models. The performance-based service business model (*papers I and II*) requires a complex contract with continuous adjustments and refinements of the contractual terms during the business model's operation. In contrast, the software-as-a-service business model requires standardized contracts to achieve scalability. Meanwhile, the contractual agreements needed for creating and managing multi-actor business models are a third example of differences. The multi-actor business model contractual agreements focus on non-disclosure agreements to enable cooperation and joint development among firms. These contractual differences underline the importance of formulating contracts that reflect the specific characteristics of business model types. A closer examination of contractual agreements in each paper will be presented in the following paragraphs.

The agreement of the performance-based business model was formed by a shared understanding of mutual objectives between the top management of Ericsson and its customer (as described in *paper I*). The following initial contract was based on a traditional product supply contract, albeit with an altered pricing structure. The contract lacked specific details on goals, governance structure, and clear boundary conditions to clarify when the price structure was viable. Besides clear boundary conditions on the price structure, the contract also lacked other details necessary for a performance-based contract, such as clarifying responsibilities for network upgrades, what type of network sites to deploy, and the pace of roll-out. The contract's deficiencies initially hindered Ericsson from capturing enough value from the performance-based business model, subsequently triggering a renegotiation and a contract revision. The most important parts of the contract revision were the clarification of boundary conditions, the introduction of governance structures, and the implementation of reconciliation mechanisms. The new contract improved Ericsson's business performance and the value captured from the performance-based service business model. It is worth noting that contract modifications continued during the operation of the business model as technology changed and other learnings surfaced.

Insights from the case study behind *paper III* reveal that the software-as-a-service business models require a different type of contract than the performance-based business model. The objective of software-as-a-service business models is simplification and efficiency, which calls for standardized and automated contracts. Ericsson's standard contracts for transactional business models were typically tailored for each specific customer and project, as opposed to standardized and automated contracts for software-as-a-service business models. The firm managed to move towards automated and standardized contracts, but it involved process modifications and deploying new web-based contracts.

Paper IV shows that the multi-actor business model requires another type of contractual agreement, since the business model aims to stimulate an innovation ecosystem, encouraging a broader usage of 5G technology. As previously noted, to achieve this expansion, the firm had to engage in collaborations and co-development initiatives outside the existing partner network, calling for new contract types to establish trust between the parties. The firm used the digital onboarding process described in section *Enhancing Skills and Resources* to respond to the requirement to manage partnership agreements. The firm also used digital signatures to speed up the agreement process and leveraged learnings from the web-based contracts from the software-as-a-service business model. The digital contracts included non-disclosure agreements regarding research and development efforts and co-marketing agreements. Table 14 summarizes findings related to designing effective agreements from the papers.

Table 14. Summary of the findings related to designing effective agreements.

Business Model Innovation process	*Designing effective agreements*
Implementing a performance-based business model (Papers I and II)	Complex contract design. Continuous contractual adaptations required.
Implementing a software-as-a-service business model (Paper III)	Standardized contracts. Automated contract process required.
Implementing a multi-actor business model (Paper IV)	Primarily non-disclosure agreements and contracts about cooperation.

Overcoming scaling challenges

This section illustrates an incumbent industrial firm's challenges when scaling its new business models. The performance-based business model's dependency on varying external factors is examined, as well as the complexities of transferring the business model logic into a new organization (*paper I*). Furthermore, the findings from *paper III* illustrate the integration challenges the software-as-a-service business model requires to secure data integrity. Lastly, the section presents how the multi-actor business models' introduction of new reseller partners affects the firm's product packaging (*paper IV*).

Scaling new business models presents a hurdle even when the challenges outlined in earlier sections are addressed effectively. This was evident when Ericsson, in due course, managed to restore the value capture of the performance-based service business model in India and then decided to replicate the business model in other markets (*paper I*). These markets included Bangladesh and several African countries, and the paper highlights the complexity of transferring a successful business model into other cultural and economic settings. Multiple adjustments to the performance-based business model were required to capture value in these new markets. Two primary scaling challenges were identified. Firstly, the business model and the emerging technology were found to be highly dependent on local and demographic factors, such as traffic growth rates, voice/data usage patterns, population density, and frequency allocations. These factors negatively influenced the business model's value capture, which required a substantial reconfiguration to restore the value capture. For instance, the new markets had variations in demographics, frequency allocations, and growth rates compared to India. This increased the need for equipment to fulfill the agreed capacity and coverage commitments. The increased need for equipment and a significantly lower traffic growth rate influenced both the revenue streams and the cost structures. The reduced value capture triggered a rework of many of the value capture components of the business model. This task was substantial, almost comparable to creating a new business model from scratch. Secondly, introducing a service-based business model to a new organization proved more complex than anticipated despite prior implementation experiences. The findings reveal similar issues in the new markets as in the initial stage of the new business model in India. Specifically, the local staff struggled to fully understand the new business model's core logic. To overcome this problem, a costly and time-consuming process was needed, where knowledge and capabilities had to be transferred to the new markets. The insights from *paper I* suggest that scaling a performance-based service business model is challenging for incumbent industrial firms when using emerging technologies.

The AI-as-a-service business model also presented scaling challenges affecting the value capture. The scaling issue was primarily due to the complex and costly integration with customers' on-premises management systems. *Paper III* shows how these integration requirements led to customized integrations, with up to 40% of each installation being customer-specific. To address this issue, Ericsson experimented with a concept called 'closed automation loops'. Ericsson uses standardized interfaces and commands to retrieve information from and control the customer's networks remotely. These closed automation loops mitigated the need for costly customized integrations and demonstrated promising potential for improving efficiency and value capture. *Paper III* further reveals that the physical location of the AI algorithms and data processing posed a scaling issue. To enable effective scaling of the AI-as-a-service offering, Ericsson would have one central point for the AI algorithms and data processing. Due to data integrity concerns and regulations, customers often prefer to maintain control of the AI algorithms and the data processing. Some customers even require that data processing be carried out on their premises. These requirements created a scaling challenge for the firm. To address this issue, Ericsson implemented a solution that placed the AI algorithms and data processing at three physical locations: a global location for customers without data restrictions, an in-country location for customers where national regulations require data storage within the country, and an on-premises location for customers requiring tight control of their data. Ericsson further implemented the same data stack across all locations, enabling a smooth and cost-efficient replication. As a result, Ericsson could manage and update the AI algorithms remotely, while the sensitive customer data processing could remain securely at its designated location.

Another aspect of scaling challenges, as presented in *paper IV*, is when firms aim to broaden the usage of their emerging technology through a multi-actor business model. The introduction of such a business model includes introducing new partners to serve as resellers of the firm's private 5G networks. Initially, the reseller privilege was exclusive to communication service providers, who had the required capacity to install, integrate, and operate 5G networks. The value distribution of the initial arrangement was skewed towards communication service providers, with 20% for the firm and 80% for the communications service provider. The multi-actor business model's purpose was to access an innovation ecosystem and broaden the pool of resellers. The firm wanted to shift the value distribution more favorably towards the firm. The value redistribution and the potential to expand market reach were expected to enhance the firm's value capture. To achieve this objective while ensuring scalability, it was necessary to re-engineer the Private 5G Network solutions into pre-packaged offerings. This approach would streamline the ordering, installation, and network management processes, empowering partners with minimal knowledge to handle the installations effectively. This strategic shift represented a new way of packaging the products and required a notable shift in the firm's traditional approach to selling network equipment. Guaranteeing the scalability of the offering to ecosystem partners required adjustments to processes, competencies, and assets. These adjustments, aligned with the findings presented in sections in earlier sections, played a critical role in scaling the Private 5G Network. The scaling challenges for the business model innovation processes in the papers are summarized in Table 15.

Table 15. Summary of scaling challenges for the business model innovation processes.

Business Model Innovation process	*Overcoming scaling challenges*
Implementing a performance-based business model (Papers I and II)	Emerging technologies' dependence on external factors. New business model logic is difficult to transfer to a new organization.
Implementing a software-as-a-service business model (Paper III)	Costly integration of external assets Securing the integrity of external assets.
Implementing a multi-actor business model (Paper IV)	Primarily non-disclosure agreements and contracts about cooperation.

Summary of synthesized findings

The synthesized findings in this chapter offer insights into the business model innovation process of three distinct business model types: performance-based, software-as-a-service-based, and multi-actor-based. The findings illustrate the challenges that emerging technologies impose on a firm's business models and present strategies, critical factors, and essential steps in the business model innovation process to ensure value capture. The business model innovation process includes four steps: restructuring internal operations, enhancing skills and resources, crafting effective agreements with customers and partners, and tackling scaling complexities. Together, the synthesized findings address the research questions: *How do emerging technologies impact the business model innovation process, and how does value capture unfold within this process for specific business models?*

Moreover, the findings show that the tactical actions at each step of the business model innovation process are not one-size-fits-all but vary depending on the business model type being implemented. Table 16 summarizes the specific details of each business model innovation process for the three business model types. The synthesized findings further reveal that the business model innovation process is not static but requires ongoing adjustments to manage the evolving characteristics of emerging technologies.

Table 16. Summary of synthesized findings.

Business Model Innovation process	*Fit between emerging technologies and business models*	*Restructuring internal operations*	*Enhancing skills and resources*	*Designing effective agreements*	*Overcoming scaling challenges*
Implementing a performance-based business model (Papers I and II)	Continuous adaptions required. Business model high dependence on emerging technologies' hardware (characteristics). Research & development alignment with business model required.	Internal process reconfiguration. Dedicated organization for new business model needed. Continuous adjustments required.	New skills to manage new business model logic required.	Complex contract design. Continuous contractual adaptations required.	Emerging technologies' dependence on external factors. New business model logic is difficult to transfer to a new organization.
Implementing a software-as-a-service business model (Paper III)	Feedback loops to improve emerging technologies' software required. Software-based emerging technologies dependent on hardware integration.	Complete rework of internal processes to achieve efficiency needed. Integration of external processes required. Dedicated organization for new business model required.	New internal skills required due to introduction of emerging technology. New tools/resources required due to introduction of emerging technology Access to external resources needed. Managing external resources required.	Standardized contracts. Automated contract process required.	Costly integration of external assets. Securing the integrity of external assets.
Implementing a multi-actor business model (Paper IV)		Requires new processes to reach out to external parties Dedicated organization for new business model needed.	New skills required to manage new business model partners. Access to external resources & skills needed. Managing external resources and skills required New tools needed for partner management.	Primarily non-disclosure agreements and contracts about cooperation.	Additional product development approach added – pre-packaged Private 5G Network solutions

Chapter 6

Discussion

The findings from Ericsson's business model innovation activities outlined in Chapter 5 offer a granular view of the complex mechanisms at play in the business model innovation process for an incumbent firm striving to capture value from emerging technologies. These findings lay the foundation for the discussion in this chapter, where theoretical and managerial contributions from these insights are discussed, and limitations and avenues for future research are suggested.

Contributions to literature

This thesis enriches the literature on business model innovation (Chesbrough, 2010; Markides, 2006; Amit and Zott, 2020; Christensen, 2006; Snihur et al., 2023; Teece, 2018) by exploring the dynamics of the two-way interplay between business models and technologies. More specifically, the thesis sheds light on our understanding of the interplay between emerging technologies and the business model innovation processes when incumbent firms strive to capture value from such technologies. The thesis further contributes to the business model innovation process discourse (Frankenberger et al., 2013; Sosna et al., 2010; Khanagha et al., 2014; Baines et al., 2020; Sjödin et al., 2020; Amit and Zott, 2020; Linde et al., 2021) by affirming the iterative nature of the business model process and by unpacking the details of the value capture aspects of the business model innovation for three types of business models. The thesis broadens the scope of our current understanding and introduces additional layers into the discourse on business model innovation research in four related ways.

The first contribution offers a process perspective on the dynamic two-way interplay between business models and technologies. This contribution extends our understanding of the relationship between the two domains, an addition to the one-way perspective common in prior research. While the established literature (e.g., Chesbrough, 2010; Teece, 2010) recognizes that technologies require a suitable business model to ensure effective commercialization and value capture, and that the balance between technological development and business model innovation affects performance and economic outcomes (Teece, 2010; Baden-Fuller and Haefliger, 2013; Chesbrough, 2010; Björkdahl, 2009; Johnson et al., 2008), the literature often presents a one-way perspective of the relationship, discussing either how technology development influences business models (Teece, 2010; Chesbrough, 2010; Björkdahl, 2009; Zott and Amit, 2011) or how business can guide technological development (Baden-Fuller and Haefliger, 2013; Tripsas and Gavetti, 2000). By doing so, the literature overlooks how the interplay between business models and technology is a dynamic and reciprocal process. This contribution goes beyond the prevailing one-way perspective in the literature and provides a detailed view of the dynamic two-way interplay between the domains. The empirical findings in *paper II* clearly illustrate how a shift in either domain induces an imbalance, thereby obstructing the value capture until the balance is restored. These insights are important because they show that the successful integration of technological advancements into a business model, or the reverse, requires continuous reciprocal fine-tuning to maintain the balance between these two domains. This is particularly important in the context of rapidly changing emerging technologies and incumbent firms, where the cost and complexity of adapting to continuous changes can impede these firms' capacity to capture value effectively.

The second contribution presents the business model innovation process as an iterative process, challenging the predominantly linear models in the existing literature (e.g., Baines et al., 2020; Frankenberger et al., 2013).

The findings reveal that business model innovation is not a static process with a defined endpoint but an ongoing activity requiring constant adjustments, particularly in the context of emerging technologies. This contribution corroborates the literature's view of this iterative process (Sosna et al., 2010; Amit and Zott, 2020) and underscores the need for continuous adaptations in the business model innovation process. The contribution further equips firms with an understanding of the need for continuous iterations of the business model in the face of rapid technology development and offers important advice for incumbent industrial firms introducing new business models for emerging technologies.

The third contribution sheds light on the value capture aspects of business model innovation processes for three distinct business model types: performance-based, software-as-a-service-based, and multi-actor-based. In doing so, it enriches the business model process literature by empirically demonstrating that each business model type requires specific sets of business model innovation activities tailored to each type for effective value capture. While the existing literature, e.g., frameworks by Baines et al. (2020) and Sjödin et al. (2020), offers views on business model innovation processes for service-based business models, it falls short in distinguishing between different types of business models – performance-based and as-a-service-based – and their specific value capture challenges and opportunities. This thesis addresses this gap in the existing literature by delineating the distinct business model innovation processes inherent to two service-based business model variants. It contrasts the specific activities of the customized performance-based business model with those of the automated as-a-service business model, a distinction essential for effective value capture, as highlighted in the findings of *papers I, II, and III*. Theoretically, this distinction provides a more granular view of the value capture, as Bigelow and Barney (2021) suggested, and aligns with Lanzolla and Markides' (2020) perspective on the interdependencies in firm activities. Practically speaking, the contribution equips incumbent industrial firms with the required knowledge to tailor strategies and operations to implement the two types of service-based business models.

The fourth contribution builds upon the detailed examination of the value capture process for different business model variants and broadens the perspective on value capture mechanisms. It goes beyond merely focusing on revenue models (cf. Linde et al., 2021), emphasizing internal operation and skills as essential additional components of the value capture process. This view corroborates that of Baden-Fuller and Haefliger (2013) that there are factors, such as operational effectiveness, equally crucial for value capture as the revenue model. This thesis contributes to a more comprehensive understanding of the additional value capture mechanisms, offering a more holistic view and extending the current literature on this topic. Furthermore, it provides practitioners at incumbent industrial firms with practical, actionable advice for value capture when implementing new business models in the context of emerging technologies.

Managerial contributions

This section highlights managerial contributions that can guide managers and leaders in developing and implementing steps to secure value capture in the business model innovation process of emerging technologies. General advice for emerging technologies' business model innovation process is presented, followed by specific advice for the three business model innovation types discussed in this thesis.

General advice – Emerging technologies and business model innovation

Three managerial contributions regarding business model innovation and emerging technologies can be extracted from the findings: the requirement of continuous adaptation even after the initial implementation, forming a cross-functional team, and the importance of including research and development expertise in the team (see Table 17). Each contribution is elaborated on in the sections below.

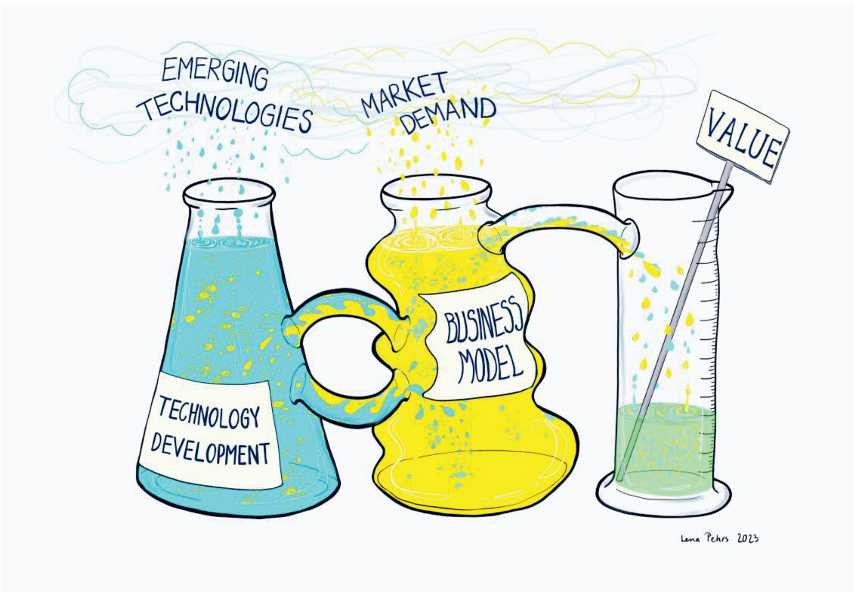
Table 17. General managerial advice for the business model innovation process.

Business model innovation type	*Managerial advice*
All	*Continuous adaptions*: ensure capabilities for continuous adaptions to balance the flow between the emerging technology and the business model to ensure the value capture.
All	*Operational restructuring*: Form a specialized cross-functional team for the new business model.
All	*R&D competence:* Include research and development expertise in the team.

Continuous adaption

The findings show that the rapid development pace of emerging technologies substantially impacts the business model. One way to illustrate the continuous two-way interplay between the two domains is to use the metaphor of communicating vessels, where the first vessel is the Technology Development and the other is the Business Model, which interacts in a two-way flow like communicating vessels (see Figure 9).

Figure 9. The Communicating vessels metaphor (Illustration: Lena Pehrs, 2023).

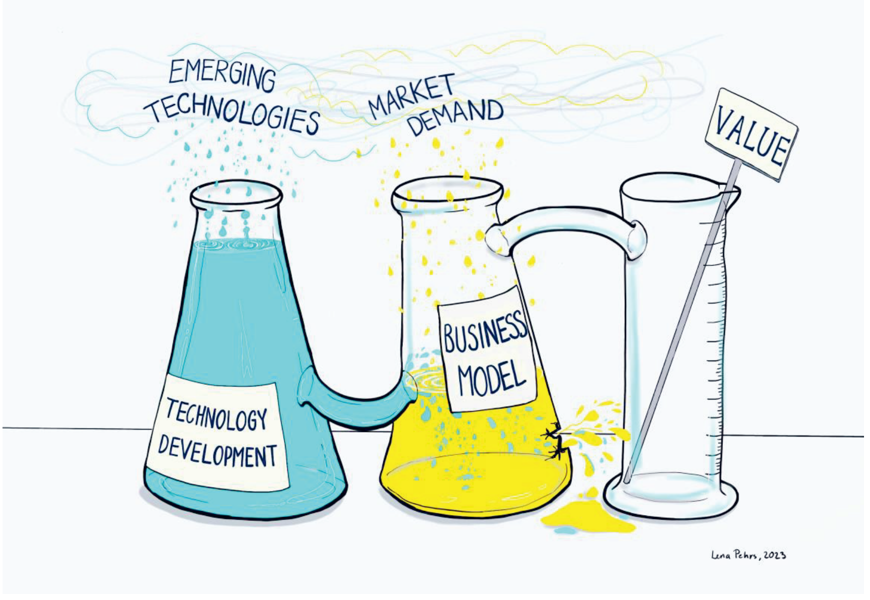


The is a two-way flow between the technology development vessel and the business model vessel, and the value is tapped from the business model vessel.

As long as the pace of the technology development is balanced with the capabilities of the business model, then value can be captured by the business model. If the technology development flow is too fast due to emerging technologies, then the flow from the technology development stresses the business model that requires continuous adaptations to secure value capture. When the balance between the domains is disturbed, the business model collapses in certain instances, and no or only limited value is captured (see Figure 10), as illustrated in *paper II* when 3G technology was introduced. The business model struggled to capture the value generated by these rapid technological advancements (refer to the extreme increase in

3G data speed, which increased more than a hundred times – from 0.384 Mbps to 42 Mbps – within a short time frame). As a result, there was a significant imbalance between the business model and the rapidly evolving 3G technology, highlighting a stark contrast with the comparatively smoother transition experienced by the performance-based business model built on 2G technology. The findings further show that continuous business model innovation activities are needed to balance the rapid technology development flow to the business model vessel.

Figure 10. Rapid technology development imposed by emerging technologies leads the business model to collapse and value capture to fail (Illustration: Lena Pehrs, 2023).



Operational restructuring and the importance of R&D resources

Chapter 5 outlines examples of operational activities to maintain the balance between the emerging technology and the business model. The first common step for the three business model innovation processes is restructuring internal operations, where creating a separate organization dedicated to the new business model is highlighted. This finding corroborates the literature's view that a separate organization is needed for incumbent firms to achieve change (Moore, 2015; Amit and Zott, 2020) and serves as a way for incumbent industrial firms to break loose from the inertia and dominant logic found in such firms. Typical practical advice is to create a dedicated organization with cross-functional competencies from the firm to capture knowledge of how the firm operates and to identify critical transformation areas in order to realize the new business model. One specific addition to the cross-functional team composition is research and development competence. The findings emphasize the importance of including research and development (R&D) resources in the cross-functional team. This inclusion is advised to ensure a critical alignment between the business model's characteristics and those of emerging technology. Integrating an R&D resource establishes a direct connection to the firm's broader R&D initiatives, something that often is neglected. This connection is critical to successfully introducing the new business model based on emerging technologies.

Advice for the three business model innovation types

The findings also offer specific managerial contributions for the three business model innovation types outlined in this thesis. Below, I highlight the critical managerial contributions for each business model innovation type (see Table 18).

Table 18. Managerial advice for the three business model types.

Business model innovation type	*Managerial advice*
Performance-based service business model	*Hardware-related emerging technologies challenges*: Firms should exercise caution and plan to continuously adapt the business model and the technology. *Contractual set-up and governance:* Contractual agreements that specify mutual goals and establish clear governance structures, continuously revised boundary conditions.
Software-as-a-service-based service business model	*Implementation challenges:* Be aware of hardware-related dependencies. *Automated contracts:* Transition to standardized and automated contracts.
Multi-actor-based business model	*External relations*: Cultivate new competencies and relations outside industry boundaries. *Effective communication and cooperation:* Invest in communication and collaboration platforms for ecosystem participants. *Non-disclosure and cooperation agreements:* Set up contracts with external participants; the challenge is often mindset, not the contract itself.

The performance-based business model, in combination with the rapid development pace of emerging technologies, requires continuous adjustments to secure the value capture. This is particularly relevant for emerging technologies using hardware-based technology. Consider the often-discussed 'role model' of performance-based business models, the Rolls-Royce Power-by-the-hour concept, built on a mature technology. Aircraft engine technology has evolved since the introduction of the business model in 1962; however, the relatively slow pace of technology development has allowed the balance between technology and business model to be maintained. The contribution suggests that firms contemplating introducing a performance-based business model based on hardware-related emerging technologies should exercise caution and plan to continuously adapt the business model and the technology.

The findings further show that the performance-based business models entail complex relationships between the provider and the customer, which require contractual agreements that specify mutual goals and establish clear governance structures. The nature of the emerging technologies further impacts the boundary conditions of the contract, and a firm undertaking this transition will have to invest in resources to adapt continuously and follow-up on the boundary conditions.

The software-as-a-service business model is more suited to emerging technologies since the rapid technological development of functions and continuous adaptions to new functions characterize the business model. Here, the difference between physical and digital technology becomes apparent. Physical technologies cannot be changed as quickly as software due to factors such as research and development lead time and a firm's capabilities. However, in *paper III*, it becomes evident that a software-as-a-service business model has hardware-related dependencies regarding the tactical implementation of the business model. The managerial contribution is that firms must consider the implementation and scaling challenges that may require physical technology implementations.

The contractual challenges for software-as-a-service-based business models are related to the introduction of standardized and automated contracts. This change might be cumbersome for incumbent industrial firms, but it is a one-time effort and is relatively easy to maintain and update once established.

The multi-actor business model type requires new competencies and the establishment of new relations with firms outside the industry boundaries. Being part of a caravan of unfamiliar actors differs from driving a taxi or a bus in well-known territories. The taxi or the bus can still be part of the caravan, meaning that both the performance-based and the as-a-service-based business models, even the traditional transactional business model, can be used in a multi-actor business model context. The challenges of the multi-actor business model type are communicating and influencing the other participants of the innovation ecosystem. Besides setting up a dedicated organization with new competencies that are skilled in talking to other industries, an effective communication platform to enable cooperation among participants in the innovation ecosystem was instrumental in reaching 900 partners, as presented in *paper IV*. The contractual challenges for a multi-actor business model are related to setting up non-disclosure and co-operation agreements among the participants of the innovation ecosystem. The actual contractual set-ups are often not an issue. The challenge is the mindset of a protective incumbent industrial firm not used to sharing sensitive competitive information with other players.

Future research

This thesis has some limitations, as discussed in the *Research setting and methodology* section. To overcome the limitation of basing research on a single firm, albeit a single multinational and multidivisional firm, future research should include firms from various industries to expand the research base. The thesis also only covers three business model types. Although they are the most prevalent for industrial firms (Ibarra, 2018), there are other types to consider. Future research should also examine other business model archetypes to further enrich business model innovation research. A specific limitation regarding the multi-actor business model type is to expand the unit of analysis from a single firm to the ecosystem of several actors by means of multiple case studies and other relevant methods, thus expanding our knowledge base.

Concluding remarks

Changing the business model in an incumbent industrial firm is more complex and cumbersome than appears at first glance; however, it is not optional if the firm wishes to continue being competitive. Since Clayton Christensen's course was one of the reasons I embarked on the industry PhD journey leading to this thesis, it is fitting to close by quoting him:

> Breaking an old business model is always going to require leaders to follow their instinct. There will always be persuasive reasons not to take a risk. But if you only do what worked in the past, you will wake up one day and find that you've been passed by.
>
> Clayton M. Christensen

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Appended papers

Paper I

Right technology, wrong business model: Evidence from Ericsson on why and how firms struggle to substitute products with services

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Abstract

Prior research pays little attention to the dynamic changes in manufacturing firms that accompany a strategic shift from selling products to selling services, the underlying reconfiguration and design needed to support a service-based business model, and the effects on performance. This article examines the strategy adopted by Ericsson, a leading supplier of high technology capital goods in the telecommunications industry, in its attempt to create and capture value from the change from selling telecommunications networks to selling network capacity across different geographical markets and shifts in technology standards (with various outcomes). We examine this transformation through a process study, based on data from 578 internal documents, 1,494 emails, 40 interviews and observation of 232 meetings.

Keywords: business model innovation, dynamic capabilities, services, technology, performance-based contracts

Introduction

Some studies of firm strategy analyze the scope and direction of manufacturing firms' boundary changes. The more recent work on manufacturing firms' strategies argues that firms need to reconsider their existing strategies and try to create competitive advantage and increase revenue by providing services (Chesbrough 2011, Porter and Heppelmann 2014, Suarez et al. 2013, Wise and Baumgartner 1999). Services have become increasingly important in the competitive strategies of manufacturing firms and are considered by most firms as a means to create and capture value under different competitive environments (Cusumano et al. 2015, Quinn 1992). This represents a shift away from increased specialization towards an emphasis on integration where the boundaries between products and services have become blurred.

Initially, services were seen as complementing products addressing customers' business needs. They were sold as stand-alone services or as a part of an integrated solution (e.g. Davies 2004, Vandermerwe and Rada 1988, Wise and Baumgartner 1999), frequently used by firms in mature industries which were finding it difficult to differentiate their products (Cusumano et al. 2015, Suarez et al. 2013, Teece 1986). Recently, provision of advanced services via performance-based contracts has become a popular way to create competitive advantage, and include notions such as performance contracting, performance-based logistics, outcome-based services, products-as-service models and power-by-the-hour (Guajardo et al. 2012, Kim et al. 2007, Porter and Heppelmann 2014). The rationale for all these arrangements is that rather than selling and supporting conventional products manufacturers deliver product performance as a service to the customer; that is sale of the service substitutes for product sales (Cusumano et al. 2015). It involves replacing cost-plus and fixed price contracts with performance-based contracts under which the manufacturing firm is compensated according to the output value achieved (Kim et al. 2007, Porter and Heppelmann 2014).

Prior literature provides an understanding of many aspects involved in the provision of services by manufacturing firms. However, it lacks detail on how manufacturing firms transform in order to compete by providing services (Baines et al. 2020, Sjödin et al. 2020). Theorizations on the transformations and dynamic changes needed have been poorly developed because little attention is paid to the process (how the change that leads to an outcome occurs over time) (Baines et al. 2017, Schilke et al. 2018, Teece 2018a). There is a particular gap related to the transformation required when switching from selling products to selling services as a part of the manufacturing firm's competitive strategy, and the interplay with its business model which needs fundamental redesign (e.g., Teece 2010, Visnjic et al. 2018). More specifically, we lack an understanding of how the transition to and the development of a so-called service-based business model unfolds over time (process), what changes in the firm's business model allowing creation and capture of value (content), and why process and content are impacted by different inner and outer contextual factors (context) such as physical technology, competitive environment, regulation, geographical scope and design and structure underlying a service-based business model (Baines et al. 2020, Foss and Saebi 2017, Teece 2007).

Numerous calls from researchers in the strategic management domain urge scholars to make time and dynamic change more central in their research (see e.g., Schilke et al. 2018, Teece, 2018a). Strategic management presupposes that strategy is treated as a process not a state which calls for activities and movement to be included in the firm analysis (Pettigrew 1992, Van den Ven 1992). Strategic management is embedded in a context and includes multiple processes and activities at different levels (Agarwal and Helfat 2009, Teece 2007), and the dynamics are difficult to understand without a process perspective (Langley et al. 2013, Pettigrew 1992).

This article examines the changes that occur in manufacturing firms searching for a viable service-based business model to create and capture value. We conduct a process study which captures important events and activities over time, and use the business model as an analytical lens to understand the transformation from provision of products to provision of services based on performance-based contracts. We demonstrate empirically the dependencies in the firm's business model in the transition to a new service-based business model, and how the changes to value creation and value capture activities pay-off as the process unfold. We also offer insights into the inner and outer contextual problems encountered when trying to develop a strategy and business model with the aim to build competitive advantage by substituting products with services.

To analyze the strategy used to create and capture value from a service-based business model, we examine the case of Ericsson, a leading telecommunications network firm, which attempted to transform from selling telecommunication networks to selling network capacity in three different geographical markets and at a time of two shifts in technology standards. Ericsson made several attempts to design a viable service-based business model, and the different designs and inner and outer contextual factors explain different outcomes. Our sample includes data from 578 internal documents on the design, development and progress of the business and its performance over time in different geographical markets, 1,494 emails on the design and development of the business model, 40 retrospective interviews with Ericsson and its customers, and observation at 232 business meetings. We also collected performance data. We show that designing a successful service-based business model for high-technology capital goods is difficult because of the many interdependent value creation and value capture activities in the firm's business model which need to be considered and changed. From a value creation and value capture perspective, value capture is the more problematic. In particular, we show that service-based business models for high-technology capital goods find it difficult to cope with technology dynamics. We show also that scalability is problematic because geographical dependencies make it difficult to apply a single service-based business model to different markets and customers, and to transfer capabilities from one market to another.

Research background

Services in manufacturing

To understand the particularity related to services and the business models of manufacturing firms, it is important to distinguish between different types of services and products. This is because the process, the content of what is changed during the process, and the influence of contextual factors are likely to differ with each product and service category. In this study, we focus on the most advanced services provided via performance-based contracts which substitute for product sales and involve high-technology capital goods.

First, the issues related to services provision differ according to whether they involve standardized products sold in large quantities to final consumer markets or high-technology capital goods (Davies 2004, Kiamehr et al. 2015). High-technology capital goods (sometimes described as complex product systems, CoPS) are related mostly to the aerospace, energy, telecommunications and transportation sectors (Davies and Hobday 2005, Guajardo et al. 2012, Kiamehr et al. 2015). They comprise hierarchically organized combinations of different types of components (Hobday et al. 2005). Because suppliers of high-technology capital goods tend to participate in long-term business transactions with their customers, this allows them to offer customized services addressing the needs of customers throughout the product life cycle. Such an arrangement contrasts with arms-length transactions related to selling consumer goods (Davies 2004). In the case of consumer goods, most services are provided after the product has been sold to the customer. Customers can select one or several services from a standardized portfolio of service offerings such as financial, maintenance, repair, warranties and other forms of after-sales services (Davies 2004).

Second, it is important to distinguish between different types of services. In the recent past, some services are sold via performance-based contracts which are especially popular with manufacturers of defence and aerospace equipment (Baines et al. 2009, Hypko et al. 2010). However, firms in other sectors including among others machine tools, construction equipment, trains, compressors, energy, machinery and elevators are also adopting performance-based contracts (see e.g., Baines et al. 2009, Björkdahl 2020). Two types of service archetypes from performance-based contracts can be distinguished depending on whether the services are complementary to the product or substitute for product sales (Cusumano et al. 2015). In the former type, manufacturers assume surveillance and maintenance tasks and provide after-sales services which are complementary to the sale of the product. In the latter type, manufacturers assume operational tasks and are responsible for the equipment's output. Here, the idea is to remove cost-plus contracts and fixed prices, and reduce ownership costs by tying the manufacturer's monetary compensation to the output value of the product generated or used by the customer (Kim et al. 2007, Porter and Heppelmann 2014). Hence, instead of selling and supporting a conventional product the manufacturer delivers product performance as a service to the customer. The increasing focus of manufacturing firms on performance-based contracts which substitute products with services is being driven by customers who are keen to reduce their investment in capital goods by outsourcing parts of their operations and maintenance. At the same time, the manufacturer is better able to differentiate from competitors and to profit from potential cost reductions and improved customer satisfaction which could lead to higher income over time (see e.g., Hypko et al. 2010, Visnjic et al. 2018). Research shows the benefits of aligning incentives between suppliers and customers; suppliers are compensated for the same outcome (product utilization and quality) that the the customer wants (Guajardo et al. 2012). Hence, suppliers are motivated to increase product performance, product reliability and product availability. Performance-based contracts therefore address potential market deficiencies by encouraging investment by manufacturers, and encouraging customers to commit to a long-term relationship (Randall et al. 2015).

Services provided by means of performance-based contracts have been studied from a transaction cost perspective, a resource-based view, option pricing and a principal agency perspective, or use more practitioner oriented approaches to address various aspects involved (see e.g., Guajardo et al. 2012, Kim et al. 2007). These include, for example, the contract choices made by customers with different preferences, supply chain coordination, vertical integration decisions, product reliability, incentive conflicts, revenue sharing contracts, incentive mechanisms and the benefits and risks for suppliers and buyers. Prior research lacks dynamic explanations and time-based analyses of this transformation and an understanding of the processes that select and coordinate the firm's attitude and actions when moving from a product-based to a service-based business model. Regardless of whether this is because most works focus on after-sales including support, maintenance and spare parts (i.e., complementary rather than substituting services), or because researchers only consider performance-based contracts as a new business model type (Foss and Saebi 2017, Ng et al. 2013), this gap limits our understanding of an increasingly important and timely strategic issue aimed at gaining competitive advantage. Strategy involves developing a business model where strategic fit and complementarities among activities are required to build competitive advantage (Helfat and Peteraf 2015, Peteraf and Reed 2007, Teece 2007). However, many firms find it difficult to understand and manage the transition to a service-based business model based on performance-based contracts (Baines et al. 2020, Björkdahl 2020). Understanding the transition and the dynamic changes involved is accentuated by the fact that services via performance-based contracts are expected to increase in a wide range of sectors as a result of digitalization. Performance-based contracts are facilitated by the ability to measure and monitor equipment utilization and cost savings using digital technologies (Björkdahl and Holmén 2019, Porter and Heppelmann 2014). Moreover, the notion of circular economy to reduce the gap in the materials cycle is enabled by service-based business models and the use of performance-based contracts which substitute for product sales (Frishammar and Parida 2019, Linder and Williander 2015).

Business models and the creation and capture of value

A business model can be understood as the link between how the firm creates and captures value (Björkdahl 2009, Casadesus-Masanell and Zhu 2013, Tidhar and Eisenhardt 2020, Zott et al. 2011). We define value creation in terms of how the firm creates value along its value chain by converting its resources, competencies and intra- and interorganizational activities and processes into value propositions and solutions for customers (Achtenhagen et al. 2013, Clauss 2017, McDonald and Eisenhardt 2020). We define the value capture domain as the revenue and cost architecture required to allow the firm to capture some of the value that is created for customers (Teece 2010, Tidhar and Eisenhardt 2020).

To maintain a profitable and competitive business over time, business firms may need to innovate their business model by changing the logic of how value is created and captured (Chesbrough and Rosenbloom 2002, Chesbrough 2010, Doz and Kosonen 2010, Teece 2018a). Business model innovation allows an escape from path dependent routines, assets and strategies (Teece 2007). The transition to performance-based contracts could be considered a business model innovation because we can assume that there are dependencies between the firm's value proposition (supplier provides services rather than products) and its revenue and cost model (supplier sells performance and increase the asset base). However, many different dependencies are involved in creating and capturing value. Business model innovation depends on the capability to recombine and reconfigure assets and organizational structures to maintain evolutionary fitness (Helfat and Peteraf 2015, Teece 2007). The capabilities to sense and seize opportunities and to transform the firm are essential for business model innovation. Teece (2007, p.1330) emphasizes that "the capacity an enterprise has to create, adjust, hone, and, if necessary, replace business models is foundational to dynamic capabilities". This is especially true if the firm wants to shape the market rather than adopting well understood best practice.

Although many scholars consider that the process of building a revenue stream based on manufacturing firm services is a subset of business model innovation, the business model concept is often used loosely in studies which invoke business model innovation as the context (Baines et al. 2017, Foss and Saebi 2017). Foss and Saebi (2017, p. 221) note that "little is known about how a shift toward service-driven business models affects the firm's existing business model and its underlying organizational design and structure to support the new business model". One way to study this shift is to explore how value creation and value capture activities change over time as the firm searches for a suitable service-based business model, and how the process and content of these activities are affected by the internal and external context. Examining the temporal sequence of events and activities over time provides an understanding of the business and organizational activities critical to change and a better appreciation of the contextual dependencies involved.

Method

We chose a process research design since we were interested in explaining the sequences of events rather than the reasons leading to an outcome (Elsbach and Sutton 1992, Langley 1999, Van de Ven 2007). A process research design allows us to understand the complex processes underlying the search for a service-based business model for high technology capital goods, and the move away from a product-based business model and sales of products. Focusing on interpreting events and activities to explain and understand a process provides a more dynamic way to understand phenomena and allows for temporal and spatial interconnections (Langley and Tsoukas 2017, Pettigrew 1992, Poole et al. 2017, Van den Ven 1992).

We selected our case based on several criteria to allow examination of the processes of interest. First, we chose a case with longitudinal data covering long periods of time to allow observable instances. Second, we chose a core business area where any changes would have large effects on the firm's business, organization and structure. Third, we selected a case that allowed for a case-within-a-case design in which the firm tried to replicate its initial performance-based contract and service-based business model innovation (India) in different markets (Bangladesh and Africa). This enabled us to explore both the processes and the scalability of service-based business models based on performance-based contracts. The focal period of interest is 2002 to 2014 for the Indian market, 2010 to 2014 for the African market and 2010 to 2014 for the Bangladesh market. In each market, the study period starts when the firm began discussions on performance-based contracts, and ends with performance-based contracts and the service-based business models being discontinued.

Data collection

In-depth interviews

We interviewed participants involved in and responsible for reconfiguring and running the business at the focal firm. Interviewees were from different hierarchical levels and were in different functional positions at Ericsson, e.g. chief financial officer, head of Ericsson India, head of Business Unit Services, head of Business Unit Networks, key account managers, account managers, contract managers, sales directors in different business units, pricing managers, commercial managers, technical experts and business controllers. We identified respondents who could provide information on events and activities along the process. We compiled an initial list of interviewees and used snowball sampling to identify other relevant respondents. We conducted 36 in-depth interviews at the focal firm during 2018 and 2020, complemented by four interviews with the customer (the executive director, the managing director, group chief technical officers) to obtain their perspectives on the processes (see table A1 on informants).

The interviews were semi-structured and included open-ended questions. We were interested in how the firm had made changes to the way it conducted business over time and the impact of contextual factors. Many questions were tailored to the respondent's specific role. If respondents provided situation-specific detail, we asked relevant follow-up questions to obtain a deeper understanding of how the processes had unfolded. The interviews were recorded and lasted between 45 and 120 minutes. Table 1 presents the type and amount of data collected.

Participant observations

One of the co-authors is a senior manager at Ericsson and had followed the process from the inside. Between 2003 and 2009, he was Sales Director India at Business Unit Networks, and was responsible for decisions about sales in India in general, and sales to the case customers in particular. Between 2010 and 2014, he was Director Business Model Management at Business Unit Networks supporting performance-contract activities, among them managed capacity contracts in Africa. He participated in many (232) business meetings and was involved in many decisions and informal conversations. His activities generated large amounts of data (such as notes from business meetings) that were used by the authors.

Since one author had been involved in the process it could be argued that this was a source of potential bias. However, we avoided this as follows. First, we did not study the process in-the-flow but after-the-fact and focused on a particular outcome and accounted for the process which led to it from within. Studying the process from within follows a strong-process continuum and results in process depth (Langley and Tsoukas 2017). Second, the outcome involved the participation of many individuals in Ericsson at different hierarchical levels and on different sites. Third, rather than the experience of only a few individuals we drew on many sources of data which enhances construct validity and minimizes bias. Fourth, the co-author remained outside the process, and both authors were involved in data coding and analysis.

Emails

We had access to the emails written and received by the co-author and his successor in India. Emails were exchanged both within Ericsson and between Ericsson and customers and were related to the business models in India and Africa during 2003 and 2014. We collected a total of 1,494 emails which provided a good understanding of events and activities and allowed triangulation with interview and archival data and participant observations.

Archival data

We collected extensive data amounting to several thousand pages of material on historical events, actions and outcomes related to the process of implementing the service-based business models. We collected internal official documents such as customer contracts, memos, reports and presentations, and unofficial documents such as working draft contracts, draft reports, details about potential fraud, and correspondence and documents related to the firm's business model. We also collected financial data on the performance of the service-based business models. In addition, we collected publicly available data on the service-based business models including articles in the trade press, teaching cases and annual reports.

Table 1: Description of data.

Data Type	Amount
<u>Primary Data</u>	
Interviews	
Semi structured interviews, lasting between 30 minutes and two hours (Dec. 2018 to Aug. 2020)	**40** (345 pages)
Participant observations	
Participation in business meetings regarding the operation in India 2003-2009	**232**
- in Delhi	124
- in Stockholm	93
Participation in business meetings regarding the operation in Africa 2010-2014	15
Emails	**1,494**
<u>Secondary data</u>	
Internal documentation from Ericsson	**578** (7616 pages)
Customer correspondence and presentations	140
Contracts on the performance-based model, MoM contracts and contract reviews	112
Descriptions, analysis and improvements of performance-based contracts	86
Notes from the MoM Steering group and decision meetings	75
Key account reports and presentations	45
Financial numbers, and reports and analysis on the financial performance	30
Publicly available material	**49**
Trade press articles	22
Teaching cases (e.g. Harvard Business School)	5
Ericsson annual reports 2004-2014	11
Customer annual reports 2003-2014	12

Data analysis

The first step in our data analysis was to develop case histories for each business (in India, Bangladesh and Africa) using data derived from the interview transcripts, participant observations, emails and archives. The case histories focused on events and activities affecting the underlying business, and its organizational design and structure caused by introducing performance-based contracts. Triangulation of data sources provided rich and reliable data on events and activities (Jick 1979). Triangulation allowed also for construct validity (Yin 2003). If we identified gaps in events, activities or timelines, we conducted follow-up interviews.

The second step in our data analysis consisted of constructing sequences of significant events and activities (which we call episodes) for each business (see e.g., van de Ven and Poole 2005). Splitting the process into episodes helped the analysis (see also e.g., Berends et al. 2016, Langley 1999). These episodes are coherent sets of actions and events based on increased understanding, to organize a business relying on performance-based contracts (Berends et al. 2016). We categorized the episodes according to how they affected the direction and progress of the process trajectory, and whether they were based on different conceptualizations, creations or adaptations of the business. To ensure that we had not missed or misinterpreted the events and activities which constituted the episodes, informants were given access to our case descriptions including narratives, timelines and episodes.

After developing the case histories, timelines and episodes, the third data analysis phase consisted of cycles of inductive and deductive reasoning (see e.g., Walsh and Bartunek 2011). To create a list of first-order codes from the data underlying the case histories, we followed the procedures recommended by Strauss and Cobin (1998) and Gioia, Corley and Hamilton (2013) and used informant-centric terms and codes. To create the first order codes, we looked for statements related to changes to achieve a viable business (see table 2).

After inductively creating first-order codes, we applied deductive reasoning and searched the literature for concepts and frameworks that matched our emerging data. This allowed for second-order theoretical categorization. The first-order codes highlighted extensive representation of a wide range of different business and organizational-related problems which needed to be managed during different periods in the process of creating a viable business. The extensive representation of various business and organizational-related problems led us to review the research on business models. Drawing on this literature stream, we grouped our first-order codes into second-order theoretical categories according to the related types of change in the firm's business model (Björkdahl 2009, Chesbrough and Rosenbloom 2002, Clauss 2017, Teece 2010). Our first-order codes showed that these changes were related to processes, resources and competencies, value proposition, revenue stream and cost structure. The second-order theoretical categories were organized into aggregate theoretical dimensions (value creation and value capture) to structure our data in line with Corley and Gioia (2004). The first-order codes, second-order theoretical categories and aggregate theoretical dimension are presented in table 2.

The fourth step in our data analysis was to analyze how the process (in each geographical market) shaped the content of the business model (using the first-order codes to identify the changes made to our theoretical categories, and whether the changes were related to value creation or value capture). This also helped us to sort out how the process and the changes in content were impacted by different internal and external contextual factors, and to analyze patterns within and across geographical markets. Figures B1-5 show the changes in theoretical categories and aggregate theoretical dimensions during each episode in each geographical market, and tables C1-3 provide empirical examples from our data of the theoretical categories.

Table 2: Coding scheme for the business model.

First-order codes	**Theoretical categories**	**Aggregate theoretical dimensions**
Statements of changes in: - Education of performance-based contracts - Organizational structure to coordinate activities - Network operation and maintenance - Network deployment - Network planning - Network design - Capacity management processes - Governance processes - Revenue recognition processes	Processes	Value creation
Statements of changes in: - Network ownership - Head of responsibility - Network planning competencies - Contract management competencies - Delivery resources - Sales resources - Business control resources	Resources and competencies	
Statements of changes in the: - Customer offering - Benefit to customers - Solving of customer problems	Value proposition	
Statements of changes in the: - Revenue model - Price parameters - Payment terms and conditions - Measurement and control of revenues (e.g. financial reporting and accounting principles)	Revenue streams	Value capture

A new service-based business model in India

In this section, first, we describe Ericsson's (supplier) and SarawatiTel's[4] (customer) relationship. Second, we discuss the nine episodes that emerged from our first order analysis, characterized by multiple dynamics in business model innovation trajectories in the Indian market. These episodes explain the evolution of Ericsson's new service-based business model and what caused its termination.

Prologue: Ericsson's and SarawatiTel's relationship

Mr. Blue[5] an entrepreneur who had created and successfully managed various types of businesses had founded SarawatiTel. Mr. Blue saw mobile telephony as a major growth area, and when the Indian telecom market was liberalized in 1995 he exploited this opportunity and launched a mobile operating service based on second-generation mobile technology (2G). The Swedish telecommunications firm Ericsson was the equipment supplier for the network. Ericsson's CEO supported Mr. Blue's plan to build a nationwide mobile network and they established an excellent business relationship.

Episode 1: Conceptualizing a new way of doing business

In January 2002, Ericsson's CEO, Mr. Blue and Jan Campbell (managing director of Ericsson India) held a conference call during which Mr. Blue suggested taking the partnership to the next level. He believed that to be successful in a high growth market, SarawatiTel should focus on acquiring customers and that the network supplier should take total responsibility for managing the network. Ericsson's CEO agreed.

SarawatiTel had problems with its network; the quality was very poor and it received many complaints from customers. Ericsson brought in experts and managed to improve the quality of the network significantly. The key account manager at Ericsson India, Bhargab Mitra, proposed to SarawatiTel that Ericsson should "manage your switching and radio network

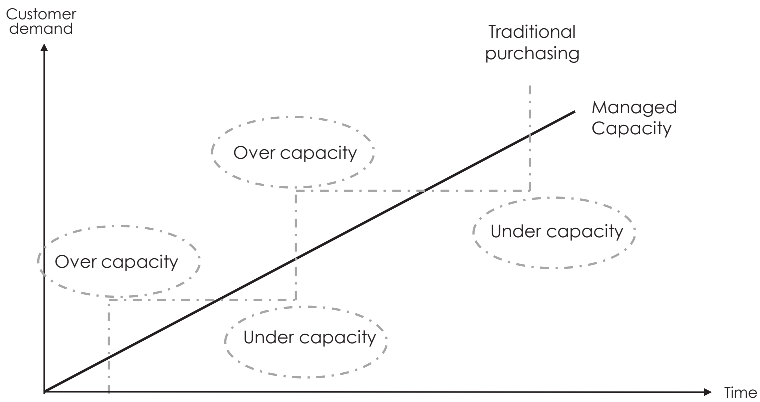
[4] The names of Ericsson's customers have been disguised.
[5] The name of the CEO has been disguised.

parts, and package that as a service for you". SarawatiTel came back with a counterproposal "if you want to do a service, why do you only want to sit in the air-conditioned rooms and do the switching and to control the base stations? Why do you not take on the planning, construction and operations of the radio base station sites as well?" The extended scope was dramatic; never before had Ericsson taken on end-to-end responsibility.

SarawatiTel's managing director thought that the traditional way of buying would not be efficient and would not help SarawatiTel to become the largest private telecom operator in India. He believed traditional procurement cycles were too slow and would be an obstacle to the rapid growth of SarawatiTel. In a conversation with the head of Global Services at Ericsson, it was agreed that Ericsson would look at a performance-based model with a certain amount of network capacity.

In a meeting with Bhargab in May 2003, the managing director of SarawatiTel expanded on his ideas for a performance-based model. He wanted a model which would avoid SarawatiTel purchasing excess capacity. The traditional way of buying network capacity was to buy 30–40 percent excess capacity to cater for unexpected variations in capacity demand (see figure 1). The managing director of SarawatiTel believed this would be Ericsson's responsibility and would improve SarawatiTel's cash flow and roll-out speed. To simplify planning and negotiation, he wanted a single price parameter based on a capacity model rather than separate pricing for each network equipment component.

Figure 1: Management of network capacity.



Episode 2: Creation of a performance-based model

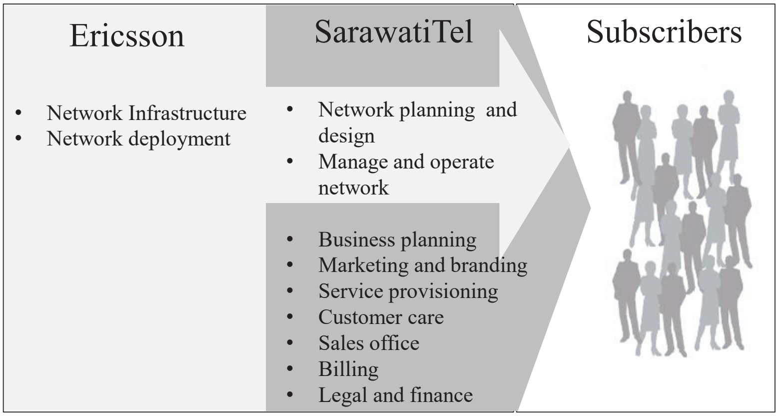
Discussion about setting up the performance-based model started in spring 2003 with a simplification of the price structures. The idea was that the price should be correlated to what the operator was selling i.e., capacity (basically voice minutes) and coverage. This was translated into Erlangs (an Erlang is the metric used to measure 60 minutes of voice calls) to measure capacity and different key performance indicators to ensure quality and coverage. This would change Ericsson's value proposition from selling telecom equipment and services to selling capacity and quality voice minutes. Ericsson called this performance-based model the Managed Capacity Model. From Ericsson's perspective, the model was considered as based on financial engineering. As the president of Ericsson India explained:

> It was a payment model that made both parties interested in getting as much in operation as possible, as soon as possible… Moreover, it was we who should build, and manage everything, so it became a model for both companies to strive for the same thing – to get as efficient production of their traffic apparatus as possible, as quickly as possible. It would make us grow together in a very interesting way – we had the same goals – we were not sellers and buyers anymore.
>
> President & Head of Region, Ericsson India

To secure the performance of the managed capacity model it was necessary for Ericsson also to manage operation of the network. To achieve this, the managed capacity model was combined with a contract related to the network operations and became the Managed Service Model. While the managed capacity model covered SarawatiTel's long-term capacity needs, including network planning, design and network deployment, the managed service model covered operations i.e. daily network operations. The managed service contract was performance-based and was invoiced as a recurrent fee based on handled capacity and a reward/penalty based on different performance indicators. The managed capacity contract was signed in December 2003, and the managed service contract was signed in January 2004. The new way of doing business was implemented immediately after signing the performance-based contracts.

Introduction of performance-based contracts substantially changed Ericsson's business activities to a focus on the downstream market. It meant that Ericsson took responsibility for many activities previous managed by SarawatiTel (see figure 2). The benefits for SarawatiTel were faster time to market and flexibility of employed capital and assured the quality of mobile services. Ericsson's benefits were perceived as a long-term contract and technology advantage. Ericsson had approximately 20 percent better coverage per 2G radio base station than its competitors. This was a significant advantage and allowed Ericsson to cover the same area as its competitors using fewer radio base stations.

Figure 2: Changed roles.



The initial managed capacity contract was based on a top management agreement, and the details at the working level had to be worked out. It did not identify how the parties should work together. There was some scepticism at the working level in SarawatiTel's organization that a supplier could handle what previously was their responsibility and this caused some friction between the organizations.

> … there was a period of time when both sides were trying to prove themselves and the customer was trying to prove that the vendor could not handle all of this. There was a lot of friction.
>
> Head Marketing & Sales at Customer Unit SarawatiTel, Ericsson India

Episode 3: Adaptation based on lack of control over revenue and profitability

In June 2004, the performance-based contracts had been in place for five months. A number of problems had been identified including how to handle the new price parameter in the customs process and how to import capacity. According to Indian regulation, only the telecom license owner could import equipment. Therefore, to resolve this ownership of equipment was transferred to SarawatiTel. However, this created another problem; Ericsson sold network capacity to SarawatiTel and all imported material had to be accompanied by a bill of quantity setting out unit prices. SarawatiTel now had to pay customs duty whatever it acquired from Ericsson, and transfered this cost to Ericsson because it was not regulated in the contract.

> We paid a huge amount of money in customs duty because SarawatiTel said… you need to take the custom duty. … that was a pass-through for them and we were penalized because the contract was not written properly.
>
> Manager Business Control at Customer Unit SarwatiTel, Ericsson India

Financial reporting became a problem for the local business controllers at Ericsson. There was no system in place for reporting the revenue from the new way of doing business and instead the bills of quantities for the equipment involved were used. However, this did not reflect actual income and resulted in faulty and inflated financial reporting.

> The finance department had not understood the contract. … they had reported after the old business case principle. … now we have delivered this much and now we shall have this margin. They sit one floor apart, but the units do not cooperate.
>
> Head of Commercial Management, Ericsson India

Financial reporting at Ericsson's headquarters in Stockholm also became an issue. At the end of 2004, there was a considerable amount of customer work in progress (CWIP) in the accounting system and although a great deal of equipment was being shipped to SarawatiTel, this was not providing revenue. Several internal investigations were launched, and an internal audit uncovered possible fraud. Finally, Ericsson was obliged to create a new revenue recognition process for the managed capacity contract.

> Our accounting and financial systems were not capable of taking care of this new model so initially, the revenues were being recognized on the shipped equipment.
>
> Manager Business Control at Customer Unit SarawatiTel, Ericsson India

Another problem was the high volume and high speed of the roll-out which changed the cost structure. SarawatiTel wanted to be the first private Pan-India mobile operator, and this required rollout of mobile coverage across the whole country. To extend built coverage required the construction of several low capacity sites. The initial costs for building low capacity sites were high which meant that cost per capacity unit was high. However, the business case was based on the assumption that Ericsson would build a mix of low and high capacity sites.

The large roll out during 2004 and 2005 resulted in very high costs and low revenue. This created friction between the local Ericsson organization in India and the business units in Sweden. Few people in the central organization understood the model and its financial characteristics. The person responsible for the new model at Ericsson had to educate the central organization about the performance-based model.

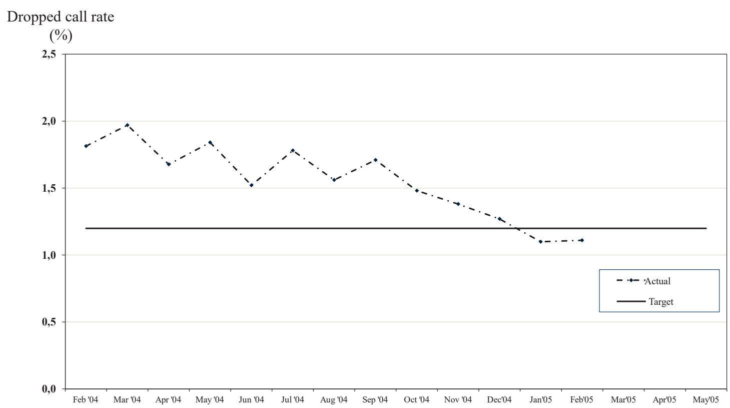
> It was a huge education exercise... are we losing money? … prior to 2004, we would get paid for every node that we supplied. So, then your profitability was very predictable. This model however, meant that in the long term this would become more and more profitable as you start to sweat the deployed assets.
>
> Head Marketing & Sales at Customer Unit SarawatiTel, Ericsson India

Episode 4: Evaluation of the performance-based model

During autumn 2005, the partnership had reached a critical point and needed a decision about whether the new way of doing business should continue. At a top management meeting at SarawatiTel, the Group Chief Technical Officer who had not believed in the model, presented the performance results for the previous five quarters. They showed significant improvements to network quality with dropped calls significantly reduced and well below target levels (see figure 3). The high quality of the network proved that the model worked, and this persuaded the doubters in the SarawatiTel organization. At the same time the new way of working resulted in a more focused company and in a more asset light balance sheet.

> It [the model] was really a paradigm shift for the industry. … the first time the objectives between a network operator and a network vendor were completely aligned.
>
> Group Chief Technical Officer, Zaratite India

Figure 3: Measurements of improved network quality.



On the other hand, Ericsson believed that this new way of doing business was unprofitable and decided to scrutinize the new model to see if it could be made viable. This happened in October and November 2005 and was managed by internal staff and a management consultant firm. The work provided some ideas about to structure and run the business profitably. It was believed that Ericsson needed 1) stronger control and governance to manage the business, 2) better network design to secure profitability, 3) to stop measuring profitability based on shipped equipment, 4) to change the price parameters by incorporating a mechanism to capture costs in the deployed network (capacity vs. coverage) and 5) new business support systems, processes and competencies to support the business.

Episode 5: Adaptation based on new boundary conditions for the price model and working practices

A new request for a proposal for an extension of the managed capacity contract was issued by SarawatiTel in December 2005. This was an opportunity for both Ericsson and SarawatiTel to revise and improve the contract according to what they had learned, and to make sure that the contract captured aligned incentives. One notable adjustment to the contract was the addition of several boundary conditions to the price model. An example of these boundary conditions was how to handle technology upgrades (in a mobile network much of the equipment needs to be upgraded every third year). These boundary conditions clarified the circumstances on the price parameters.

> The end-to-end understanding was really important, and it did not happen overnight, it took us a long time.
>
> Head of Price Management, Ericsson India

During finalization of the new contract, new business principles and several key processes between SarawatiTel and Ericsson were also established and added to the contract on how the performance-based business should be managed. Particularly important were the capacity management and the governance processes. The new contract was signed in August 2006 and the new processes were implemented at both Ericsson and SarawatiTel.

> We created a lot of working-level processes as well, which were anchored not just away from us, but SarawatiTel as wel."
>
> Contract Manager, Ericsson India

Ericsson also changed the way of working internally as a consequence of its investigation of the business. A new account head was appointed with a mandate to build a separate organization. The new organization did not follow the standard blueprint of doing business, and the new organization included delivery, business control and sales resources and a good understanding of both the commercial and technical aspects of the performance-based business. One major resource which was incorporated in the organization was network planning expertise because network planners played a pivotal role to secure the profitability of the new model. A contract manager role to achieve better control of sales and delivery was also implemented. In addition, new business decision points were implemented in both the sales and delivery processes.

Many of the identified problems were now mitigated but new problems arose that needed to be resolved. At Ericsson's central level, the split of the revenues between different business units became problematic. The issue related to performance-based contracts is that they cannot be directly correlated to one delivered product in one business unit. The managed capacity contract used a capacity-based price parameter which only reflected the capacity in the radio part of the mobile network. However, mobile networks include core networks with various switching equipment and software as well as charging products all of which belong to different business units. The split across different business units caused problems for the business controllers and business managers in Ericsson's Stockholm headquarters. An "equal pain/gain" method was established to handle the split but some business units continued to feel aggrieved, and it became the subject of recurring debate between the business units.

> The very split of that revenue became an internal problem. Because you had a hardware section, you had a service section... and this created a problem.
>
> Director at Business Unit Networks, Ericsson Sweden

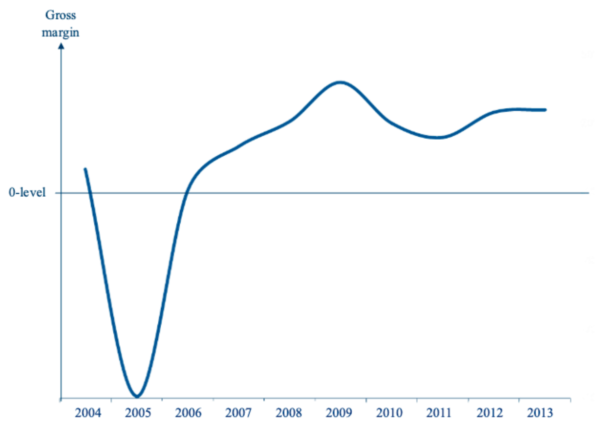
Episode 6: Exploitation of the performance-based business

Establishing a dedicated organization to handle the new business, and the systematic work of introducing new processes and boundary conditions were positive actions. Between 2006 and 2008, Ericsson's profitability improved greatly (see figure 4) while SarawatiTel's network grew faster than those of its competitors and it became the first private operator with pan-

India network coverage. SarawatiTel was adding 6.3 million new subscribers and 1,500 radio base stations per month on average. This growth was unprecedented in the world. Also, SarawatiTel was considered the number one operator by the end-users in India for quality. An executive director of SarawatiTel explained:

> I think our relationship with Ericsson has been fantastic on two fronts. One is that it helped us to roll out the network at the pace we wanted but more importantly it helped us to manage the quality of the network and the day to day challenges which come with such a vast network. And I think this is where the managed capacity contract has been very, very effective.
>
> Executive Director, SarawatiTel India

Figure 4. Gross margin development for the Ericsson SarawatiTel account in India.



Episode 7: Conceptualization of the business because of a technology shift and declining growth

In 2009, the performance-based business began to experience problems. First, the model was dependent on growth, and the 2G traffic growth had started to slow at the beginning of 2009. As a result, both revenues and margins began to decline (see figure 4 on gross margin). Second, the competition increased; Chinese telecom vendors entered the Indian market and began offering equipment. In 2009, Huawei and ZTE were offering network equipment at very low prices which prompted SarawatiTel to try to renegotiate the Erlang price with Ericsson. This resulted in lengthy discussion between the parties. Third, it was announced in 2009 that third generation (3G) mobile technology would be implemented in India with a license auction to be held in May 2010. The 3G technology represented a paradigm shift from purely voice traffic to voice and data bundles. Ericsson needed to adjust its revenue model and operate using two price parameters. It proposed dollar per Erlang (DPE) for voice and dollar per megabit (DPM) per second for data. However, SarawatiTel felt it would be paying twice for the same thing. To create a viable revenue model both parties needed a better understanding of the interaction between product characteristics and available spectrum, and how to dimension and build a 3G network.

> The data model required much more in-depth technical understanding. It was far more complex and challenging technically to co-create, what should be charged and what should be excluded from the calculations which eventually would become the payment mechanism.
>
> Vice President & Global Customer Unit Head SarawatiTel, Ericsson India

Episode 8: Adaptation to manage 3G and to restore profitability

In October 2011, Ericsson and SarawatiTel finally agreed new revenue models; DPM for the 3G network and DPE for the 2G network which meant two contracts for managed capacity. In November 2011, the DPM-contract was signed but implementation of the 3G network had started in September 2010 based on a memorandum of understanding. However, the slowdown in 2G traffic growth was accompanied by poor take off of 3G due to the high price of 3G handsets. As a result, the 3G traffic did not offset the declining growth of 2G and was not sufficient to cover the costs associated to technology upgrades and network operations. After a period of renegotiation, in mid-2012 an annual recurrent fee was added to the

DPE price model. However, Ericsson felt that this still did not cover all the costs of network operations in the saturated 2G market.

Episode 9: Discontinuation

Later in 2012 the DPE contract was due for renewal. Discussion over lowering the DPE price for the radio transmission part of the contract was intense. Ericsson was not ready to accept a lower price, and subsequently the radio transmission part of the network was removed from the contract because SarawatiTel decided to buy from Chinese vendors. This had a negative effect on Ericsson central management's view of performance-based contracts and SarawatiTel's 'cherry picking' behaviour began to challenge the fundamentals of the model.

In 2012 the Indian authorities issued 4G licenses. Ericsson and SarawatiTel discussed a managed capacity model for a 4G network which was technologically more sophisticated than 3G and thus warranted another type of model. The 4G technology was new and had not been tested thoroughly in other parts of the world. Ericsson's central management was reluctant to use the new business model for SarawatiTel and for the 4G technology given its prior experience in capturing value from performance-based contracts. SarawatiTel came up with a proposal for the 4G contract but Ericsson felt that SarawatiTel did not want to pay a decent price for the performance-based business based on 4G.

In September 2012 the annual executive management meeting between Ericsson and SarawatiTel took place in Stockholm. Present were among others, Mr. Blue, the main owner of SarawatiTel, and Ericsson's CEO and head of networks. Mr. Blue wanted to close the 4G discussion and presented a compromise on the price issue to Ericsson. Mr. Blue asked Ericsson's CEO "shall we agree on this?". The CEO turned to the head of networks for his view which was, "I'm sorry but we won't". SarawatiTel subsequently bought the 4G network from Huawei, and in 2014 when the existing 2G and 3G performance-based contracts expired, the business between SarawatiTel and Ericsson reverted to a transactional model.

Scaling up to include new geographical areas

In January 2010, SarawatiTel bought a 70 percent stake in Courier Telecom Bangladesh and took over management control and rebranded the company's services as SarawatiTel. In June 2010, SarawatiTel also acquired the mobile operator Honour's operations in 15 African countries making it at the time the fifth-largest mobile operator in the world. SarawatiTel's top management wanted to use the new business model in Bangladesh and Africa to grow its 2G networks. Ericsson's top management thought it would be a good idea to export and exploit the model which at the time worked quite well in India. In this section, we present the episodes that emerged from replicating the Indian service-based business model to these other markets to illustrate the scalability of a service-based business model for high-technology capital goods.

Episode 1 (Bangladesh): Creation by replication

SarawatiTel and Ericsson believed that the Indian business model could be replicated without any changes. Implementation started in February 2010 based on a memorandum of understanding related to the Indian contract terms.

Episode 2 (Bangladesh): Adaptation

In mid-2010, it became clear that replication of the contract and service-based business model was impossible and the company faced several business problems. Neither the SarawatiTel organization, consisting mostly of former Courier staff, or Ericsson's organization in Bangladesh had any experience of operating the model. It proved difficult to transfer knowledge developed over many years in India to operations in Bangladesh. Neither Ericsson nor SarawatiTel were clear about the activities, processes, relations and responsibilities involved.

In July 2010 Ericsson appointed an experienced manager from the Indian organization to run operations in Bangladesh. Ericsson's key account organization in Bangladesh lacked resources such as dedicated contract managers and network planners to handle the new business efficiently. It was decided that the key account organization in India would run the key account in Bangladesh and that the team in Bangladesh would only be operational.

> I have agreed with [Head of Ericsson India] that we will even share key account managers with the India team and only have the operations team in Bangladesh… Thus we will run through the [SarawatiTel's key account managers at Ericsson India].
>
> President & Head of Ericsson South East Asia and Oceania

The new operations head established a new separate organization because the existing organizational set-up was not suitable for the operation of the business. When it was in place, it took time for team members to get used the new model and to build the necessary capabilities.

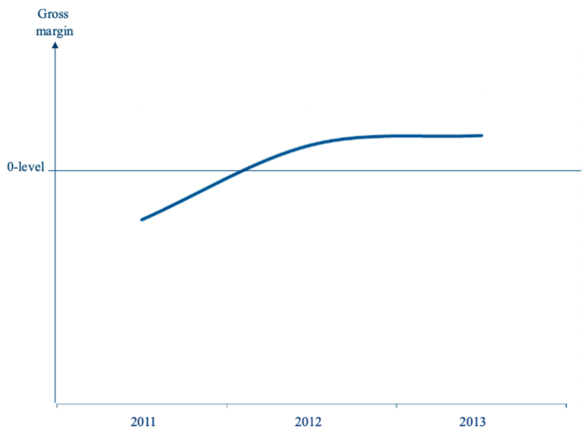
The challenge in Bangladesh was implementation of the contract where the service organization did not initially fall in line. They still wanted to go with their set up. There was a bit of a struggle I would say over there. But then when I went there, I made them understand how we needed to run this. Then I would say it took some time in the implementation, in the subsidiary organization. (Chief Operating Officer, Ericsson Bangladesh)

Other unforeseen issues had to be managed. Bangladesh had its own legal jurisdiction with different customs processes compared to India. This raised similar but different problems related to import capacity, and a unique Bangladesh solution had to be developed. Demographic differences, frequency allocation and mobile usage also were problematic. The replicated coverage, capacity, and traffic profiles affected Ericsson's costs negatively. In 2011, this part of the contract was renegotiated to try to restore the profitability.

> It was difficult to replicate the model... Bangladesh was a new scenario with new conditions.
>
> Sales Director Bangladesh at Business Unit Network, Ericsson Sweden

Capacity needs for the different parts of the network were unclear which resulted in accumulation of materials in warehouses. There were no inventory processes which resulted in costly materials handling and a lot of scrapping of equipment. As a result, replication of the service-based business model in India initially resulted in low margins. However, establishing a dedicated organization, renegotiating the contract and making the key account in India responsible for commercial aspects, improved profitability quite quickly (see figure 5).

Figure 5. Gross margin development in Bangladesh.



Episode 3 (Bangladesh): Discontinuation

Although profitability had started to improve during 2012, at the end of that year SarawatiTel decided to remove parts of the network from Ericsson and buy them instead from Chinese vendors. Also, in 2012 discussion over 3G started and in November 2013 Ericsson implemented a separate contract in a few cities based on the learning from India. However, 3G take up and revenues in Bangladesh were low. In 2014, Ericsson abandoned the model in Bangladesh.

Episode 1 (Africa): Creation by replication

SarawatiTel was eager to get the business going and believed that the model applied in India and Bangladesh could be replicated without significant changes also in Africa. However, the 15 markets in Africa were at different technical levels. They had different software releases and various hardware versions which had to be resolved before a contract could be signed. A project called Bootstrap was launched to upgrade these 15 networks to the same technology level which Ericsson charged for separately. In July 2010, during the network upgrades, 15 performance-based contracts (one for each country) were signed and implementation began immediately. The contracts were similar to the contracts used for India and Bangladesh, and the customs duty processes, and the coverage, capacity and traffic profiles were identical in all the contracts.

Episode 2 (Africa): Adaptation

The local Ericsson team in Africa had received training from Ericsson India about the new way of doing business. However, this training was insufficient and inventory pileups became substantial. The local Africa team continued to use traditional revenue recognition based on delivery of equipment. In August 2011, an expert team of contract managers and techno-commercial people from India was given responsibility for the African business. It was decided that a separate organization was needed also in Africa.

We landed in trouble because there was a big inventory pileup without revenue monetization. It took us almost 18 months to clear that up and get the understanding into the team. (Head of Commercial Management at Global Customer Unit SarawatiTel, Ericsson Africa)

This organization took time and was more cumbersome to implement in Africa compared to India because 15 different countries were involved. Lack of local competence in one country could not be compensated for from central resources because it was more difficult to travel between different countries in Africa than between states in India. The cost of running the new performance-based model in Africa was much higher than expected.

> It took me around four months to put the whole organization in place. Because it was, as I said, a big operation – 15 countries, different terrains and all that.
>
> Vice President & Customer Unit Head SarawatiTel, Ericsson Africa

At the end of 2011, a centrally driven project BIGMAC (Business Improvements for a Great Managed Capacity) was launched aimed at identifying and addressing commercial issues related to the performance-based contracts in Africa. The project team included experts from Ericsson India and Sweden. It identified several issues similar to those that had occurred in India but more complex due to the multi-country situation. Import duty problems were more difficult in the Africa case because each country had its own regulations, and specific processes had to be implemented in each country. The coverage, capacity and traffic profiles and tariffs used in Africa were based on the India contract which caused problems due to the different demographics in Africa and India. Cities in India were very dense, while Africa included many scattered villages, and tariffs had to be redefined to match the African demography.

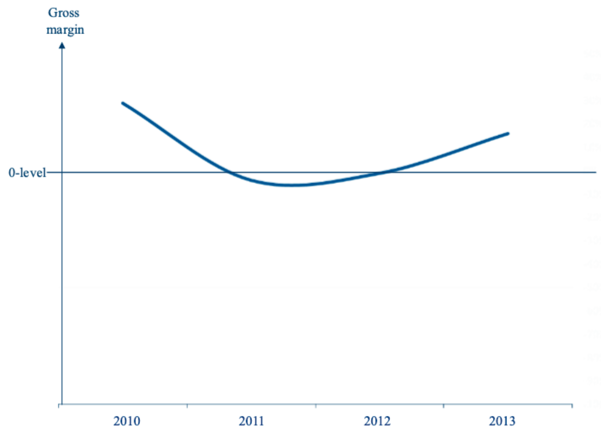
> We knew that Africa was a low-volume site market, so you don't have high capacity sites. We completely had to change the pricing across all the relevant parameters. We fixed the coverage/capacity-variance-table and we changed the boundary conditions.
>
> Head of Commercial Management at Global Customer Unit SarawatiTel, Ericsson Africa

There were also traffic profile differences between India and Africa which affected the ratio of the core equipment in the mobile network. The African traffic profiles required 20 percent more base station controllers than in India which affected profitability negatively. Warehouse issues were multiplied in Africa since each country was required to have its own warehouses. Also, country borders made it impossible to shift equipment between warehouses. A warehouse support system (the 'site handler') was implemented to help to optimize and track deployment of site equipment.

> In Africa we could not move the goods from one country to the other. There were massive challenges in terms of movement of goods. There were customs issues, there were all of those sorts of issues. Rather than to have one inventory, it had to be on 25 different locations.
>
> Head of Contract Management, Ericsson India

The BIGMAC project addressed all of these problems and introduced a stronger and quicker governance process, resulting in increased profitability and more accurate revenue recognition (see figure 6).

Figure 6. Gross margin development in Africa.



Episode 3 (Africa): Discontinuation

For the same reasons as in India and Bangladesh, in 2014, Ericsson abandoned the model for all African markets.

Results

The strategy to substitute product sales with services meant that Ericsson needed to select, design and develop a service-based business model (content of the transformation under examination when the firm moved from a present to a future state) which could create and capture value in order to build competitive advantage. As illustrated, the process for developing a successful business model was influenced by and interplayed with various firm internal and external contextual factors. Below we summarize how change occurred in the business model as the process unfolded, and provide evidence of the main patterns explaining why the business failed to establish competitive advantage.

Process patterns of business model change

How did change occur in the business model based on the strategy to substitute products for services? Ericsson and the customer conceptualized a new way of doing business based on cognitive search and creation of a service-based business model new to the market. The initial model generated value for the customer not Ericsson. This prompted a number of episodes of adaptation and progression, involving changing the business model based on experience accumulated to restore profitability. Ericsson's initial stance was that the performance-based contracts were mostly about financial reengineering and providing a service rather than a product but the adaptations moved it beyond financial reengineering and changed all parts of the business model radically as the process unfolded. We show that the main reason for Ericsson changing its business model over time was interference from several internal and external contextual factors related to the design and operation of a business model that would create and capture value. Many of the internal factors could be handled by reconfiguring processes, procedures and organizational structures and upgrading skills, decision rules and disciplines. These changes improved the balance between the value created for the customer and the value captured for Ericsson. However, Ericsson continued to face new issues related to external contextual factors which caused value capture to lag behind value creation.

The episodes in figures B1-B3 related to the Indian market map the evolution of the service-based business model. Each episode illustrates changes to the business model components and how they interacted as the process unfolded (empirical examples are presented in table C1). The data show that the strategy to substitute products with services and the introduction of performance-based contracts required multiple changes to the established product-based business model. The changes to the business model components reveal that the same components changed several times over the business model innovation trajectory, and are evidence of a processual relationship across episodes. Figures B1-B3 show also that multiple business model components changed in several of the individual episodes, indicating tight interactions between business model components for the development and operation of performance-based contracts. This demonstrates the difficulty firms can experience when specifying the causal linkages among alternative actions and outcomes related to value creation and value capture because attempts to do so are limited by the many potentially relevant variables in the business model and their interrelationships.

Although many contextual factors influenced the process and how the change occurred, we identified a particular pattern of contextual dependency across the geographical markets as responsible mainly for why Ericsson failed to establish a sustainable service-based business model regardless of its dynamic capability to redeploy its assets. The discriminating factor which mostly caused the service-business model to fail was technology dynamics that did not resonate with the business model. Another and interrelated pattern constraining the potential establishment of competitive advantage was the repeated difficulties to apply and scale a single service-based business model to different markets and customers.

Technology dynamics

The main reason why the service-based business model failed was related to technology dynamics. Changes to the technology both upgrades and shifts in technology standards made it difficult for Ericsson to capture value. It experienced difficulties related to being paid for upgrades to the network. Customers paid for coverage and capacity not for new technology features or standards. The problem related to technology changes are that they are difficult to plan for and involves large investments in R&D. However, for a service-based business model to be a valid alternative for customers, the networks must be kept up to date. Our data show that several times Ericsson had to change the value capture mechanisms by changing the price parameters to restore profitability when new technology upgrades were introduced. These changes improved the balance between the value created for the customer and the value captured for Ericsson but did not resolve the problem if new technology was introduced (see e.g., episodes 5 and 8 in India, and episode 2 in Bangladesh). Two major technology shifts (changes to technology standards) emerged while the service-based business models were in operation, and these caused even larger problems related to operating the service-based business model. The first was the shift from 2G to 3G. In the 2G contract the value proposition and corresponding price paraments were based on voice only not data traffic. This forced Ericsson to develop a new contract for its 3G technology. The second shift was from 3G to 4G, and these different technical characteristics warranted yet another contract. The shifts in core technology required replacement of the whole core network without knowing in advance how the network would function. This was the main reason why Ericsson ultimately abandoned the service-business model in all its markets.

Geographic transfer of the service-based business model

The second reason for failure of the service-based business model was that it was difficult to scale. In 2009, when the model worked well in India, Ericsson had aspirations which it communicated to the market to implement the model on a global scale. Top management saw the service-based business model as a strategic renewal which would have a significant effect on Ericsson's long-term prospects. However, the difficulty involved in scaling the model became immediately evident when Ericsson tried to replicate the business model used in India in Bangladesh and Africa. Although Ericsson had replicated the business model in India it underwent many changes after implementation in the other two markets (see figures B4 and B5 and tables C2 and C3 for empirical illustrations). We show that there were two reasons in particular why it was difficult to scale a service-based business model for high-technology capital goods. First, service-based business models based on performance-based contracts are highly dependent on location. Trying to use the same contract in different markets did not work because the different geographical markets had different demographics, frequency allocations and growth rates which resulted in different revenue streams and cost structures (hence a different value capture architecture). Also, customers tend to have different traffic profiles (voice and data usage characteristics) which make scaling even more difficult. Telecommunications networks differ for all customers and markets in contrast for instance to the Rolls Royce performance-based concept of 'power by the hour' where an engine works the same way regardless of where it is used. Second, to apply a service-based business model to a new organization seems difficult. Although, the local staff was educated before implementation they did not manage to replicate the model's core logic which meant that the model was difficult to transfer (see tables 4 and 5 episode 2 for the necessary changes). According to Ericsson, operation of the new business model involved knowledge and capabilities that were difficult to transfer.

Discussion and conclusion

This article examined Ericsson's strategy in its attempts to create and capture value when reconfiguring from selling telecommunications networks to selling network capacity using performance-based contracts. We highlighted the difficulty involved in redeploying assets and capabilities when switching from an established routinized product-based business model to a service-based business model and how technology dynamics and uncertainties caused Ericsson's strategy to fail. Our findings contradict received wisdom that manufacturing firms should move to the provision of services (Baines et al. 2020, Chesbrough 2011, Cusumano et al. 2015, Porter and Heppelmann 2014, Sjödin et al. 2020, Suarez et al. 2013, Visnjic et al. 2018). The patterns of change identified by our empirical data provide important insights into the tensions and contradictions involved in switching to a service-based business model. In conducting a process study to understand the dynamic changes that occur in firms searching for a viable service-based business model, we contribute to prior research on strategy and business models in four related ways.

First, we shed light on the process of a complete reconfiguration of the business model used. Our work responds to recent calls for research to examine the processes involved in shifting to a service-based business model (e.g., Baines et al. 2017, Foss and Saebi 2017) and for a process perspective on a strategic management issue (e.g., Pettigrew 1992, Schilke et al. 2018, Teece 2018a, Van den Ven 1992). We support prior research showing that dynamic capabilities and flexibility are critical for business model innovation (e.g., Teece 2007, Teece 2018a, Winter 2003). We show that without strong dynamic capabilities it is difficult, if not impossible, to achieve successful business model innovation involving substitution of products with services.

Prior research builds on non-processual studies and emphasizes the sequential steps involved in the transition from a product-based business model to a service-based business model (see e.g., Baines et al. 2020, Foss and Saebi 2017, Sjödin et al. 2020). Overall, there is a lack of empirical investigations of the activities involved in business model innovation that capture the nuances and details of implementation and adaptation (Teece 2018a). Indeed, few studies of business model innovation reveal the change process by including holistic and dynamic analysis of change. Without sufficiently understanding the role of activities and time we risk ending up in a simplistic view of business model innovation where researchers rush into prescriptive writing before rigorous analysis (see e.g., Pettigrew 1997). Our process study provides an examination of the progress of accumulated events and activities (cf. Langley et al. 2013).

We show that the tensions between and amongst the capabilities of sensing, seizing and reconfiguration make it difficult to plan for business model innovation. Many interdependent value creation and value capture activities in the business model need to be considered and changed to move from a product-based business model to a service-based business model. These changes interplayed with different contextual factors and needed to be accompanied by the reconfiguration of processes, procedures and organization structures. The managerial cognitive capabilities needed to sense are very different from mobilizing resources and reconfiguring (Helfat and Peteraf 2015, Teece 2007). While the capability to sense and seize the opportunity from transforming the business model was done by top management, the reconfiguring to a large extent was done by managers at different working levels. Because the working level procedures and processes were routinized, they were difficult to change. In fact, the reconfiguration was first done in the established local organizations which also ran the established business model for other customers. In all three markets, reconfigurations were impossible without break out structures to establish proper processes and procedures and to achieve complementarities between activities in the service-based business model. Hence, the firm failed to develop and integrate the capabilities needed in the established organizations. Also, despite establishing separate organizations, the reconfiguration took time because the organizations needed to cope with all changes in the business model in order to create and capture value, and to build new routines and operational efficiency. In other words, overhauling the business model requires a change in routines, and the change of routines can be very costly. The dynamic capabilities therefore set bounds to what extent the strategy of shifting to a service-based business model is feasible. Strategy and business model innovation require strong dynamic capabilities, financial resources and ongoing commitment from top management. However much the firm plans for its business model design, successful transformation involves numerous activities and decisions which cannot be known ex-ante and require huge organizational adaptability.

Prior research on business model innovation does not link changes to the business model to financial outcome (see e.g., Aversa et al. 2015, Zott and Amit 2008) which makes it difficult to understand to what extent different changes made to the business model are productive. We show explicitly how adaptations to the business model had positive effects over time as the firm searched for new ways to create and capture value, and the importance of searching for the right business model when moving to a service-based business. Yet, no matter how much effort and financial resources firms spend, or how good governance and leadership they have, success will not come if firms have the wrong business model (Teece 2007).

Second, we found that alignment between the business model and physical technologies is critical for business performance. Although some consider that the business model can unlock the value of new technologies (Baden-Fuller and Haefliger 2013, Björkdahl 2009, Chesbrough and Rosenbloom 2002, Christensen 2006, Snihur et al. 2021, Teece 2018b), the interplay between business models and physical technologies "is a much-overlooked component in strategic management" (Teece 2007, p.1327). In the case of innovating established business models involving physical technologies, the role of these technologies is treated as almost non-existent. The prior research instead emphasizes the organizational challenges involved when product firms shift the focus to services (see e.g., Baines et al. 2020, Chesbrough 2011, Visnjic Kastalli et al. 2013). We show that when there are dynamic changes to the core technologies it is difficult to align value creation and value capture in a service-based business model. Firms cannot simply swap business models without considering how this will be affected by the physical technologies.

Third, we support Hart and Moore's (2008) emphasis that contracts as reference points are needed for complex relationships where it is impossible to predict all events. We show that performance-based contracts used for service-based business models entail complex relationships and the need to specify mutual goals and establish a governance structure to align expectations and interests. A business relationship depends on more than a contract. However, trying to align value creation and value capture by selling performance is difficult if not impossible in the absence of proper contracts. The initial agreement between Ericsson and SarawatiTel was based on top management understanding and sensing of mutual goals. However, the contract negotiations were enacted at the operational level, resulting in a transactional contract. The only difference with the traditional supplier contract was the inclusion of a new revenue model and its price structure. The contract included no details on goals, governance structures or boundary conditions such as who should pay for network upgrades, what type of network sites should be built and how fast roll-out should be. The contract was incomplete (cf. Hart and Moore 1990). Incomplete contracts can lead to ex-post bargaining power if ex-ante investments have already been made, and can result in hold-up problems (Hart 2016). The incomplete contract in this case resulted in it being difficult for Ericsson to capture value and little incentive to continue to roll-out the network given its poor performance.

The contract was renegotiated after two years under conditions of symmetric information, in line with the so-called vested methodology for creating formal relational contracts (see Frydlinger et al. 2019). Notable changes included boundary conditions to clarify when the price mechanism was viable, introduce governance structures into the contract and handle residual control and reconciliations for instance. The renegotiated contract substantially improved Ericsson's business performance and fulfilled customer expectations. However, the contract was not enough to handle the uncertainties related to technology shifts, to control for how the technology worked in different markets or as a template to reconfigure assets, capabilities and organization structures when scaling the service-based business model to fit new markets.

Fourth, we provide evidence that it is difficult to scale a service-based business model to fit new geographical markets. Indeed, designing a service-based business model for one market or location is not a viable strategy for a multinational firm. To be worth the investment involved, the business model needs to be scalable. Few studies examine scaling of service-based business models to substitute for an established product-based-business model.

It is well-known that the main benefit of a proven and routinized product-based business model is the economies of scale derived from replicating standardized procedures across markets (Chandler 1977). However, prior research shows that it can be difficult for multi-unit firms to replicate the procedures used in one market or location in another market (see e.g., Cyert and March 1963, Lawrence 2020, Winter and Szulanski 2001). In particular, firms can find it difficult to transfer knowledge and capabilities between markets (Helfat and Peteraf 2003, Zander and Kogout 1995), and frequently need to make local adaptations based on experience (Levinthal and Marino 2015, Winter and Szulanski 2001). Indeed, the transfer of knowledge and capabilities is critical for business performance and is key to dynamic capabilities (Teece 2007). We found support for work on the difficulties involved in transferring knowledge and capabilities from one market to another when scaling a service-based business model. The problems involved in scaling and replicating a business model for use in a new market are very similar to the problems experienced when developing the original service business. Entering new geographical markets involved experiential learning and adaptation of downstream assets to country-specific contexts. However, given the striking tension in already having a product-based business model for selling the technology, we found that local managers often do not try to replicate some business procedures for the service-based business model. All the local geographical markets which adopted the new service-based business model were required to create break-out organizations to increase governance control and transfer knowledge and capabilities. This reduced effectiveness and produced inertia in the replication of the business model (cf. Jensen and Szulanski 2007). In addition, the performance-based contract used for the service-based business model and its price mechanisms was not applicable to new markets with different demographics and traffic profiles. The price parameters in the contract initially were (easily) replicated but had to be renegotiated based on the conditions in the local markets to align value creation and value capture between seller and buyer. This suggests that under certain circumstances such as dynamic technologies, that a service-based business model where the firm sells performance is more difficult to replicate and scale up than a product-based business model.

Our study has some limitations. First, we focus on a single multinational multidivisional firm in a strategic capital goods industry. Although the bad experience of Ericsson raises questions about the feasibility of transforming from a product-based business model to a service-based business model, more research is needed to reveal whether the difficulties we identified in finding a viable and scalable business model are unusual or are part of a broader pattern across firms and industries. We acknowledge, for example, that the redeployment of assets and capabilities is easier in firms with narrower geographical and product scope. Second, we focused on a firm situated in an industry with large R&D investments, fast moving technologies and technology standards. We showed that there is a strong connection between physical technologies and the business model for how firms create and capture value but this dependency might be less obvious and easier to deal with in other firms. However, because the existing research mostly ignores the role played by physical technologies in the shift to service-based business models, we suggest future research could explore this interdependence.

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Paper I – Appendix A

Table A1: Informants.

1	Head Marketing & Sales Customer Unit SarawatiTel, Ericsson India	India	2003-2008
2	Regional Manager/Customer Unit Head SarawatiTel, Ericsson India	India	2005-2010
	Managed Services Chief Operating Officer, Ericsson Bangladesh	Bangladesh	2010-2011
	Vice President & Customer Unit Head SarawatiTel, Ericsson Africa	Africa	2011-2014
3	Sales Director India, Business Unit Networks, Ericsson Sweden	India	2009-2014
4	Director New Sales, Business Unit Networks, Ericsson Sweden	India	2003-2004
	Managing Director, Ericsson Bangladesh	Bangladesh	2005-2009
	President & Head of Ericsson South East Asia and Oceania	Bangladesh	2010-2014
5	President & Head of Ericsson Region India, Ericsson India	India	2006-2008
6	President & Head of Region India, Ericsson India	India	2003-2005
	Vice President & Corporate Officer, Ericsson Sweden	Africa	2009-2014
7	President & Head of Business Unit Services, Ericsson Sweden	India	2003-2008
	Chief Financial Officer, Ericsson Sweden	India	2003-2008
8	Vice President Engagement Practice, Business Unit Services, Ericsson Sweden	India	2006-2011
	President & Head of Region India, Ericsson India	India	2011-2013
	President & Head Ericsson Region sub Saharan Africa	Africa	2013-2014
9	Director, Business Control, Business Unit Networks, Ericsson Sweden	India	2007-2009
	Vice President Commercial Management, Ericsson Sweden	India	2009-2011
10	Price Manager, Ericsson India	India	2009-2011
11	Commercial Manager, Business Unit Networks, Ericsson Sweden	India	2003-2004
	Head of Commercial Management, Ericsson India	India	2004-2007
12	Director of Operations, Customer Unit SarawatiTel, Ericsson India	India	2004-2006
13	Price Manager, Ericsson India	India	2006-2007
14	Head of Price Management, Ericsson India	India	2010-2011
15	Vice President & Customer Unit Head SarawatiTel, Ericsson India	India	2003-2005
16	Head Marketing & Sales Customer Unit SarawatiTel	India	2007-2009
17	Corporate Vice President, Ericsson Sweden	India	2003-2005
18	Head of Contract Management Customer Unit SarawatiTel, Ericsson India	India	2007-2009

19	Head of Price Management, Ericsson India	India	2003-2010
	Commercial Manager, Business Unit Networks, Ericsson Sweden	India	2010-2013
20	Strategic Product Manager 3G, Business Unit Networks, Ericsson Sweden	India	2006-2012
21	Vice President & Global Customer Unit Head SarawatiTel, Ericsson India	India	2009-2014
22	Sales Director sub Saharan Africa, Business Unit Networks, Ericsson Sweden	Africa	2010-2013
23	Head of Contract Management, Ericsson India	Africa	2009-2011
24	Price Manager, Ericsson India	India	2008-2012
	Head of Commercial Management, Global Customer Unit SarawatiTel, Ericsson Africa	Africa	2012-2014
25	Product Marketing Manager, Business Unit Networks, Ericsson Sweden	India	2008-2011
	Head of Expert Sales 3G, Ericsson India	India	2011-2014
26	Sales Director India, Business Unit Multimedia, Ericsson Sweden	India/Africa	2007-2011
27	Sales Director Bangladesh, Business Unit Networks, Ericsson Sweden	Bangladesh	2009-2011
28	Sales Director sub Saharan Africa, Business Unit Networks, Ericsson Sweden	Africa	2013-2014
29	Price Manager, Ericsson India	India	2003-2006
	Manager Business Control, Customer Unit SarawatiTel, Ericsson India	India	2006-2009
	Manager Contract Management, Customer Unit SarawatiTel, Ericsson India	India	2008-2009
30	Sales Director India, Business Unit Networks, Ericsson Sweden	India	2009-2012
31	Contract Manager, Ericsson India	India	2007-2012
32	Pricing Manager, Ericsson India	India	2004-2006
33	Managing Director, SarawatiTel India	India	2003-2010
	Managing Director, SarawatiTel Africa	Africa	2010-2014
34	President & Head of Region India, Ericsson India	India	2013-2014
35	Vice President Sales, Global Services, Ericsson Sweden	India	2003-2005
	Executive Vice President & Head of Business Unit Networks, Ericsson Sweden	India	2008-2014
36	Business Controller, Business Unit Networks, Ericsson Sweden	India	2005-2009
37	Group Chief Technical Officer, SarawatiTel India	India	2002-2008
38	Group Chief Technical Officer, SarawatiTel India	India	2008-2009
39	Executive Director, SarawatiTel India	India	2003-2007
40	Head of Design and Planning, Ericsson India	India	2005-2014

Paper I – Appendix B

Figure B1: Illustrative summaries of Episode 1, 2 and 3 (India).

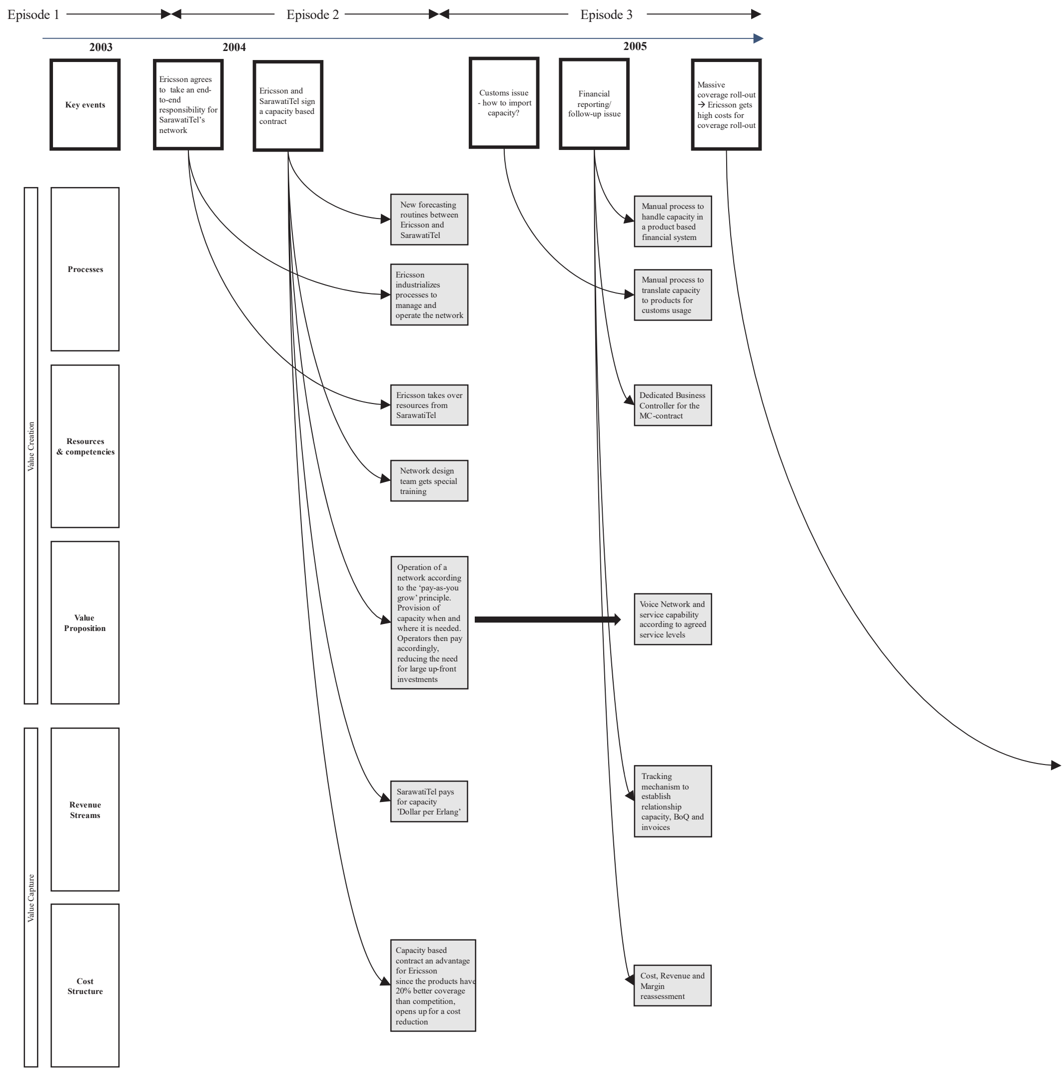


Figure B2: Illustrative summaries of Episode 3, 4, 5, 6 (India).

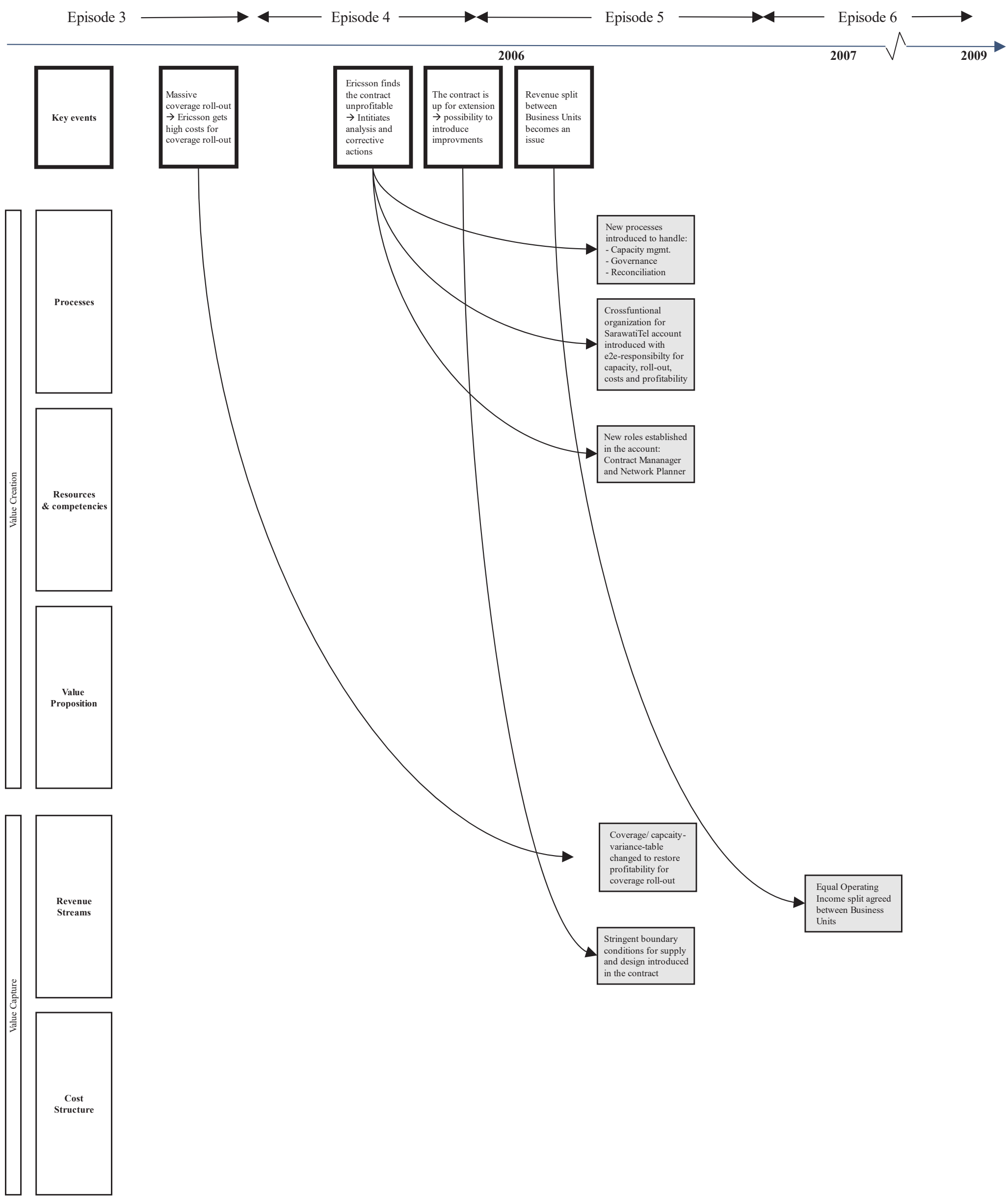


Figure B3: Illustrative summaries of Episode 7, 8 and 9 (India).

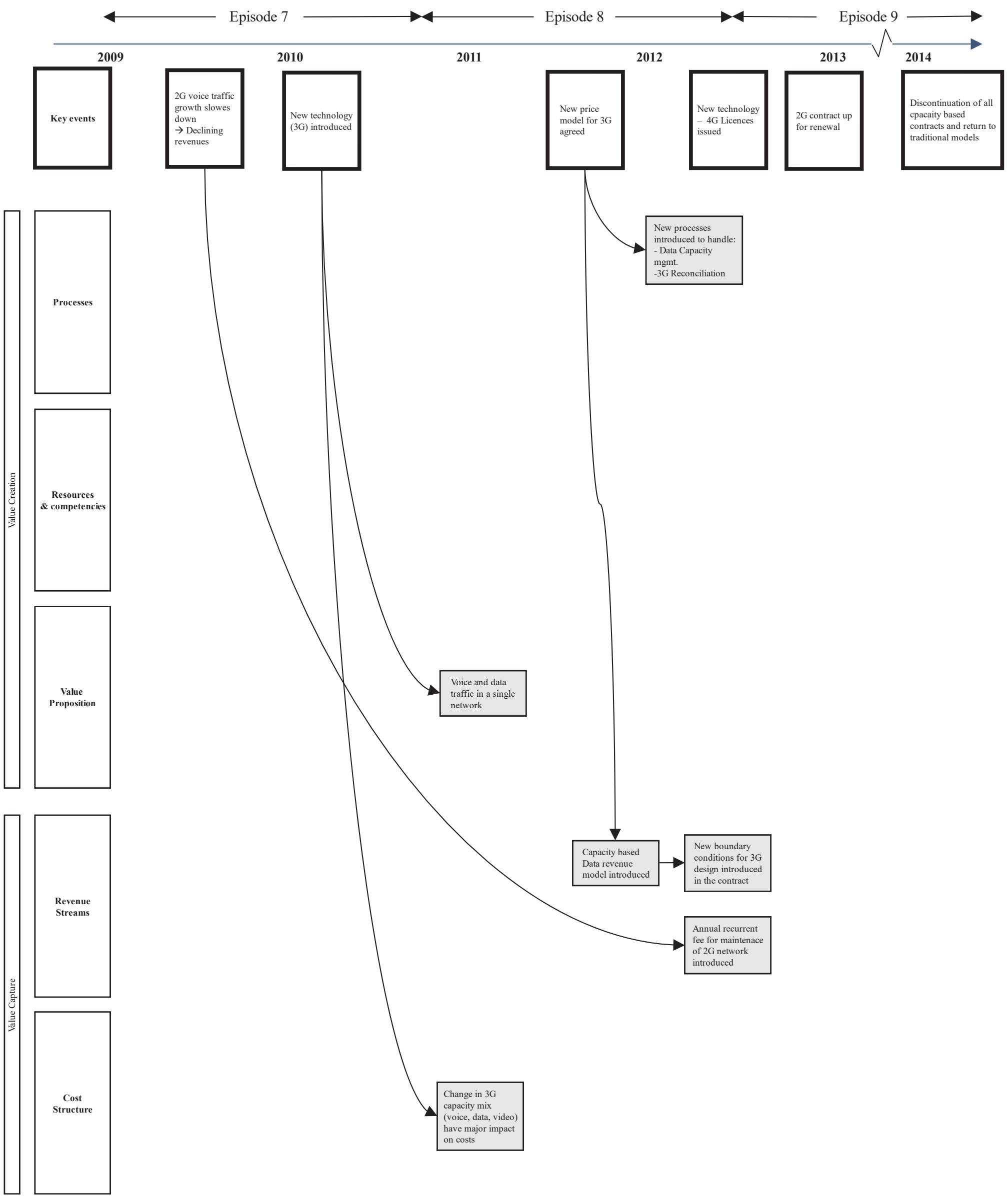


Figure B4: Illustrative summaries of Episodes (Bangladesh).

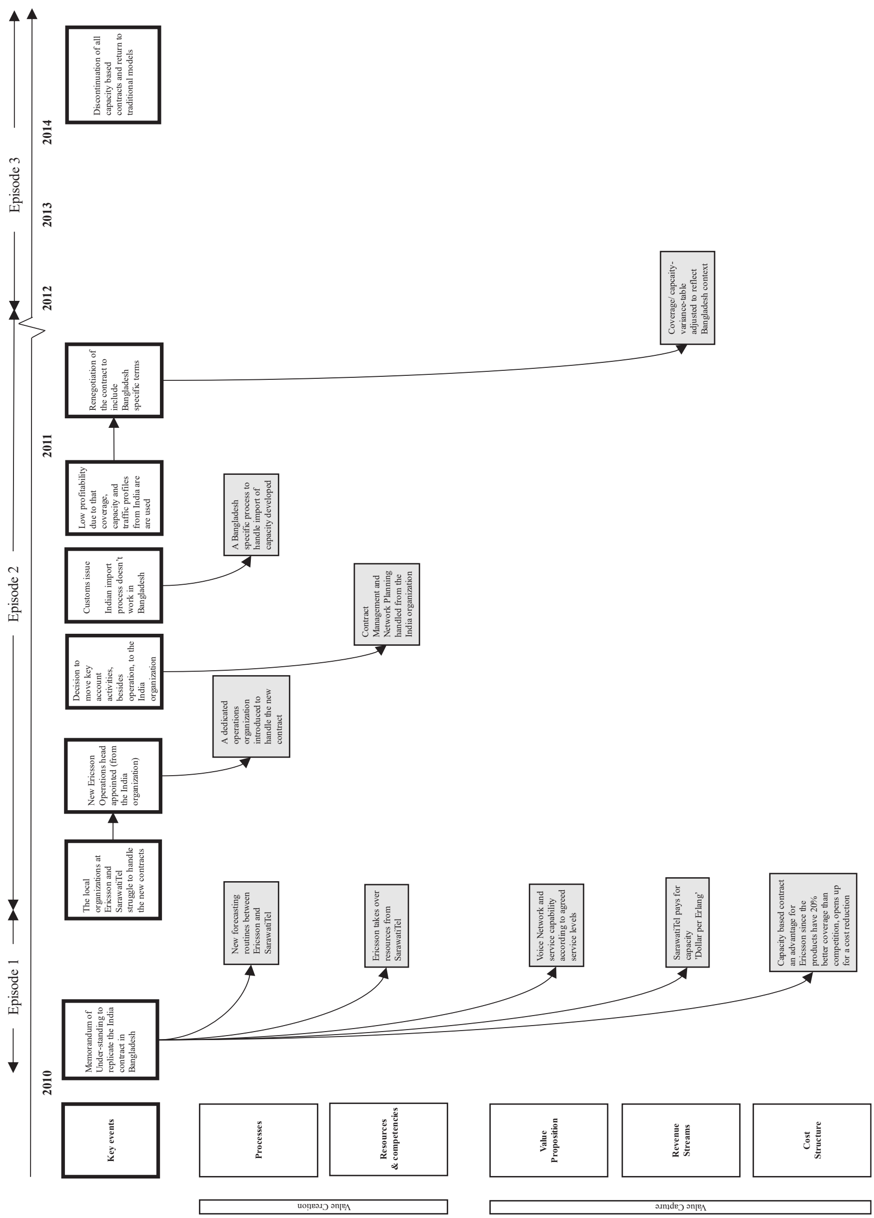
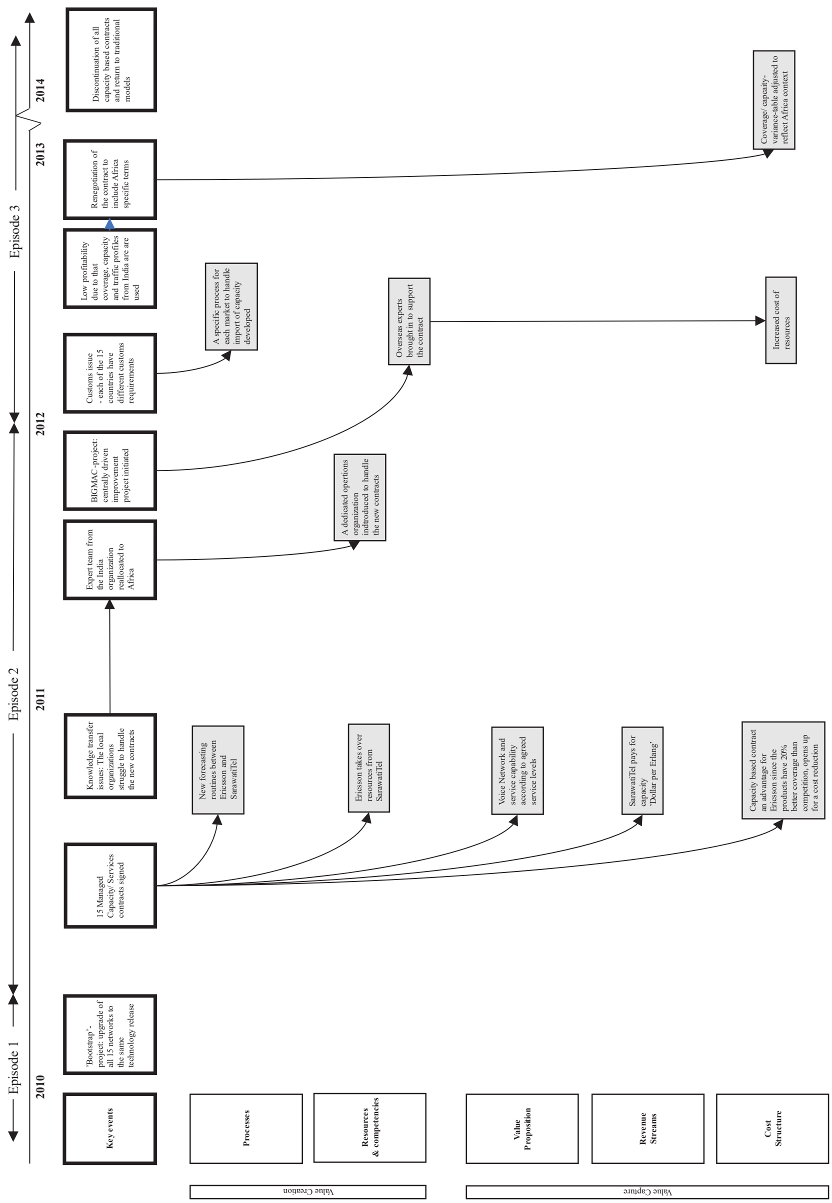


Figure B5: Illustrative summaries of Episodes (Africa).



Paper I – Appendix C

Table C1: Empirical examples from the business in India

Theoretical categories	Episode 2	Episode 3	Episode 5	Episode 8
Processes	"in IN [Intelligent Networks] and BSS [Business Support Systems], you don't get any voice calls or capacity, it is only signaling. So I had to alter my process to measure signaling so it could be equal to the correct Erlangs. *Interview, Head of Design and Planning, Ericsson India* SarawatiTel gives forecast of Erlangs and Sites for each quarter per Circle before the beginning of that quarter. For example: In July SarawatiTel provides Erlangs for the Q4 rollouts. *Model Description, Ericsson internal document* "The journey, operationally, was one of a massive, massive ramp-up, because we inherited an organization that was quite entrepreneurial and small, and very quickly you needed a fully industrialized process, because it was the only way to deliver 2000 sites a month". *Interview, Director of Operations, Customer Unit SarawatiTel, Ericsson India*	… we have devised a template that would enable tracking of Erlangs and its financial value, from its estimation stage through to Purchase Order's and Invoices and eventually to installation and utilization. *SarawatiTel Managed Capacity Contract - Information Requirement for Revised Revenue Recognition Principle, Ericsson internal document* "the revenue was recognized only equivalent to the monthly Erlang sign off. This was so very complicated so to help put all this data together we also developed a tool which helped us to some extent of reducing the manual work in accounting and so that tool used to compile all the data, calculate revenue and then we used to feed it into our SAP system". *Interview, Manager Business Control, Customer Unit SarawatiTel, Ericsson India* [Process to handle Erlangs in a product based financial system:] …each circle's quarterly Erlang requirement would be treated as a distinct product. Such a product would comprise contribution in the form of various equipment from various Business Unit's. It is proposed that these contributions from the individual BUs be captured into separate and distinct project IDs till such time that the final product (i.e., the required Erlangs) is delivered to the customer. *Description, SarawatiTel MC – Project ID Process, Ericsson internal document*	Process changes implemented under the new contract: - Tighter reconciliation process - Better KPI reward/penalty process - Automation of capacity management - Introduction of a new tool, 'Managed Capacity Tool', to track profitability *The SarawatiTel Deal, Key account presentation, Ericsson internal document* [Organizational improvements implemented:] Decentralization of responsibilities Introduction of 3 Regions, Manage and Operate and a National Core-3 team Organizational Improvements Executed Decentralized regions, each region is responsible of: - Tracking of revenue and costs - Check and balance responsibility - Red Flag responsibility for Capacity, Roll out, Costs and Revenue *Improvements, Key Account presentation, Ericsson internal document*	"the accounting became very complex for 3G compared to 2G, and finally a model was found. So that was the last milestone achieved before the 3G-model could be operationalized." *Interview, Price Manager, Ericsson India* "I think the definition of boundaries was a very, very important milestone of the [3G] contract formulation. And even more important is how do you govern the contract. Because that is where, either you can make money, or you can continue to lose money." *Interview, Vice President & Global Customer Unit Head SarawatiTel, Ericsson India*
Resources and competencies	"the not insignificant part of the deal was that SarawatiTel was transferring a technical organization to Ericsson. Not just what you see in many Managed Services deals, not just the maintenance, but also the design, engineering, and the rollout capabilities. They now would have to be combined with the rollout	… we need an expert resource to help us crack the accounting and control issues surrounding this contract. We should aim for getting a person down here by the last week of October. *E-mail, CFO Ericsson India* [Ad for a Business Controller to manage the SarawatiTel account:] This contract provides us with an opportunity	[Introduction of contract manager role:] Transaction Management Plan should be established and an overall business responsible person appointed, prior to contract execution. *Managed Services Contract Management, Ericsson internal directive*	N/A

Table C1: Empirical examples from the business in India (continued).

	capabilities of Ericsson Sweden and Ericsson India". *Interview, Director of Operations, Customer Unit SarawatiTel, Ericsson India* "The Network Design team was embedded into the Customer Unit to be able to work closely with the commercial team. … I also build and designed a special training for my team that in case of manage capacity, how would you dimension, how would you plan and how would you design the network". *Interview, Head of Design and Planning, Ericsson India*	to establish new ground rules in the areas of financial accounting, internal controls and work procedures, working capital management, SOX / IFRS compliance, transfer pricing, risk management etc. As a Controller for SarawatiTel Account this position provides an opportunity to work on a wide variety of issues and new challenges, with extensive cross functional exposure into other domains such as technical, marketing, project management etc. in a dynamic and demanding environment. This is an exciting and challenging opportunity for a finance professional who has diversity of knowledge, competence and experience. *Internal Advertise at Ericsson*	[Introduction of network planner role:] Decision: Provide assistance, 1 FTE (Full Time Employee) for optimizing the capacity configuration and reviewing network design. *MoM Managed Capacity Steering Group Meeting, Ericsson internal document*	
Value proposition	Managed capacity means that we operate a network according to the 'pay-as-you grow' principle. We provide capacity when and where it is needed. Operators then pay accordingly, reducing the need for large up-front investments. *Ericsson Annual Report 2004*	…new business models such as managed capacity, where an operator buys coverage, capacity and network performance, or hosted services, where companies like Ericsson provide the network and/or service capability according to agreed service levels. Under such business models, operators gain flexibility in capital employed, resources and time to market – all with an assured quality of service. *Ericsson Annual Report 2005* Internally, we concentrate on the brand, we concentrate on the customer, and we concentrate on our people. Everything else we've left to the experts to manage it for us. Our networks are managed by Ericsson. *Presentation: Group Chief Technical Officer, SarawatiTel India*	N/A	The deployment of a WCDMA/HSPA [3G] network offers SarawatiTel the opportunity to offer voice, media and advanced data services in a single network and over a common spectrum resource. *Ericsson proposal for SarawatiTel 3G network, Ericsson internal description*
Revenue streams	Capacity is measured in Radio Erlangs ("Dollar per Erlang" or DPE) The DPE that the customer pays are subject to: - A fixed Bill of Quantity - A traffic profile Key deliverables: - Capacity v/s coverage build out - Network performance – KPI *Managed Capacity, Ericsson internal presentation*	… the tracking mechanism aims at establishing a clear relationship between Erlang forecasts, bill of quantities, purchase orders and invoices (and hence the associated cost of sales) both in terms of monetary values and Erlang. The tracking of the equipment into its final installation would become possible, and the exercise of determining monthly costs and CWIP valuations would become more reliable. *SarawatiTel Managed Capacity Contract - Information Requirement for Revised Revenue Recognition Principle, Ericsson internal document*	"in MC1 [the existing contract] boundary conditions were not clear and we couldn't get paid, but then we created a new annexure for boundary conditions and then we introduced the reconciliations that was done for the boundary conditions. Yeah, so that was created in MC2 [the new contract]." *Interview, Manager Business Control, Customer Unit SarawatiTel, Ericsson India* Tighter boundary conditions for design and supply introduced in the new contract.	Introduction of DPM ('Dollar per Megabit per second') price model for data traffic, based on: - Bouncing busy hour traffic (intervals where the traffic is highest) - A setup fee - A variable fee, which depended upon how the traffic moved - A 3 year backstop *SarawatiTel Managed Capacity – 3G, Ericsson internal document* New recurrent price parameters introduced to handle no-growth situations:

Table C1: Empirical examples from the business in India (continued).

			The SarawatiTel Deal, Key account presentation, Ericsson internal document [Revenue-split between Business Units agreed:] We will accept to follow the amendment to document AD 09 signed by all Business Unit's (June 2006 doc) which say we will do an equal Operating Income split, *E-mail, Head of Sales Ericsson Business Unit Networks*	- Logistics + Warehouse Management - Project Management + Design and Planning - Replenishment of Spares *New Managed Capacity Construct, Ericsson internal document*
Cost structure	"Ericsson's products with 20% better coverage than the competitors open up for a cost reduction." *Interview, Product Marketing Manager, Business Unit Networks, Ericsson Sweden* The [Ericsson] Expander is a cost-effective solution for networks and network management as it uses 25-30% fewer radio sites and consumes less power. *Deutche Bank Company Focus Report*	[Coverage/Capacity – cost variations] Even considering that Ericsson will get a return on investment from low configuration sites by increasing the capacity on these sites in the future, the NPV of these are currently not sufficient to break-even. *E-mail, Ericsson Managed Services Sales Manager* [Cost, Revenue and Margin reassessment] Two exercises are being carried out for estimating profitability for the balance three quarters of this contract, (a) based on the current year TPCM [Profitability calculation] and (b) based on capex budgeting. These will individually be converted to a 'Start to End' project analysis, using the results of the inventory exercise. *E-mail, Minutes of Meeting telephone conference*	N/A	"The support was part of the managed services contract. The introduction of 3G increased the complexity of the support, but the cost was initially not captured in the Managed Services contract." *Interview, Sales Director India, Business Unit Multimedia, Ericsson Sweden* "The fact that you have very little [3G] spectrum forces you to build with cell reuse. That means that you need to build a denser network to offer the same capacity, you need to build a denser network with more base stations. So that's more complicated cell planning, more interference-prone cell planning, and definitely more costly." *Interview, Sales Director India, Business Unit Networks, Ericsson Sweden* "For 3G, it is voice, video, and data. Any change in the proportion between them and you arrive at completely different throughputs and completely different capacities which affect the costs". *Interview, Head of Expert Sales 3G, Ericsson India*

Table C2: Empirical examples from the business in Bangladesh.

	Theoretical categories	Episode 1	Episode 2
Value creation	**Processes**	"We took over a contract that had been implemented and executed in India for 6 years, without any experiences of running it. We had neither the organization nor the processes to handle the contract". *Interview, Sales Director Bangladesh, Business Unit Networks, Ericsson Sweden*	"The challenge in Bangladesh was implementation of the contract where the service organization did not initially fall in line. They still wanted to go with their set up. There was a bit of a struggle I would say over there. But then when I went there, I made them understand how we needed to run this. Then I would say it took some time in the implementation, in the subsidiary organization." *Interview, Managed Services Chief Operating Officer, Ericsson Bangladesh*
	Resources and competencies	"I think we had a bit of a challenge initially with the customer to make them understand what their role is because they thought that they have given everything to us." *Interview, Managed Services Chief Operating Officer, Ericsson Bangladesh*	"[Managing Director, Ericsson Bangladesh] completely teamed up with India team and in fact I was not part of Bangladesh then I was head of sales for Ericsson in India. But I was given the responsibility for closing the Bangladesh merger." *Interview, Managed Services Chief Operating Officer, Ericsson Bangladesh* I have agreed with [Head of Ericsson India] that we will even share Key Account Managers with the India team and only have the operations team in Bangladesh… Thus we will run through the [SarawatiTel's Key Account Manager at Ericsson India]. *E-mail, President & Head of Ericsson South East Asia and Oceania*
	Value proposition	…new business models such as managed capacity, where an operator buys coverage, capacity and network performance, or hosted services, where companies like Ericsson provide the network and/or service capability according to agreed service levels. Under such business models, operators gain flexibility in capital employed, resources and time to market – all with an assured quality of service. *Ericsson Annual Report 2005*	N/A
Value capture	**Revenue streams**	Erlang price is uniform over contract term based on - Contracted design assumptions - Model network with contracted "capped items" - Milestone reconciliations on EPS variation, capped items, excess capacity - KPI reward/penalty *Customer presentation: Managed Capability Construct, Ericsson presentation*	[Coverage/Capacity-variance-table changed:] A Bangladesh table with high low-EPS premium introduced. *Managed Capacity, Ericsson internal document*
	Cost structure	Capacity based contract is an advantage for Ericsson: "Ericsson's products with 20% better coverage than the competitors opens up for a cost reduction." *Interview, Product Marketing Manager, Business Unit Networks, Ericsson Sweden*	N/A

Table C3: Empirical examples from the business in Africa.

	Theoretical categories	Episode 1	Episode 2
Value creation	**Processes**	" … and in the supply we were losing money because the same issues what we experienced in India initially, people had not learned and they were also damaging in a similar manner, they did not know how to take the monthly sign offs, the capacity wasn't recalculated at the right manner." *Interview, Vice President & Customer Unit Head SarawatiTel, Ericsson Africa* "Now, we also transferred our employees who are network employees to Ericsson, in India, as well as in Africa. So the organization design changed because we moved people to Ericsson." *Interview, Managing Director SarawatiTel Africa*	"Then we carved out a Managed Capacity organization separately and we said, "Let managed service and Managed Capacity work differently," because we had so many issues on the ground." *Interview, Vice President & Customer Unit Head SarawatiTel, Ericsson Africa* System set up for all contracts complete, for all countries in ONE. Baseline business case agreed with all stakeholders and work has started. Customer PO [Purchase Order] process agreed with SarawatiTel i.e. PO's to be issued per contract per country on a quarterly basis -> no mixed PO"s to be accepted. *BIGMAC Steering report #4, Ericsson internal report*
	Resources and competencies	"India was simpler that way, because we had a good team and we had reasonable cost, but Africa was a new team and. They did not understand the model very clearly, despite the fact that we did a lot of work on making them understand. Even the Ericsson team took time to understand." *Interview, Managing Director SarawatiTel Africa* "I think here that understanding was missing initially and it took some time, almost 12 to 18 months to put those understanding into the whole organization. Developing capability and organization to understand how the Bill of Quantity will be developed in terms of capacity and how those capacity will be deployed on the ground." *Interview, Head of Commercial Management, Global Customer Unit SarawatiTel, Ericsson Africa*	"Then for the Managed Capacity, I appointed a director of Managed Capacity I hired a guy from India who had large experience of this. He reported directly to me as director of operations for Managed Capacity and then we took control of entire ordering and damage thing and everything. That's how we got things back on track." *Interview, Vice President & Customer Unit Head SarawatiTel, Ericsson Africa* "Whereas in Africa we were dealing with so many other countries, 15 countries with very poor or hugely different capability and even the cost of resources was coming out to be higher and then it needed to be supplemented massively by overseas resources/experts." *Interview, Head of Contract Management, Ericsson India*
	Value proposition	…new business models such as managed capacity, where an operator buys coverage, capacity and network performance, or hosted services, where companies like Ericsson provide the network and/or service capability according to agreed service levels. Under such business models, operators gain flexibility in capital employed, resources and time to market – all with an assured quality of service. *Ericsson Annual Report 2005*	N/A
Value capture	**Revenue streams**	Managed Capacity (for supply + rollout + customer support services) – based on uniform Erlang price based on model network bill of quantity over contract term; DPE based on incremental network build. Price variation on Erlangs per site to cater for coverage vs capacity buildout; Reconciliation (quarterly) based on capped items, excess capacity due to variation from model network dimensioning, excess capacity based on delivered capacity "in advance" *Ericsson powerpoint presentation to customers*	"We re-opened a signed contract, we re-negotiated the managed capacity contract, although it was still running." *Interview, Vice President & CU Head Ericsson Africa* "We completely changed the parameters across all the pricing. Across the countries. …, we gave discounts on the higher EPS which we thought that will never come in Africa, and which was the case. And then we reshifted money on the lower slabs of the ERLANG table. We fixed the table and we changed each country's boundary conditions … These things we kept on fine tuning in the model to make it region-specific or country-specific." *Interview, Head of Commercial Management, Global Customer Unit SarawatiTel, Ericsson Africa*
	Cost structure	Capacity based contract is an advantage for Ericsson: "Ericsson's products with 20% better coverage than the competitors opens up for a cost reduction." *Interview, Product Marketing Manager, Business Unit Networks, Ericsson Sweden*	"Whereas in Africa we were dealing with so many other countries, 15 countries with very poor or hugely different capability and even the cost of resources was coming out to be higher and then it needed to be supplemented massively by overseas resources/experts." *Interview, Head of contract management, Ericsson India*

Paper II

Technological Development and Business Model Dynamics: Exploring the Triadic Interplay for Servitization Business Models

Authors
Mats O. Pettersson, Joakim Björkdahl, and Stefan Arora-Jonsson

(Still under development)

Abstract

As firms strive to remain competitive in the face of rapid technological change, the adaptation and utilization of technology to enhance their business models become crucial. A firm's business model – interdependent activities to create and capture value – play a central role. Managing the interplay between the evolving technology landscape and the dynamic nature of business models poses a significant challenge for firms. This paper investigates the complexity of the technology-business model interplay by expanding the conventional dyadic perspective to a triadic framework that incorporates the behavior of the customer. Through a case study of Ericsson's transition from a transaction-based to a servitization business model in the Indian market, we examine the firm's struggles in managing the new business model amidst technological advancements from 2G to 4G. Our findings shed light on the challenges associated with coordinating the actions of the seller and the buyer in servitization models, emphasizing the importance of addressing divergent expectations, communication issues, power dynamics, and building internal organizational coalitions. This research contributes to a deeper understanding of the dynamics between technology and business models, emphasizing the need to consider the triadic interplay and the complexities arising from the customer's role in shaping business model success.

Introduction

Technological development provides firms with opportunities as it can increase their competitive repertoire to create and capture economic value (Jacobides and Tae, 2015; Hacklin et al., 2018; Snihur et al., 2021). Every opportunity for an innovator or new entrant represents a potential challenge for an incumbent firm seeking to remain competitive. As the pace of technological change increases, so does the pressure on firms to adapt to and make use of technological change to remain competitive (Teece, 2018; Zott and Amit, 2020).

Core to our understanding of how firms create and extract economic value from technologies is the concept of a business model – a system of interdependent activities that a firm undertakes to create and capture value (Afuah, 2003; Snihur and Eisenhardt, 2022; Amit and Zott, 2002). A long line of research shows that firms become successful if they are able to develop and implement a business model that fits with the potential for a technology to generate value for customers (Siggelkow, 2002; Chesbrough and Rosenbloom, 2002; Teece, 2010). Developing and reconfiguring a business model is, however, only one part of the challenge that firms need to manage. Technology changes, and so will – for many reasons – the business model; managing the interplay between the business model and changing technology(-ies) is increasingly recognized as a critical factor for business success (Tidhar and Eisenhardt, 2020; Teece, 2010).

Earlier work shows that reconfiguring a business model to technological development is more complex than it may seem at first glance. As the business model is intimately interwoven with the strategy, structure, and operations of a firm (Casadesus-Masanell and Ricart, 2010; Lanzolla and Markides, 2021; Massa, Tucci and Afuah, 2017; Teece, 2018), changes to it may require significant organizational changes. Moreover, a business model can act as a filter on the strategic sensemaking of the firm (Chesbrough and Rosenbloom, 2002; Tripsas and Gavetti, 2000), making it difficult for firms to accurately and timely assess technological development (Christensen, 1997).

Although important, these earlier writings are limited in that they have conceived of the interplay between technology and business model in dyadic terms – one firm and its ability to adapt to changing technology – when there are compelling arguments that the interplay should be conceived of as a triad: a firm, the technology and the customer of the firm. Consider the almost iconic case of the business model of Rolls-Royce, the airplane engine manufacturer that shifted from selling engines to selling minutes of engine operation. They own and operate the engines attached to an airplane, that an airplane manufacturer sells to an airline to transport passengers, and Rolls-Royce is paid for the time their engines are in operation rather than for the sale of an engine (Rolls-Royce, 2018). The case of Rolls-Royce is an example of a servitization business model – an increasingly popular business model where the producer sells an ongoing service rather than a one-off product (Cusumano, Kahl and Suarez, 2015; Visnjic Kastalli and Van Looy, 2013). The feasibility of the Rolls-Royce business model is not only contingent on its matching with technological developments but also on the way that the customers utilize the service. The challenge of managing the interplay, from the perspective of a focal firm, is thus to match the business model to changes in either or both technology and customer behavior. A common way to coordinate the business model with the behavior of the customer is the extensive use of contracts (Frydlinger, Hart and Vitasek, 2019; Vitasek and Manrodt, 2012), but as is well known, contracts cannot foresee everything. Moreover, the impact of technology change is difficult to manage contractually.

In this paper we we analyze the case of the telecommunications major Ericsson as it changed its business model in the Indian market from a transaction-based to a servitization business model. We follow this process from the vantage point of an insider to this process and study how the firm struggled with managing the new business model from its inception in 2003 through the significant technology changes from 2G to 4 G and in the interaction with its large servitization customer until the firm reverted to its earlier transaction-based business model in 2014.

We unravel some of the complexity of the interplay between technology and business models by expanding the dyadic perspective to a triad. Where a standard conceptualization of a business model as the extension of Ericsson's strategy would have focused our analytical attention on Ericsson's efforts to capitalize on technology development from 2G to 4G, our perspective sheds light on other important aspects. Technology development was not the main challenge faced by Ericsson; it was the lack of control over the strategy of the buyer of the service. To succeed, the business model required a measure of coordination between operation and sales in how mobile customers were served, but as the business model meant a separation of these functions between Ericsson and its new partner, it became a site of divergent expectations and communication issues. Attempts to resolve this pointed to two further important aspects of business model management: the balance of power between Ericsson and its partner, and the challenges of building and managing internal organizational coalitions (March, 1961, 1994).

Literature

Technology and business models are distinctively different things (Chesbrough and Rosenbloom, 2002; Teece, 2007). Firms create and capture value with the help of technologies, but technologies have no single objective value by themselves and need to be commercialized through business models (Chesbrough, 2010). The connection between the choice of business model design and technology is thus two-way (Baden-Fuller and Haefliger, 2013). Even in the case of a good fit between business model design and technology that allows a firm to capitalize on its investments, a main concern for any firm should be that technologies and business models cannot be static if it wants to sustain competitive. However, changes in business models or technology can create a misalignment in how firms create and capture value.

One strand of research emphasizes that to capture value from technological development and innovation, the firm's business model sometimes needs to be changed (Baden-Fuller and Haefliger, 2013; Björkdahl, 2009; Chesbrough and Rosenbloom, 2002; Snihur et al., 2021; Teece, 2010). David Teece contends that "every new product development effort should be coupled with the development of a business model which defines its 'go to market' and 'capturing value' strategies. Clearly, technological innovation by itself does not automatically guarantee business or economic success – far from it" (Teece, 2010, p.183). This notion is supported by several empirical studies of how a firm's technological development and innovation may need to be accompanied by changes in the firm's business model. For example, Björkdahl (2009) showed that in order to create and capture value from diversifying the technology base of products (that open up new subspaces in the existing technical performance and functionality space), firms were required to accompany it with changes to their business models.

A related line of reasoning examines how business models determine the direction of technological development and innovation (Baden-Fuller and Haefliger, 2013; Chesbrough, 2010; Christensen, 1997; Tripsas and Gavetti, 2000). Baden-Fuller and Haefliger (2013) suggest that business models work as cognitive devices, influencing the technological outcome. The standpoint is that established firms have difficulty exploiting and capitalizing on emerging technology or even minor technology shifts (Tripsas, 2009). Even if the firm could develop the technology, profiting from the development has implications beyond the technology itself and is related to its business model (Tripsas and Gavetti, 2000; Tripsas, 2009). Instead, firms usually progress along a technological trajectory in an incremental and cumulative manner by solving specific sets of problems (Abernathy et al., 1983; Henderson and Clark, 1990; Nelson and Winter, 1982) where the firm's direction of search and accumulation of new knowledge for developing technology are influenced strongly by its current business model (Tripsas and Gavetti, 2000; 2007). Christensen's seminal work on disruptive innovation (1997; 2003) emphasizes the problem incumbent firms face with emerging technologies. According to Christensen, the root cause is the business model incumbents use for capitalizing on technological development and that they have difficulties exploiting the emerging (disruptive) technologies themselves using the established business model. Similarly, Chesbrough and Rosenbloom (2002) showed how the technological development that did not fit with Xerox's business model was spun out from the firm. They argue that an established business model logic in a given firm constrains the search for an alternative business model when developing new technologies.

Business model design and technological development are thus interrelated. It has been shown that technology development influences business model design and that business model design influences technology development. Technology is fundamental for value creation and business model design is fundamental for implementing technology and to capture value (Chesbrough and Rosenbloom, 2002; Tidhar and Eisenhardt, 2020; Teece, 2010). Clearly, it can be argued that there must be a fit between them in order to achieve business success (Teece, 2007; Teece, 2010). If they are not aligned, firms will not be able to capitalize on their investments and use the full potential of their efforts (Chesbrough and Rosenbloom, 2002; Björkdahl, 2009). Why can the interrelation between technology and business model design be problematic? When firms develop new technologies, the alignment with the business model can become weak since the balance between value creation and value capture can be disrupted. This does not necessarily have to be a problem if firms can adjust the business model to capitalize on the technology's full potential (Björkdahl, 2009; Chesbrough and Rosenbloom, 2002). At the same time, a new business model for an established technology changes the current activities and potential to capture value because the technology may not support a forward-looking business model. There are many examples of firms that have reinvented their business model proactively with success, but it does not necessarily have to turn out as a positive outcome (Johnson et al., 2009). Either way, investments and the development of new technology commercialized with an established business model or a new business model for an established technology can create a misalignment between value creation and value capture.

We know that business model influences technology development and that technology development influences business model design. But how do they interact? Prior work is one-dimensional in terms of a conceptualization where the business model of a single firm and technologies interact. Moreover, it tends only to explore one of the directions – that technology development may need a new business model or that a firm's business models influence technology development (often as a way to explain why established firms fail with managing technology shifts or emerging technologies). However, a firm's technology bases evolve, and so do the firm's business models. While the relationship between technology development and business model innovation has been established by scholars from both conceptual and empirical angles, the intricate details of the relationship remain unexplored. As emphasized by Baden-Fuller and Heafliger (2013), "business models and technologies regularly interact."

It is worth emphasizing that many inner and outer contextual factors affect and interact with a business model – not only technology. Internal factors are organizational routines, structures, culture, identity, and capabilities (Barnett, 2008; 2016; Christensen, 1997; Teece, 2007; Tripsas, 2009;

Tripsas and Gavetti, 2000). Therefore, changes in business models can be associated with very high costs. A business model implicitly also encompasses contractual agreements with firms and customers in the ecosystem that affect the business model.

Customer identification and engagement are important parts of any business model. However, downplayed in the current conceptualization of business models as an extension of the strategy of a single firm are the coordination issues that inhere in any business model. A business model always represents an interface between two (or more) actors in a value chain (or network): a seller and a buyer. Coordination between buyer and seller has proven unproblematic in studies this far, as the focus has mainly been on cases with standardized products sold in large quantities to final consumer markets based on arms-length transactions.

Not all business models rely on a market for coordination, however. An important and increasingly common business model is the servitization business model (Visnjic Kastalli and Van Looy, 2013), when a firm sells complex product systems that comprise of hierarchically organized combinations of different types of components (Davies, 2004) – who then uses a service to satisfy its customers (typical settings are found in the aerospace, energy, telecommunications, and transportation sectors). Since the services are developed specifically to address customers' unique requirements, sellers tend to participate in long-term business transactions with their buyers. This way of doing business differs in an important way in the relationship between the seller and the buyer; whereas it is still mediated by a market, the market does not act as a cutout between the buyer and the seller. What the buyer of the service wants to do with the service will matter to the seller in a different way than how the usage of the product matters . At its core, this set-up is useful because it creates an ongoing relationship between the seller and the buyer of the service, allowing each to focus on their core activities. But this relationship is also what introduces a new degree of coordination, as the market does not serve as a cutout between their activities any longer. This introduces a complex dimension by connecting sellers and buyers where their individual actions can result in consequences for each other, and where the interaction between business model design and technology can be understood as a triad rather than a dyad. Optimally, contractual agreements should control changes in technologies and how business is done between a seller and buyer. This is why serivitization business models can shed new light on how technologies and business models interact.

Method

Research design

To study the interplay between business model and technology development, we conducted a longitudinal research study, as we aimed to uncover the details of the interplay process and gain a deeper understanding of the intricate interactions between business model design and technology development (Langley, 1999; Van den Ven, 2007). The research methodology is predominantly abductive, as we draw inspiration from Chesbrough and Rosenbloom's (2002) model – where the business model serves as a mediator between the technical and social domains – to generate theoretical insights and discoveries related to the interplay between business models and technology development (Bamberger, 2019).

We applied a case study approach, using an extended timeframe (2002-2014), that allowed us to observe the interplay processes over an extended period of time. This design allowed us to study the interplay between business models and technologies in detail. Our study began when the firm started to discuss changing its business model to serve one customer, and we followed the evolution of the business model and its design through two significant exogenous technological changes.

Data collection

Pre-understanding/Insider positionality

One of the co-authors of this study held a senior position at Ericsson from 2003 to 2009, responsible for business decisions in India for the specific client involved in the case. He attended over 200 business meetings related to the case, which provided him with extensive insider perspective on the case as well as notes from the meetings. While preunderstanding is often considered a source of bias, using it systematically and collaborative with other authors can enhance the interpretation of the case (Alvesson and Sandberg, 2022), which were the principles employed by the research team.

In-depth interviews

To gain insights into the interplay between business models and technological development and the factors affecting the same, we conducted 40 in-depth interviews between 2018 and 2022 with individuals who were involved in business and technology-related activities. We also conducted four interviews with customers, including the executive director, managing director, and group chief technical officers, to get their perspective on the processes. Our interviews were semi-structured and included open-ended questions focused on how the firm evolved its business practices over time and how external factors have influenced these changes. To gain a deeper understanding of the interplay between business model changes and technological changes, we conducted follow-up interviews with informants possessing greater insight into these processes. The insider perspective aided in tailoring questions to the interviewees' specific roles, and the preunderstanding allowed us to ask relevant follow-up questions when situational details were provided (Alvesson and Sandberg, 2022).

E-mails and archival data

The research team had full access to data on the process of implementing the new models in India between 2003 and 2014. This dataset includes 1,494 e-mails exchanged between Ericsson and between Ericsson and customers and several thousand pages of archival data, such as official contracts, working drafts, technical reports, and financial data. In addition, we collected publicly available information on the business model transformation from sources such as trade press articles, teaching cases, and annual reports. These data sources provided a comprehensive understanding of events and activities related to the business models and technological changes. They allowed us to cross-check and validate findings from multiple sources, including interviews and meeting notes. Table 1 summarized the data material.

Table 1: Data material.

Sources	*Description*	*Dataset*	*Purpose*
Semi-structured interviews	Semi-structured in-depth interviews with different hierarchical levels and in different functional positions at Ericsson and WindTel, e.g., chief financial officer, head of Ericsson India, head of Business Unit Services, head of Business Unit Networks, key account managers, account managers, contract managers, sales directors in different business units, pricing managers, commercial managers, technical experts and head of product units.	40 transcribed interviews	To add depth and details to the events that unfolded during the transition to a performance-based business model.
	Additional semi-structured in-depth interviews with technical and commercial specialists at Ericsson	6 transcribed interviews	To deepen the understanding of the technical and commercial decisions during the technology shift from 2G to 3G and its impact on the performance-based business model.
Participant observations	Participation and notes from business meetings regarding the operation of the business model from 2003 to 2009	Notes from 232 business meetings	To identify respondents, discussion points, and decisions made during the transition to a performance-based business model.
Emails	Emails written and received by researcher one when he was responsible for the WindTel business and his successive emails for the remaining period of interest. Emails were exchanged both within Ericsson and between Ericsson and customers and were related to the business models in India.	1,494 emails	To provide a good understanding of events and activities and allow triangulation with interview and archival data and participant observations.
Internal documentation from Ericsson	Customer correspondence and presentations Contracts, MoM on contracts, and contract reviews Descriptions, analysis, and improvements on contracts Minutes of meetings from the steering group and decision meetings Key account reports and presentations Financial numbers and reports	578 documents (7,616 pages)	To provide detailed information about the technology and business model changes that occurred during the operation of the new business model.
Publicly available material	Trade press articles Teaching cases (e.g., Harvard Business School) Ericsson Annual Reports 2004-2014 Customer Annual Reports 2003-2014	49 documents	To obtain an outside perspective on the introduction of a performance-based business model.

Data analysis

We analyzed our data in two steps. First, we created a timeline and a case history for the business model transformation, drawing on various data sources, including interview transcripts, our preunderstanding, e-mails, and archives. The case history and timeline focused on events and activities related to the launch of the new business model and the impact on the technology used and market activity. We utilized a search module plugin in MS Outlook to process the large volume of e-mails, and documents were categorized by content (contract-related, customer correspondence, key account reports, business model descriptions/analyses, steering committee meetings, and technical documentation). Data from the various sources was then cross-checked and validated through triangulation, and follow-up interviews were conducted to address any gaps or inconsistencies.

The second step of the analysis was to construct sequences of significant events and activities based on an understanding of how the business model and technology changed during the operation of the new business model, taking into account the influence of market and customer activities, as well as the technological shift from 2G to 3G, and 3G to 4G. Drawing inspiration from Langley (1999) and van de Ven and Poole (2005), this approach enabled us to conceptualize the development and adaptations of the new business model and the technological changes over time.

Our analysis used a process flowchart to present the event chronology coded in multiple ways (Langley and Truax, 1994). We divided the technical domain into two primary categories of changes: technological characteristics of existing products and exogenous technological development. The first category encompassed product characteristics, technical feasibility studies, and product development decisions. The second category covered exogenous technological advancements in technological standards and features derived from the firm's technological roadmaps for each radio technology. The social domain included customer activities and market events that influenced the technical domain or the business model. The business model component of the analysis comprised changes in the value proposition, price models, and contracts (mainly terms and conditions).

Throughout the analysis, we used different labels for various activities and events: events, decisions made by the firm or the client, technology characteristics (enabler or constrainer for the business model), exogenous technology development, and activities within the firm. The timeline analysis is shown in Figure 1.

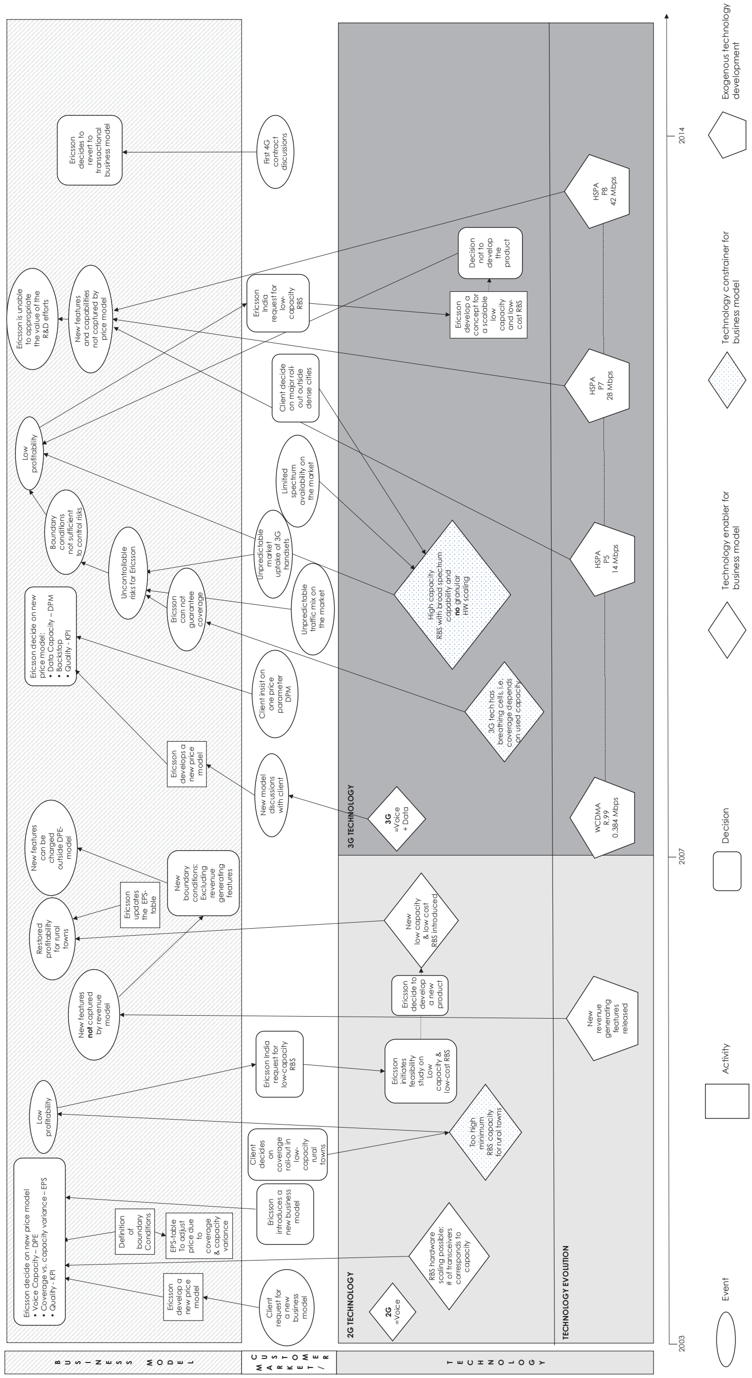


Figure 1. Timeline analysis – Process flowchart.

Empirical context and the beginnings of a new business model

Ericsson is a Swedish multinational technology firm specializing in manufacturing and developing communications technology and services. It is one of the world's largest telecommunications equipment providers, which offers a range of products and services, including network infrastructure, digital services, and managed services. Ericsson is present in 180 countries where communications service providers, enterprises, and governments use the firm's products and services. Ericsson India, an Ericson subsidiary, has a strong presence in the Indian market and has been a key player in the growth of the country's telecommunications industry.

In 2004, Ericsson Sweden was organized into five business units, two of which were the main actors in this case, the Services and Networks business units. These business units developed and maintained competitive, high-quality products and service offerings. The consolidated financial responsibility fell within their domain with the aim of achieving profitable growth. The Networks business unit handled product portfolio, ownership, and management. This responsibility encompassed various tasks, such as overseeing the unit's profit and loss, developing product roadmaps (long-term product strategy), handling product life-cycle management, and developing business cases for investment decisions. The Networks business unit had in 2004 four sub-units: Sales and marketing, Technical sales support, Product area GSM (2G), and Product area WCDMA (3G). The product areas had product managers who made decisions on product development based on market information and customer requests. On the other hand, sales and marketing pushed market requirements on product portfolios towards product management.

In the early 2000s, Ericsson began to offer operation and maintenance of its customers' networks, i.e., Managed Services, which led many communications service providers to outsource the design, operation, and maintenance of their networks to Ericsson. Ericsson had mainly used a transaction-based business model, i.e., where they deliver products and services and are paid on delivery of the same. In conjunction with the introduction of Managed Services, Ericsson began experimenting with new business models, such as Managed Capacity, where an operator buys coverage, capacity, and network performance – a servitization business model. Ericsson then provided the network and service capacity according to agreed service levels. With such a business model, the communications service provider gained flexibility in capital deployment, resources, and time to market – all while ensuring quality of service (Ericsson Annual Report, 2004).

The case we examined concerns the introduction of a new business model for one client that we call WindTel (a pseudonym). The starting point was a top-down decision made in 2002, when the CEO of Ericsson and the owner of WindTel, a communications service provider in India, decided to strengthen cooperation between the firms. At a subsequent meeting the firms' chief financial officers explored a new business model based on network capacity. The idea was for WindTel to focus on customer acquisition and delegate the reminder of the operations to Ericsson. Eventually, this concept reached the respective organizations where the specifics were to be worked out.

Further development of the model was driven by the Services business unit of Ericsson Sweden, since both the Network business unit and the India unit were skeptic to the introducing the new business model.

> "At that time, Networks were very much against it in Sweden and the India team was very much against it. Because they thought that meant we would not sell as much as we are selling to WindTel because the whole concept was to try to reduce the cost. And if cost is down then of course our price is down. So [Ericsson] India resisted a lot, and they felt it would be very complex and would delay their sales and everything. Networks were also very much against this concept. The Services team was very excited because they thought that through this we can sell the Manage Services contract. So they were supportive, very supportive of this."
>
> Business Manager Business Unit Services Ericsson

The discussions about the new business model started with the simplification of price parameters and a longer-term relationship. The idea was to simplify the procurement process and use price parameters that should correlate with the operator's business objectives, i.e., to sell mobile voice traffic (capacity) and coverage. The voice traffic was translated into Erlangs (one Erlang is a telecom metric to measure the capacity needed for a 60-minute voice call) to measure the capacity delivered and Key Performance Indicators (KPIs) to secure quality and coverage. Implementing the above changed Ericsson's value proposition to sell capacity (or quality voice minutes) instead of the traditional sales of telecom equipment and services; however, Ericsson primarily considered the model to be financial engineering. Ericsson subsequently named the new business model Managed Capacity.

> "We started by presenting that they have to give us commitment, and then we will give them a Bill of Quantity, which gets translated into fixed fees per year. That didn't work out and then eventually we made a final proposal and say okay, how is minutes calculated? Minutes is nothing but Erlangs and we are into delivering Erlang capacity. So, let's make it model called 'Dollar per Erlang'. How much they have to pay for per Erlang and that dollar per Erlang was called Managed Capacity."
>
> Account Manager WindTel Account Ericsson

> "But over a period of time then Ericsson India started to realize that this is going to be good because irrespective of model we will sell if WindTel is growing and we have a reasonable price, I think then they came on board. But it took almost five or six months to bring Ericsson India onboard to this."
>
> Account Manager WindTel Account Ericsson

In brief, Ericsson's servitization business model had the following construction:

- The price model builds on a base case design, including all telecom equipment that gives a certain capacity for a specific area of coverage, translated into a single price parameter Dollar per Erlang (DPE).

- To handle capacity and coverage variances, there is an adjustment table – an Erlang per Site (EPS)-table – which increases the price for low-capacity sites and reduces the price for high-capacity sites.

- To secure the quality of the network, there was a set of KPIs that gave bonuses/malus depending on the outcome of the network quality KPIs.

The revenue model also needed defined boundary conditions, i.e., under what circumstances the price (DPE) was valid. The EPS table was an example of a boundary condition, that were part of the terms and conditions in Managed Capacity contracts.

> "Boundary conditions, or a tight contract, is very important. Otherwise, I mean, these [business] models can have any interpretation when they get into operationalization … I think the definition of boundaries was a very, very important milestone of the contract formulation. Because that is where, either you can make money or you can continue to lose money."
>
> Key Account Manager WindTel Account Ericsson

To be able to commit to the quality and performance of the managed capacity model, Ericsson also needed to control and manage the operations of the mobile network. To this end, the Managed Capacity model was combined with the network operations part, Managed Services. Managed Capacity contract catered for WindTel's long-term capacity needs, network planning and design, and network deployment. The Managed Services contract handled the operational part, i.e., the daily operation of the network. Hence, the new way of doing business resulted in two separate, but linked, central contracts in order to go from a transaction-based business model to a servitization business model, Managed Capacity. The Managed Capacity contract was in place in December 2003, and the Managed Services contract was subsequently effective from January 2004.

> "It [Managed Capacity] is a payment model that makes both parties interested in getting as much in operation as possible, as soon as possible… Moreover, it was we who built, managed, we did everything, so it became a model for both companies to strive for the same thing - to get an as efficient production of their traffic apparatus as possible, as quickly as possible. It made us grow together with WindTel in a very interesting way – we had the same goals – we were not sellers and buyers anymore."
>
> Head of Market Unit India Ericsson

The technical characteristics and cost structure of the then-current technical standards – 2G technology and GSM technology –supported the managed capacity model very well. The capacity (Erlang) scaling translated into the number of transceivers (TRX) hardware steps, which correlated with cost in a rudimentary way. The GSM technology was very hardware-oriented and did not have many software features to enhance the capacity. In the later phase of the 2G technology life-cycle, a limited number of new features were released that could, for example, increase end-user experience. In addition, the focus of GSM technology was primarily voice and there were only a few data services (SMS, GPRS, and Edge). These features were not captured in the DPE pricing parameter, which initially caused a problem for Ericsson. However, they were subsequently excluded from the DPE price model and priced separately.

> ”The GSM as a technology was very simple … It had a very simple granularity in terms of capacity scaling, because it was TRX for TRX. And at that time, there were relatively small and few steps in terms of where you could radically improve capacity with software steps, or where you could radically change the characteristics of the base stations with software- or hardware improvements.”
>
> Product Manager, radio base station expert Ericsson

The profitability of the managed capacity model depended on how much capacity each radio base station had, i.e., how many TRXs were used in a radio base station. When capacity was increased due to traffic demand, the radio base station part significantly improved the profitable for Ericsson.

> “So initially, in the first phase, when you go for a (2,2,2)-configuration [2 TRX each in 3 sectors], it does not show any profitability or anything, barely managing the cost or a little bit more. But when it goes from (2,2,2) to (3,3,3), then you plug three TRXs and you get another $20,000 dollar.“
>
> Key Account Manager WindTel account Ericsson

A first challenge: matching the business model to customer strategy

WindTel’s strategy was to become the first private India-wide mobile operator, leading them to rapidly expand mobile coverage across the country. Coverage and capacity are the two main cost drivers in building a mobile network. Coverage determines the area the mobile network covers, while capacity determines the number of mobile calls that can be made simultaneously. Several low-capacity sites are required for initial coverage of a given area. Since the initial investment to build a site is high, the cost per unit of capacity for a low-capacity site is also high. Increasing capacity at an existing site incurs additional costs but, when a site reaches a high capacity, the cost per unit of capacity becomes lower. The Managed Capacity contract has only one pricing parameter – DPE (price for capacity measured in Erlang) – and the price is based on a network configuration model with a specific mix of sites with coverage and capacity. The business case assumed an average capacity of 72 Erlang per site, corresponding to a high-capacity site. The problem was that the pricing model did not give Ericsson a return on investment for network coverage expansion if it was not followed by capacity expansion. The EPS-table gave some compensation for variations in coverage and capacity, the low-capacity sites received a price premium, and the high-capacity sites received a price discount reflecting the different costs.

The viability of the business model thus was directly dependent on the strategic decisions of the customer, as it was they who decided on the rate of expansion and, thereby, the level to which the network was working to capacity.

> "In 2004 and 2005 was when they [WindTel] also decided to go for a much wider coverage which meant we had to supply much more equipment which would not be utilized for a longer time. But that was kind of understood. It was a growth market and India would start to boom around 2005 and 2006, much more traffic and much more subscriber additions, but it was an initial higher Capex investment kind of model"
>
> Account Manager WindTel Account Ericsson

The EPS-table did not adequately cover the costs of low-capacity sites, and the large-scale introduction of low-capacity sites in 2005 resulted in low profitability for Ericsson. The Ericsson Sweden radio base station product unit was shipping much equipment but felt it was not generating revenue, which caused friction with the local Ericsson India organization. The reason was the new servitization business model, where revenue came in later compared to the earlier transaction-based business model. However, within 9-12 months, the low-capacity sites became high-capacity sites due to strong market demand for capacity, the radio base station product unit delivered capacity additions in the form of TRXs at very high margins, and there were no further complaints from the radio base station product unit. Very few at the headquarters in Stockholm understood the model and its financial characteristics, and constant education about the model was needed.

> "…prior to 2004, we would get paid for every node that we supplied. So, then your profitability was very predictable. This model, however, meant that in the long term this would become more and more profitable as you start to sweat the deployed assets … It was a huge education exercise. Are we losing money?"
>
> Account Manager WindTel Account Ericsson

In 2005, WindTel launched an even larger coverage campaign to cover 5000 small new Indian towns. The head of Ericsson India, was concerned since the expected capacity expansion in these cities was not anticipated to be sufficient for acceptable profitability.

> "… it went well when you had big sites and the turnover was very fast, you grew quickly. But, on the other hand, when you built a rural site then and got paid for it, it became a basic cost that we didn't get paid for as much percentage-wise for all the equipment we sent with"
>
> Head of Ericsson India

> "the price per Erlang was linear, which means that if there were very few Erlangs on a site, they cost nothing. But for Ericsson, of course, it cost a lot, our fixed costs for the products, for the base stations and so on."
>
> Radio base station expert Ericsson India

When using the Managed Capacity model in rural areas with low-capacity growth, it became clear that a new type of radio base station with limited capacity and low cost was needed to ensure profitability. The head of Ericsson India was informed of the urgent need for a new radio base station with low capacity and low cost to ensure the profitability of the new servitization business model.

Product decisions were usually made by product managers in the product units. They typically take input from customers, Ericsson local accounts, and other sources and then make decisions based on potential market size, required development resources, and the product's fit with the firm's dominant business model. The product decision process took time, and the head of Ericsson India realized that the normal process would not be an alternative. To speed up the product decision process, the head of Ericsson India invited the head of the radio base station product unit to visit India.

> ”I invited [head of Ericsson’s RBS Product Unit] to come to India in order to describe the new business model and why it needs RBSs with low capacity and low cost... He was very understanding and took the requirements picture with him to Sweden”
>
> Head of Ericsson India

The head of the radio base station Product Unit received a follow-up e-mail from the head of the Ericsson India explaining the specifications of the new radio base station type. He then ordered a preliminary investigation in his organization, and it was recommended to adapt an existing product that was designed as a capacity enhancer for congested metropolitan areas.

The product management took on the challenge of adapting an existing low-capacity, low-cost radio base station to meet the requirements of the WindTel contract. They struggled with resources and eventually found resources in the Ericsson China organization to take on the task. It was challenging to meet the time schedule because of the difficulty of the required specifications for the Indian market. The product was initially too heavy to be installed at the top of the poles, which was a requirement for low cost for the entire site. To reduce the weight, a new chassis had to be cast, which unfortunately required a long lead time. This caused friction between the sales organization and product management, but the delivery of the new radio base station, named RBS 2111, was finally secured in mid-2006.

The new radio base station’s availability significantly improved the contract’s profitability. The EPS table and the boundary conditions of the Managed Capacity contract were then updated to reflect the new radio base station. To ensure the ability to capture the value of new features not included in the DPE price, an addendum to the boundary conditions also specified features not included in the DPE price.

After the initial learning hurdles with the right products, as well as setting up a dedicated organization to manage the Managed Capacity model and systematically introducing new processes and boundary constraints, the Managed Capacity model was working well. The model was now more predictable and scalable, which enabled Ericsson to manage the risks associated with the Managed Capacity model. Between 2006 and 2008, Ericsson's profitability increased significantly while WindTel's network developed faster than its competitors' and WindTel became the first private operator to offer nationwide network coverage in India.

> "And then we started tasting the fruits of coming out of the commercial construct. Suddenly, our margin from the low 20s started reaching to the late 30s or early 40s. That was the inflection point which came around this business. We started taking the benefit of the good construct, of the ERLANG-model fly-off in this specific year."
>
> Commercial Manager Ericsson India

> "India in 2009 had really black, good numbers. Incredibly good numbers. So, all of a sudden, this managed capacity 2G contract was incredibly profitable. And they had very high average Erlang per site. And then the average capacity per site was high. The problem that we had before was that we don't get a big return when we build coverage, but the upside comes with the capacity."
>
> RBS Product expert Ericsson India

A second challenge: exogenous technological change

In 2001, the world's first WCDMA or 3G network was launched in Japan; it marked a paradigm shift from voice traffic only to voice and data bundles. It would be many years before this new mobile technology was introduced in India. Nevertheless, in 2006 WindTel and Ericsson began discussing the new technology. WindTel thought early on about extending the existing managed capacity contract to 3G.

From the perspective of the current business model the characteristics of 3G technology were fundamentally different from 2G technology. From a scaling perspective, 3G technology had much larger hardware steps for capacity, and the initial capacity on each radio base station was also very high, resulting in high initial costs. There were software locks to limit the initial capacity, but that did not change the high initial cost.

> “The 2G radio base station can incrementally grow capacity step by step, and you actually deploy new physical hardware to take the incremental steps with the TRX, versus the 3G base station that has the full capacity in terms of the equipment from the start… The 3G radio base station scaled to some extent in terms of hardware, how we equipped the base station. But it was a much, much rougher steps, and the basic capability and capability potential was much greater.”
>
> Product Manager RBS Expert Ericsson

> ”You went from a one-dimensional very granular capacity model to having a two-dimensional capacity model that was hardware-wise much less granular but it could use software licensing to make it more granular. But that means that all costs are up front for Ericsson in such a model.”
>
> Product Manager radio base station Expert Ericsson

The 3G radio base stations also supported multiple radio carriers, meaning they had a wide bandwidth and could use the available spectrum and maximize capacity performance. This was appreciated by the majority of Ericsson’s customers and supported the traditional transaction-based business model well. In addition, 3G technology includes voice, data, and video traffic. The different mix of traffic affects the throughput and capacity of the product, which in turn affects the hardware configurations and the costs. These technology characteristics made it difficult to capture the delivered value with a managed capacity-based business model encompassing simplified pricing parameters.

> ”For 3G, it is voice, video, and data. Any change in the proportion between them and you arrive at completely different throughputs and completely different capacities which affect the costs”
>
> Radio base station expert Ericsson India

Furthermore, the 3G technology was more software-driven than the 2G technology. New software releases frequently increased data capacity and speed, introducing new value-added features.

> "I would argue that our software development capabilities accelerated during the 3G era, that is, our ability to make significant leaps in capability through software improvements, and perhaps associated hardware modernizations. But it took on a completely different life than what we had during the 2G era."
>
> Product Manager radio base station Expert Ericsson

The 3G technology also had 'breathing cells', which meant that coverage from each radio base station depended on the capacity used, i.e., high use of data capacity at a particular radio base station reduced coverage. As a result, network planning became difficult, and there was a risk of coverage gaps. Discussions on a capacity-based 3G model accelerated in 2007 between Ericsson and WindTel, as well as within Ericsson between the 3G radio base station product unit and the Indian market unit. The discussions were complex, mainly because of the complexity of the technology.

> "…your team is comfortable with one type of technology operation and when a new technology is being introduced it is always very complicated. So, there was a commercial challenge in translating an Erlang model into a megabit model"
>
> Account Manager WindTel Account Ericsson

> "…the 3G characteristics were very different. And then to combine that with an understanding of "how does a mobile network work in terms of coverage, capacity, traffic load and how do different types of services drive traffic load in a mobile network?" That understanding, at least in my memory, it was not deeply rooted, it was not deeply understood by very many who were involved in the commercial discussion."
>
> Product Manager radio base station Expert Ericsson

From the Ericsson 3G radio base station product unit's perspective, it was necessary to use at least two pricing parameters in the revenue model. The pricing parameters proposed by Ericsson were "dollar per Erlang" (DPE) for voice and "dollar per megabyte per second" (DPM) for data. However, WindTel was hesitant about this proposal and felt that they would have to pay twice for the same service.

The revenue model

The strategic pricing in the product units defined the global pricing models for a product; the same organization must approve any deviation from the global guidelines. The 3G RBS product unit organization was not convinced that the two pricing parameters could ensure 3G value capture. They were also very skeptical about engaging in a new business model as they were fully engaged in technology development. They were overwhelmed with serving the global market with products suitable for the transaction-based business model. Pressure from the Indian market unit and customers finally convinced the 3G radio base station product unit that they had to propose a pricing model for the new business model. A conservative model emerged with three pricing parameters: Channel Elements (CE), Mbps (for data), and an initial fee for each radio base station.

The three price parameters were discussed at length and in detail between WindTel and Ericsson. WindTel was clear that they wanted only one parameter, a data parameter. Under pressure from the customer and the Ericsson India sales organization, the 3G product unit finally agreed on one parameter, DPM (dollar per Mbps), for the 3G network and to continue with DPE for voice traffic on the 2G network.

> ”Our proposal was a model that was based on both voice and data. Thus, both a price per Erlang and a price per megabit per second, as well as that we would have boundary conditions, that per site they had to buy a minimum number of megabits per second, or minimum number of Erlang. So that Ericsson could reasonably cover our costs when they build in rural areas"
>
> Radio base station expert Ericsson India

> "When the 3G opportunity came up, we were as an organization fairly well prepared, and we proposed a two-legged model. One was on data and the second leg was on number of channel elements, which was to take care of basically audio and video or traffic that runs in the network. But the form in which the contract finally got signed was more a data centric and data driven model"
>
> Key Account Manager WindTel Account Ericsson

The lessons from the 2G Managed Capacity business model were that boundary conditions that clarified when the price mechanism was valid was an important part of the contract. For the 3G Managed Capacity business model, the task of defining the boundary conditions became even more complex for many reasons. First, the unpredictable market uptake of 3G handsets. 3G handsets were expensive, which made it difficult to estimate the growth of 3G usage (data capacity) and, thus, define boundary conditions in the contract.

> "Because, unlike voice, the data extorted exponentially, and I do not think we had algorithms in place that could give us a successful set of boundary conditions to save us from this 3G variability. So I would say the unpredictability in case of data was much more trickier to manage compared to the more linear voice network."
>
> Commercial Manager Ericsson India

Second, 3G was a new technology, and it was also difficult to estimate the traffic mix between voice, video, and data in the Indian market. This also made it difficult to set the boundary conditions. Third, uncertainty about where traffic will occur, and the technological constraint of breathing cells made it difficult to set boundary conditions for promised coverage. The above complexities put pressure on the business model and the ambiguity of boundary conditions led to lower profitability for Ericsson.

> "… it is a best estimation game, whatever boundaries one could think about, about the knowledge of the equipment at that point in time. Because there are [technology] roadmaps that come and not always are you predicting those roadmaps that would be three years down the line."

> Key Account Manager WindTel account Ericsson

The technological development of 3G was very rapid, with almost annual leaps in 3G radio base station technology capabilities providing end users with higher speeds and capacity.

> "… it was a brutal technological development, if you take 3G, it started with 384 bits per second and Ericsson actually had 63 megabits per second as the final case. For 4G, it started at 75 megabits per second and is up over a gigabit today. It is a fantastic development within each generation. Plus, lots of other things that have really raised the level of technology."

> Head of 3G radio base station product unit, Ericsson

The 3G Managed Capacity model, with a DPM price parameter that captured only capacity, failed to capture the additional value of new features and capabilities. This caused concern among management.

> "… it was as if they hadn't really thought out that the capacity increase in the network which is based on software and there was no parameter that captured it"

> Business Manager India, Business Unit Networks Ericsson

> "… I think that the model is too simple and that a lot of what was worked on, having like add-on values does not appear in that model ... there are so many different things to sell on when different new different features come out"

> Head of Business Unit Networks Ericsson

> "… if the product is complex and it involves evolving technology and a changing situation in terms of the users of this network, how they evolve and how they change. Earlier it was voice and now it is more of data or predominantly data, then the change in the usage of the network has big repercussions on at least the managed capacity part"
>
> Account Manager WindTel account Ericsson

Mobile technologies depend on the availability of spectrum bandwidth, a scarce resource for communications service providers in India compared to other countries. As described earlier, Ericson's 3G radio base stations had high initial capacity and could serve multiple carriers to operate efficiently on a bandwidth. However, the limited spectrum availability in India means that radio base stations with multiple carriers become a technical barrier as networks become more expensive to build. More radio base stations were needed, making the 3G Managed Capacity model less viable.

> "the fact that you have very little spectrum forces you to build with cell reuse. That means that you need to build a denser network to offer the same capacity, you need to build a denser network with more base stations … The bandwidth problem comes on the fact that you have a given hardware with a given cost, you put it out at the customer, who wants to get paid for what they use, and they cannot use it for much. And it's not their fault. I mean, it's basically because of regulations, because of the price of spectrum and availability of spectrum, which means that, for the customer, the value will automatically be reduced to that. But your offering is the same as the one that you would have sold in Australia."
>
> Business Director India Business Unit Networks Ericsson

3G deployment began in dense cities with high data traffic. Over time, WindTel also wanted to expand 3G coverage and introduced 3G in other, more rural parts of the country. In this long-tail rollout, data usage was low, so the high capacity of RBS again became a barrier to profitability. An internal report at Ericsson showed the concerns of product management.

UMTS [3G] traffic distribution is typically such that capacity expansion upside is limited to a fraction of the sites. In 3G our risk exposure increases further given the lack of RBS scalability. Internal Ericsson report

> "… when we had agreed the contract and then we started rolling out. Then we had to do coverage and then we had to equip the long tail basically in terms of capacity we have. And then the long tail, at that time there is not much traffic anywhere and also we didn't understand as an organization, that there is actually a long tail that remains and then once you have established that long tail, you sort of lost your money on it."
>
> Business Director India Business Unit Networks Ericsson

It became clear that an entry-level radio base station for 3G with lower capacity and lower initial cost was needed for the 3G Managed Capacity model to become viable.

> "…we needed to build coverage at the beginning, but we won't need to have all the capacity, so we wanted some kind of entry level RBS with, say, one megabit per cell"
>
> Radio base station Product expert Ericsson India

A new radio base station that was more scalable was discussed between the market unit and the product unit. A concept called PSI, a Main-Remote Splitter Combiner, was developed, a radio base station with lower initial capacity and a carrier scaling capability. A new radio base station product were considered as ideal for the 3G Managed Capacity business model.

> "With a new product [PSI - Main-Remote Splitter Combiner] we could scale the capacity and could expand in a similar way that you did for GSM. If we had PSI then we could go between one radio and three radios, then, we could somehow manage the price and scalability much better for rural solutions and extra capacity in the cities."
>
> Radio base station Product expert Ericsson India

"…way back in 2010 and 2011, when we did the negotiations for 3G, at that time, the PSI concept was there, but the product was not there."

3G driver WindTel Account Ericsson

However, the 3G product unit believed that high-capacity, broad-spectrum RBSs were a priority because they served the traditional business model and most of the largest global customers well. They also had limited resources and budgets and needed to focus on delivering the global product line.

"They [the 2G product unit] had more muscle to develop special products, we didn't really have topline enough to be as flexible"

Head 3G Product Unit Ericsson

Another technical leap and the abandonment of the business model

In 2012, the Indian authorities issued 4G licenses, and Ericsson and WindTel had been discussing a managed capacity 4G model for some time. 4G technology had very different technical characteristics than 3G and warranted a different model. Moreover, 4G technology was new and had not been thoroughly tested in other parts of the world, so Ericsson's central management, which wasn't satisfied with the 3G Managed Capacity model, was reluctant to introduce a different 4G business model for WindTel.

However, Market Unit India worked on a new type of business model for 3G and 4G, and the suggestion was a KPI-based model that leveraged Ericsson's 4G radio base stations, which have 25% better coverage than competitors. It was a simplified model with a transactional base-price and a KPI-based premium if Ericsson could prove the better uplink performance.

"Then our RBS uplink had a performance advantage against the competition. And it would then give a 25-30 percent better coverage."

Head of Region India Ericsson (2)

At the annual meeting of the management of Ericsson and WindTel in Stockholm in 2012, the discussion of the new business model came up. Among those present were the owner of WindTel, the CEO, and the head of Ericsson's network division. The owner of WindTel wanted to close the 4G discussion and presented Ericsson with a compromise on the price level.

> "[Head of Business Unit Networks] shook his head ... then he and I got really annoyed with each other ... and then all of Delhi and the entire LTE [4G] radio network then went to Huawei." Head of Region India (2)

> "I think what happened was that there was a proposal on 4G, and CEO of WindTel reached across to [CEO of Ericsson] to say, "Shake my hand, We'll split the difference." It was the argument about price, I think.... And rather than saying, "Yes, I'll do it," [CEO of Ericsson] turned around to [Head of Business Unit Networks] and said, "Well, what do you think we should do?" And then he said: 'No, I'm afraid not' …And so then the relationship was broken a bit by that."

> Head of Region India Ericsson (3)

> "[Head of Business Unit Networks] said that he didn't want to... That was the very first [4G] RBS-shipments [for this frequency band] that Ericsson was making, and [Head of Business Unit Networks] was very afraid of ruining our price levels."

> Business Director India Business Unit Networks Ericsson

Ericsson was very reluctant to adopt a new business model for 4G, and the head of Business Unit Networks rejected the WindTel CEO's proposal. WindTel then bought the 4G network from Huawei. In 2014, when the existing Managed Capacity contracts for 2G and 3G expired, the deal between WindTel and Ericsson reverted to a transaction-based business model.

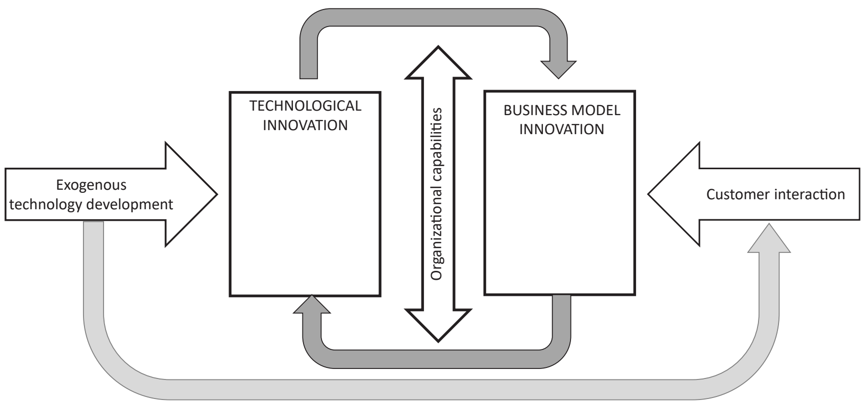
Explaining the interplay of business models and technology from a triadic perspective

In line with earlier work, our case study clearly shows how technological change – from 2G to 3G, and from 3G to 4G – required Ericsson to reconfigure its servitization business model extensively and that the difficulties in doing this, in the end, lead to the abandonment of the model. However, what is not as often seen is the importance of the strategy and actions of Ericsson's customers and their impact on the interplay between technology and business models. The first important challenge to deal with was not so much technical, as it was caused by the intention of WindTel to expand rapidly into the smaller cities of India.

Such a challenge could be met by altering the business model, but this can be expensive and difficult. Instead, Ericsson chose to fast-track the internal product development of a modified radio base station that suited the customer strategy and the business model. A clear example of the two-way interplay between technology and business model theorized in earlier work (Baden-Fuller and Haefliger, 2013), but which has seldom been empirically investigated. When Ericsson faced the challenge of an exogenous technology change, from 2G to 3G, which put pressure on the business model for a different reason, they tried to innovate their way out of that problem too. Due to internal organizational limitations – inertia and issues of managerial attention – the calls for developing another radio base station that would fit the business model did not material. The result was that the business model became misaligned with the technology and the strategy of the customer, which in the end led to the abandonment of the servitization business model and a return to the traditional transaction-based business model.

Based on our findings, we abstracted a process model that explains the triadic interplay between the focal firm, technology, and the actions of the customer. First, exogenous technological market development influences technological innovation, generating incentives to engage in business model innovation; second, customer strategic actions put pressure on the business model, generating incentives for a firm to engage in technological innovation. We also find that organizational capabilities in bargaining power, risk management, and research and development (R&D) resources are moderating variables that influence the interaction between business model innovation and technological innovation. Here, our results suggest in particular that organizational capabilities play a critical role in the long-term viability of a business model. Our proposed mode is described in figure 2 below.

Figure 2. The reciprocal interplay between business model, technology, and customer.



In our case, the characteristics of the 2G technology and the associated cost structure played an essential role in the initial development of the new business model, as hardware expansion costs correlated with the revenue model. Here, the physical scalability of the technology relates to the scalability of the hardware and illustrates the link between the physical technology and the business model (see Teece, 2007). This result is also consistent with the view in the literature that technological developments fail commercially if the business model design is not aligned with the new technology or product (Baden-Fuller and Haefliger, 2013). In contrast to earlier work that shows that technology influences business model, our case also shows the reverse – the business model influences technology changes while the business model is in operation. In order to keep the business model viable, Ericsson needed to develop a radio base station that enabled scaling of capability in a way that accorded with the negotiated revenue model. The subsequent introduction of a new radio base station that met the new business model's requirements restored the business model's profitability. The above results extend the view that the business model acts as a mediator between technology and firm performance (Baden-Fuller and Haefliger, 2013) and demonstrate a continuous two-way interaction between the business model and technology development and innovation.

Customer actions: influencing the business model and triggers technology development

To the standard dyadic model of technology and business model interplay, we add the role of the customer and its actions to create a triad interplay. Strategic actions by the customer can affect the business model and the interaction between the business model and the technology. A customer action that pressures the business model can trigger development and innovation in the technology domain. In our scenario, when the client's choice to massively expand low-capacity sites intersects with a technological limitation, namely, a high minimum capacity requirement in a radio base station, it led to a negative economic outcome and triggered a technology shift. The subsequent technical development of a more suitable product positively affected the business model, and the two-way flow between the business model and technology was restored. The case also shows that the refusal to satisfy a market demand leads to a continuous negative impact on the business model outcome and a continuous imbalance between the business model and the technology.

Moreover, the 3G part of our case shows that the market adoption and use patterns of the new 3G technology were very unpredictable. This illustrates the dilemma of emerging technologies and their impact on the business model. Emerging technologies are new technologies whose use and impact are diverse and have yet to stabilize around a recognized set of patterns (Bailey et al., 2022) before a balance between the technology and the business model can be reached.

Exogenous technological development: influencing the firm's technological development and triggers business model development

The case illustrates that when exogenous technological development, where technology standards drive the firm to develop and introduce new functionalities and features that add value, the business model have to adapted. If the business model is unable to appropriate value, an imbalance occurs between the business model and the technology. The finding is consistent with e.g., Baden-Fuller and Haefliger (2013), Björkdahl (2009), Chesbrough and Rosenbloom (2002), Snihur et al. (2021) and Teece (2010) view that new technology features that add value to the customer require a change in the business model to ensure appropriation of the value. However, our case suggests that the pace of exogenous technology development plays an essential role in maintaining the balance between technology and business models. When technology is mature, the opportunity to adapt the business model to technological progress is manageable (see the 2G part of the case). When technological advancement is rapid, as for the 3G part of the case, an imbalance occurs, and the business model cannot capture the value created by technological development. The Rolls-Royce Power-by-the-hour concept is the often-described combination of mature technology using a servitization business model. Although the technological development of the aircraft engine has evolved since the business model was introduced in 1962, the slow pace of technological development has allowed the balance between the business model and technology to be maintained.

Organizational capabilities: moderating the interplay

An important moderating variable in our model is the organizational capabilities of the focal firm. Organizational capabilities include how the focal firm can leverage its R&D resources, the contractual terms of the business model, the ability to renegotiate the terms, and the firm's risk appetite . These capabilities are important for the adaptions needed when the business model and physical technology are out of balance. Our case shows that the lack of R&D resources became a driving factor for terminating the business model when a market demand for a new product could not be developed. With unlimited R&D resources, the imbalance caused by the decision could have been corrected, and the balance between the business model and physical technology could have been restored. Returning to the comparison between physical and digital technologies: Available R&D resources and production capacity are limiting factors for physical technologies, thus limiting the ability to moderate the balance between the business model and physical technology.

In our case, the contract terms of the business model are visible in the form of constraints, such as under which circumstances the DPE price is valid. The ability to renegotiate the terms of the contract if, for example, the technology changes is an essential factor in keeping the business model viable (Baden-Fuller and Haefliger, 2013). In our case, the local organization was unable to implement some key terms. However, in another similar case with another servitization business model, the local organization had a different experience. As one of the technical experts present at both negotiations put it:

> "When we were in India, the commercial negotiation was incredibly central, and the technology aspects played a limited role. I did not experience it that way when I worked with [European CSP]. They were much more focused on the technical aspects and getting the implementation we chose right. Then followed the commercial negotiations."
>
> Ericsson Manager (at a joint governance organization, including Ericsson and [European CSP] personnel)

The pace of change also plays a role here. The case shows that market events or exogenous technological developments happen quickly. Then, the contract terms need to be constantly updated, which is very impractical in many cases. Frequent updating of contract terms would limit the value of a capacity-based business model whose features are simplified pricing parameters.

Discussion

Business models are a central concept to understand the ability and actions of firms in creating and capturing value from technology and innovations. A core question has been the development and adoption of business models that fit with firms' technology and market settings. Of late, attention has also been paid to the challenge of managing the interplay between technology changes and the business model. We bring another perspective to this discussion, where we consider this interplay to be triadic rather than dyadic as earlier assumed. The customer and its strategic and market actions are – we argue – in the case of servitization business models central to the question of managing the interplay between technology and business model. We see three main implications of our findings where we see a need for further work: 1) the expansion of the conceptualization of business model – technology interplay to a triad, at least with respect to servitization business models. 2) reinventing the business model, which is often the assumption in literature, is often not the first alternative for a firm that needs to adapt to technological or customer challenges to its business model. There are organizational costs and, in the case of servitization, often contractual limitations on the flexibility of the business model. 3) organizational capabilities and structures are crucial in the moderation of the ability of the focal firm to manage the interplay between technology and customer challenges to the business model. Below, we elaborate on these three in turn and what this means for existing literature.

In a business model the customer is fundamental in terms of defining the customer, how firms engage with the customer, and how value is captured based on the value delivered to the customer (Demil et al., 2015; Teece, 2018). In the literature on business models, customer behavior is downplayed. We argue this is because of three reasons. The first reason is because business models sometimes can be seen as a snapshot at a given point in time. The second reason is that business models have a focus on identifying the customer and how to engage with the customer and solving its needs – not to understand individual customer behavior. The third reason is that prior studies tend to rely on a market for coordination in understanding business model innovation processes. Cases involve standardized products sold in large quantities to final consumer markets based on arms-length transactions. However, if we want to understand the relationship between technology development and business model design and how they interact over time, we cannot understand the relationship by solely taking into account who the customer is, how the firm engage with the customer or the customers' willingness to pay. Our study shows that customer behavior has a major impact on how business models are designed, how technologies are changed, and how technologies and business models interact over time. At least, we see this in circumstances involving servitization business models where services are developed specifically to address customers' unique requirements.

Prior research has shown that changes in technologies sometimes need to be accompanied by changes in business models and that business models determine the technological trajectory (Chesbrough and Rosenbloom, 2002; Björkdahl, 2009; Christensen, 2006; Snihur et al., 2021; Tripsas and Gavetti, 2000). Innovation is a way to manage the interplay between technological development and business model design and their link to economic performance. We show that there are two ways to potentially improve the performance from how technologies render economic performance and to find a better fit between the interaction between technology and the business model used. To innovate the technology or the business model, and that the innovation in one of the dimensions affect the other. However, there is a tradeoff between finding the right balance between technologies and business models through innovation and the fact that established business models tend to be very effective (Kaplan, 2012). We show that there are inner and outer contextual dependencies that make it difficult to find the right fit between a business model and a technology. To reinvent the business model is costly. It is also time-consuming, and in our case, the right fit was sometimes found at a point in time when there is a need for new technological development or technological shifts. Because changes in customer behavior affect the interplay between technological development and business model design, investments in reinventing a business model is risky if it is tailored for a specific customer. Reinventing the business model should, therefore, not be taken lightly.

Organizational capabilities and structures are critical if a firm should master the interplay between technology development and business model design. We showed that changes in the interplay between technologies and business models need to be accompanied by reconfiguration of processes, procedures and organization structures. For example, the organizational design can become an issue because the creation of different roles, processes and the structures by which activities are organized and coordinated are initially unclear. Much of what Ericsson did to support the new servitization business was based on the established organizational design for selling products (and within the same organization). Instead, Ericsson needed to create new roles, processes and structures as it became clear that they were not sufficient, or were lacking, to support the servitization business model. This conflict in internal logic took time and was cumbersome for Ericsson to deal with as the process unfolded. The internal systems and procedures are other mediating factors that influence the interplay between technology development and business model design. For Ericsson, there were no financial and accounting systems in place for reporting the revenue from selling networks as a service. Neither were there any clear procedures on how to split the revenues between the different divisions. This resulted in uncertainties about the performance of the servitization business. A frequent problem was the difficulty to transfer knowledge about the new model within the organization and to those who should operate the model. Although Ericsson did provide training and education about the model, it became unclear on how to manage the new model. At the same time, Ericsson needed to be agile and develop new technologies to support the new business model.

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Paper III

Profiting From AI: Evidence from Ericsson's Quest to Capture Value

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Abstract

This article explores the challenges faced by companies, using Ericsson as a case study, in profiting from AI. It highlights that while AI holds great promise, realizing returns on investment has been slow. The article identifies two main strategies: bottom-line improvements and top-line growth. Bottom-line improvements focus on internal efficiency gains, while top-line growth involves creating new businesses enabled by AI. The latter strategy is particularly challenging due to the need for co-specialized complementary assets, which amplify data, capability, and value challenges. The study emphasizes the importance of clear strategic objectives and a deep understanding of complementarities for successful implementation.

Keywords: Artificial intelligence, co-specialized complementary assets, strategies, value capture

Introduction

The number of sophisticated applications of artificial intelligence (AI) is large, but profiting from AI is challenging. It requires firms to develop deep understanding of their customers' business needs, to leverage complementary assets, and to build dynamic capabilities. It is especially difficult to profit from AI when value capture is based on top-line growth by new business development rather than on bottom-line improvements by efficiency gains, and the explanation can be traced to the nature of relevant complementarities.

The promise of artificial intelligence (AI) is grand. There has been a surge of reports discussing how AI can be used to reinvent businesses, create new value propositions, and enhance competitive advantage, something that was recently showcased to a broad audience through the introduction of ChatGPT. However, it is not easy to turn the promise of AI into business success, and return on investment has been slow to materialize.[1] This sheds new light on one of the key challenges for innovators, i.e., how to profit from investments in innovation. Since the 1980s, the profiting from innovation (PFI) framework has stood the test of time, convincingly and repeatedly showing how appropriability regimes, complementary assets, and timing are key determinants of how profits from innovation are distributed among innovators, imitators, and complementors.[2] But profiting from AI is especially challenging due to the complexity of the technology, its broad span of use cases, and its close interdependencies with data.[3] In this article we provide timely observations from the leading telecommunications network firm Ericsson on the difficulties and challenging decisions that need to be made to profit from AI. Our conclusions echo one of the main messages in the classical PFI framework; that complementary assets play a key role in explaining how profits from innovation are distributed. However, our results also provide novel insights on how new sorts of technological complementarities[4] in the digital and AI-driven economy impede value capture for innovators, even for large incumbent firms with strong positions in intellectual property, production and distribution capabilities, and other complementary assets.

About the Research

The study is based on an in-depth investigation of the mobile telecommunications firm Ericsson, which currently holds the largest number of AI patents in the mobile telecommunications industry. The study is based on observations from working within Ericsson, hundreds of internal documents and 34 interviews with key informants from different functions, including, e.g., the strategy director, service portfolio director, head of capability development, head of commercial management and data scientists.

The Promise of AI

For many firms AI is critical for success. For example, digital companies such as Alphabet, Amazon, Alibaba, Baidu and Spotify use AI for product suggestions, targeted advertising, pricing, and demand forecasting.[5]

Executives in established non-digital industries are also beginning to recognize that AI can help them to create business value by embedding AI in products and services, and in their upstream activities.[6] Large incumbents across industries have invested in AI both through own R&D and through acquisitions of AI firms. Firms spent $21.8bn on acquisitions related to AI in 2017 alone, and this number is growing.[7]

There are several cases showing how AI has been successfully used to improve firms' offerings and operations. For example, the automotive company BMW uses AI in its products and in its internal business processes to reduce errors and ensure efficient operations.[8] The energy company Chevron uses AI applications to diagnose performance and to predict machinery maintenance.[9] The industrial conglomerate Siemens uses AI to improve train availability and reduce maintenance costs.[10] While these use cases illustrate the potential of AI, they say little about the challenges of transforming a company into a successful AI-driven organization where AI fuels profits.

Is it Really that Simple? Evidence from Ericsson

As the promise of AI has become increasingly evident,[11] the number of scholarly and consultancy frameworks on how to use AI in business have exploded.[12] However, few explain the real challenges business leaders face when trying to profit from AI.[13] We now witness an increasing number of reports also on failed investments in AI.[14] Profits will not always follow from investments in AI, and with the case of Ericsson we will show that investments in AI technologies need to be accompanied by a deep understanding and management of complementarities and investments in dynamic capabilities to be successful.

Ericsson's Starting Point to Become an AI-driven Organization

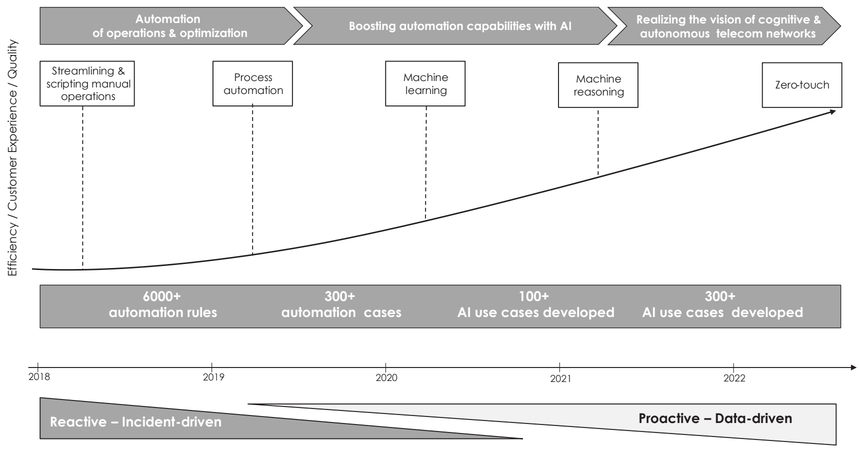
The business area Managed Services is one of Ericsson's four business areas. It designs, optimizes, and manages networks, IT, and datacenters for mobile operators around the world. The business area provides managed services in more than 100 countries with approximately 1 billion subscribers, employs about 28,000 people, and monitors about 700,000 sites. In part due to customer-specific contracting, the business area suffered from low scalability and poor efficiency in the 2010s. In 2017 Ericsson appointed a new CEO, Börje Ekholm, who initiated work on improving profitability of the Managed Services business area. This was also pushed by some large shareholders, in particular a private equity firm backed by Carl Icahn. Ericsson soon discovered that cost-cutting efforts and the scraping of bad customer accounts were not enough, and decided to make use of AI to automate operations.

Ericsson Operations Engine

Ericsson redesigned the entire Managed Services business by three steps. The first step was to streamline manual operations by reengineering and simplifying 26 different processes, and creating tool platforms with data driven architectures. The second step was to add a cognitive layer by adding AI and machine learning to achieve proactivity. This resulted in operations involving digitalized and automated processes and the creation of automation analytics platforms. The third step was to create data-driven operations. At this stage, Ericsson processed over 175 terabytes daily to track and improve their customers experience and created an AI platform.

Over three years Ericsson invested 130 MUSD to build what was named the Ericsson Operations Engine, which involves over 1000 multi-skilled experts with both telco and data science expertise and 100 AI researchers. The result so far is 6,000 automation rules with 85% reuse and the automation of 10,000 tasks. AI is now the cornerstone of Ericsson's strategy and vision for Managed Services, with the goal to manage the best networks and service experience in the most cost-effective way. Ericsson's AI transformation is illustrated in Figure 1.

Figure 1. Ericsson's AI transformation.



From Bottom-Line Improvements to Top-Line Growth

As for many mature firms venturing into AI, the business strategy was initially unclear in differentiating between what Ericsson could do with AI and what it actually should do—and how to capture the value from these investments. The lack of strategy resulted in a broad scope. From initially trying to increase internal efficiency with AI it quickly turned toward using AI to help customers becoming more efficient and increasing their revenue generation, with hundreds of AI use cases for its customers.

> "We first had to solve our own improvement areas and then once the value was proven, we are helping our customers with the same types of aspects."
>
> Strategy Director

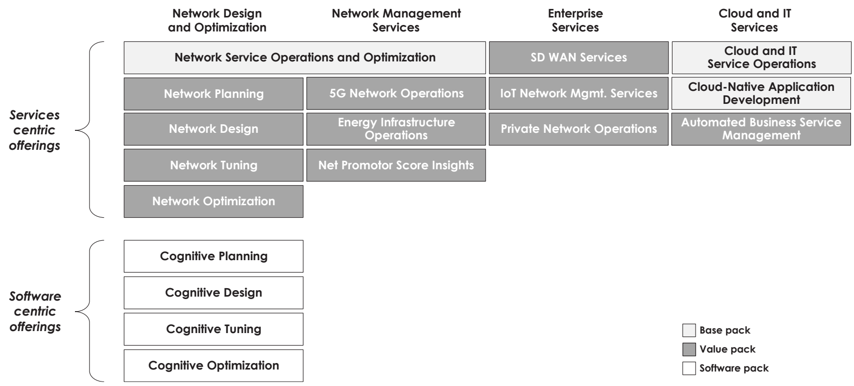
Ericsson now tries to profit from AI in four ways (see Figure 2.): By reducing its own cost of operations, by making its customers more efficient, by improving the customers' experience, and by generating more revenues for its customers. Ericsson divides its offers based on two types of customer categories when trying to create and capture value, depending on if Ericsson is managing the networks or not. For existing customers where Ericsson operates the customers' network, Ericsson provides service-centric offerings where it sells different types of AI packages—AI base packages and AI value packages, respectively. In base packages AI is used to improve the customers' operational efficiency in their networks, including network service operations and optimization, cloud and IT service operations, and cloud-native application development. The benefit to the customer is that a complex multi-vendor network can be managed at relatively low costs. Customers that use Ericsson's base packages usually achieve 95% automation of front office (first line of support), a big reduction in network unavailability (some up to 50%) and a big reduction in customer complaints (some over 50%). For this Ericsson charges the customer based on a performance-based contract. The AI base packages also help Ericsson to increase profits through more efficient internal operations.

Figure 2. Four areas where AI is used.

	Task type	*Bottom / Top-line Improvements*
Operational Efficiency at Ericsson	Reducing the cost of operation for the business area	Expected bottom-line improvements for Ericsson
Customer Efficiency	New levels of efficiency through energy and operational savings resulting in lower total cost of ownership	Expected bottom-line improvements for customers and top-line improvements for Ericsson
Improved Customer Experience	Improving the customer experience with AI-powered optimization in relation to network performance, design and customer operations	Expected improved experience, performance and qualities for customers and top-line improvements for Ericsson
Revenue Generation for Customers	Improving the customers' revenue generation e.g., through guaranteed quality for end-users.	Expected top-line improvements for customers and top-line improvements for Ericsson

The AI value packages employ AI to predict network performance and incidents, and enable proactive network management, for example before the end-user experience becomes poor. The value packages also improve energy efficiency and plan, design, and tune networks. For example, the mobile network operator Indosat Ooredoo uses Ericsson's value pack Energy Infrastructure Operations in a highly loaded 4G residential cluster with more than 3000 mobile sites. The AI takes into consideration the full site of the operator which contains active and passive equipment such as radio network parts, diesel generators, batteries, and temperature meters from many different manufacturers, and has led to significantly improved network performance and reduced power consumption. When Ericsson operates customer networks, customers are charged for AI value packages with a value-based pricing scheme.

Figure 3. The base, value and software packages.



Ericsson also provides AI-based offerings as software licenses or as AI-as-a-service packages to customers running their own networks, including cognitive planning, cognitive design, cognitive tuning and cognitive optimization. In 2022 Ericsson had 48 commercial customers worldwide using Ericsson's AI software offerings. One is Swisscom, which uses Ericsson's Cognitive Optimization offering, which reduces the power consumption of the network. Typically, when an operator reduces the power to the network it will lose coverage. However, the AI solves this by actively iterating between reducing power and tilting antennas up and down to compensate for the power reduction. This has helped Swisscom to lower its energy consumption at the same time as it has improved the customer experience. The AI has resulted in a 20% transceiver power reduction, resulting in 3.4% energy savings per base station, 5.5% downlink user throughput gain and 30% uplink user throughput gain. Another mobile network operator, XL Axiata, uses Ericsson's AI Cognitive Tuning, to speed up network optimization and site approval. Historically, operators who rolled out new networks had to do significant manual work on measuring interference and network performance. With AI, crowdsourced data and device data is used to perform virtual drive tests quickly and accurately, completely remotely. The speed of rollout is accelerated by achieving 60% faster site acceptance and 20%

higher project capacity. It also improves the customer experience through better network performance and quality.

Where are the Profits?

While Ericsson identified and developed several applications of AI, it turned out to be difficult to profit from these applications. One manager explains:

> "I certainly think that you need to be very clear on what you are trying to achieve with AI, even in the experimentation phase. In the early days, Ericsson was a little bit too focused on the belief that AI was a transformational capability. And then heading off, down more of a technology driven track to build AI models without having a clear view of how the value was going to be captured. And then realizing once we went down that track, that value was a little bit more elusive than what we thought. We ended up spending a lot of time building AI models, which did not bring what we thought was going to be the value."
>
> Head of Capability Development

Why is it difficult to capture value from AI? Despite significant investments and efforts, Ericsson's generation of top-line growth by the use of AI solutions was hampered by several problems, including difficulties in articulating value of its AI solutions, scaling the solutions in a cost-efficient way, and pricing the solutions. Much of this relates to challenges associated with co-specialized complementary assets. As we will show, access to and investments in customer-controlled complementary assets are key to profit from AI in this setting.

First, it was difficult for Ericsson to articulate and convince customers to pay for Ericsson's AI value packages. The value of the offerings are specific to the customer context, for example depending on the size of the network and network complexity, and are impossible to specify without considering complementarities with customer assets.[15] As a resolution Ericsson started to quantify the outcome for the customers to "prove" the value by calculating the total cost of ownership (TCO) before and after an implementation of an AI value package. The TCO calculator was used to quantify the savings in operational expenditures (OPEX) and capital expenditures (CAPEX) as well as increases in revenues that each value package brings.

This worked well when it came to value packages devoted to, for example, lowered power consumption and increased battery lives. Here Ericsson started charging based on energy savings of its customers. However, value packages that resulted in OPEX savings for the customer, but required more and better trained staff for implementation, were difficult to sell. Moreover, value packages intended to improve the quality of the network or increasing the revenue for the customer were even more challenging to commercialize, since this value was difficult to evaluate and articulate.

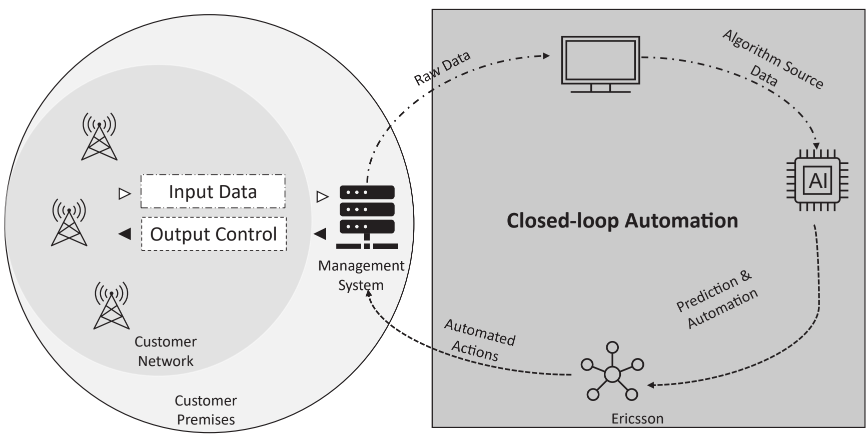
Second, Ericsson experienced difficulties in selling AI solutions to customers for whom Ericsson was not operating the networks. AI solutions are often associated with customization and specialized investments, leading to co-specialization between supplier and customer. It was therefore challenging to sell stand-alone AI-as-a-Service (AIaaS) offerings.

> "Each customer is very different with their strategies and how they really work and how they operate their network. So I think for every use case, 60% is something we can consider as usable, but then, 40% is something which we really need to customize as per customer's need, because there are a lot of things, every customer has different bands, every customer has different command structure to do operations[…] I think when we are in full control of processes, it is much easier, you have the data and the processes, you can bring in AI much easier than if you were to do it with a new customer. With their tools and processes it becomes much more difficult because you need to spend time on understanding the data, processes and organization."
>
> Service Portfolio Director

Since almost every implementation of AI required some level of co-specialization between Ericsson's and its customers' assets, it was difficult to scale AIaaS offerings efficiently, which led to limited value capture. To better industrialize and scale software-centric offerings, Ericsson needed to reformulate and change its approach to sell stand-alone AI solutions by reducing the level of co-specialization and moving away from costly on-site integration.

To mitigate this challenge, Ericsson combined its AI-based insights and recommendations with a closed automation loop with standardized interfaces. Instead of customizing the integration on-site at the customer, Ericsson developed standardized interfaces and commands, enabling remote information retrieval and processing without, relaxing the need for customization.

Figure 4: Closed automation loop.

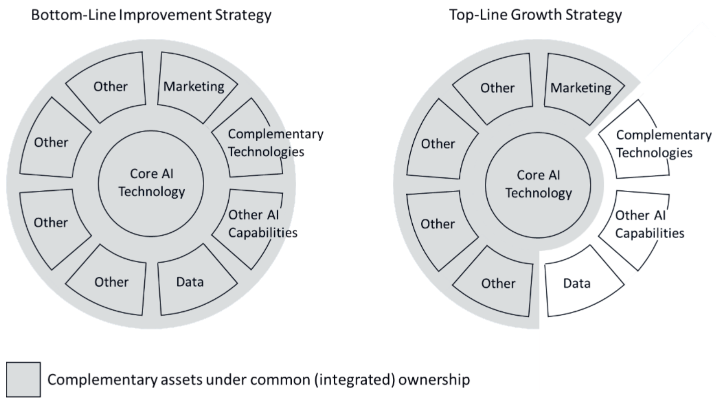


Profiting from AI has been easiest when AI is used to optimize internal processes, where relevant complementarities are within the boundaries of the firm, giving rise to own bottom-line improvements, and where it is used to improve customers' bottom-line by decreasing easily measurable costs at client sites, such as energy consumption. These benefits have helped to turn around the negative trend for the business area. For example, the gross margin improved with 7.2%-units from 2018 to 2021. However, it has been significantly more challenging to capture value from providing standalone and value-enhancing—not only cost-reducing—AI solutions to Ericsson's customers.

Implications for Profiting from AI

We have identified two main strategies for established firms to create and capture value from AI, based on the case of Ericsson's AI transformation. First, a strategy to grow the bottom-line with focus on using AI to improve internal efficiency. Second, a strategy to grow the top-line with focus on new businesses enabled by AI. Just like the original PFI framework predicts, complementary assets are necessary to profit from investments in AI. However, they play out differently in strategies aiming at top-line growth as compared to strategies aiming at bottom-line improvements. In particular, top-line growth strategies rely on co-specialized complementary assets distributed across firm boundaries, which amplifies three important AI appropriation challenges, including a data challenge, a capability challenge, and a value challenge.

Figure 5: Control of complementary assets in different strategies.



Data Challenge

There are strong complementarities between AI and data.[16] Great AI technologies cannot be developed without great data, and data access is more challenging for building new businesses aiming a top-line growth than for improving the efficiency of old ones. For example, when developing internal AI for efficiency and bottom-line improvement, Ericsson could rely on its vast access to data on internal operations. When developing new AI-driven businesses, however, customers' data was an essential complementary asset outside Ericsson's immediate control. Customers are generally reluctant to share data for AI that could be used in competitors' operations.

Customer data is typically the customer's property, and much effort is often needed to get data access and to deal with anonymization of data. To access and use external data, firms need also to comply with data integrity and regulations. The physical location of AI algorithms is usually a concern for customers due to data integrity and data regulations. In some cases, AI algorithms must be physically located on the customer's premises, which creates difficulties to utilize data to improve and scale AI offerings. Ericsson's approach to solve this problem was to offer AIaaS placement in three different physical locations: 1) global location for customers who have no data restrictions, 2) in-country location for customers who have national regulations that require data to remain in-country, and 3) on-site location for customers who require all data to remain on their premises. By using the same data stack across all types of sites, replication was still smooth and cost-effective, and management of the algorithms could still be controlled by Ericsson, with only the sensitive input data remaining at its location.

Capability Challenge

Profiting from AI is not only about data. Ericsson estimated that 60% of its efforts in AI were related to reconfiguring processes and building new capabilities. For example, Ericsson estimated that 90% of all the employees at the business area needed training to be upskilled and reskilled.[17] And it has taken five years to assess and/or certify 63% of the employees.

This is especially challenging when aiming for top-line growth, where capability development is needed across a larger share of the functions of the firm, and where it often also needs to be matched with capability development on the customer side. A bottom-line growth strategy does not necessarily require any major change to the existing business model. Ericsson could continue to sell customized solutions with individual pricing based on performance-based value capture. This stands in sharp contrast to the capabilities needed for the strategy to grow the top-line by means of building new businesses, where AI competence is required all the way from engineering to sales and customer support. Strategy formulation, business model design and dynamic capabilities are tightly connected, and for Ericsson this interdependency made it significantly more difficult to profit from top-line growth than from bottom-line improvements.[18]

Value Challenge

It is easy to fall into the trap of developing cool AI while forgetting how it solves customer problems. To be successful, the customers' pain points must be identified and evaluated. However, even for AI that is creating customer value it might sometimes be difficult to profit, as shown in this case. Due to the complementarities between AI, data, and complementary technologies, AI is impossible to value on its own.[19] In other words, the value of AI is truly context-specific, and when the context is controlled by the customer, the value challenge multiplies.

Ericsson uses TCO calculators to articulate and capture the value of an AI for its customers—for example in terms of energy reductions. TCO calculators combined with AI form an important feedback loop that ensures the intended outcome is delivered and increases the accuracy of TCO calculations. Nevertheless, measuring and communicating the value of an AI service to customers is a significant challenge. Firms therefore need to tread carefully when choosing among different opportunities from AI. Put simply, the value capture logic should be a central consideration when prioritizing between AI applications.[20]

Figure 6: Strategies and challenges to profit from AI.

	Bottom-line Improvement	*Top-line Growth*
Main Logic	Improved efficiency of existing business	New business and new business model
Data Challenge	Collecting and cleaning internal data	Accessing, combining, and cleaning external customer data
Capability Challenge	Capability development in AI and engineering	Capability development in all parts of business
Value Challenge	Internal value measurement	External value articulation, measurement, and capture

Conclusion

Taken together, it is clear that AI can be used to enable both top-line growth and bottom-line improvements. While all types of AI transformations are challenging, transformations aiming for top-line growth are especially difficult due to distributed complementary assets, which amplifies data challenges, capability challenges, and value challenges. An important differentiator between AI strategies for bottom-line improvements and top-line growth, respectively, is indeed the nature and locus of complementarities. Top-line growth often requires external data access and integration with customer technologies—thus a level of co-specialization between the innovator's AI and the customers' assets—leading to significant value capture challenges for the innovator. To grow the top-line with AI, firms must analyze complementarities carefully and invest heavily in competence, technology, data and dynamic capabilities. In some cases, firms may be better off only using AI for their own efficiency gains.

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Paper IV

Generative Innovation Ecosystem: The formation and layered combinatorial innovations

Authors
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Abstract

In the contemporary digital era, the prominence of innovation ecosystems in industrial B2B settings is undeniable, with generativity playing a crucial role. This generativity may originate from a generative community, architecture, and governance. Yet, despite its significance, our understanding of how industrial firms invoke generativity within innovation ecosystems remains in its infancy. Consequently, this study delves into the formation of a generative innovation ecosystem and its impact on producing combinatorial innovation. Using an in-depth case study of a world-leading telecommunications equipment provider of 5G technology, informed by 54 interviews and document study, we pinpoint the generative levers essential for the generative innovation ecosystem's formation, namely, designing generative ecosystem governance, generative ecosystem community expansion, and value architecture envisioning. Additionally, we demarcate two orchestration modes of converging and diverging, rendering different forms of combinatorial innovations, respectively, viable innovations and emergent innovations. To further detail the temporal progression of generativity, viable innovation possesses inherent generative potential that subsequently promotes generativity in emergent innovations. By merging these insights, this research aims to enrich both theoretical perspectives and practical implementations concerning the innovation ecosystems and their generative capacities.

Keywords: innovation ecosystems, generative innovation ecosystem, generativity, combinatorial innovation, 5G solutions

Introduction

In today's digital landscape, innovation ecosystems are at the heart of business success (Adner and Kapoor, 2010; Altman et al., 2022; Autio and Thomas, 2014), especially in the industrial B2B context (Ansari et al., 2016; Jones et al., 2021; Khanagha et al., 2022; Ozalp et al., 2018). For instance, the global telecommunications equipment provider Ericsson has created an innovation ecosystem around its 5G solutions leveraging targeted collaborations among a wide spectrum of partners to unlock the 5G potential to various applications, from smart infrastructure to healthcare and mission critical projects (Ericsson, 2022; Teece, 2018). These innovation ecosystems, described as meta-organization (Altman et al., 2022; Gulati et al., 2012; Kretschmer et al., 2022), encapsulate "the collaborative arrangements through which firms combine their individual offerings into a coherent, customer-facing solution" (Adner, 2006, p. 2) that represents a system-level goal that is attainable only by the collective action (Leong et al., 2023; Marciniak, 2013). More importantly, innovation ecosystems enable generativity (Miremadi et al., 2023; Nambisan et al., 2019; Thomas and Tee, 2022) through an unbounded range of potential value propositions (Dattee et al., 2018). Generativity is usually described as growth engendered "through unfiltered contributions from broad and varied audiences" (Zittrain, 2008, p. 70), signaling at the potential of the generative community, or a sociomaterial view arguing that a finite number of a building blocks “can lead to the emergence of a seemingly infinite number of variations and speciations” (Yoo, 2013, p. 232), singling at the generative architecture and combinatorial innovations (Lanzolla et al., 2021; Thomas and Tee, 2022). To create and manage an emerging innovation ecosystem, ecosystem architect needs to engage in new activities focused on inter-organizational cooperation, dynamic control of ecosystem dynamics, and system innovations (Stonig et al., 2022). However, current understanding of how to invoke generativity in industrial innovation ecosystems is limited (Jovanovic et al., 2022; Kohtamäki et al., 2019; Lingens et al., 2021; Pattinson et al., 2022).

The existing literature on innovation ecosystems has made significant contributions to our understanding of the importance of generativity, albeit implicitly (Autio and Thomas, 2014, 2022; Granstrand and Holgersson, 2020). Scholars have shed light on the necessity of fostering voluntary contributions from openness yet partner alignment with the ecosystem's overarching value proposition (Autio, 2022; Cenamor and Frishammar, 2021; Thomas et al., 2022). Similarly, literature has also suggested that innovation ecosystems allow the potential for value expansion through novel resource combinations that allow parallel innovations (Lanzolla et al., 2021; Rubens et al., 2011). Specifically, the role of ecosystem architect in orchestrating innovation ecosystem (Daymond et al., 2022), a central theme in this domain, involves the intricate task of connecting, facilitating, and governing inputs from autonomous entities within the ecosystem (Reypens et al., 2021), negating the need for hierarchical oversight or formalized supplier contracts (Autio, 2022). A majority of prior research has investigated ecosystem orchestration focused on formulating a prescriptive 'blueprint,' outlining not only the value proposition but also the intricate governance structures and roles for participants (Adner, 2017; Eisenmann, 2008; Iansiti and Levien, 2004; Lingens et al., 2021; Williamson and De Meyer, 2012) indicating a more centralized approach that is in conflict with the more open principles of generativity (Um et al., 2013). However, a recent stream in this literature has highlighted the relevance of a decentralized approach of ecosystem orchestration and posits that the ecosystem's value propositions are indeterminate a priori (Dattee et al., 2018) implicitly hinting at a generativity perspective (see also Ahuja et al., 2013, generative appropriability). In this novel paradigm, multiple ecosystem partners facilitate the co-discovery of value within a context where pre-established outcomes remain elusive (Ansari et al., 2016; Järvi et al., 2018). This approach relies on enabling and coordinating productive yet unpredictable activities and partnerships (Altman et al., 2022; Autio, 2022). Notably, the orchestration of generative innovation ecosystems, aiming to cultivate an unbounded range of potential ecosystem value propositions, presenting unique challenges for ecosystem architect in the absence of prescriptive guidelines (Dattee et al., 2018).

A significant gap becomes evident within this literature, especially in the industrial B2B context that increasingly leverages generative technologies (e.g., 5G). While some studies acknowledge the importance of generativity (Thomas and Tee, 2022), no study has yet to comprehensively examine the design choices, outcomes, and temporal dynamics of generative innovation ecosystems. Several important questions remain unanswered, such as how firms can effectively design innovation ecosystems to promote generativity and what are the effects of generativity on innovation outcomes? Specifically, despite the progress made in understanding the early dynamics of innovation ecosystems (Murthy and Madhok, 2021), there is still a significant gap concerning the temporal evolution of generative innovation ecosystems and their capacity for producing innovations. While Zittrain (2008) foundational work highlighted the potential for unexpected innovations from open systems, we know little about how ecosystem architects orchestrate generativity, the mechanism by which innovation ecosystems produce combinatorial innovations (Daymond et al., 2022). Therefore, the evolution of generative innovation ecosystems over time, as they give rise to various viable and emergent combinatorial innovations, and the relationships between subsequent combinatorial innovations, remain largely uncharted (Thomas and Tee, 2022). Addressing these queries is essential, given the limited literature focused on the intersection of innovation ecosystems, generativity, and its potential for combinatorial innovation.

Building on the aforementioned gaps in the innovation ecosystem literature, this study sets forth to answer pressing questions. Our primary research question is: What are the generative levers that enable ecosystem architects to orchestrate the formation and evolution of generative innovation ecosystems that consistently produce combinatorial innovations? To unravel this, we conducted an in-depth case study of a world-leading telecommunications equipment provider intricately involved in formation of an innovation ecosystem surrounding 5G technology. Methodologically, our insights draw from 54 interviews with professionals deeply embedded in the 5G initiatives within this innovation ecosystem.

Our research augments the current literature in multiple significant dimensions. We identify the foundational generative levers pivotal to the formation of generative innovation ecosystems. This insight advances our understanding of emergence phase of the generative innovation ecosystems. Next, another contribution is our illumination of how the orchestration of generative innovation ecosystems yields varied forms of combinatorial innovation. We present a nuanced understanding by differentiating meta-orchestration modes of converging for viable innovations from those diverging for emergent innovations. Finally, we shed light on the temporal evolution of generative innovation ecosystems. This involves mapping the inherent generativity of viable innovations, specifically base solutions and customized solutions, culminating in the realization of generativity via emergent innovations, specifically complementary-driven solutions and experimental solutions. In synthesizing these findings, we aim to foster both theoretical advancement and practical applications in the realm of innovation ecosystem and its generative potential.

Conceptual background

Industrial Innovation Ecosystems and Generative Perspectives

Contemporary business landscapes, marked by their intricate digitalization and industry convergence (Jacobides, 2022), necessitate an increasing shift towards specializing in general purpose technologies with broad applicability in many markets (Conti et al., 2019). For instance, Open AI (e.g., ChatGPT), blockchain, 5G, cloud computing, and quantum computing, can be considered to be a general-purpose technology (GPT), an adaptable technology with broad applicability with the potential to generate significant positive externalities, drive productivity, innovation, and transform entire economies (Freeman and Louçã, 2002). Yet, the restructuring of industries and their architecture is an inevitable consequence of GPTs (Gambardella and McGahan, 2010). For instance, innovators of enabling GPT technologies, such as 5G, face a distinctive business model challenge. Given their generative applicability to numerous downstream sectors (Ahuja et al., 2013), it becomes virtually unfeasible to retain comprehensive ownership of all associated complementary assets, as they, both vertical and lateral, not only serve as potential avenues for value appropriation but are also integral for the technology's efficient functionality (Teece, 2018). Since this coordination and cooperation problems cannot be solved by markets and the price system alone, requiring assistance from ecosystem architect (Foss et al., 2023). For instance, the global telecommunications equipment provider Ericsson has created an innovation ecosystem around its 5G solutions leveraging targeted collaborations among a wide spectrum of partners to unlock the 5G potential to various applications, from smart infrastructure to healthcare and mission critical projects (Ericsson, 2022; Teece, 2018). Therefore, industrial innovation ecosystems , described as meta-organization (Altman et al., 2022; Gulati et al., 2012) of independent yet interdependent firms (Jacobides et al., 2018), encapsulate "the collaborative arrangements through which firms combine their individual offerings into a coherent, customer-facing solution" (Adner, 2006, p. 2) that represents a system-level goal that is attainable only by the collective actions (Kretschmer et al., 2022; Leong et al., 2023; Marciniak, 2013).

In the industrial innovation ecosystem, generative technology acts as an enabler by providing the foundational digital infrastructure and capabilities for industries to adopt and integrate advanced digital solutions into their operations (Henfridsson and Bygstad, 2013; Tilson et al., 2010). This perspective takes generativity as an increase in content, services, and functions (Fürstenau et al., 2023) by leveraging powerful affordances of digital technologies (Alaimo and Kallinikos, 2021) that allow physical products to be entangled with software-based capabilities of re-programmability and self-referencing (Yoo et al., 2010) and become digital artifacts. Therefore, the inherent features of digital artefacts enable to leverage properties such as decomposability, adaptability, traceability, and interoperability (Faulkner and Runde, 2013; Kallinikos et al., 2013). More importantly, digital artefacts diffuse easily (Yoo et al., 2010) as their form and the function are separated (Autio et al., 2018), for instance, service is independent from the device (Kallinikos et al., 2013). Enhanced generative potential is driven by the increase of the space of possibilities, ideas for new services and new assemblage of modular components (Baldwin and Clark, 2000; Baldwin, 2023; Bygstad, 2010, 2017) or combinatorial innovation (Lanzolla et al., 2021; Thomas and Tee, 2022; Weitzman, 1998; Yoo et al., 2012). Overall, these are generative architecture levers (Van Der Geest and Van Angeren, 2023).

Simultaneously, generativity acts as a catalyst by spurring industries to innovate and evolve, driving the development of new complementary applications, services, and business models that were previously unfeasible (Teece, 2018; Yang et al., 2022). For instance, with 5G's low latency and high bandwidth, sectors like healthcare can introduce real-time remote surgeries, while the automotive industry can push the boundaries of autonomous solutions (Thomson et al., 2023) . This socio-technical perspective views generativity as "the ability of a self-contained system to create, generate, or produce a new output, structure, or behavior without any input from the originator of the system" (Wareham et al., 2014, p. 1195). Specifically, openness encompasses the assimilation of inputs from a distributed and heterogeneous array of generative community to facilitate the co-creation of multifaceted outputs (Cenamor and Frishammar, 2021; Majchrzak et al., 2023; Miremadi et al., 2023; Nambisan et al., 2017). These varied outputs are subsequently repurposed as resources, catalyzing the genesis of novel and complex combinations or complexity arrangements, that in turn, yield an expanding the horizon of possibilities (Garud et al., 2011; Jarvenpaa and Välikangas, 2022). Literature argue that a generative architecture and a generative community only result in combinatorial innovation when they have a generative fit moderated by generative governance (Thomas and Tee, 2022). Therefore, generative governance plays a critical role in striking the balancing openness and control, that is standardization and variation, autonomy and control, and individualism and collectivism (Autio, 2022; Wareham et al., 2014). Hence, generative governance encompasses collective governance to effectively empowers the community to harness and contribute to these emerging digitally enabled opportunities (Thomas and Ritala, 2022). Mastering these generative levers is pivotal for unlocking recombinatorial innovation, where orchestration facilitate the effective search and recombination of knowledge in the innovation function (Lanzolla et al., 2021). Presently, our understanding of how to invoke and orchestrate generative levers within innovation ecosystem remains nascent (cf. Thomas and Tee, 2022).

Ecosystem Orchestration and Temporal Dynamics of Generativity

Orchestration of innovation ecosystems remains the key task for the ecosystem architect to align inputs from independent yet interrelated actors within an ecosystem, circumventing the need for hierarchical oversight or formalized supplier contracts (Autio, 2022). Instead, the objective lies in engendering voluntary contributions from complementary partners and align their activities towards the ecosystem's overarching value proposition (Dhanaraj and Parkhe, 2006; Foss et al., 2023; Helfat and Raubitschek, 2018). Ecosystem architects require integrative capabilities of orchestration that involve establishing and maintaining relationships, facilitating collaboration, and managing conflicts within the ecosystem (Helfat and Raubitschek, 2018). Specifically, the emergence or formation phase of innovation ecosystems has garnered attention (Daymond et al., 2022; Gomes et al., 2022; Hannah and Eisenhardt, 2018; Murthy and Madhok, 2021; Pushpananthan and Elmquist, 2022; Thomas et al., 2022). Scholars have portrayed ecosystem emergence through stages such as initiation, scaling, and control, with orchestration addressing technological, economic, institutional, and behavioral layers at each stage (Autio, 2022). Similarly, scholars also framed ecosystem emergence through facilitating the formation of a shared vision, inducing others to make ecosystem-specific investments, and engaging in ad hoc problem solving to create and maintain stability (Foss et al., 2023). Yet, such stages highlight the process that is converging ecosystem to a controllable system rather than invoking generativity. More importantly, existing literature delineates two predominant paradigms for orchestrating innovation ecosystems: a top-down and a bottom-up approach.

The top-down paradigm emphasizes centralized coordination structure akin to conventional supply chain management (Adner, 2017). Here, the ecosystem's architect formulates a prescriptive 'blueprint' (Lingens et al., 2021), outlining not only the value proposition but also the intricate governance structures and roles for participants (Adner, 2006, 2017; Iansiti and Levien, 2004; Williamson and De Meyer, 2012). Ontologically speaking, in this framework, the ecosystem's value proposition is predefined, facilitating a derivative ecosystem design process (Autio, 2022). Conversely, the bottom-up approach operates on the premise that the ecosystem's value propositions are indeterminate a priori (Dattee et al., 2018). Here, multi-stakeholder negotiations process occurs, facilitating the co-discovery of value within a context where a pre-established outcome is elusive (Ansari et al., 2016). This paradigm hinges on enabling and coordinating productive, albeit unpredictable activities and partners (Autio, 2021; Altman et al., 2022). Orchestration is, therefore, oriented towards actors probing and establishing shared knowledge as a basis for collective actorhood (Thomas and Ritala, 2022), with no formal rules or coordination mechanisms as the ecosystem's value proposition may emerge and evolve through the joint search process (Järvi et al., 2018).

Clearly, the orchestration of generative innovation ecosystems most closely aligns with the bottom-up approach. The inherent goal of generative innovation ecosystems is to cultivate unbounded range of potential ecosystem value propositions, thus presenting unique challenges for ecosystem architects in the absence of prescriptive guidelines (Dattee et al., 2018). First, the notion of collective actorhood plays a crucial role in the orchestration of interdependent and autonomous communities towards a common goal (Thomas and Ritala, 2022). Still, given that actors frequently engage with an ecosystem based on spontaneous discovery rather than systematic planning, it is imperative for the ecosystem architect to play a more proactive role (Dattee et al., 2018) and leadership (Foss et al., 2023). Therefore, this prevalent orchestration approach nudges ecosystem architects to disseminate the explorative and prefigurative generation of alternatives instead of making speculative commitments to specific applications (Dattee et al., 2018; Järvi et al., 2018). Second, existing literature recognizes the importance of the orchestration in managing and balancing control, especially during the formation phase of an innovation ecosystem's evolution (Thomas et al., 2022). Literature argue that it is imperative for ecosystem architect to embed control points within the growing innovation ecosystem and steer the value creation discovery process to ensure ultimate value capture (Cennamo and Santaló, 2019; Pagani, 2013; Tilson et al., 2010). This mirrors the assertion that value emerges from a future-oriented value proposition or generative appropriability (Ahuja et al., 2013), necessitating foresight rather than mere retrospection (Dattee et al., 2018). Despite its relevance, the literature has yet to provide comprehensive insights into how to effectively orchestrate generativity within innovation ecosystems, a gap particularly evident in the industrial context.

Finally, for all the progress in understanding the dynamics of generative innovation ecosystems, a substantial gap remains when considering the temporal evolution of combinatorial innovations. Recent literature challenges the assumption that generativity always leads to unbounded growth as generativity may be bounded and stabilize combinatorial potential (Fürstenau et al., 2023). Specifically, how generative innovation ecosystems evolve over time, as they render various viable, uncoordinated, and emergent combinatorial innovations, and the relationships between subsequent combinatorial innovations are still largely uncharted (Thomas and Tee, 2022). The questions thus persist: How can ecosystem architect orchestrate generative innovation ecosystems for combinatorial innovation? And what are the ramifications of generativity for different types of combinatorial innovation? Addressing these queries is essential, especially given the dearth of literature focused on the intersection of innovation ecosystems, generativity, and its combinatorial innovation potential.

Data and Methods

Research setting

Within our research's setting framework, we delved into the pivotal role of technology providers in facilitating digital transformation (Kalogiros et al., 2020). Emphasis was placed on technology connectivity providers, who act as the backbone of 5G solutions and catalyze diverse applications across various vertical sectors (Nahum et al., 2020). Despite the promising attributes of the 5G network, such as a 20-fold speed enhancement over 4G, minuscule latency of 1 millisecond, a thousand-fold bandwidth enhancement, the capacity for 100 times more devices per unit area, and an outstanding 99.999% availability (Ahrend et al., 2019), the evolution of these networks and associated solutions has presented multifaceted challenges for technology providers (Kalogiros et al., 2020). Historically positioned towards the rear in the telecom value chain (Yoffie and Kwak, 2006), these providers have traditionally been dependent on communication service providers (CSPs), exemplified by relations between Ericsson and Telia (Håkansson and Ford, 2002; Håkansson and Lind, 2004). However, as 5G's potential permeates various sectors, there's a marked expansion in the cadre of critical partners, encompassing both upstream and downstream stakeholders, OEMs, consultants, and other entities (Chen et al., 2016). Given their intricate technical competencies and their positioning in the value chain, technology providers grapple with conceptualizing the full spectrum of 5G's value propositions and maintaining visibility with partners and end-users (Dattée et al., 2018). Concurrently, they must navigate threats from competitors poised to dominate the 5G landscape or potential substitute technologies meeting industrial digitalization prerequisites (Zhang and Liang, 2011), the sustainability and expansion of technology providers are now intrinsically linked to formation of open-ended innovation ecosystem for 5G (Moore, 1996; Zhang and Liang, 2011) that could display generative capacity to render innovations for various industry verticals.

Given that the earliest stages of innovation ecosystem creation remain largely unexplored in the literature, we follow a qualitative approach (Edmondson & McManus, 2007; Dattee et al., 2018). We conducted an open-ended inductive study (Eisenhardt, 1989; Langley, 1999) of the incumbent technology provider labelled Epsilon, which started to develop an innovation ecosystem in the form of hub-and-spoke engagements with heterogeneous partners to push the cross-industry adoption of 5G solutions. Inductive studies with a grounded theory-building approach (Glaser and Strauss, 1967) are particularly useful for analyzing complex processes that evolve over time (Langley, 1999). Longitudinal data are required to observe how these processes unfold across the sequences and transitions (Langley et al., 2013). This study follows an in-depth single case study-based approach ((Eisenhardt and Graebner, 2007; Yin, 2017) since it allows to collect well-grounded, rich descriptions of a particular phenomenon within its real-life setting (Miles and Huberman, 1994; Robson, 2002). More specifically, this type of data could unpack the decisions in the early phases of innovation ecosystem formation (Cassell and Symon, 1994).

Data collection

The data collection for the study spanned the period between May 2019 and November 2022. The research team collected data from three primary sources: i) semi-structured interviews; ii) direct observation of the Epsilon's day-to-day operations and meetings; and iii) archival data from internal Epsilon's documents and external reports, such as industry reports, industry conference presentations, news articles, and press releases (Yin, 2017).

Interviews. To gain a preliminary understanding and overview of the Epsilon process of building an innovation ecosystem, initial exploratory interviews with Epsilon informants were conducted during 2019. Next, during 2020 to 2022, an additional 54 semi-structured interviews were conducted with Epsilon to try and understand the process and allow Epsilon informants to fully onboard various partners and share these partner engagement episodes with the research team. During these interviews, particular attention was paid to the innovation ecosystem leveraging mechanisms that correspond to the hub firm's role in different ecosystem formations. When conducting semi-structured interviews, we drew on a list of theory-based questions and themes to be covered. However, we did not follow a rigid order of questioning. Rather, we allowed informants to describe the phenomenon in their own terms and from their own viewpoint (Kvale, 2007). Natural or convenience sampling (Collis and Hussey, 2014) was used in this study because the choice of informants was influenced by interviewees' roles within Epsilon and their involvement in the company's innovation ecosystem. The majority of respondents held senior positions within Epsilon (e.g., VP Head of Advanced Industries, Head of IoT Ecosystem and Partnerships, Head of Business Development & Product Marketing, Director Global Partnerships, Partner Manager Ecosystems). They were chosen because the nature of their positions allowed them to provide a high-level view of the engagement process and discuss the roles the hub firm took in various ecosystems. Therefore, the criterion for selecting interviewees from Epsilon was that they were involved in orchestrating the innovation ecosystem formation process. Second, we specifically sought to interview employees who participated in different 5G solutions, where the hub firm, Epsilon, occupied a different role. In order to verify the accuracy of the analysis and interpretation, repeat interviews were conducted with a vice president of Epsilon. Repeat interviews also allowed for cross checking of information collected from other respondents and secondary data. Interviews were recorded and transcribed. In addition, detailed notes were taken during and immediately after each interview.

Observations. The second author is an Epsilon employee with full access to Epsilon's internal documentations and systems and Epsilon's leadership supported this study. More specifically, the second author is a senior researcher at the focal firm and has been involved in various collaborative and ecosystem-building activities since 2015. In the period from 2019 to 2021, he was involved in the partner engagement process in which Epsilon engaged different partners (e.g., communication service providers, manufacturing companies, software and device vendors, and consulting firms). Moreover, he was also present at no less than 80 business meetings on behalf of the hub firm. All of these encounters, conversations, and casual conversations have created a deep pre-understanding of the phenomenon.

Pre-understanding is often considered a source of bias but, when it is used systematically and in collaboration with other authors, it can enhance interpretation of the case (Alvesson and Sandberg, 2021).

Documentations and Artifacts. In addition to primary data, secondary data were collected to complement and verify interview data. Therefore, rich data collected from multiple sources allowed for triangulation, which enhanced the robustness of the findings (Eisenhardt, 1989). Discrepancies between interview data and secondary data raised new questions, which guided subsequent data collection efforts. Secondary data used in this study consists of Epsilon's internal and externally published documentation, industry reports, Epsilon's white papers, news articles, and Epsilon's newsletters in relation to ecosystem building. In addition, the research team participated in internal and external webinars and had access to presentation materials. Finally, the research team had access to Epsilon's Ecosystem Operating Model, including the detailed partner engagement processes of the model. The overall data collection efforts are presented in Table 1.

Table 1. Description of data

DATA TYPE		
Primary data		
Interviews	Semi-structured interviews with key stakeholders, lasting between 30 minutes and two hours: Business Development & Product Marketing Head (1), Business Development Lead (2), Business Value Specialist (2), Client Principal (3), Commercial Director (5), Customer Success Lead Dedicated Networks (1), Dedicated Network Smart Manufacturing Lead (1), Director Automation (2), Director Global Partnering Strategy (2), Director Global Partnerships (1), Director Service Layer (1), Ecosystem Manager (1), Global Director Sustainable Innovation (1), Head Business Development DN (1), Head Commercial Management (1), Head Dedicated Networks (1), Head Ecosystem Expansion (1), Head IoT Ecosystem and Partnerships (1), Head of Business Control (1), Head of Commercial Management (1), Head of Strategic Program Practice (1), Head Thought Leadership (1), Industry and Ecosystem Manager (2), Key Account Manager (1), Manager Radio Network (1), Master Researcher (3), Partner Manager Ecosystems (1), Portfolio Manager Smart manufacturing (1), Principal Researcher (2), Program Manager 5G for Industries (1), Researcher (2), Researcher Ecosystem (1), Senior Manager (1), Senior Researcher (2), Standardization Manager (1), Strategic Marketing Director (1), VP Head of Advanced Industries (1)	54
Participant observations	Participation in business meetings regarding ecosystem formation	40
	EU project – Epsilon, CSP and manufacturing firms	15
	Manufacturing industry collaboration project	10
	Facilitation at collaboration meeting between Epsilon, CSP, system integrators (e.g., consultancy firms), software and device vendors, and manufacturing firm OEMs	15
Secondary data		
Internal documentation from Epsilon	Ecosystem operating model descriptions	2
	Knowledge-sharing sessions	19
	Webinars	18
	Reports and white papers	36
	Newsletters	22

Data analysis

In keeping with the principles of grounded theory development, we engaged in iterative rounds of data analysis during and throughout our data collection (Glaser and Strauss, 1967). Interview transcripts were coded using constant comparative analysis (Corbin and Strauss, 1990; Glaser and Strauss, 2017). As the study progressed and new data were collected, identified empirical themes and conceptual categories were continuously compared to the previous data. When data produced novel or contradictory information, the categories were adjusted to take these new developments into account. This process was repeated until no new categories emerged, and no new information was inconsistent with existing categories – that is to say, until theoretical saturation was reached (Corbin and Strauss, 1990; Glaser and Strauss, 2017). The constant comparative analysis involved data triangulation by cross-checking statements across informants and verifying them against secondary data. Initial open coding produced twenty-four empirical themes describing steps in the partner engagement process and twelve empirical themes describing a hub firm's role in ecosystem formation. Therefore, as we cycled between data collection, coding, and existing theoretical constructs, empirical themes were aggregated using axial coding into six conceptual categories corresponding to the aggregate dimensions of innovation ecosystem partner engagement processes and four conceptual categories corresponding to the aggregate dimensions of the hub firm's role in ecosystem formation (Corbin and Strauss, 1990). The data structure that resulted from this iterative analysis is presented in Figures 2a and 2b. The following section discusses each of the dimensions in greater detail.

Figure 2a. Data structure from the iterative analysis.

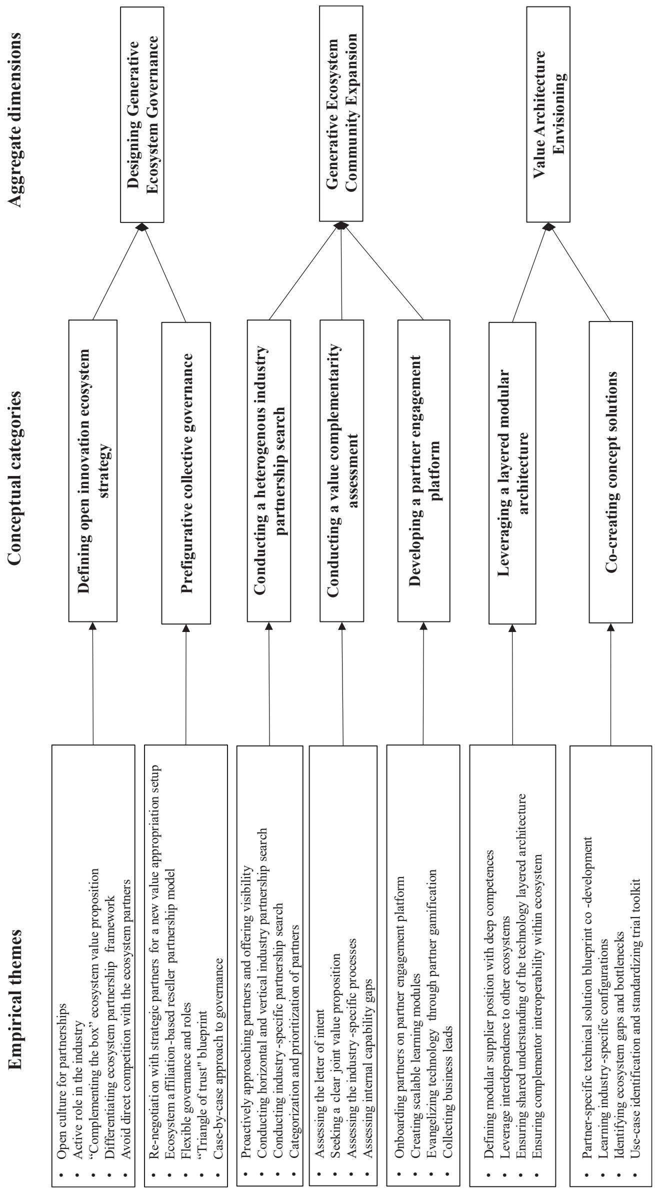
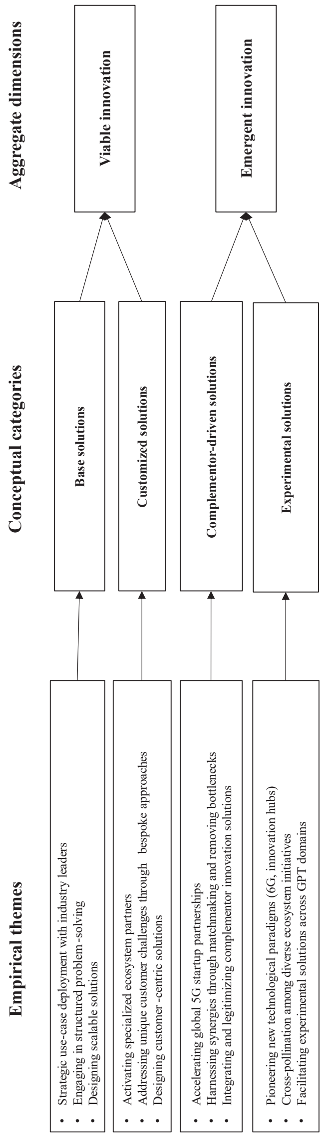


Figure 2b. Data structure from the iterative analysis.



Findings

Generative innovation ecosystem formation for 5G

Epsilon, a global leader in 5G technology, provides comprehensive solutions for both mobile and fixed networks, underpinned by a robust emphasis on research and development. As a forerunner in the 5G arena, Epsilon has been pivotal in facilitating digital transformations across diverse sectors. Currently, the rapid acceleration of 5G deployments underscores its emerging commercial significance. Despite the transition to 5G being potentially less transformative for mobile broadband users compared to the 3G to 4G shift, the momentum towards 5G is largely driven by industries and governmental bodies keen on harnessing its capabilities. Examples of 5G initiatives range from mission-critical endeavors like the USA's FirstNet Authority to applications in smart cities, underground mining and manufacturing facilities, connected healthcare with VR and AR-enabled remote surgery rooms, and ventures into smart homes as well as connected and autonomous vehicles.

To accelerate the deployment of 5G solutions with enormous industrial applicability, Epsilon has spurred the formation of an innovation ecosystem aimed at unlocking the generative potential of 5G. Initially, Epsilon designed generative ecosystem governance structures defined by open innovation ecosystem strategy and a prefigurative ecosystem governance structure that enabled the innovation ecosystem to self-organize and self-adapt. Next, Epsilon initiated the expansion of the ecosystem community by opening to and bringing in heterogeneous industry partners for 5G such as startups, industry leaders, creating a rich innovation ecosystem that fosters collaboration and provides ample opportunities for discussing 5G applications, assessing complementary potential of different partners and developed a scalable partner engagement platform to nurture digital working environment. Finally, to effectively manage the development of ecosystem value propositions, it was also necessary to establish processes in relation to value architecture envisioning that includes defining multilayered modular architecture and co-creating concept solutions. Therefore, a comprehensive understanding of these conceptual components was critical for Epsilon to effectively manage the innovation ecosystem formation and leverage its generative potential. In the following section, we unpack these approaches to generative innovation ecosystem formation.

Designing Generative Governance

Before embarking on its efforts to ecosystem community expansion, Epsilon recognized the need to design a generative ecosystem governance. In the past, the company had adopted a closed partnership approach, which became obsolete with 5G. To address this challenge, Epsilon established a more open innovation ecosystem strategy for 5G and created a pre-configurative ecosystem governance structure.

Open innovation ecosystem strategy. Epsilon leadership recognized the importance of creating an open culture for partnerships in order to facilitate the partner onboarding process. However, as a large, multinational, predominantly closed organization, Epsilon was hard to approach. Consequently, Epsilon had to signal to prospective partners that "the new Epsilon" is "easy to become friends with". Epsilon also realized the urgent need to surround itself with partners because the connectivity potential might be unlocked by other access technologies if Epsilon did not move quickly to assist ecosystem partners in promoting cellular 5G technology. A senior executive reflected on how building an innovation ecosystem required Epsilon to re-invent itself.

> But we have to enable our partners so that it's easy for them to become friends with Epsilon. And before, that hurdle was too hard, and we created too big governance structures. We were too slow in Epsilon to move fast here. And that's what we have been working on.

Epsilon had to take a more active role in the industry and redefine its role as a challenger. It also required to establish a new balance of power and re-position itself to complement other partners in the innovation ecosystem, rather than compete with them.

> So, in our perspective, you have to see that we at Epsilon are not the incumbent. We are the challenger stepping in, the new technology into the space. Hence, the ecosystem becomes even more important.

> Instead of trying to say that Epsilon is the best here, we are trying to say that, okay, there's already a lot of players who are the best here, but this is what they can do with 5G.

As part of this shift towards a more open partnership framework, Epsilon defined "*complementing the box*" ecosystem value proposition. It involves utilizing its core 5G competencies and allowing the access to the innovation ecosystem to collaboratively co-develop 5G solutions. By doing so, Epsilon managed to unlock the full generative potential of 5G technology to ecosystem partners. Through "complementing the box" innovation ecosystem value proposition, Epsilon was well-positioned to establish an innovation ecosystem that fosters innovation, collaboration, and growth.

> We have to make it clear that we are doing the 4G/5G communication. And we are setting up the best private network. Then, there are a lot of areas we could do at Epsilon. For example, we can sell edge computing capacity. We can sell IoT platforms. We can do a lot. But this ecosystem is specifically for complementing the box.

To successfully govern the innovation ecosystem, Epsilon also recognized the need to differentiate ecosystem partnership internally. Epsilon has a different supply chain relationship with various partners, potentially creating confusion around this innovation ecosystem engagement. For instance, Epsilon may sell to and buy from a specific partner, but innovation ecosystem relationships have a distinct underlying logic. Epsilon's manager has provided an example.

> If we take the (leading OEM) example, we are primarily working on the partner relationship (with them). We also have a supplier relationship with (leading OEM). We buy robots and other things from them. We sell various items to (leading OEM), in some cases very selectively, though. However, here we are having a relationship about research, go-to-market, IT, data connection. But all this is about how we make the market creation, the joint value propositions…

Similarly, due to numerous sales channels for 5G solutions, Epsilon decided to avoid direct competition with their ecosystem partners or have conflicting business models. A senior vice president of Epsilon elaborated on how their competing technology providers opted for a more aggressive corporate strategy.

> It's very rarely good to mix two business models or compete with your existing customers. So, therefore, we are clear. We don't compete with our existing customers. But we educate them, that this is another ecosystem that they step into, with new values, and a new balance of power.

Prefigurative governance structures. The term "prefigurative" refers to the idea that the means used to achieve a goal should reflect the end goal itself. One key feature of prefigurative governance structures put their emphasis on collective decision-making and participatory collective governance. Epsilon aimed to create a culture of collaboration and cooperation, where all ecosystem partners are encouraged to participate in decision-making processes and take ownership of the outcomes. Therefore, before reaching out to new partners, Epsilon had to ensure that communication service providers (CSPs) were onboarded and familiar with their prefigurative governance structure. CSPs have been a key go-to-market partner for Epsilon for many years, as they were the primary purchasers and users of Epsilon's telecom equipment and services. However, with the new 5G use cases and technologies, such as IoT, private 5G networks, and edge computing, Epsilon is expanding its partner and customer base beyond traditional CSPs to include new partners and governmental units. Consequently, Epsilon had to engage in re-negotiation with strategic partners. In its governance model, Epsilon sells solutions in collaboration with ecosystem partners through the CSP in a co-sell setup that benefits the CSP, ecosystem partners, and Epsilon.

> So, your question was regarding CSP and Epsilon. And, Epsilon is still selling through them, but we are changing our goal-to-market model from the perspective of introducing a reseller approach. Then it's up to the CSP if they like that or not. But this is an opportunity to step in.

Therefore, the potential value appropriation has shifted in the context of innovation ecosystem for 5G, with Epsilon now holding a larger portion of the overall 5G solution value than the CSP. Previously, Epsilon accounted for around 20% of the total value, while the CSP held the remaining 80%. However, with the introduction of a reseller approach for 5G, Epsilon has now taken on a larger role in value appropriation, accounting for 80% of the value, while the CSP contributes only 20% in terms of connectivity.

> Hence, the shift of value moved from where Epsilon maybe stood for 20% and the CSP stood for 80% and flipped to Epsilon for 80% of the value, the CSP is 20% of the connectivity, because we have them signed up, with the CSP as a reseller.

Epsilon has introduced an ecosystem affiliation-based reseller partnership model for 5G, enabling the company to expand its partner base beyond traditional CSPs to include other industries, enterprises, and governments. This approach allows Epsilon to leverage the expertise and market knowledge of its ecosystem partners to reach new customers and markets while also reducing its sales and marketing costs. By partnering with resellers, Epsilon ensured their 5G technology will be embedded and deployed and seamlessly operating across various 5G applications.

> And then going from a traditional approach that Epsilon sells to just the CSP, and they put together the solution and sell it. We created a resell model; hence the balance of requirements is put on us. We have to make the product ready as a product, not as component based. As a real product that is called (solution name), with the CSP then as the reseller.

Moreover, Epsilon opened such reseller approach to all ecosystem partners. More specifically, Epsilon ensured that "priming" or orchestration of the specific 5G project is flexible, both in terms of governance and roles. A senior vice president of Epsilon explained.

> Up until like a couple of weeks ago, we had only CSPs as reseller. So, they always needed to be in the in the deal. And then, we have seen both variants that sometimes the CSP is priming and sometimes the system integrator is priming.

> That's kind of depends on who has the best existing relationship with the customer. I mean, it might be that this deal is coming from the system integrator who is building a factory or whatever. The most successful deals are when they (partners) are flexible on who is prime. We do see other ones that, where maybe the CSP says that, no, we would always prime and that's a bit less successful because you need to accept it. I mean you don't always have the best relations with a customer.

Therefore, Epsilon created a "triangle of trust" blueprint that fosters trust and collaboration among ecosystem partners. Epsilon realized the need to team up in a new arrangement that welcomes other ecosystem partners. The "triangle of trust" refers to Epsilon–CSP–ecosystem partners. This blueprint includes alignment blueprint for win-win-win outcomes that enables three or more partners to co-create value. By establishing this governance structure, Epsilon is creating a more open and collaborative blueprint embedded in innovation ecosystem that can adapt and evolve to meet the changing needs of its customers and partners as per individual 5G solution project.

> That's why we needed to change the game, why we refer to this as the triangle of trust. Epsilon sells to our CSP who then has the financial contact with enterprise. But all these partners in between, the system integrators, device partners, the independent software vendors, we need to work with. And that's why we treat this work with our operating model.

> We can ensure, then, that the industry again has a relevant offering that is ready to run, and with local spectrum capacity that the CSP has. And also, the potential upsell for the CSP and other partners to offer new services. So, we give them a seat at the table. And the industry gives an opportunity to get wireless communication that is the world's best without the challenges and the hassle that comes with it in the traditional way, why they hadn't adopted 4G in the first place.

Ultimately, Epsilon came to the realization that the governance structure must be adjusted to reflect the maturity of the industry and its partners. In many instances, a case-by-case approach to governance is essential to meet the unique requirements of inclusive 5G solutions.

> You can say that governance set up, like Capex and Opex, is not KPI based, in the majority of cases. But in some cases, we do. So, we're exploring those. But, it depends on the maturity of the industry and the partners and so on, so it involves... It becomes a bit more case-by-case. We talked about micropayment (e.g., data-as-a-governance), and how everything will be similar to the IT world, small transactions everywhere. I still believe in that mission, but it's so much integration to make it happen. There are many forces that make it a hard thing to combat. Paper-wise, super good idea. Reality, much harder.

Generative Ecosystem Community Expansion

Within the context of 5G networks, Epsilon's management identified the crucial need to establish a diverse array of partner relationships, encompassing specialized software providers, device manufacturers possessing sensory expertise, prominent original equipment manufacturers (OEMs) in distinct industry sectors, as well as system integrators and consulting firms. The significance of equipment and device collaborators, including 5G device producers that incorporated Epsilon's 5G technology, lay in their capacity to guarantee the requisite level of integration for ultra-reliable low-latency communication. Concurrently, software partners who developed an assortment of communication application programming interfaces (APIs) such as Voice over Internet Protocol (VoIP), Short Message Service (SMS), integration of social chat platforms (e.g., WhatsApp, Facebook), video streaming applications (e.g., Zoom, Teams), verification applications, and overall omnichannel communication management, served as vital components in driving 5G's commercial value proposition. More recently, partners specializing in the design and development of services that capitalized on Virtual Reality (VR), Augmented Reality (AR), and Artificial Intelligence (AI), which were contingent upon the extensive bandwidth and minimal latency afforded by 5G networks, were anticipated to become increasingly valuable for Epsilon.

Consequently, collaborating with ecosystem partners allowed Epsilon to facilitate a streamlined and effective deployment of their 5G network, accommodating the requirements of diverse industries and fostering the development of a broad spectrum of novel 5G solutions. Epsilon's approach to ecosystem community expansion encompassed *conducting a heterogeneous industry partnership search* to encourage diverse collaboration, *conducting a value complementarity assessment* to uncover mutually beneficial synergies, and *developing a partner engagement platform* to streamline communication and education among partners. Implementing these steps significantly contributed to the successful formation and sustainability of Epsilon's innovation ecosystem.

Conducting a heterogenous industry partnership search. Epsilon was proactively approaching partners using desktop research, industrial events, and conferences. Epsilon's manager guided us though the entire process as follows:

> Essentially, it's a 'need to partner' that we want to find. From Epsilon's side, it could be as simple as: we need devices that are 4G and 5G. And then, we say, "Okay, who are the leading players in this vertical who have devices?" And then, you start listing; It's pure desktop research. You check, okay, do they have 4G today? Who is the manager for typically remote site connections? That's where you typically find the 4G options, and then you reach out. And you do this kind of standard lead team approach, or you find them in an event, wherever.

As a heavyweight telecom technology provider player with a high centrality position in the industry, Epsilon was proactively approaching partners by providing visibility and promotion on the Epsilon's innovation ecosystem website. For instance, a manager shared with us one situation with a prospective ecosystem partner.

> We started from the device side, we say, "Oh, we see that you have 4G/5G options. We are super happy that you have that. So, can we just promote that from your side?" So then, they are typically interested in, okay, free marketing from Epsilon, that's a good start. Because every time our customers, or internally, are asking what 5G devices we have out there, we don't have a good answer, but we are now building this ecosystem, and we want to refer to this page so everyone can find it.

In its efforts to map out the most ecosystem-relevant partners, Epsilon invested in both horizontal and vertical partnership search. As a conventional technology provider, Epsilon had to scan for partners both inside and outside the traditional industry boundaries. Initially, 5G devices found applications in IoT warehousing solutions by reducing the use of manual labor, the incidence of errors, and increasing the speed of processing and managing inventory. Therefore, the warehouse automation was an early showcase where reliable, secure, and real-time 5G solutions can enhance the customer experience but also unlock efficiency and profits. Later, Epsilon expanded to mining, manufacturing, ports, airports, energy plants, and other industries. A senior vice president at Epsilon provided insights on how broad and deep its scanning activities were.

> In the beginning, we were focusing just on factories and warehouses. We also saw the need for going broader, especially where the seamless communication is required between a specific site and what's happening outside. So now, we have the focus on six new vertical sites, still industrial sites. It can go from a nuclear power plant with very mission-critical activities to underground activities in mining, or oil refinery, far away. The question was, do you go purely horizontal? No, we don't. But, we have to always think about the T model, that you can't go too deep.
>
> So, right now, we're putting significant effort into both research, engagement, building up the ecosystem, which means that we're not just going horizontal, we're going deep, vertically.

Situated at the core of the telecommunications industry, Epsilon lacked a similar central position in other sectors where the development of 5G solutions was on the rise. Epsilon's management acknowledged the necessity of enlisting the support of prominent partners, ranging from software developers to device manufacturers, and from system integrators to consultants within industry-specific domains. Consequently, to achieve market penetration in these domains, it was imperative for Epsilon to identify and map out key partners within each respective area.

> We sell to and through the operators, and we help the operators go to market in selected industries, but that's important to understand for the mining companies, or any business, right? They have their usual suspects that show up in any procurement they do. They're the lead at size in that industry; if it's Hitachi and Capgemini and the likes, in the forest industry, it happens to be Capgemini, Tieto, and AFRY. Those are the three; they're always there. It doesn't matter what you want to do; if you ask for IoT or an HR function, those are the three.

With a total pool of over 900 mapped partners, Epsilon had to develop a new categorization of partner types. Today, Epsilon's innovation ecosystem has mapped out hardware (e.g., HMS, GE, AVI, AMIC) and software vendors (e.g., PTC, SaS, SAP), system integrators (e.g., Accenture, Capgemini, Fujitsu), OEM partners such as large manufacturing firms (e.g., Epiroc, ABB, Hexagon, Bosch, and Atlas Copco). A Senior Vice President explained:

> We had to divide our partners into different categories. We have the software application partners, we have the hardware and device partners, we have business advisors/system integrators (SIs), and we have OEMs.

As 5G solutions has proved to be an enabler for automation across multiple industrial and applications, Epsilon has reached an astounding portfolio of on-boarded partners. An ecosystem managed explained the maturity of their ecosystem work:

> Partners that we have span across multiple industries, so we got that, in addition to what we aimed to do in the beginning. Right now, we have 900 partners on our (ecosystem) partner relationship management portal. We have 62 official partner companies that are onboarded. So, this is real.

Next, based on the previous relationship with partners and the success rate of proposed leads, Epsilon began prioritizing the partners based on previous engagement, such as the number of leads that led to commercial solution delivery. An executive, continued, with an interesting parallel between friends and partners:

> So, I would divide them into those two categories, like all the ecosystem partners, which means they are scope scale, or they are, let's say, the more strategic. I could refer to it as friends. We all want to have as many friends as we possibly can, because it's always nice to have friends.

Table 2: Innovation ecosystem partnership typology

Innovation ecosystem partner type	*Strategic partners*	*OEM partners*	*Software and device vendor*	*System integrators*
Description	CSP/ISP (e.g., Telia, Tele2)	Industry leader Key player in the industry vertical	Technology vendors for software and hardware modules	Consulting firms Implementation firms

Conducting a value complementarity assessment. Epsilon recognized the need to develop an effective way to assess what different ecosystem partners were bringing to the table. A senior executive provided insights on the importance of having a clear letter of intent where ecosystem partners would present their plan on how to unlock opportunities with 5G connectivity solutions and what would be their role in the ecosystem. An ecosystem manager explained the importance of assessing the partner's complementary potential in the letter of intent.

> So that's why on the first phase here, I don't accept any partners if it is not clear, and we can translate here, a clear one pager of intent. What are we trying to get out of this? And how does this complement our products? Can we sell more private network if we do this with this partner or not?

Next, the success of the innovation ecosystem was strongly dependent on the Epsilon's ability to seek a clear join value propositioning. This clarity is essential for building mutually beneficial partnerships that create value for all stakeholders. Therefore, Epsilon tried to avoid lukewarm or vague solutions, as this can lead to confusion and dissatisfaction in innovation ecosystem. To establish successful ecosystem partnerships, partners had to understand the fundamental offerings of Epsilon and collaboratively strive to identify opportunities for joint value creation. Therefore, in the initial stages of collaboration, it is crucial for businesses to focus on gaining a thorough understanding of each other's offerings and exploring potential synergies. By doing so, they can develop a clear and compelling joint value proposition that meets the needs of their customers and creates sustainable competitive advantage in the dynamic 5G ecosystem.

> And the fundamental thing for succeeding with the ecosystem and the new business model is that you have to be crystal clear with what you are selling. If you are not 100% clear, then it's very hard for any ecosystem partner to help you, to work for you. Then, if you step in and be gray with overlaps, like I may be doing this or I could do that, that is not good. You have to be, "This is what we're doing. You don't like it, you're not part of our ecosystem. But if you like it, we'll rock." And usually, this is very beneficial for all partners because it's not good with lukewarm or gray salts. You have to be very clear where you put them on the plate.

> I mean, maybe step, step one is to have them understand our offering, and we understand their offering. So, we kind of have, I mean, the fundamental offerings understood and then also to try to look at what would the joint value be? So, we have some kind of understanding why they are interested, also why are we interested in them, and the joint value.

To identify relevant 5G-related opportunities, Epsilon needed to assess the industry-specific processes. More importantly, these opportunities were not always evident on first sight. A senior executive explained:

> Take either equipping those people in the mine with devices that make the vehicle aware and can automatically brake, right? None of that actually requires cellular technology. You need a radar and a radar connected to the brake of the machine. You don't need cellular technically. There are many ways of solving it. But, when you put all the use cases together, we're going to have remote controlled vehicles. We're going to have remote inspections, with 4K cameras, and different types of drones that could fly close, and do the inspection. Well, when you stack them all together, a cellular connectivity in the mine could be a solution to do the low-latency remote control vehicles.

On the other hand, Epsilon recognized that their deep industry knowledge in the 5G market has limitations when it comes to digital solutions in various industrial applications. Therefore, assessing the internal capability gaps was a vital reality check for Epsilon.

> So, 90% of all IoT is not cellular, which means that Epsilon can never be the leader in IoT. Just by share and market definition. Because 90% doesn't even touch a cellular component ever in the value chain, right? And we've got to remember, connectivity is only, like, I don't know, 5, 10%, I guess? Depending on who's making the calculation, the connectivity part is 5 to10% of the total value unlocked. If we are all in that 10% out of those 5 to 10%, we cannot be seen as a leader. We can be seen as a thought leader.

> We have identified what they have, they know what we have. They need to have that knowledge to share our 5G in the world, right? So, from their perspective, we make sure that they are trained, they understand the system how to use it.

Developing a partner engagement platform. Epsilon created a collaborative digital platform that provides a secure and accessible space for partners to interact, share insights, and collaborate on new ideas. This included implementing social features such as chat, forums, learning modules, and project management tools that facilitate open communication and idea exchange. Importantly, Epsilon implemented an interactive partner onboarding process that enabled new partners to integrate into the ecosystem and quickly formalizing partnership agreements via digital signature to facilitate the process, allowing partners to generate value. Therefore, with promising ecosystem partners Epsilon proceeded with onboarding partners and signing the ecosystem partnership agreement, which included a non-disclosure agreement (NDA) on research and development efforts and co-marketing agreements. The engagement platform played an important role in scaling Epsilon's efforts to simultaneously engage with multiple partners. The senior executive explained:

> We give them access to our part portal, where we have all the training, we have all the documentation, so they really can understand what's there. What can our solution do? And, and in a similar way, we try to understand them what, what do they do, how do they create value? So, we can kind of map them into the ecosystem. When can we use them?
>
> And then we initiate and use primary DocuSign as just a click to accept, and the marketing agreement that is pre-populated, PRM onboarding out of our partner relation management portal. But this is all going in parallel, so it's not that you have to wait for one step. They can execute them.

However, the intention was to push the relationship even further that that required training the partners. Epsilon leveraged scalable learning modules that enabled partners to get trained and learn. Providing such support for partners to develop their skills and capabilities. This approach promoted a culture of continuous learning and skill development, empowering partners to generate new ideas. More importantly, Epsilon recognized creating scalable learning modules on the partner engagement platform in order to effectively engage with a number of ecosystem partners.

> No one is reading 45 pages of Word document, okay. Then you do a PowerPoint. Yes, but then they quickly run into conclusions that it's not really well educated, because you have to flip through quickly and you only see slides. So, then we thought, let's create the learning module that is online that they have to go through, all the ecosystem team members, and pass. So, it actually worked well.
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> Getting a whole industry to change requires that we automate, ensure that our partners get trained, and that we give them value fast, and that they have access to material.
>
> In the initial first few months, we take more an active role that also gives us the insights into how the product is being developed and enhanced, firsthand, and ensure that we're building up our training material for our ecosystem partners in the best possible way.

As a thought leader in 5G, Epsilon had a very knowledgeable group of experts who also worked on evangelizing 5G technology by providing probono consulting to prospective ecosystem partners. In addition, Epsilon provided gamified partner training and validation that incentivized partners to engage in generative activities and share their knowledge and resources. Training on the engagement platform included partner gamification. Ecosystem partners were incentivized to complete learning modules and achieve differentiation in relation to other partners using innovation ecosystem badges. Once the co-marketing agreement was finalized, the ecosystem partner could display badges on its own and Epsilon websites.

> We're kind of spreading that for free to that ecosystem. And I think that's... like if you look specific on our device, the part of the ecosystem, we have a very knowledgeable device group who actually consult them to see, okay, what is the bands that are coming up now with industrial spectrum in some countries, all of these headaches that they typically anyways need to spend a couple of days on, and they still don't understand it because it's a complex world.
>
> In that sense, it becomes more like you're leading partners in a direction and educating and enabling them to be very good at this direction that you're leading them into, which for us is 5G.
>
> A little bit like gamification of the whole ecosystem work, like introducing that, just like you can start out in our ecosystem, and if you do more to incentivize activities with us, that's what we're spending a lot of effort on right now, because it's unsustainable for us to sit and do one-on-one with every partner. That's just the traditional Epsilon way to run our partnerships, but since we need to change the whole industry. You do the online training. And every partner that we have, if you have four employees (from partner firm) that have done the training, they get a badge, and that's the whole gamification.

Finally, Epsilon ensured that the business leads were collected in the partner engagement platform. Using a partner engagement platform to collect leads provided an effective and transparent overview of the prospective leads but also ensured that the partners are knowledgeable about the process of collecting leads. An ecosystem manager explained:

> So, this is for all of our sales team to be able to easily present to our customers to trade the lead generation that is here. So, we have a lead generation tool that we have a partner-generated lead. Like if they are tracked there and we move them over and actually close the deal, that's how we are measured as a central team to ensure that more leads get into a closed deal.
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> And then we have created these brochures and explanations for all the partners. How do you do the lead generation, how do you partner landing pages, and so on? And then we can explain it in more detail throughout this whole journey for anyone that needs it.

Value architecture envisioning

Value architecture envisioning is a structured approach to designing a modular and flexible solution that enabled ecosystem partners to co-create new value in a generative way. At the heart of this approach is a layered modular architecture that allowed Epsilon to engage with partners to integrate their expertise and resources in a digital-ready 5G solution that is flexible and adaptive. Additionally, value architecture envisioning involved co-creating technical blueprints that enabled partners to create new digital options, identifying innovation ecosystem gaps and bottlenecks, use case identification and development of trial solutions kits.

Leveraging layered modular architecture. As a leader of this 5G innovation ecosystem, Epsilon defined modular supplier perspective with a focus on local, business-driven initiatives and scalability. Epsilon leveraged a modular supplier position with deep competences to foster a collaborative environment rather than leading by force, ensuring that decisions were driven by the unique needs of each region. By prioritizing modular approach to build scalable solutions, Epsilon successfully supported the growth and innovation of the innovation ecosystem while maintaining a customer-centric approach.

> So, our strategic attempt is not to be the sum that all the other system players have to circle around, more that we are one piece of the building block. But we are going to be the one best piece of that building block, so by default, most selected. That's where we believe that we will end. The reality, though, is different in the first phases of deployments. So, awareness and understanding, and the competence around 5G is limited, today. Hence, the balance of power, you could say, shifted towards ours, because there is no one that really knows how to integrate the 5G system. We have to do it, which means it gives us an opportunity for Epsilon to take that role and sell that service.
>
> Yet, it is not our intention, to build up a strong system integration arm in Epsilon. Again, we've done that before. It didn't turn out well because of the risk exposure. We rather want to keep that locally, business-driven, if we think about scale, here.

With superior modular expertise, Epsilon leveraged interdependence to other ecosystems to create flexible and scalable solutions. By utilizing a modular approach, Epsilon efficiently collaborated with partners across different industry ecosystems, fostering innovation and driving value creation. This interdependence allowed for seamless integration of new technologies and services, ensuring that prospective 5G solution remained agile and adaptable to emerging opportunities.

> Leverage strong interdependence to other ecosystems with many potential partners. The other thing that we did was that since most networks are multi-vendor networks, we did a lot of making sure that our network equipment, our radios worked with someone else's core and our core worked with someone else's radio, and so on.

Next, Epsilon recognized the complexity of 5G solutions, with numerous components and partners that required careful mapping and integration. Epsilon ensured that there is a shared understanding about how all the pieces of the innovation ecosystem are mapped out considering a technology layered architecture, ensuring system interoperability. Drawing inspiration from LEGO Technic, Epsilon approached this challenge with a similar mindset, constructing prospective 5G solutions piece by piece to build a robust and flexible 5G innovation ecosystem.

> It's a little bit... I think you talk about the LEGO piece there, and I think there's a really good learning. So, 4G, this one when you build was fairly small amount of pieces, very simple things you build. You build the ambulance, you build a police car, and those kind of things, and 46 pieces. When does this start? Four years old, then you could do these kinds of things.
>
> The McLaren GTR is like 830 pieces. So, 5G is very much from an ecosystem development perspective, it is like playing with LEGO Technic. Because you got more pieces, you got way more flexibility in creating a variety of different things, but without the map and 860 pieces, even an experienced LEGO builder or an ecosystem builder in this world struggle to put it all together. This is how I visualize to people what's happening in the ecosystem. It's not necessarily replicable, but this is highly replicable. With 5G ecosystem, we're up to is pretty much this.

As Epsilon progressed with the development of the innovation ecosystem, management endeavored to ensure seamless integration and functionality across various components, such as devices, networks, and cloud systems. The focus was to support diverse industry applications and implementing advanced features, necessitating a more complex arrangement of building blocks. In that context, Epsilon devoted significant effort to ensure complementor interoperability within the ecosystem to guarantee compatibility and smooth functioning. For instance, concerns about the compatibility of third-party applications with the Epsilon network did not arise, as these discussions and necessary adjustments had already been addressed.

> As we move forward with the ecosystem development and we're doing more. This is like putting together making sure that a phone works with a network and a centralized cloud at the other end. As we're looking more to support different industry applications and doing more advanced things, there's more elements in the building block.

There is a lot of effort put into securing interoperability and relationships and so on within the ecosystem. So, no one called, "Hey, will my Airbnb app work with an Epsilon network?" Those conversation and so on didn't take place.

Co-creating concept solutions. As part of the value architecture envisioning process, Epsilon actively engaged in co-creating concept solutions, focusing on several key elements. Epsilon collaborated with partners to co-develop technical solution blueprints, fostering joint value propositions and aligning efforts with industry-specific configurations. Additionally, Epsilon identified innovation ecosystem gaps and bottlenecks to address potential challenges. This approach also involved use-case identification and the standardization of trial toolkits, ensuring that our concept solutions were both relevant and applicable to a wide range of industries and scenarios, ultimately driving value and innovation within the 5G ecosystem.

Therefore, Epsilon embarked on the process of partner-specific technical solution blueprint co-development, collaborating closely with ecosystem partners to establish a joint value proposition for potential use cases. This involved aligning and emphasizing the mutual benefits for all partners involved. In developing the technical blueprint, Epsilon not only assisted partners in its creation but also helped produce joint brochures that effectively communicated the combined value of the partner's solution and Epsilon's expertise. This synergy showcased the competitive advantage of developing 5G solutions within the innovation ecosystem.

> Here it's content creation, making the technical blueprints, creating our joint value propositions. There has to be a clear win-win in this.

> Technical blueprint, they have to do, and we have to help them to create the joint brochures that explain the value of why the (ecosystem partner) solution plus Epsilon’s solution is so good.

> So, when it comes to the device vendors, we make sure that the devices and ecosystem are tested and, and kind of qualified. We try to make it as easy as possible for them to reuse the other pieces of the ecosystem and build on top of our product. We make sure that they have these building blocks readily available. When it comes to the system integrators or the independent software vendors, we make blueprints together with them. We give them access APIs. It's kind of free, integrated, again, making it very easy for a system integration to take that building lock and put it into the complete stack solution. And with OEMs, we work together with them, so they can integrate 5G into their products.

Epsilon recognized the importance of learning industry-specific configurations, acknowledging the valuable insights gained through close collaboration with partners possessing deep industry knowledge. By conducting technical sessions and creating blueprints for end-customer 5G solutions, Epsilon was able to acquire substantial understanding of the unique requirements and configurations needed for each industry. Epsilon approached this learning process with humility, prepared to make adjustments based on the specific needs of each industry and adhering to relevant certifications and regulations, such as those required in the mining sector, as highlighted by the Epsilon executive.

> But then, it comes to technical stream; we also have the educational part. So, we kind of use that carrot a little bit, you know, what do we get in return. But what we get from them is very deep industry knowledge. When we do these technical sessions, we do a technical blueprint on how an end customer solution would look like with a private network. And that's where we learn a lot.
>
> You would miss a lot of those industry specific configurations that are needed. So, we have to be humble, and be prepared to do adjustments based on the specific industry as we learn. With certain certification that comes in, for example, mining. With blasting, that has to be approved for certain certification areas. We are very humble when we step into these industries.

The subsequent stage in the process entailed identifying and addressing gaps and bottlenecks within the innovation ecosystem. Frequently, during the technical blueprint co-development sessions, previously unrecognized gaps would emerge, prompting Epsilon to either approach and onboard new partners or utilize existing partners within the innovation ecosystem's pool. This iterative process facilitated a more comprehensive understanding of the ecosystem, enabling Epsilon to continually refine its approach and optimize its ecosystem partner for maximum combinatorial innovation.

> When we have done this technical exercise, we also start to understand where we have gaps, and then, who are the other partners that we need to get into this. It's in the process, but it's typically pops up by itself… okay, but who are the customers that we could put this account through, and this is like a great thing to do.

Ultimately, Epsilon concentrated on use-case identification and standardizing the setup of trial kits to expedite the prototyping process for solution development and deployments. By engaging partners and leveraging their enthusiasm and expertise, Epsilon facilitated the development of trial kits, which were then tested and made available for market adoption. For instance, through collaboration with HMS, Epsilon launched 5G starter kits based on their equipment, and HMS combined their efforts with ifm, the world's largest sensor provider. This strategic approach enabled partners to create 5G solutions, making Epsilon increasingly relevant to their respective industries. Our informant explained:

> And then, we have this use case identification where we define what use cases can you enable. What is cool, then, if you just give your partner a little bit, they get excited and put their passion into it. Like HMS, they now start to see that there is a need for having trial kits. We have talked about trial kits for a while, but then they just made it happen, and now you can order it on their page. And we made sure that we tested it. And it helps us because we need to get more and more devices to adopt 5G solutions, and they combined that with ifm, which is the world's largest sensor provider.
>
> They launched their starter kits for 5G, and they are doing that based on Epsilon equipment. They're putting in their coming POC-2-Cash analysis and presales activities from KPMG that they promote. So, if you do things right, the partners trade the assets for you and make you relevant to their industry.

Unlocking combinatorial innovations from generative innovation ecosystems

The goal of Epsilon's 5G innovation ecosystem was to expand the value of Epsilon-powered 5G solutions across various markets. However, each 5G solution necessitated a custom combination of different ecosystem partner types, including software and device vendors, system integrators, and OEMs. Therefore, the generative levers developed in the formation phase of the innovation ecosystem allowed Epsilon to effectively participate in diverse 5G solution deployments. More specifically, we identified that innovation ecosystem formed in a generative way rendered two layers of combinatorial innovations with distinct characteristics, viable and emergent innovations. Viable innovations were strategically planned with key industry partners and consisted of core innovations that enabled spatial expansion of a wide range of highly replicable and scalable 5G solutions for diverse market needs and requirements, and modular innovations that allowed complexity expansion and different partners and components to connect, interact, and create customized value together. These inherently generative viable innovations provided a solid base for the further generative growth and advancement of 5G solutions. Concurrently, emergent innovation was building on top of viable innovation and comprised of complementary innovator attraction, which facilitated proximate search and the integration of known innovators, and exploratory innovator search that enabled distant search and the emergence of previously unknown innovators, expanding the value of generative innovation ecosystem.

This layered and generative approach to innovation allowed Epsilon to continuously evolve and enhance the 5G innovation ecosystem, fostering a dynamic and adaptable landscape for technological advancement and effectively addressing the challenges posed by the diverse nature of 5G solutions.

Viable innovations

Core innovation. As part of the viable innovation, core innovations unfolded through strategic use-case deployment with industry leaders, engaging in structured problem-solving, and designing scalable solution deployments with the generative outlook to enable multiple opportunities around the focal solutions. In the context of strategic use-case deployment, co-creation occurred through collaboration between prominent partners, such as industry giants. These projects with leaders in their respective industries fostered innovative solutions, as they jointly addressed complex challenges, leveraging their combined expertise and resources to generate innovative 5G solution deployments. A director of 5G North America explained:

> The co-creation can happen in two fundamentally different ways. It could be like two companies, big companies that get together. So, an Epsilon working with a Meta or Apple or Ford or someone like that. When there's two big companies working together where the viability of each company is unquestioned, they're typically the leaders in their specific industry, or they get together and start talking about, "Hey, we're trying to solve this and this and that and this."

Next, from the Epsilon perspective, engaging in structured problem-solving involved addressing the specific needs and concerns raised by application owners, such as car manufacturers. For instance, when approached with inquiries regarding the readiness of 5G networks to support assisted driving or autonomous vehicles, Epsilon assessed the extent of network connectivity along various roads. By evaluating whether the 5G network coverage was sufficient for the intended application, Epsilon effectively addressed the challenges and ensured that the proposed solution could be feasibly launched and operated within the 5G infrastructure.

> It's typically the application owner, like a car manufacturer, someone that comes to us and tell, "Hey, we're planning to do the following. Are the networks ready to do that?" Take a very concrete example, if you're going to put assisted driving or autonomous vehicles on roads, you more or less need to understand, hey, which roads are connected? Is 10% of the roads connected or 80% of the roads connected? Can I even launch this service with an understanding that the reach of the network is good enough for the application I'm trying to use?
>
> If they can describe that, like the first three applications that's going to drive the initial investment, if that is a sports venue or a university campus, or a manufacturing plant, and so on. Whatever it is, if you can explain those things, you most likely have the chance to go.

Designing scalable solutions was a crucial aspect of Epsilon's approach to core innovation. By identifying and understanding the fundamental components of various industries and applications, Epsilon was able to strategically tailor their solutions to meet the specific needs of each sector. By asking teams to define the essential elements of their objectives, analogous to the "burger, French fries, and soda" of their projects, Epsilon ensured that the first few key applications driving initial investments were well-defined, whether they were related to sports venues, university campuses, or manufacturing plants. This focus on scalability and adaptability enabled Epsilon to create solutions that had the potential to succeed across diverse contexts and industries.

> So, getting to the point where all the different pieces in the ecosystem required understand, "Hey, we are part of the basics for a given industry, a given application, a solution so that they see, "Hey, we can answer the question..." I always ask the question to every single team I come across, "What's the burger, what's the French fries, and what's the soda in what you're trying to do?"
>
> When I look at what it takes to deliver those solutions and getting out to the market with them, it's a little bit like going back to 1938 when McDonald's was established. You don't have to have everything in place, but you have to have burgers and French fries and something to drink. If you miss out on one of those, you can't really open your burger restaurant.
>
> So, you have two different fundamental movements going on in the ecosystem, which is about, how do I for a new industry or a given box of some shape that I define, how do I get a base solution in place, so I get from zero to one?
>
> And the next thing is how do I scale that to more locations? So, if I can sell... It's like in Sweden where the first McDonald's was at Kungsgatan in '23, how do I scale that to Hamngatan? If you got all the basic in place, you got hamburgers, you got French fries, and you got soda. You got all that juicy stuff in place, getting to that point through a pilot or something so you get something that is scalable. You cannot go in and build everything from scratch all the time.

Modular innovation. As part of the viable innovation, modular innovation played a critical role in utilizing the generative potential of Epsilon innovation ecosystem. This approach encompassed activating a wide range of ecosystem partners to extend the 5G solutions, ensure ecosystem agility, and further configure viable innovations to meet the specific needs of different industries and applications. The activation of onboarded ecosystem partners was crucial for unlocking the generative potential of the innovation ecosystem, facilitating Epsilon's innovation ecosystem expansion, diversification of offerings, and addressing a broader range of market needs. By engaging with ecosystem partners and promoting their active participation in local markets, Epsilon successfully established a vibrant 5G innovation ecosystem that spurred innovation and value creation across multiple industries. This approach also enabled Epsilon to efficiently scale their solutions and replicate successful implementations across various markets but also ensure a high-quality customization of 5G solutions.

> I think it's quite easy to scale, but with what we've seen is we need to activate the ecosystem in the local market as well, because even if we have done and we have a we have done something in one market and we can't have domestically, they move to another mark and say, yeah, we won't want to do the same thing as you did in Finland.

> They are so big companies, they understand what value they bring into a specific deal. A completely different scale is when we work with very small niche companies.

Modular innovations ensured core innovation agility to adapt and respond to diverse market demands and partner requirements. By maintaining a high degree of flexibility within the ecosystem, Epsilon was able to cater to a wide range of 5G solutions applications, from large-scale rollouts to smaller, specialized solutions tailored to specific industries and verticals. Modular innovations allowed Epsilon agility to support and accommodated various configurations and solution deployment types, fostering a dynamic environment for continuous growth.

> You have to create an agility within the ecosystem not only to deal with Brie guys rolling out 40 kilos at one end and out 40 kilos at the other end. That's still super important, but you have to be able to add the capability on top of it, like, hey, coming in with 200 grams of Bries that are going to go through the

> system, and 20 grams of Gorgonzola, and so on. Those are each and every individual solution that is created for an industry and a vertical and so on.

Epsilon placed significant emphasis on configuring customized solutions to accommodate to the unique needs of diverse industries. Drawing from the empirical analogy of parmesan wheels, Epsilon recognized the importance of delivering highly specific and well-defined solutions to meet the demands of various market segments. By focusing on custom configurations, Epsilon demonstrated its ability to provide tailored and targeted 5G solutions that addressed the distinct requirements of their partners and end-users, driving innovation and value creation within the ecosystem.

> They (customers) want everything customized to solutions to becomes customized you pick together the parts that fits that. When we are looking at SMEs and how do we scale it to them, they want something that is kind of off the shelf. And there, I think there is a smaller ecosystem, we have solutions that is prepackaged. We create that together with the whole ecosystem.

Emergent innovation

Complementary innovator attraction. As part of the emergent innovation, Epsilon focused on complementary innovator attraction in order to expand the generativity of viable innovations, which encompassed three key aspects. First, Epsilon actively supported and accelerated global 5G startups, helping them grow and contribute to the overall 5G innovation ecosystem. Second, Epsilon played a crucial role in matchmaking partners for innovation, fostering collaboration and synergy among the innovation ecosystem participants. Lastly, Epsilon was leading as a complementor, and enhancing the value of other ecosystem partners, known and unknown, by providing expertise and resources that enabled the expansion of innovative 5G solutions.

In the context of complementary innovator attraction, Epsilon actively accelerated global 5G startups by fostering a second layer of combinatorial innovation that built upon the viable innovations. Drawing inspiration from the evolution of menu offerings at fast-food establishments like McDonald's, Epsilon understood the importance of catering to diverse and changing customer needs, which could be achieved by enabling startups to develop unique and innovative solutions. By creating an environment where startups could thrive and contribute their own "menu items" to the 5G ecosystem, Epsilon expanded the range of use cases and applications within the 5G landscape, ultimately driving the innovation ecosystem forward.

> The second wave of that evolution is when you look at what's happened at McDonald's. There comes in a guy at six o'clock in the morning and he goes, "Hey, what do you want?" "Do you have a Big Mac and company?" And say, "Hell no, I want to stay awake until I get to work. Do you have coffee?" Then you can add coffee to the menu. And then the soccer mom comes in with four kids at four o'clock in the afternoon and say, "Do you want four Big Mac and company?" "No. Hell, no. Do you have some nuggets, so the kid survives the practice this afternoon?" And then on Sunday people come in and say, “Do you got any dessert? Can I get some nuggets, or can I get some apple pie, or some sundaes, and stuff like that?"
>
> So, the other thing that we're doing is when someone has a small cool innovation of some shape and form, typically a startup they've come up with something, then they go to Epsilon startup 5G.
>
> And also, and also being a global player when we act in, in Asia, we can see, yeah, these are the learnings we, we have from working with European companies and that's often insights that they don't have. So, that gives us an advantage, even if we don't, we are not super experts in their vertical, we bring something that they don't have.

Epsilon played a crucial role in matchmaking innovators and ecosystem partners and eliminating potential bottlenecks. By launching the Epsilon Startup 5G initiative, Epsilon created a platform that connected large service providers with smaller, innovative companies, essentially functioning as a “smörgåsbord” of opportunities. This approach not only facilitated collaboration and co-innovation between industry players but also provided startups with access to valuable market insights and the ability to validate their solutions within the context of Epsilon's innovation ecosystem, thereby fostering an environment of mutual growth and innovation.

> And Epsilon startup 5G, you can say that is like a... What we're trying to do there is that it is hard for each and every mobile operator to choose to identify and find good innovative companies to work with.
>
> Whether it's like this huge company, they are looking at billion-dollar additions to the revenue streams, working with the company, which is 20 employees, and so on. Especially if with over 700 service providers going to hunt out, where does those company exist, what do they do, and what's possible?
>
> So, the Ericsson Startup 5G initiative is essentially see it as a smorgasbord where we on one side inviting large service providers, come and look at what we have on the table. Then on the back door, we're inviting small and interesting companies to come in and present what they have.
>
> When those guys then go and pitch and we put them on the Christmas table or smorgasbord, they can tell, "Yeah, okay, what do you know about the market?" "Yeah, we've tapped into everything Ericsson knows, so this is how we position ourselves." "And does the work?" "Yeah, we have tested our stuff with Ericsson's network."
>
> We started two years ago, we started in the middle of the pandemic. In 2020, in the fall, we created a meeting place for... Because the first part of this is essentially... It's a bottleneck, but it's also a question of who need to be connected to who? Who is going where and why? We had a vision that, "Hey, we should create a meeting place where people can come and talk about the new cool things."

Instead of taking on the role of a prime system integrator, Epsilon focused on supporting the ecosystem by leading as a complementor and providing the most accessible and easily integrated customized solutions, facilitating the use of its 5G as an industrial digital backbone. This strategic decision allowed Epsilon to minimize risk and foster an environment in which a diverse range of partners could collaborate and innovate, ultimately contributing to the growth and success of the innovation ecosystem as a whole.

> In any type of deployment for any industrial site, it requires a lot of products and solutions coming together. And it's by default, usually, a system integrator (SI), and a prime system integrator that take that role. Epsilon has, in the past, tested to take the prime SI role. They have a very strong system integration capacity at Ericsson. Usually, that also incorporates a lot of risk. So, as we now develop this ecosystem, our strategy is quite clear. We want to not be the prime integrator. We will have the most and easiest way to integrate product. As many partners as possible feel familiar with, have been trained upon, so that 5G becomes the industrial digital backbone for an industry.

Exploratory innovator search. Emergent innovations, such as experimental innovations, played a pivotal role in facilitating the rise of unknown innovators by augmenting local innovation impact and capacity. This was achieved through initiatives such as hackathons and innovation hubs, which fostered cross-pollination of ideas and applications across unfamiliar industries. Moreover, the engagement of complementary General Purpose Technologies (GPTs), such as artificial intelligence and virtual reality, further enriched the innovation ecosystem by providing diverse, synergistic opportunities for collaboration and development.

Epsilon strategically focused on enhancing global-local innovation capacity by establishing innovation hubs and organizing hackathons across various regions. For instance, Epsilon established centers across the globe to foster a conducive environment for ideation and experimentation. The remarkable achievements of participating teams in these events demonstrated the immense potential of digital innovation across different regions, showcasing Epsilon's commitment to fostering talent and promoting cutting-edge technological advancements on a global scale.

> So, there's a second wave of innovation that takes place in the ecosystem, which is outside of the core thing, and that is more or less happening locally. And once the foundation is in place, people start looking at that and seeing how that is driving.

> We're doing that very much as part of the Epsilon (innovation hub name). That is innovation activities that exist both in the (country) and in (country) and a few other places, but we have a center in Silicon Valley where a lot of those kind of collaborations and so on take place.

> The remarkable level of ingenuity and creativity shown by the winning team is a true testament to the exceptional talent in the (country) and the immense potential of digital innovation in the region. We at Epsilon take enormous pride in promoting digital innovation in the (country), and we look forward to enabling many more experimentations at the frontier of technology.

Epsilon also facilitated the cross-pollination of diverse ecosystems that transcended traditional telecom-centric ecosystem boundaries. This ecosystem fostered experimental innovation by facilitating strong interactions between 5G, IT, and various industry verticals, creating an unprecedented level of interconnectivity. As a result, Epsilon contributed to the evolution of the 5G ecosystem into a highly dynamic and diverse environment, catalyzing innovation on a scale larger than ever before, and fostering the development of groundbreaking solutions across multiple domains.

> The first thing that is important to see when you look at the ecosystem with 5G, this is an ecosystem where 5G and IT in different industry verticals meet. It's not only a 5G network telecom-centric ecosystem. It is like a vital ecosystem that interconnects a lot stronger with IT and a lot stronger with different industry verticals and so on.

> This one goes back almost to 2008-9 when we start to get those kind of requests. But it's clear that the ecosystem, it's a way bigger thing. Way bigger and more interconnected than anything you have seen before.

Epsilon strategically engaged with complementary general-purpose technology (GPT), such as AI and VR, to bolster experimental innovation within their ecosystem. By structuring their initiative, called 5G Things, around five key technology areas - 5G, XR, IoT, AI, and cloud - Epsilon facilitated cross-disciplinary collaboration and knowledge exchange, enhancing the innovation process. This approach fostered synergies between diverse technological domains, enabling Epsilon to explore novel solutions and applications that leveraged the full potential of converging technologies.

> So, we created something that's called... It started off as an event called 5G Things. We structured it in five areas: 5G, XR, IoT, AI, and cloud. We thought those were five good technology areas that say, "Hey, these guys need to talk to each other." So, a certain thing is a little bit of edge in cloud, a little bit of IoT, and a little bit of networks.

Towards a generative innovation ecosystem

This study presents a comprehensive exploration of generative innovation ecosystems. We introduce a framework that delineates the formation phase of these ecosystems, from which emerges the layered evolution of diverse combinatorial innovations. In the fostering formation phase, three generative levers evolve simultaneously: Designing Generative Ecosystem Governance, Generative Ecosystem Community Expansion, and Value Architecture Envisioning.

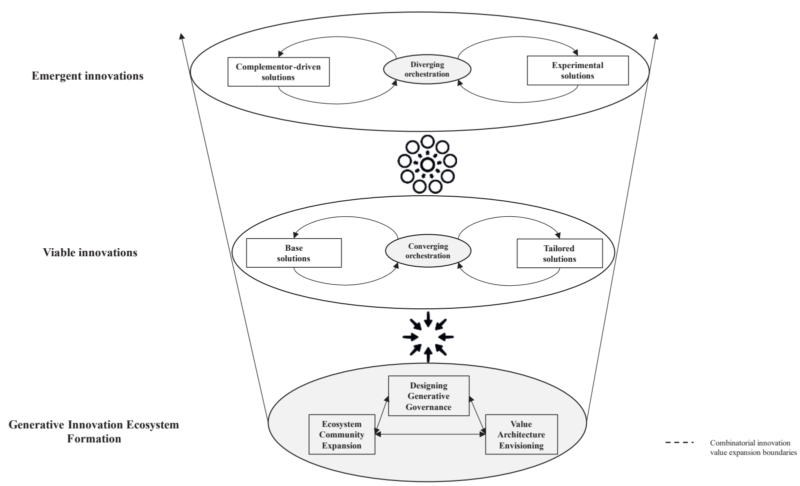
The design of Generative Ecosystem Governance is characterized by shaping an open ecosystem strategy. This strategy envelops flexible yet pivotal rules and guidelines, rooted in collaboration and transparency principles, aiming to seamlessly weave together diverse actors and components. The embodiment of prefigurative collective governance acts as a catalyst, nurturing an environment ripe for growth and innovative exploration. Parallelly, Generative Ecosystem Community Expansion hinges on nurturing a community abundant in diversity and engagement, combining a wide array of expertise and viewpoints. The ambition is to foster an environment apt for collaboration and resource exchange, crucial for churning out innovative solutions that are scalable, customizable, and adept at catering to diverse market demands. A diverse industry partnership search and a thorough value complementarity assessment occur simultaneously to meld various knowledge bases and resources. Moreover, creating a partner engagement platform is paramount for bolstering both scalability in engagement and strategically expanding existing partnerships, enhancing the depth of collaborative exploration. Lastly, Value Architecture Envisioning focuses on harnessing a layered modular architecture as its anchor. This architecture is malleable, streamlining the consolidation of varied components and enabling growth of the innovation ecosystem. The inherent adaptability in this structure facilitates co-creation of concept solutions and devising solutions tailored for industry-specific needs. This adaptability and personalization are pivotal, playing a major role in the innovation ecosystem's expansion by welcoming the onset of novel use cases and applications. Collectively, these three generative levers, orchestrated in harmony, set the stage for a generative innovation ecosystem.

Within this scaffolding, the generative innovation ecosystem unveils a dual-layered design of innovation endeavors. Initially, the generative innovation ecosystem is converging towards Viable Innovations. Herein, Core Innovation embodies activities orchestrated by the ecosystem architect alongside core partners, focusing on spatial expansion across various applications while reinforcing the foundational innovative capabilities of the generative innovation ecosystem. In contrast, Modular Innovation, which offers complexity expansion, involves activities where the architect interacts with a wider range of ecosystem partners, aspiring to build on and magnify the core innovation. This synergy between activities empowers the generative innovation ecosystem to materialize the inherent generativity of the core innovations.

Venturing beyond this convergence, the framework probes the capacity of the generative innovation ecosystem to blossom into a more diverging layer. This second tier is defined by Emerging Innovations, where innovation is not strictly directed. It sprouts organically via two unique avenues. Complementary Innovator Attraction, emphasizing the proximate search, is powered by recognized innovators who infuse complementary skills and assets. On the other side, Exploratory Innovator Search, underscoring the distant search, encompasses ecosystem architect attracting innovators traversing uncharted territories, ushering in unprecedented and fresh innovations.

The proposed framework illuminates the multilayered dynamics embedded within the generative innovation ecosystem. It underscores the delicate dance between formation phase, convergent innovation ventures and the more organic, divergent innovation styles. This nuanced perspective offers a holistic lens, revealing the intricate tapestry of innovation journeys, from their inception through meticulous crafting, to their metamorphosis into surprising and novel generativity forms. Thus, the framework presented in this study stands as a foundational model for navigating the creation and manifestation of generative innovation ecosystems. By demarcating the generative mechanisms and illustrating the multifaceted dynamics of convergent and divergent innovation, it paves the way for deeper insights and beckons further exploration in the ever-evolving domain of innovation ecosystem evolution.

Figure 2: Towards a generative innovation ecosystem



Discussion

In this research, we explored generative innovation ecosystems, specifically focusing on their formation and layered evolution. Drawing from our findings and the framework developed, we contribute to the expanding literature on innovation ecosystems in several ways.

First, our study extends this literature by systematically unpacking the generative levers pivotal in the formation (emergence) of the generative innovation ecosystems. By highlighting the nuances of governance, community expansion, and architecture, we provide scholars and practitioners with a more granular understanding of the levers that can be manipulated to foster generativity (Thomas and Tee, 2020). Specifically, the notion of ecosystem governance in regard to openness and control is expanded with the unique insights about prefigurative forms of governance and "frames" (triangle of trust) that are replicable and malleable across the different contexts and with different partners (Hanelt et al., 2021). Such frames facilitate the community building and value architecture envisioning. Moreover, modularity is presented as a core generativity driver in terms of social structures and digital architectures (Baldwin, 2023).

Second, one of the most overlooked aspects in the prevailing literature is the temporal progression of generativity (Thomas and Tee, 2021). Our study responds to this lacuna by mapping the evolution from initial design of generative levers to the realization of generativity. Building upon Zittrain's (2006) argument, wherein TiVo represents a class of appliances that exploit the generativity of the deeper layers but are not generative in themselves, our 5G contexts present a nuanced contrast. We found that Viable Innovations not only exploit the generativity of the formation layer but also exhibit inherent generativity. This is a crucial differentiation that underscores the dynamic nature of Viable Innovations. Unlike traditional appliances that leverage generativity without contributing to it, Viable Innovations extend that same openness and flexibility to the next layer, that is Emergent Innovations, reinforcing the ecosystem's generative capacity for continuous innovation and adaptability. This temporal perspective is particularly salient for practitioners, as it provides a roadmap for the maturation and evolution of innovation ecosystems, allowing them to anticipate challenges and opportunities that may arise at different stages of the generative innovation ecosystem's lifecycle.

Third, the debate on orchestration the innovation ecosystem literature has been confined to a dichotomy: top-down versus bottom-up orchestration strategies (Adner, 2006; Dattee et al., 2018, Foss et al., 2023). We challenge this limited perspective by presenting an integrated view of orchestration, where converging and diverging are not mere endpoints but fluid states. Our distinction between "viable innovations" and "emergent innovations" paints a vivid picture of this continuum. Viable innovations, with their emphasis on spatial expansion and complexity expansion, serve as converging forces, while emergent innovations, through proximate and distant search, represent the ecosystem's diverging capabilities. Such a nuanced understanding transcends traditional classifications, urging us to appreciate the multifaceted nature of innovation activities within generative innovation ecosystems.

Conclusion

In conclusion, our study shines a light on the intricate dynamics of generative innovation ecosystems, offering both theoretical advancements and practical insights. As innovation ecosystems continue to shape the contours of the global business landscape, understanding their generative potential and the mechanisms that underpin it will undoubtedly remain at the forefront of management research. Our research holds implications for both scholars and practitioners. Academically, we beckon future research to delve deeper into the intricacies of generative levers, perhaps examining them across different underlying generative technologies, industrial contexts, or geographical settings. Practically, our findings offer ecosystem architects a blueprint for fostering generativity, emphasizing the importance of flexible governance, community engagement, and adaptive value architectures. Given the nascent stage of our understanding of generative innovation ecosystems, we believe that there is ample scope for future research.

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