Innovating Mass-customized Service

Application of a service perspective lifecycle innovation management (SLIM) model in an ICT-intensive firm in a fast-changing environment

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Innoveren van mass-customized dienstverlening

Toepassing van een service perspective lifecycle innovation management (SLIM) model in een ICT-intensief bedrijf in een snel veranderende omgeving

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Contents

Preface

This thesis explores the subject of 'innovating mass-customized service', with particular attention to the challenges of managing an innovation process in a fast-changing environment. Both in academia and in business the relevance of integrating the areas of mass customization, innovation management, service perspective and information technology is generally recognized. In this study, a qualitative framework serves as both a tool and a product to develop an integrated innovation management system that can be applied to position, design and organize the innovation process in the above context.

An important motivation to pursue this study was the intellectual challenge to establish scientific foundations for innovation management-related phenomena. This thesis is the result of a research process spanning almost six years. However, the basis for this study was already laid a decade ago when I started recognizing recurrent issues in how the innovation process was conducted within my employer's organization and how this affected both operations and continued innovation in a transition toward a mass-customized service company.

Combining this study with my work as manager and consultant has proved a major challenge. However, because my work practice and study are closely related, the two could be combined well for the duration of the study. I would like to thank my employer, KPN, and a number of managers and other colleagues, specifically the interviewees, for supporting me throughout this study and enabling me to pursue the above combination of activities.

This study could not have been completed successfully without the full support of Professor Felix Janszen, who already agreed to be my promoter before I even started on this adventure. I would also like to thank my second promoter Professor Marc de Jong, who offered valuable comments throughout my study, focusing particularly on the effectiveness of the work. Furthermore, I would like to thank Professor Nico Baken and Dr. Marc Zegveld for their early contributions to this research, and for participating in the extended promotion commission.

I am especially indebted to Dr. Harrrie Bastiaansen, Bert Feunekes MSc and Dr. Bertus Verhage, who meticulously read the entire manuscript as co-reader. Their amazingly complementary contributions substantially improved the quality of this thesis. Furthermore, the manuscript has been reviewed by Beter Engels Vertaalbureau. I would like to thank Jan Warndorff for the careful English editing and useful comments to improve the text. I also wish to thank my friend Tony Ultee for designing the attractive book cover.

I am much indebted to Professor Teun Hardjono and his team of 'Promoveren in Deeltijd' (PiD) at Erasmus University Rotterdam who taught me what it takes to be a (part-time) researcher. The PiD group provided an inspiring environment with a number of 'peers' from various backgrounds. I am grateful for the input and comments by all members of the group. In particular, I would like to thank Professor Frits van Engeldorp Gastelaars for his special role: he provided all kinds of visible and invisible support at exactly the right moments.

Finally, I would like to thank my wife Annemarie van Dijk. Her continuous love, support and patience were indispensible to completing this study.

Rob Reitsma
Nieuw Vennep,
September 27, 2011

1. Introduction

1.1 Background

Mass customization is a business approach that is aimed at the low-cost production of high-variety, even individually customized goods and services (Pine 1993). The concept has predominantly been applied in manufacturing, but it is also increasingly used for mass produced service products to respond to the needs and wishes of individual customers. Enabled by 'next generation' networking technologies, incumbent telecom operators are in the midst of a transition toward a 'flexible factory of innovative services', with a converged network, transporting voice, video and data in one single network, reducing operation and capital expenditure, and making possible new sources of revenue with the combined services (Sato and Dergint 2006).

This research builds upon an in-depth case study within 'Telco', a mid-size European incumbent telecom operator. In various ways and with mixed success, Telco has spent almost a decade attempting to replace multiple product/technology-based silos – which are tightly connected combinations of products and production assets (network infrastructure and human and ICT-based processes) – with a 'horizontally layered', rationalized and modular portfolio of products and production assets. These activities coincide with the gradual replacement of the existing networking infrastructure by an Internet Protocol (IP) based infrastructure. The goal of these efforts is to provide better, integrated and customizable services against much lower cost. This broadly matches the above concept of 'mass customization', although Telco rarely used this term explicitly to label these developments.

Telco has spent almost a decade attempting to replace multiple product/technology-based silos …

From 2000 onward, the researcher became steadily more intrigued by the fuzziness of the application of the terms 'product', 'service', and 'process' within Telco and the effect of this phenomenon on the innovation process, and subsequently on the operational processes. Within Telco, one particular name could interchangeably refer to a product, a service, a process, a technology, or could imply the name of a project or program. Likewise, one particular release number could refer to a new product or platform release, or could imply a project or program phase. How can one innovate for mass-customization, encompassing portfolio rationalization, modularization and 'de-siloing' of products, services and processes if the meaning of these concepts varies so widely across the organization? In a number of cases the impact of this confusion, in combination with other phenomena, on the effectiveness of the innovation process within Telco became manifest. Patterns emerged in the relationship between the management of the innovation process and the innovation results, and subsequently with the operational performance. Given the vast amount of innovation activities within Telco, the overall impact for the company was likely to be

substantial. It furthermore became clear to me, through contacts with other telecom service providers and financial service firms, that other ICT intensive companies pursuing mass-customized service struggle with the same issues. A brief initial review of the literature also revealed a number of gaps in this area.
During the last decade, the researcher was personally involved in several rationalization and modularization initiatives within Telco. In these initiatives the researcher's role varied from driving roles as initiator or contributor to by-roles as an observer. This study builds largely on this experience, with Telco serving as the research context for an in-depth case study with multiple units of analysis. After explaining the background of this study and formulating the research question and research sub-questions, this first chapter elaborates on the purpose and relevance of this study. The chapter concludes with a discussion of the research design and approach, and with an outline of this dissertation.

1.2 Research question

The subject of this study is innovation management in ICT-intensive service perspective mass-customized firms[1], focusing on the intersection of innovation management and mass customization in a service perspective context (Figure 1.1).

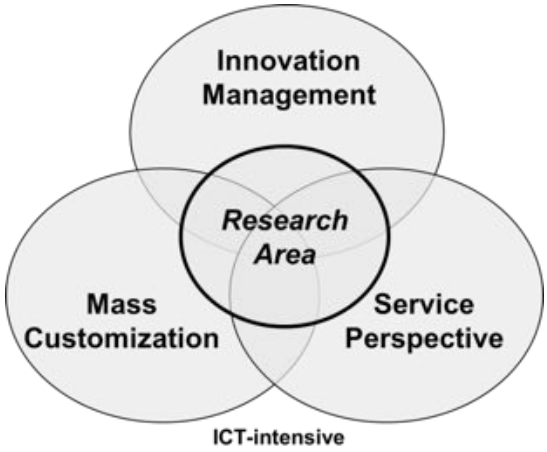

Figure 1.1 Research scope

Although the application of ICT plays an important role in this study, it is not an information systems study but a management study, which seeks to holistically combine such heterogeneous areas as corporate strategy, organization theory, innovation management, technology management, marketing management, human resource management, and ICT. Throughout the study, theory and practice in these areas are combined and mutually confronted.

[1] Hereafter referred to by the acronym 'ISM firms'.

The research question is formulated as follows:

> ***What are the challenges in managing innovation for mass customization in ICT-intensive service perspective firms in a fast-changing environment?***

The following paragraph offers a brief explanation of the main terms contained in the research question. After explaining the purpose and relevance of the study in Paragraph 1.3, Paragraph 1.4 subdivides the research question into four research sub-questions. A more detailed elaboration follows in subsequent chapters.

Challenges
The research question *'What are the challenges in managing innovation for mass customization in ICT-intensive service perspective firms in a fast-changing environment?'* is aimed at exploring and developing a framework that responds to the challenges in this area. 'Challenges' refers to prerequisites that should be in place, important issues that should be clarified, or substantial obstacles that should be removed to enable the management of innovation for mass customization in ICT-intensive service perspective firms. These challenges specifically present themselves at the intersection of the three above areas: innovation management, service perspective, and mass customization. ICT plays an important overall role in enabling a 'mass' application.

Managing innovation
For this study innovation is defined as "changing the value and satisfaction from resources obtained by the customer" (Drucker 1985, p. 33). This definition includes both a customer demand perspective and a resources supply perspective. It is not limited to one particular form of innovation, but may include radical innovation as well as incremental, architectural and modular innovation that (partly) builds on the existing (Henderson and Clark 1990). This definition is also not limited to any one category like product or process innovation. The innovation process is defined as "the development and implementation of new ideas by people who over time engage in transactions with others within an institutional context" (Van de Ven 1986, p. 591). Innovation management is a management process that manages the innovation process. The development process forms a subset of the innovation process. In the literature, the terms New Product Development (NPD) and New Service Development (NSD) are applied to products and services respectively (Booz-Allen and Hamilton 1982; Easingwood 1986; Scheuing and Johnson 1989; Cooper 1990). These terms usually denote a more or less formalized process including the development of the associated production processes.

Mass customization

Mass customization is a business approach in which mass production is combined with strategies to accommodate individual customer needs by offering and delivering customized goods and services against 'mass' costs. Already the first publications on mass customization by Davis (1987) and Pine, Davis et al. (1999) referred to 'products *and* services', but until the 1990s the focus was on manufacturing. Anderson (2004) foresaw a transformation from a 'short head' of many copies of the same product to a 'long tail' of millions of products for niche markets. Successful long tail businesses will treat consumers as individuals, not as part of some arbitrary demographic group. According to Anderson, mass customization will be at the heart of businesses that thrive under these marketplace conditions.

This study applies a broad notion of mass customization: every approach aimed at delivering the combination of customized goods/services at (relatively low) mass pricing. It aims to combine principles of customer value[2] creation with economies of scale. This includes strategies like product and process modularity (Ulrich and Tung 1991; Baldwin and Clark 1997) and platform thinking (Meyer and Zack 1996; Meyer and Lehnerd 1997; Robertson and Ulrich 1998; Sawhney 1998; Jiao, Zhang et al. 2006). For the successful implementation of mass customization, it is necessary "to develop a coherent framework within which systematic approaches can be taken to enable the realization of mass customization" (Tseng and Jiao 1998, p.2).

Service perspective

The scope of 'service' ranges from 1) broad economic perspectives of the service sector, via 2) after-sales service as a by-product of manufacturing and 3) company-internal services to 4) ICT-perspective notions like 'web services' and 'service-oriented architecture'. Consequently, there are many definitions of 'service'. Grönroos defines a service as "a process consisting of a series of more or less intangible activities that normally, but not necessarily always, take place in interactions between the customer and service employees and/or physical resources or goods and/or systems of the service provider, which are provided as solutions to customer problems" (Grönroos 2000, p. 44). In a recent article, the same author defines service concisely as "value-creating support to another party's practices" (Grönroos 2011, p. 14). Vargo and Lusch define service as "the application of specialized competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself" (Vargo and Lusch

The notion of 'service perspective' applies to this study …

[2] Woodruff (1997) defines customer value as follows: "Customer value is a customer's perceived preference for and evaluation of those product attributes, attribute performances, and consequences arising from use that facilitate (or block) achieving the customer's goals and purposes in use situations." Woodruff, R. B. (1997). Customer value: the next source for competitive advantage. Journal of the Academy of Marketing Science 25(2): 139-153.

2004a, p. 2). These definitions from service marketing and management research form a starting point for this study.
However, the scope of this study is not limited to the 'pure' service area. Already two decades ago J.B. Quinn observed that "the boundary between services and manufactured goods is extremely fluid and varies widely over time" (Quinn, Baruch et al. 1988, p. 53). A well-known example is Apple's iPod, which provides a music download service via iTunes, but also functions as MP3 music player. It is expected that this trend of 'servicizing products' and 'productizing services' will continue to rise (Howells 2001).
Grönroos (2000) uses the term 'service perspective' to denote firms that take the view that an enhanced offering is required to support the customers' value generating processes, and that the core solution (a physical product, service or combination of goods and services) is not sufficient to differentiate the firm's offering from that of competitors. Service perspective firms view the role of service components in customer relationships as strategic for their overall success. Lusch and Vargo seem to aim for the same with the term 'service-dominant logic' (Lusch and Vargo 2006). For example, they position goods as service appliances which offer the customer value-in-use (Vargo and Lusch 2004a). This study will use the above notion of 'service perspective'.

Firms in a fast-changing environment
The focus of this study is on firms in an environment where change happens simultaneously with a high pace of development in multiple areas, notably customer demand, technologies, regulations, and competition. This applies especially to the area of ICT-intensive firms described earlier. Already in 1994, the extremes of such an environment were explored by Richard d'Aveni in his book *Hypercompetition* (D'Aveni and Gunther 1994).
In such an environment, the firm cannot be viewed in isolation: it forms a system in itself with its internal relationships, but only becomes meaningful as part of a larger eco-system with external partners. Although in this study the emphasis is on the innovation management challenges of a firm itself, these challenges will be approached from the perspective of the firm as an element in a chain or web of co-innovating companies. In the literature notions like (national) 'systems of innovation' (Edquist 1997; Padmore, Schuetze et al. 1998; Edquist 2005; Lundvall 2010), 'innovation networks' (Koschatzky 1999; Koschatzky, Kulicke et al. 2001; Von Hippel 2007), or 'value networks' (Christensen and Rosenbloom 1995; Allee 2000; Peppard and Rylander 2006) are used.

... the firm cannot be viewed in isolation ...

Although the term 'firm' is used here to characterize the research area, the term is rarely used to discuss the concepts in this thesis. Instead supply chain role variants of 'firm' will be applied, notably 'supplier', 'provider', and 'customer'. According to ISO 9000 'customers' can be people or organizations that can be either external or internal to the supplier organization. For example, a factory may supply products or services to another factory (customer) within the same organization. Examples of customers include clients, consumers, end-users, purchasers, retailers, and beneficiaries (Praxiom 2010). Also according to ISO 9000, 'suppliers' are persons or organizations that

supply products. Suppliers can be either internal or external to the organization. Internal suppliers provide products to people within their own organization while external suppliers provide products to other organizations. Examples of suppliers include organizations and people that produce, distribute, or sell products, provide services, or publish information (Praxiom 2010).
The term 'provider' or 'providing firm' will be used throughout this thesis to denote the central unit of analysis. The provider is a customer of one or more suppliers and a supplier to one or more customers.

ICT-intensive
Information and Communication Technology (ICT)[3] is an enabler of the aforementioned concepts: ICT seems indispensible for mass-customized operations in service perspective firms. Hence, the scope of this study is Information and Communication Technology (ICT)-intensive firms. These are firms that depend heavily on information and communication technologies for their core business processes. Examples can be found in areas such as the media, telecommunication, banking, insurance, travel and logistics.
Another fast growing area is formed by web-based businesses: various configurations of manufacturing and service-providing 'bricks and clicks' companies. ICT-intensive services broadly cover the scope of so-called production-intensive services like transportation or telecommunication services, but also include knowledge-intensive services like computer and information technology-related services, including software services (as mentioned in Miles, Kastrinos et al. 1995). ICT is not only important in the operational processes of mass-customized service providers, but is also increasingly important in supporting the innovation process during the various stages (e.g. Gago and Rubalcaba 2007; Bygstad and Aanby 2009).

ICT ... is also increasingly important to support the innovation process ...

Although ICT-intensity is an important characteristic for the scope of this study, 'ICT-intensive' is not placed at the center of the research scope (Figure 1.1) since ICT itself is not the focus of this study.

1.3 Purpose and relevance of the study

The objective of this study is to contribute to the (further) development of theory on the intersection of innovation management and mass customization in an ICT-intensive, service perspective context. Such theory should also have direct relevance for business: it is aimed to provide 'pragmatically useful theoretical contributions' as advocated by Corley and Gioia (2011). The motive for this study emerged from the antecedents and consequences of

[3] The acronyms ICT (Information & Communication Technology) and IT (Information Technology) are used interchangeably in this thesis.

'de-siloing'[4] as observed within Telco starting the early 2000s. This paragraph will explain the study's relevance for both research and business. Note that it only addresses the main gaps in the literature; following the 'Structured Case' research approach (see Paragraph 1.5 and Appendix B) further literature is introduced at the start of each research cycle of this study.

Innovation research tradition: organizations-oriented research
According to Adler (1989), there are two complementary traditions in innovation research: economics-oriented and organizations-oriented research. In the economics-oriented approach analysis is performed at the macro and intermediate ('meso') levels. In organizations-oriented research, the interest is in the structures and processes through which individuals innovate (Brown and Eisenhardt 1995). This study belongs to the latter category. However, the macro and intermediate levels cannot be left totally untouched given the networked service perspective environment that has emerged with the advance of e-commerce during the last decade. In such an environment, it is increasingly difficult to view a firm in a pure stand-alone mode.

Relevance for research: mass customization requires decoupling of product and process
Pine, Davis et al. describe the decoupling of product and process as a "key advantage creator" in the system of mass customization (Pine, Davis et al. 1999, p. 255). Product and process lifecycles are managed independently, yet coherently, to enable a dynamic flow of products and services. Product innovation is enabled by shortening process lifecycles and increasing agility in resources and capabilities. However, in a service environment the distinction between product and process is fuzzy[5] (Davenport 1993; Bitran and Pedrosa 1998; Hauknes 1998; Uchupalanan 2000; Djellal and Gallouj 2001; Gallouj 2002; Van der Aa and Elfring 2002; Tether 2005; Miles 2008). How can developers effectively cooperate in innovating mass-customized products and processes if the scope of these concepts is ambiguous for all actors in the innovation process? Therefore, a starting point and central issue in this study is the definition and positioning of the concepts of product and process for service perspective firms, thereby laying a clear foundation for the innovation process in a mass-customized context.

... in a service environment, the distinction between product and process is fuzzy ...

Relevance for research: 'missing' innovation objects in services
In services, the products/processes that are delivered to or co-produced with customers are predominantly intangible. This not only applies to the operations level, but also from an

[4] The notion of silos and de-siloing will be extensively discussed in paragraph 2.7. 'Silo' is preliminary defined here as a product/technology-focused organizational unit.
[5] This issue is not confined to the service industry. In some other industries, e.g. the chemical process industry, it is also difficult to separate the end product from the production process.

innovation management perspective. According to Bitran & Pedrosa (1998, p.170) "high intangibility is therefore at the root of most difficulties in dealing with innovation. It makes the precise definition of a concept and its subsequent design difficult at best". It increases the need for an intensified level of communication between the people involved in the service development and delivery process, as the new service cannot be touched, felt or seen (Seegy, Gleich et al. 2008).
Although a pure manufacturing environment may encompass some less tangible elements, like electronic distribution channels, the main elements are quite tangible: the product that is delivered to customers and the production lines that produce the products. Both the products and production lines may be handled as distinguishable innovation objects from an innovation management perspective[6]. In the service area it is less obvious what the corresponding 'innovation objects' are. According to Edvardsson, services consist of three basic components as the targets of renewal: service concept, service process, and service system (Edvardsson and Olsson 1996; Edvardsson 1997). However, such components are still quite 'intangible' from an innovation management perspective. More tangible is e.g. the component concept in the literature of 'business componentization'; yet but this concept, despite its name, is usually not related to the business level but is confined more to the IT level (Sanz, Becker et al. 2007). The application of mass customization supportive principles, like modularization, in a service perspective context should not be limited to the technology part, but should also incorporate the non-technological elements. Given their mutual dependence, these areas should preferably be combined in an integrated approach to 'the missing innovation objects'. Literature on the absence of tangible innovation objects in services and the consequences for the innovation process is scarce. This study will address some major issues concerning this subject.

In the service area it is less obvious what the corresponding 'innovation objects' are ...

Relevance for research: other references and observed lacunae in the literature
While the service area form by far the larger portion of the economy (e.g. Schettkat and Yocarini 2006), research on service innovation has been relatively scarce for many years. The increase in articles on service development has been fast in percentage terms but only because the initial levels were so small (Page and Schirr 2008).
Bessant and Davies (2007) note mass customization as one of three core trends that have particular relevance for service innovation, besides 'servicisation' of manufacturing, and outsourcing. According to Da Silveira, Borenstein et al. (2001, p. 9), "the lack of studies dealing with mass customization in service operations is perhaps one of the main gaps in the current mass customization literature". The existing mass customization-related research is still largely focused on manufacturing operations, especially batch industries.

[6] Even in manufacturing this does not imply that the value of a product for the customer is easy to grasp. Buying a (manufacturing-based) product could in this respect be regarded as 'providing a service to oneself'.

Van Ark and de Jong (2004) call for management tools to improve productivity (in innovation) of service providers. According to Van Ark tools should be created with which to modularize service output and standardize and streamline the service production process. Vermeulen and Van der Aa (2003) indicate that the organization of the innovation process is one of the most important success factors in service innovation, but that research in this area is scarce. As valuable exceptions they mention the work of the authors Drew (1995), Sundbo (1997), Lievens and Moenaert (2000b) and Tidd and Hull (2005). Recent contributions include work from De Vries (2006), Blindenbach-Driessen and Van den Ende (2006), Froehle and Roth (2007), Miles (2008), Seegy, Gleich et al. (2008), Tether and Tajar (2008), and Arvidsson (2009). The current study focuses on a number of aspects concerning the organization of the innovation process within the given context of ISM firms.

In his book *Innovation Management in the Knowledge Economy*, Dankbaar (2003) provides an overview of recent, predominantly European, thinking on the issues and challenges for innovation management in the modern, knowledge-based economy. The current study addresses organizations-oriented issues on the four areas that are explored in the above book: the growing importance of services and of innovation in services; the growing interest in competence-based approaches to strategy and innovation; the role of technology in innovation processes; and the increasing importance of knowledge management in innovation management.

Synthesized/integrative approach - innovation management system

A synthesized/integrative approach to service innovation recognizes that such innovation focuses attention on hitherto neglected elements of innovation that are relevant to both service delivery and manufacturing (Gallouj and Weinstein 1997; Coombs and Miles 2000; Miles 2000; Sundbo 2001; Gallouj 2002; Drejer 2004). This study adopts such a synthesized services/goods view of firms, and an integrative services/goods approach to innovation management.

... development of an innovation management system for ISM firms ...

An innovation management system is defined as "any working combination of methods, tools (manual and computerized) and software that are used to support the activities in the innovation process" (Koivuniemi 2008, p. 10). The availability of an innovation management system is one of the main success factors in the management of service innovation (Ichimura, Tuominen et al. 1995; Pleschak and Sabisch 1996). The ambition of this study is to respond to the research question in terms of the development of an 'innovation management system' for ISM firms. This could lay a foundation for the implementation of processes and (ICT) tooling to support innovation management in ISM firms.

Relevance for business

The motive for this study stems from extensive experience with the innovation process at Telco. During the last decade, some recurrent issues were encountered in how the

innovation process was managed to accomplish mass-customized operations. It specifically struck the researcher that diverse programs were planned and executed within Telco related to 'de-siloing', 'portfolio rationalization' and 'modularization' without a clearly agreed upon foundation in terms of working methods, product/process structures, roles and tooling for the new environment. As the existing product/technology-related silos were indeed broken down how can the actors in the innovation process effectively cooperate without the 'natural' structuring principles of these vertical organizational fabrics? The above issues of 'unclear distinction between product and process', and 'the missing innovation objects' play a major role. The antecedents and effects of these issues will be clarified by describing and interpreting a number of observations concerning Telco in Chapter 2, and in the case study throughout the thesis. Contacts with other telecom operators and financial service providers revealed that these issues are not confined to Telco; they seem equally applicable to other ICT-intensive service perspective firms. With a growing number of firms pursuing a service perspective the relevance will extend to even more sectors.

While responding to the research question and having available the contours of the above-mentioned innovation management system, ICT-intensive service perspective firms may obtain practical tools to organize and manage the innovation process for mass-customized operations. The results of this study can support the design and implementation of processes, roles, and tooling for innovation management in ISM firms, and support the incorporation of mass customization-related concepts from manufacturing, notably modularization and platform thinking, into a service perspective context.

... these concepts are frequently approached from a technological/engineering point of view ...

Manufacturing-originating concepts and tooling like Product Lifecycle Management (PLM) and Product Data Management (PDM) can support mass customization (Ramani, Cunningham et al. 2004; Simpson, Marion et al. 2006). However, these concepts are frequently approached from a technological/engineering point of view. Especially in a service perspective context, PLM/PDM requires a broad management and business view. With a growing role of ICT in service perspective firms the relative importance of innovation increases since the performance of the innovation process directly translates into the performance of ICT-enabled operations. This puts additional strain on how service perspective firms innovate.

1.4 The challenge areas – research sub-questions

In the preceding paragraph, the issue of decoupling (service perspective) product innovation and (service perspective) process innovation emerged as a challenge area to apply mass customization principles in a service perspective context. This challenge area occurs at the intersection of mass customization and 'service perspective'. Furthermore, the issue of 'the missing innovation objects' in service perspective firms became apparent:

what is the end result of the innovation process and how can the actors talk about this end result while innovating ICT-intensive service perspective mass-customized services? This challenge area emerges on the intersection of 'service perspective' and innovation management. A third challenge area can be identified at the intersection of mass customization and innovation management: the challenges of innovation management to enable mass customization. In Figure 1.2 the challenge areas are shown in mutual coherence. Given the overarching role of ICT – as said before ICT plays a role in all areas – the term 'ICT intensive' has been left out of the figure.

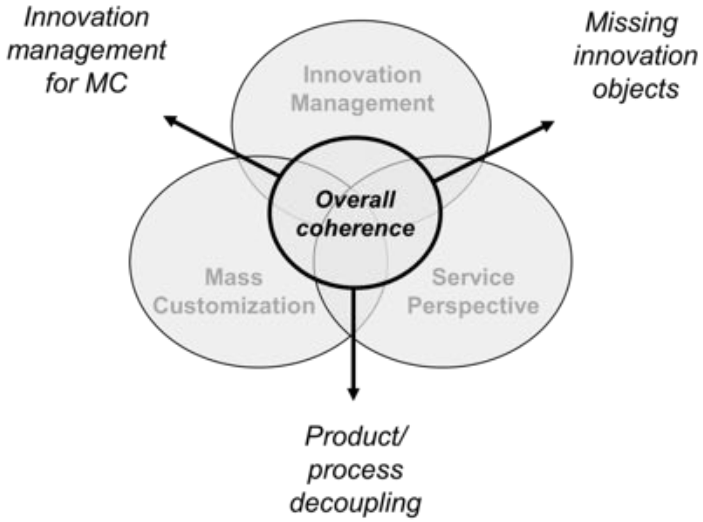

Figure 1.2 Three challenge areas in managing innovation in ISM firms

The challenge areas can be described as three research sub-questions (RSQs):

RSQ1. 'Product/process decoupling' at the intersection of mass customization and service perspective: What do the terms 'product' and 'process' mean in a service perspective context, and how can their lifecycles be decoupled in the innovation process to apply mass customization principles?

RSQ2. 'Missing innovation objects' at the intersection of service perspective and innovation management: How can the end result of the innovation process be defined in terms of 'tangible' objects for the actors in the innovation process?

RSQ3. 'Innovation management for mass customization' at the intersection of mass customization and innovation management: What are the challenges in managing innovation for mass customization?

The research sub-questions RSQ1, RSQ2 and RSQ3 will be discussed in Chapters 3, 4 and 5 respectively. Furthermore, the sum of the intersections relating to these research sub-questions does not add up to the overall research area. Therefore a fourth research question is formulated:

RSQ4. What is the overall coherence between mass customization, service perspective, and innovation management given the main research question? The resulting coherent framework can be viewed as an innovation management system for ISM firms. This study will provide various linkages between the three challenge areas. Chapter 6 will further integrate these linkages with reference to RSQ4.

1.5 Research design and approach

This paragraph will clarify how the research question 'What are the challenges in managing innovation for mass customization in ICT-intensive service perspective firms?' is approached in this thesis.
The research philosophy is interpretivism (Saunders, Lewis et al. 2003). It is the researcher's belief that a shared social reality is produced and reproduced through ongoing social interaction, and can only be interpreted, rather than 'discovered', as formulated by Orlikowski and Baroudi (1991). Innovation processes can be conceived as "processes of communication and information processing" (Lievens and Moenaert 2000b, p. 734). To understand these processes it must rely on qualitative data provided by single individuals or small groups of people. Predictions of outcomes can therefore only be probabilistic (Carroll, Swatman et al. 1999). The emphasis should be on explanations that may, rather than will, predict future events. According to Walsham "interpretive research produces understanding of trends rather than explanations that are wholly predictive" (Walsham 1995, p. 79). Of the three paradigms for social research described by Arbnor and Bjerke (1997) - the analytical approach, the systems approach, and the actors approach – this research is most closely affiliated with the systems approach, or more precisely the 'hermeneuticist systems approach'. Hermeneuticist systems approach creators of knowledge "assume that people look for meaning in their actions because they are interpretive creatures and tend to place their own subjective interpretations on whatever happens around them" (Arbnor and Bjerke 1997, p. 130).

... this research is most closely affiliated with ... the hermeneuticist systems approach ...

The development of theory
The aim of this study is the development of theory that has both a sound scientific basis and practical relevance for business. According to Bacharach (1989, p. 498), "a theory may be viewed as a system of constructs and variables in which the constructs are related to each other by propositions and the variables are related to each other by hypotheses. The whole system is bounded by the theorist's assumptions". Weick views the process of theory construction in organizational studies as "imagination disciplined by evolutionary processes analogous to artificial selection." Theorizing is not a linear mechanistic process, but "encompasses intuitive, blind, wasteful, serendipitous, creative quality in the process" (Weick 1989, p. 518-519). The motivational theorist Locke identified six characteristics of

a good theory: "1) it is based on observations and data, 2) it defines concepts in a way that differentiates them from other concepts, 3) it integrates concepts and resolves apparent contradictions, 4) it identifies causal relationships, 5) it typically takes time to develop, and 6) it is open ended, allowing for extensions and re-applications" (Locke and Latham 2005, p. 144-146). Atkins and Sampson (2002) have developed an extensive checklist of 'critical appraisal guidelines for single case studies'. This checklist, based on 'best practices' in interpretative case study research combined with the work of McKay and Marshall (2000), was used to provide guidance throughout the research process.

Research approach: Structured-Case

In search of an effective and efficient approach for an interpretivist research philosophy with support of qualitative data, the Structured-Case method was selected (Carroll and Swatman 1999; Carroll and Swatman 2000)[7]. A main element in this method is the development of a 'Conceptual Framework' during the research process. In this study the conceptual framework went through three research cycles. In reality, however, even within a single research cycle much iteration occurred in a much less linear mode as suggested by the plan-collect-data-analyze-reflect cycle of the model. Figure 1.3 shows how the structured case methodology is applied in the various chapters of the thesis.

The research model in this chapter serves as the initial Conceptual Framework 0 (CF0) of this thesis. Chapters 1 and 2 provide a foundation for the development of the first conceptual framework (CF1) in Chapter 3. CF1 forms the starting point for the development of both CF2 and CF3 in Chapters 4 and 6 respectively. CF3 is the final conceptual framework, integrating the findings of Chapter 3, 4, and 5. This integrative framework is discussed in Chapter 6.

A main element in this method is the development of a 'Conceptual Framework' ...

In this study the 'case' within the Structured-Case approach is concerned with the role of innovation management, including supporting tools and practices, to support the transition to a mass-customized operator within the national business and wholesale portfolio of Telco during the last decade. During this period, the company has undertaken several efforts to make the transition from a product and infrastructure focused technology company to a mass-customized service perspective company. Since the researcher was personally involved in the initiation and development of a number of these efforts, the study also has characteristics of 'longitudinal case' and 'action research' research. A longitudinal case examines the same single case at two or more different points in time (Yin 2003). Action research focuses specifically on action, particularly on changes within the organization (Marsick and Watkins 1997).

[7] For a brief description of the Structured-Case method refer to Appendix B.

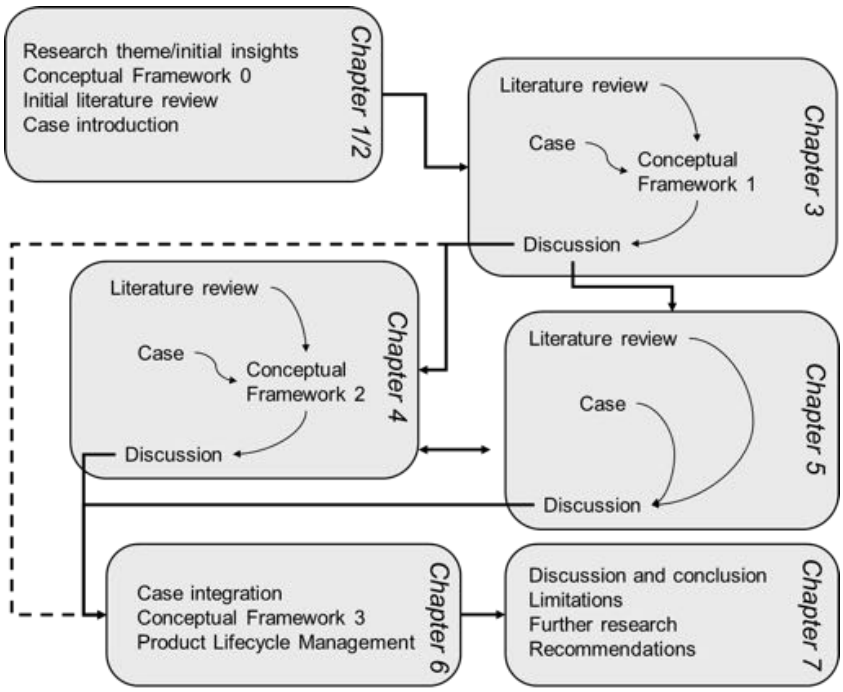

Figure 1.3 Relationship between research approach and thesis outline

One point of concern may be the researcher's double role in this study as 'practitioner-researcher' (Saunders, Lewis et al. 2003, p. 98-99). In several cases the researcher had an initiating or contributing role (see the right column in Table 1-1). This dual practitioner-researcher role offers several advantages, including swift access to research data, and a thorough understanding of the research context. However, this dual role could also lead to research bias. This effect has been minimized as much as possible, e.g. each case description and interpretation has been reviewed by at least two (ex)colleagues that were involved as actor in that particular case. Furthermore, the initial understanding of the phenomena under study will be clarified during each research cycle.

This dual practitioner-researcher role offers several advantages ...

The research model: Conceptual Framework 0

The research model, treated as Conceptual Framework 0 (CF0) in the Structured-Case method, relates the research question to the combination of two interrelated activities of the firm: Mass-Customized Innovation (MCI) and Mass-Customized Operations (MCO; Figure 1.4). MCO represents all core operational business activities of the firm directed toward marketing, selling, sourcing, producing, distributing and delivering mass- customized

goods/services to customers[8]. MCI represents all business activities aimed at changing the value and satisfaction obtained from (MCO) resources by the customer[9]. The term 'Mass-customized' indicates that both MCI and MCO are geared to (optimally) delivering mass-customized goods/services to the customers of the firm. MCI enables MCO by providing the prerequisites for MCO (Edvardsson and Olsson 1996). Note that both MCI and MCO may include business activities that have been sourced from external parties. In Chapter 2, the relation between the innovation and operations functions will be explained further, with reference to how these concepts were applied within Telco.

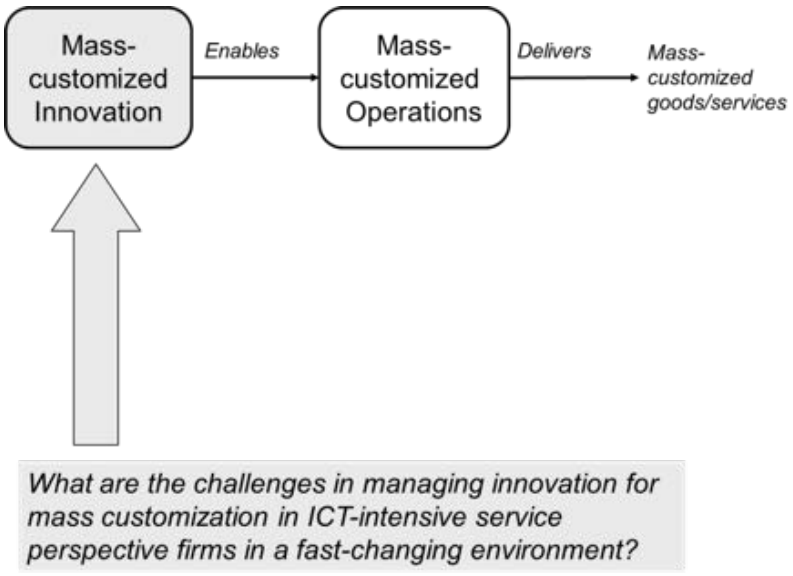

Figure 1.4 Research Model – Conceptual Framework 0

This study focuses on challenges in the area of MCI; it does not look at specific mass customization enabling operational strategies like front-end customization or customer input driven product configurators (Bourke 2000). This implies that research effects can be acknowledged/measured at the level of MCO, with evidence of mass customization-related concepts like modularization, as well as at the level of the *output* of MCO, corresponding with the mass-customized goods/services that are delivered to/co-produced with customers.

[8] This corresponds to the 'Operations' area in the TMF NGOSS eTOM framework, see Case 4-3.
[9] This corresponds to the 'Strategy, Infrastructure and Product' area in the TMF NGOSS eTOM framework, see Case 4-3.

Case study approach

Within the Structured-Case approach the main research method is a single-case study (Yin 2003) consisting of 12 'embedded' sub-cases (each sub-case is hereafter referred to as 'case'). According to Walsham (1993, p. 14) the single-case study is "the most appropriate method for conducting empirical research in the interpretive tradition". Single-case studies are particularly powerful in exploring a phenomenon in its context while retaining the richness of the studied phenomenon and its context. Multiple-case studies will sacrifice some richness but will typically be able to develop theory that is more robust, more generalizable, and easier to test (Eisenhardt and Graebner 2007). In the single-case study of the current research richness will be achieved because all 12 cases apply to the same research context – innovation management within the business and wholesale & operations area of Telco – while the various cases approach this research context from a different unit of analysis (Yin 2003, p. 40). An embedded design may enhance insights into the single case. However, Yin warns against the risk that the case study may shift its orientation if too much attention is given to the individual subunits of the embedded cases (Yin 2003, p. 46). The effects of this risk have been minimized by applying an integrative research approach as described in this chapter. Furthermore, tables are applied to summarize evidence for theorical constructs. According to Eisenhardt and Graebner (2007, p. 29) this is an effective way to present the case evidence.

... in-depth single case study ... with 12 embedded sub-cases ...

Case – Introduction I

'Telco' is the leading telecommunications and ICT service provider in its home country, offering wire line and wireless telephony, internet and TV to customers, end-to-end telecommunications and ICT services to business customers. A subsidiary operates a global ICT services company offering end-to-end solutions in infrastructure and network-related IT. Furthermore, the company holds a leading market position in mobile services in two other European countries, provides wholesale network services to third parties and operates a global IP-based infrastructure[10]. The case study of this research is concerned with the role of innovation management, including supporting tools and practices, to support the transition toward a mass-customized telecom operator within the national business and 'wholesale & operations' portfolio of Telco during the last decade. Thus the case study focuses on B-2-B services, although the 'operations' part of the above scope also covers B-2-C services as part of Telco's consumer propositions. The cases (Table 1-1) were selected to provide different and complementary perspectives on the same phenomena and thus provide multiple ways to triangulate the data. This chapter will only briefly introduce the cases as part of a discussion on the research design and approach. Chapter 2 will provide some more background as part of an overall description of innovation at Telco.

[10] Company profile, accessed from the internet August 2011, slightly summarized.

Four cases (2-1, 2-2, 3-2, and 3-3) describe rationalization programs within Telco's national business and wholesale segments: two smaller-scale rationalization programs within the business market, and two large-scale corporation-wide programs. These four cases primarily serve as an illustration of how Telco explicitly tried to make the transition to a mass-customized company. Furthermore, in these four cases some elements of the other cases are introduced. The other eight cases describe supporting concepts, technologies, innovation roles, governance structures and organizational issues that have relevancy for Telco's transition toward a mass-customized telecom operator. These eight cases directly support the development of the conceptual framework.

Table 1-1 - Overview of the cases

Case ID	Case name	Chapter	Start	Initiative type	Case scope	Researcher role
2-1	**Portfolio Rationalization Business Market**	2	2001	Program	4 months	Contributor
2-2	**Modular Portfolio Business Market**	2	2003	Program	1 year	Observer
3-1	**1-Model**	3	2001	Intervention	3 years	Initiator
3-2	**IT Reference Architecture**	3	2002	Program/ Governance	8 years	Observer
3-3	**IP-based Networking & Services**	3	2005	Program	5 years	Observer
4-1	**Technical Infrastructure Platform**	4	199x	Governance	10 years	Observer
4-2	**Product Structure**	4	199x	Governance	10 years	Contributor
4-3	**TMF NGOSS/eTOM framework**	4	199x	Governance	10 years	Observer
4-4	**Business Process and Supply Chain Modeling**	4	1999	Governance	10 years	Contributor
5-1	**New Service Development process**	5	1990	Governance/ process	10 years	Observer
5-2	**Release Management on Processes**	5	2003	Process	7 years	Initiator
5-3	**Development Manager role**	5	1995	Organization	15 years	Contributor

The cases are described in the chapter deemed most relevant for that particular case. However, some cases relate to other cases and chapters. In such event, it will be mentioned in the case description and discussion. Furthermore, Chapter 6 offers a summary ('Integration of ISM-supporting concepts') of how these eight cases relate to each other. This should help clarify how the research data is connected in the development of the conceptual framework.
The cases will be described throughout the thesis as separate exhibits in a grey colored background as shown here. The exhibits only provide a factual description of the observations and events.

Interpretations and discussions of the cases are given outside the exhibits in the main text. In Chapter 2 the case introduction will continue with a summary of the content of the various cases (Case – Introduction II).

Data collection and analysis

According to Yin evidence for case studies may come from six sources: documents, archival records, interviews, direct observation, participant-observation, and physical artifacts (Yin 2003). Various data collection methods have been used in this study:

- Direct intervention, observation and memoing by the researcher; notes of events and interpretations. This includes numerous meetings, discussions and conversations with professionals and (senior) managers in both the business/commercial area and the operations/technical area.
- Semi focused interviews with various stakeholders: 17 interviews have been held with 11 functionaries of both Telco's commercial/product management area and process/technology area.[11] Appendix C provides an overview.
- Studying documentation: presentations, meeting notes, specifications etc.

A 'Managing Successful Programmes' (MSP)-based overview was applied as a spreadsheet-based template to collect and analyze the data from the cases. This template acted as a "case study database" (Yin 2003, p. 101). MSP is a comprehensive and widely used program management framework, published and used by the UK Office of Government Commerce (OGC 2003, 2007a), and purports to offer pragmatic guidance in the form of key principles and techniques. Although only part of the cases relate to a program in the formal meaning of MSP, collecting and analyzing data in the MSP format of all case data offered the advantage of being as thorough as possible while having all data available in a comparable format.

Wherever appropriate the link from the data to the concepts (and vice versa) will be shown. This process was supported by operationalizing the main concepts into a number of characteristics that were matched with the case data. However, this only partially explains the conceptual framework that emerges from this study. While processing the data from the cases in the above-mentioned MSP-based spreadsheet, it became clear at an early stage that a strict analytical pattern-matching procedure – "comparing observed patterns with expected patterns to test the correctness of hypotheses" (Dul and Hak 2007, p. 95) – would be of limited support during the research process due to the subjectivity in the interpretations and the multiplicity of phenomena in the innovation process. The spreadsheet was helpful in bringing order to the data and in creating an overview of broad patterns.

[11] No interviews were held with customers and suppliers. Customers of 'mass' products were not directly involved in Telco's innovation process during the study period. A number of strategic alliances were formed with technology suppliers and outsourcing partners during the study period. However, these have not been considered as part of this study.

During the early phases of the research process it became clear that the study was performed along the lines of 'Systematic Combining' (Dubois and Gadde 2002). Systematic Combining is an approach to case research that is grounded in abductive logic (Peirce 1931; Fann 1970). While Structured-Case provides a tight and evolving way to develop a conceptual framework in a number of research cycles, Systematic Combining further helps guide the research process in such a way that the case serves as a 'tool' as well as a 'product'[12].

1.6 Outline of the thesis

The outline of the thesis (Figure 1.5) is based on the various research cycles that were conducted in the Structured-Case approach. This should help the reader understand the interpretations that were made within each cycle and during the transitions from one cycle to the next. A conceptual framework is successively constructed in Chapters 3 to 6, with each chapter building further on the preceding one.

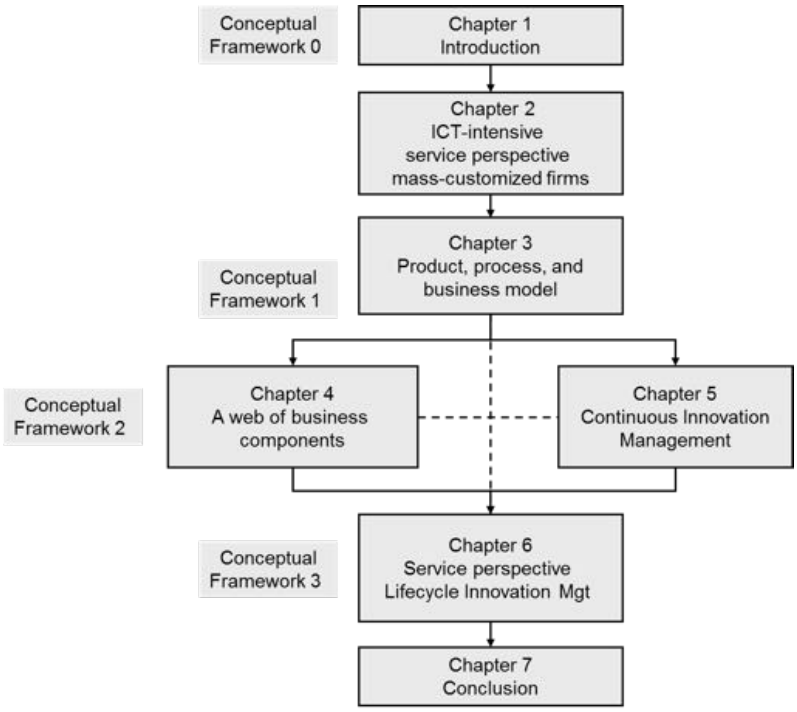

Figure 1.5 Outline of the thesis

[12] For a brief description of Systematic Combining, see Appendix B.

After the current introduction in Chapter 1 with the research question, research sub-questions, and research model (Conceptual Framework 0), Chapter 2 provides an overview of the literature on the main research subjects. It additionally explores the main developments in the telecom sector and how Telco coped with these. Note that Chapter 2 does not discuss a literature review in the 'hypothetico-deductive' sense but rather provides an 'initial literature review' as implied in the Structured-Case approach. In the further research cycles of Chapters 3 to 6, additional literature will be introduced as new research data, together with the various Telco cases.
Chapter 3 discusses the issue of 'product/process decoupling' and defines the concepts of product and process in a service perspective context, resulting in Conceptual Framework 1 (CF1). This pivotal chapter lays the foundation for both Chapter 4 and 5, and for the integrative Chapter 6.
Chapter 4 explores the issue of 'the missing innovation objects': defining and handling the outcome of the innovation process of ISM firms as 'tangible'/'perceivable' objects for the actors in the innovation process. This chapter concludes with Conceptual Framework 2 (CF2).
Chapter 5 examines how the innovation process may be organized to enable mass customization, resulting in the third Conceptual Framework (CF3).
Chapter 6 further integrates the concepts of Chapters 3, 4 and 5 into an innovation management system for ISM firms.
Chapter 7 forms the conclusive chapter of this thesis. This chapter contains final discussion and conclusions, limitations, further research suggestions and recommendations.

2. ICT-intensive service perspective mass-customized firms

2.1 Introduction

This chapter lays a further foundation for the study by giving some background on developments in the telecom landscape and Telco's position in this landscape. This foundation should facilitate an understanding of the challenge areas to be developed in the course of this chapter. An overview of the three sub-domains and the literature in these areas will be given: service perspective, innovation management and mass customization (Figure 2.1). The role of ICT in these areas will be discussed in a separate paragraph. Furthermore, the subject of 'horizontalization' or 'de-siloing' will be discussed extensively. Each of these paragraphs will offer a general introduction including related literature, and observations within Telco concerning the subject.

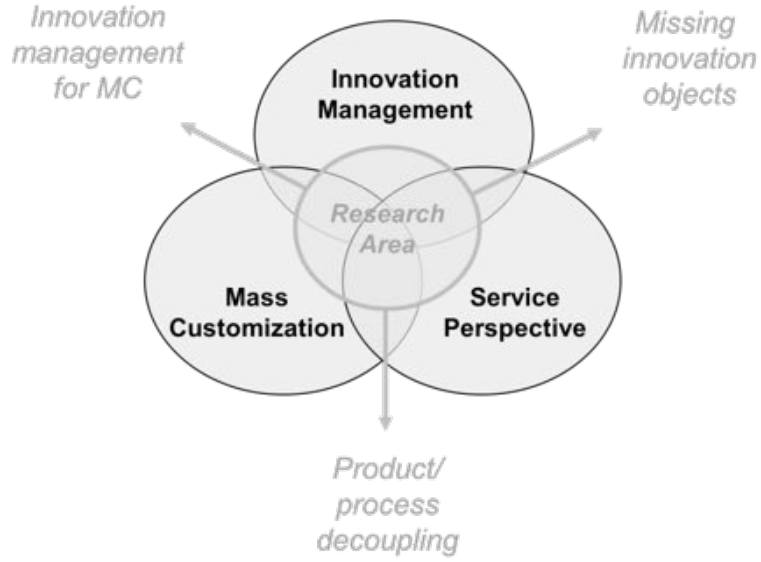

Figure 2.1 Overview of the research sub-domains

Concerning innovation and innovation management, this chapter only provides an introduction that is necessary as a starting point for the next chapters. Innovation and innovation management in the context of this study will be discussed extensively in Chapter 5. Chapter 2 provides a further subject-matter introduction to the cases, and takes a closer look at two particular cases: two smaller-scale rationalization initiatives within Telco. These cases primarily serve as an illustration of the phenomena discussed in this chapter.

2.2 The telecommunications industry and the need for mass customization

This paragraph describes the changing telecommunications industry landscape, that is, Telco's business environment. It will clarify why the concept of mass customization is increasingly important for the sector as a whole and for Telco, as a representative of this sector, in particular.

The telecommunications industry has gone through major transitions during its existence. The sector comes from a history of monopolistic, state-owned and frequently nationally-oriented telecom operators. These operators - usually dubbed 'incumbent telecom operators' - had long-term and predictable relationships with their suppliers and users/customers. Over the years, telecom operators have gone through three broad phases with two major transitions between the phases:

1. Utility provider phase
2. Product supplier phase
3. Service perspective phase

Utility provider phase: focus on the infrastructure (1880 – 1980)
This phase started with the inception of the telegraph and telephone services more than one hundred years ago and ended in the 1980s with the privatization and liberalization of the telecom markets. The core business of an infrastructure provider was to build and maintain telecom infrastructures (notably fixed voice) to which the users could connect. The concept of 'customer' was not relevant for this kind of business. In fact, the operation was not even considered a 'business', and the output not considered a 'service' but rather a government-controlled public task. Innovation played a minimal role: it was limited to network engineering and development in the production processes. Although some significant technological changes happened during this phase, the major business transitions took place after this phase.

Product supplier phase: focus on the product (1980 – 2000)
The first major transformation occurred in the 1980s when telecom operators became private companies and telecom markets were deregulated. The focus shifted to sales and delivery of telecom products like telephone switches, data communication equipment and mobile phones. The core business of a product supplier was to profitably deliver products to its customers, along with the continued delivery of infrastructure as a utility. Products and customers became more important during this period. Consequently the role of product innovation became more prominent, although most products and markets were approached from a 'mass commodity' view point. For larger customers (virtual) private networks were built, in which managed (network) infrastructure and equipment were mixed and matched. In its earliest stages product supply was heavily subsidized by the utility provider business, but

Products and customers became more important during this period …

telecom operators gradually became commercial telecom product suppliers rather than state-owned utility providers. After deregulation most products and services, including most 'utility provider' services were delivered in full competition with other companies like equipment vendors, but the prevalent mind-set was still one of a monopolistic utility provider.
The 'telecom boom' period started in the mid-90s, in which incumbent operators grew larger and more diversified through costly acquisitions and expansion into diverse, sometimes non-telecom-related, activities. This was followed by the 'telecom bust' phase in which many telecom operators were transformed into companies of smaller scale and scope.

Service perspective phase: focus on service and customers (2000 -)
The second transformation occurred during the first decade of the new century, when most incumbents, after surviving the 'telecom boom and bust' period, realized that the focus should be on a service perspective. This phase is still ongoing; most incumbents are in the earliest phase of becoming a truly customer-focused service perspective company. The core business of a service perspective company is to profitably deliver goods/services that continuously satisfy customer needs. A service perspective company is less concerned with one-off delivery (of goods) but rather geared to long lasting service relationship with customers. Innovation becomes even more important to constantly deliver customer value in an increasingly competitive market. This requires a combination of product innovation, (production) process innovation, and business model innovation. The mass commodity attitude of the product supplier phase should be replaced by a mass customization business concept.

A service perspective company ... is geared to a long lasting service relationship with customers ...

A complicating factor is that telecom operators remain obliged to perform a 'utility provider' role, in the sense that part of the business is still regulated by national governments. Telecom operators must deliver certain services, e.g. leased line services, against pre-defined regulatory conditions (e.g. no cross-subsidizing allowed). However, a true service perspective operator would make no distinction in how customers are treated when delivering regulated (obliged) versus non-regulated goods/services to customers. This is even truer since the same customer could receive both kinds of services at the same time.

During the phases described above, the telecom service sector saw some major technological changes; e.g. the transition from electromechanical switching to digital switching in the 1970s. However, the pace of developments seems to have increased over the years. Berkhout and Van der Duin (2006, p. 5-9, partly adapted) outlined five major trends in mobile telecom that seem equally valid for the entire telecom business. For each trend the related innovation opportunities and challenges are given:

1. Increase of bandwidth. Both in fixed and mobile telecommunications, the hunger for bandwidth cannot be appeased due to the growth in applications, especially in the areas of (mobile) Internet and audio/video streaming. The growth in bandwidth in turn facilitates new applications, together defining a range of innovation opportunities.
2. Unbundling of the industry. This trend, initiated by (European) policy and enforced by national regulators, refers to the development in which vertically integrated telecom operators, in many situations the national incumbent operators, are split into separate commercial organizations that often become independent companies. In this new structure, innovation is increasingly occurring between different companies that occupy different positions within the telecom value chain. Innovations are created by external partnerships.
3. Convergence of telecom with ICT, media, and other sectors. The telecom sector is no longer a business on its own but has mixed in many ways with businesses outside the sector, especially with information technology and media businesses. According to Wirtz (2001) there are three drivers for convergence: technological drivers such as digitization and the emergence of the Internet Protocol (Postel 1981), deregulation spurred by the liberalization of vertical integration and the privatization of former state-owned PTT's, and demand-related drivers expressed as changing customer preferences. The trend of cross-sector convergence forces telecom operators to cooperate with companies outside their own industry to ensure cross-sector innovation.
4. New business models. Both the processes of sector unbundling and cross-sector convergence have resulted in a rearrangement of the position of telecom operators in this sector. One consequence is that any representation of today's value chain by a linear type of model is no longer valid. Telecom operators and their partners have different roles and functions. Companies are innovating and operating in a networked 'value network' mode (Li and Whalley 2002) and telecom operators must reconsider their role in the network.
5. New services. The effects of cross-company technology and multi-sector business models are reflected in the development and introduction of many new services, both business to business and business to consumer. These 'data' based services extend far beyond the traditional telecom voice portfolio and include availability on multiple devices like mobile phones, PDAs, game consoles etcetera. An important issue for telecom operators is what services should be developed and how the innovation and operations of these services is best done in the value network.

Especially the first three items represent major industry trends, with a strong relation between item 2 (unbundling) and 3 (convergence). The other two can be regarded as a reaction to these trends by telecom operators. For these companies, an important way to cope with these trends is the technological transition from circuit-switched Public Switched Telephone Network (PSTN) networks to packet-switched Internet Protocol (IP) networks. This transition, known in the telecom world as the transition to the Next Generation Network (NGN), is about building a 'flexible factory of innovative services': a converged infrastructure transporting voice, video and data across a single network, reducing

operational and capital expenditure, and enabling new sources of revenue through the combined services. With this IP-based network, incumbent service providers should have more flexibility in adapting the network to the customer, rather than the other way around. This implies finding new niche markets as well as retaining existing customers and attracting new customers. It may then become feasible to provide 'mass customization of services', which is not possible with the current traditional PSTN technology (Sato and Dergint 2006, p. 26).

However, while IP-based networks may potentially be operated at a much lower cost level, this not only depends on the technical infrastructure, but also on how this infrastructure relates to the operational processes. As the term Next Generation Network suggests, the scope of NGN is sometimes limited to the technical infrastructure, yet at other times the term covers a broader scope including the process capabilities that make the NGN available for customers. Bruce (2008) distinguishes between 'service function capabilities' used directly by the receiving party like broadband access or location information, and 'service management capabilities' supporting the product offering with capabilities like order handling or billing[13]. In this thesis, the notion of NGN and the scope of innovation management include both service function capabilities and service management capabilities.

... NGN is about building a flexible factory of innovative services (Sato and Dergint 2006) ...

The development of an NGN involves substantial investments, both in the network infrastructure area and in the development of service management capabilities. Telecom providers are eager to achieve swift returns on the investments, but for these returns they are heavily dependent on how users and 'over-the-top' (OTT) content providers will apply NGN capabilities. The term 'over-the-top' is used in the telecom industry to denote parties that have no network of their own, but offer home entertainment services such as internet TV on telecom companies' broadband networks. Basically, for incumbent operators it represents the struggle between the Internet model (decentralized and 'free'/low cost) and the incumbent operator model (centralized and charging as much as possible for premium services). In describing this phenomenon Sato and Dergint (2006), referring to Beniger's 'control revolution' (1986), expect that the NGN may represent a telecommunications revolution that in turn will be the enabler for a services revolution. A standards-based, all-IP platform could allow for faster innovation and easier integration with web applications. With the NGN, telecom providers could play a crucial role as part of an innovation landscape with multiple actors outside the chain or network. In this vision the NGN is not the end of developments, but rather the beginning of an era with mass-customized services in a highly dynamic open innovation environment, encompassing an enduring high level of uncertainty and change.

Figure 2.2 gives a generic overview of the relationships between the participants in the

[13] This distinction between 'service function capabilities' and 'service management capabilities' will be made throughout the thesis.

telecom industry. This clearly shows how multiple actors in the telecom industry cooperate and compete to provide goods and/or service-based products to customers (Zhang 2008, p. 1112, slightly adapted). Each actor can have multiple faces; e.g. a customer can also be a content provider. Existing telecom operator business models are under pressure by the earlier described changes in the telecom industry landscape.

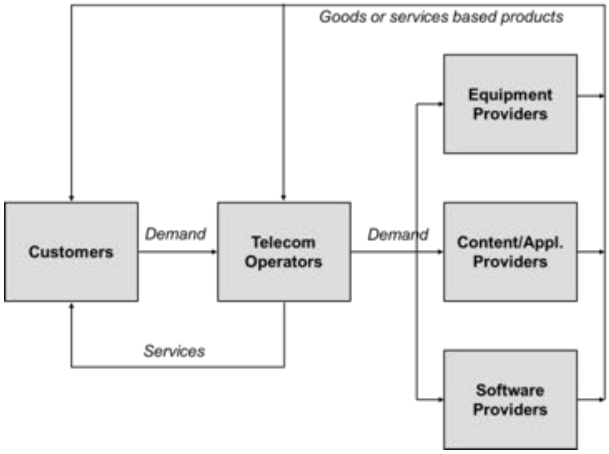

Figure 2.2 Relationship between the participants in the telecom industry (Zhang 2008)

2.3 The Telco case

The above developments in the telecom industry landscape are also broadly applicable to Telco. In the utility provider era customer focus was virtually nonexistent. Instead, the focus was almost entirely on the functioning of the network infrastructure. Of course there were users connected to the network, but these users were not regarded as customers but rather as infrastructure-using end-points of the network. During the telecom product supplier era, network infrastructure users gradually became customers. However, there was still more interest in the product and the underlying technology than in the customers buying these products. The focus was on the one-off delivery of devices and infrastructure to the customer. This gradually changed during the service company transformation. Especially during the last decade, customer focus increased dramatically. It became clear that a 'service perspective' with long-term customer relationships is a prerequisite for survival and growth. This process was 'facilitated' by the telecom bust in 2001: after heavy cost cutting for survival it was time to rethink the core values. In 2005, three customer segments were formed: Consumer, Business and Wholesale & Operations. These changes were also reflected in the development of Telco's corporate image and

Focus was on the one-off delivery of devices and infrastructure to customers …

branding. In 2006, the logo became much 'softer' and less 'technical', and the emphasis shifted to connecting people instead of connecting network nodes, marking a shift from technology orientation to (human) connectivity orientation.
Other recent changes are reflected in Telco's explicit market communication as a multimedia provider in the consumer market (notably interactive IP-based TV as part of a 'triple play' package together with voice and broadband Internet) and as an ICT solution provider in the business market. Although ICT already played an important role in the internal processes of telecom operators, this again is a major change because the scope of the services has now broadened from basic telecom infrastructure services to (software) applications for consumers and business users. The scope of ICT has extended from basic service management capabilities to converged service function and service management capabilities, including applications like web-based customer self-care. The Internet Protocol (IP) plays an important role in this convergence since IP provides a common industry language for interoperability between devices and software applications of all sorts. In 2007, Telco became one of the first incumbent operators to combine fixed and mobile operations into one converged organizational structure.

... since IP provides a common industry language for interoperability ...

Development of Telco's business processes
Another expression of Telco's transformation from infrastructure provider, via product supplier, into a service company is the development of the business processes.
During the *utility provider* period the emphasis was mainly on maintaining and expanding the (predominantly voice) network infrastructure. Customer processes were limited to billing and rudimentary customer care. Most processes were handled as manual mass production processes and there was little room (and seemingly limited need) for customization.
As a *product supplier* Telco added product management and marketing as core processes, although these were still loosely associated with the existing operational processes. In this period further customization was pursued, often on a per customer basis, and a lot of IT systems and applications emerged within the company. New products were frequently introduced by adhering to a 'green field' approach to avoid complex and lengthy modifications of, and cumbersome integration with, legacy platforms and ICT. This way the basis was formed for multiple 'stove-pipes' or 'silos'. In such a stove-pipe or silo, products have their own dedicated network and process/ICT infrastructure that cannot easily be (re)used by other products[14].

[14] The terms stove-pipe and silo are regarded as interchangeable. In the remainder of this thesis the term 'silo' will be applied.

Given the centrality of the concept in this thesis, the term 'silo' in the context of a firm requires explicit definition:

> ***A silo is defined here as a 'vertical' organizational part of a firm delivering a limited set of the firm's product portfolio to customers, and applying product specific technology/processes in such a way that the inclusion of or integration with other products and/or technology/processes is impeded.***

If a customer requires products delivered by only one silo there is no problem. However, if a customer requires products from multiple silos product integration (if at all possible) is largely left to the customer himself. For the firm, customer and service focus as well as economies of scale, notably in the back-end of operations, are hard to attain.

Customers expect customized solutions without custom-made (and custom cost) operations…

During the transformation to a *service perspective* company the complexity of this plethora of legacy IT and product silos become a hindrance toward a customization-effective and production-efficient 'mass-customized' service company. Operations in this new setting should be characterized by a customer-knowledgeable front-office, supported by highly effective customer relations management software and processes, web-based customer self-care capabilities for customers and a highly automated back-office.
Internet Protocol-based networks, applications and devices can (and therefore must) be operated at much lower operational costs. Customers expect customized solutions without custom-made (and custom-cost) operations. This implies high agility in innovating products and processes. In this mass-customized paradigm, services are not developed from a 'stand-alone' approach, but incrementally/modularly built up, and fully integrated with, existing families of products and processes. A next step in the application of ICT, which has already been happening for some time, is the further automation of operations in which customer-initiated requests directly translate to new services or changes in existing services. Within Telco, this development was labeled as 'zero touch' operations.

Organizational development of Telco
Another way to look at the differences between the three phases: utility provider, product supplier and service perspective company, is to assess the organizational structure of (the national part of) Telco during these phases. Figure 2.3 provides a simplified overview. In this overview, only the 'extremes' have been given, so not all intermediate variants during the numerous reorganizations conducted throughout the years. The figure does not show the organizational structure during the *utility provider* period until the 1980s. Basically, this was a technology oriented organization, organized as a governmental department, with only rudimentary customer interfaces.

The organizational structure during the *product supplier* period in Figure 2.3 shows a number of business units and operator units. The business units were responsible for the business results and front-end customer interface; they were organized at the level of products/technologies, e.g. telephony and Internet. The operator units, combined into one operations organization that was sometimes referred to as 'the factory', were responsible for the technology and some 'back-end' operational processes. Most operator units had a one-to-one interface with the business units; together they formed one logical 'silo'. Some functions relied on secondary 'cross connects' between business units and operators. Although marketing and sales were organized at the level of customer segments in an early stage, customers with multiple services had to rely on multiple autonomous business units and Operators. They had to cope with multiple front-ends and multiple 'factories', and act themselves as 'systems integrator' for Telco provided services.

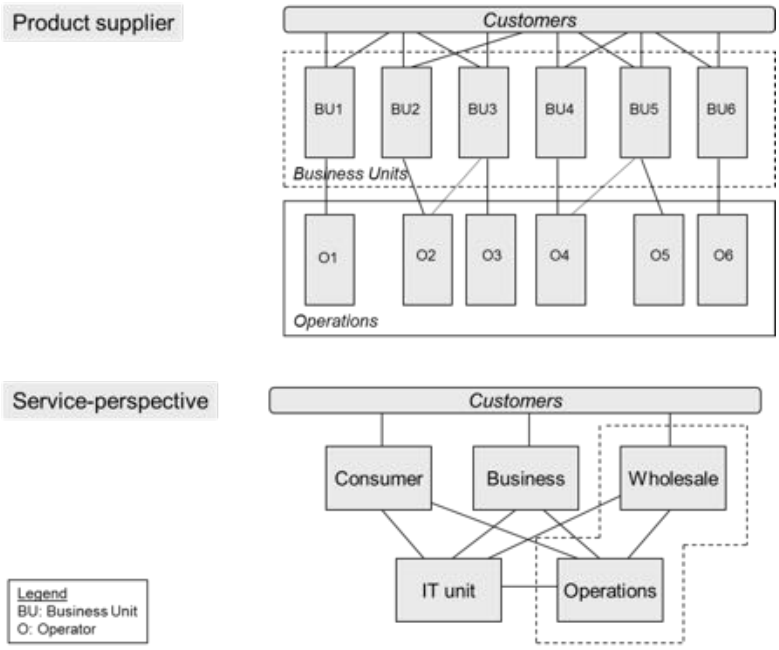

Figure 2.3 Organizational structure of Telco

During the introduction of the *service perspective* phase, the business units were transformed into three customer-facing segments: Consumer, Business and Wholesale. In 2005 this structure was implemented for the fixed services area only; in 2007 it was extended to a converged fixed-mobile setup, encompassing the entire national business scope. Operations and IT unit provided 'back-end' operational processes for all three

segments[15]. The idea was that customers with multiple services could now rely on a single customer-facing segment for all their services. Customers would get an integrated and customized package of services from the segments, and the segments would rely on efficiently produced back-end services from Operations and the IT unit.
In Chapter 1 the cases were briefly introduced. It has been made clear why these cases were selected, and the researcher's role in the various cases was clarified. The next exhibit provides a summary of the content of the cases, as a follow-up to the introduction (Case – Introduction I) as provided in Chapter 1.

Case – Introduction II

As mentioned in Chapter 1, the case study of this research is concerned with the role of innovation management, including supporting tools and practices, to support the transition to a mass-customized telecom operator within the national business and wholesale portfolio of Telco during the last decade. Table 2-1 provides an overview of the cases with a summary of some main characteristics per case.
In Chapters 2 and 3 four illustrative cases are described (2-1, 2-2, 3-2, and 3-3). They describe rationalization programs within Telco's national business and wholesale segments: two smaller rationalization programs within the business market and two large corporate-wide programs. Case 2-1 in Chapter 2 describes one of the earliest 'rationalization' programs in 2001. Case 2-2 could be viewed as a follow-up to Case 2-1. Cases 3-2 and 3-3 in Chapter 3 describe large-scale corporate initiatives to restructure the entire IT and networking technology landscape of Telco. All these initiatives started off as formal programs. However, given the lengthy duration of the programs described in Case 3-2 and 3-3, these programs were gradually adopted by the existing line organization. Additionally, the initiative described in Case 3-2 could also be viewed as a corporate-wide governance initiative guiding corporate IT investments.
The other cases serve as a foundation for the conceptual framework developed during this study. Case 3-1 may be viewed as the starting point for this thesis. The 1-Model as described in this case is not a program, but rather an intervention to make the organization aware of the implications of 'technology thinking'. The cases in Chapter 4 (4-1, 4-2, 4-3, and 4-4) describe various governance initiatives related to product/process structuring and 'business componentization'. It is shown how these governance initiatives have evolved during the last decade, and how they have gradually facilitated mass-customized innovation/operations.
The cases in Chapter 5 (5-1, 5-2, and 5-3) directly relate to the innovation process within Telco. Case 5-1 describes the process and governance structure concerning new service development (NSD). Case 5-2 describes how the release management process was applied

[15] Operations was mainly geared at (technical infrastructure-based) service function capabilities, while the IT unit was mainly geared to providing IT services for service management capabilities like order fulfillment. However, in practice, this distinction of tasks between Operations and the IT unit was less clear. This will be clarified in Case 4-4 (Chapter 4).

on the process level. Case 5-3 describes a pivotal organizational role related to the (lifecycle) management of the operational processes.
Chapter 7 provides a 'case integration' in which the relationship between the various concepts from the cases is discussed. This should facilitate the understanding of the relationship between the cases and the development of the conceptual framework over the course of this thesis.

Table 2-1 - Overview of the cases

Case ID	Case name	Start	Initiative type	Case scope	Initial drivers	Driving role	Primairy goals
2-1	**Portfolio Rationalization Business Market**	2001	Program	4 months	Cost and complexity reduction	Line Management Business Market	Immediate cost and complexity reduction
2-2	**Modular Portfolio Business Market**	2003	Program	1 year	Customer demand for Ethernet-based products	Product Management Business Market	Clear portfolio of Ethernet-based VPN services
3-1	**1-Model**	2001	Intervention	3 years	Confusion as to what portfolio to rationalize during Case 2-1	Corporate architects	Clarify product/process dichotomy
3-2	**IT Reference Architecture**	2002	Program/ Governance	8 years	IT complexity and cost level reduction	Telco top management	Long-term cost reduction and de-siloing
3-3	**IP-based Networking & Services**	2005	Program	5 years	Future market pricing/ IP technology cost level	Telco top management	Long-term cost reduction and de-siloing
4-1	**Technical Infrastructure Platform**	199x	Governance	10 years	Infrastructure continuity	Management	Infrastructure continuity/ lifecycle management
4-2	**Product Structure**	199x	Governance	10 years	Network modeling	Network/Corporate architects	Network modeling, asset reuse and de-siloing
4-3	**TMF NGOSS/eTOM framework**	199x	Governance	10 years	Common industry vocabulary/supplier interaction	Corporate architects	Implementation of COTS IT products from suppliers
4-4	**Business Process and Supply Chain Modeling**	1999	Governance	10 years	Business process modeling	Corporate architects	Process and organization modeling
5-1	**New Service Development process**	1990	Governance/ process	10 years	Speeding up innovation; grip on the innovation funnel	Product Management	Innovation selection and risk management
5-2	**Release Management on Processes**	2003	Process	7 years	Managing supplier product versions	Management	Infrastructure continuity/ lifecycle management
5-3	**Development Manager role**	1995	Organization	15 years	Counterpart for Product Management	Management	Bridge role to Product Mgt; manageability of processes

2.4 Service and service perspective

This paragraph will further examine the notions of 'service' and 'service perspective', and will clarify these concepts in relationship with Telco.
The services sector accounts for more than 70% of total labor and value add in the OECD economies: the largest part (50/70) applies to market services, the smaller part (20/70) to public services (OECD 2005). However, the term services sector has become somewhat blurred: the traditional separation between goods suppliers and service providers has vanished because service aspects are also becoming important for

... the term services sector has become somewhat blurred ...

goods suppliers ('servitization', Vandermerwe and Rada 1988) while service providers are adding 'tangibles' to their offerings ('tangibilization', Hyötyläinen and Möller 2007)[16]. According to Levitt (1976): '[t]here is no such thing as a service industry. There are only industries whose service components are greater or less than those of other industries. Everybody is in service'. Rathmell argues that there are very few pure products and pure services. He introduced a 'goods-service continuum', with pure goods at one extreme and pure services at the other, and argues that most 'economic products' fall between these two extremes. "Most goods are a complex of goods and facilitating services; most services are a complex of services and facilitating goods" (Rathmell 1966, p. 34).

Moreover, the entire perspective on goods and services has changed during the last decades. Gummesson (1995, pp. 250-51) states that "customers do not buy goods or services: they buy offerings which render services which create value … The traditional division between goods and services is long outdated. It is not a matter of redefining services and seeing them from a customer perspective; activities render services, things render services. The shift in focus to services is a shift from the means and the producer perspective to the utilization and the customer perspective." This coincides with Drucker's view that "what business thinks it produces is not of first importance. What the customer thinks he is buying, what he considers value, is decisive. And what the customer buys and considers value is never a product. It is always a utility, that is, what a product does for him" (Drucker 1973). Already in 1992, Martin and Horne argued that the focal point should be to model 'bundles' of products and services, rather than concentrating on one or the other (Martin and Horne 1992).

... the core solution is not sufficient to differentiate the offering from those of competitors (Grönroos 2000) ...

Grönroos (2000, p. 7) uses the term 'service perspective' to denote firms that take the view that an enhanced offering is required to support the customers' value generating processes, and that the core solution (a physical product, service or combination of goods and services) is not sufficient to differentiate the offering from those of competitors. These companies view the role of service components in customer relationships as strategic for their overall success. Vargo and Lusch believe that marketing is developing toward a service dominant logic with the main focus on intangible resources, the co-creation of value, and relationships (Vargo and Lusch 2004a; Lusch and Vargo 2006; Vargo and Lusch 2008).

[16] A related term is 'service productization', denoting the development of systemized service offerings as to improve their competitiveness and performance. Usually this term refers to making the service offering more or less 'product like', i.e. defining the core process and its outcome so that they become more 'stable' and visible Valminen, K. and M. Toivonen (2007). Improving competitiveness and performance through service productization. A case study of small KIBS companies participating in a productization project. Service Engineering and Management Summer School (SEM 2007), Helsinki, Helsinki University of Technology.

Positioning and characterization of service(s)

Within this service perspective and integrative approach of goods and services, it is questionable whether there is a need to individually define the concept of goods and services. However, it may be beneficial to define the concepts to study specific antecedents and consequences. A review of the literature reveals that there is no commonly agreed upon definition of the term service (Cook, Goh et al. 1999; Lovelock and Gummesson 2004; Sampson and Froehle 2006; Sanz, Becker et al. 2007). Consequently, the term 'services' currently has different connotations for different audiences. There are many definitions of the term service; it seems easier to state what services do *not* lead to: services are activities that do not lead to transfer of ownership (of a 'thing') to a customer. Chapter 1 gave two definitions from the service marketing research: Grönroos defines a service as "a process consisting of a series of more or less intangible activities that normally, but not necessarily always, take place in interactions between the customer and service employees and/or physical resources or goods and/or systems of the service provider, which are provided as solutions to customer problems" (Grönroos 2000, p. 44). Vargo and Lusch define service as "the application of specialized competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself" (Vargo and Lusch 2004a, p. 2). The above definitions by Grönroos and Vargo/Lusch are considered equally valuable as a foundation underpinning the current study. However, in the next chapter the definition of service (and goods) will be revisited after further exploring the concepts of 'product' and 'process' in a service perspective context.

There is a general consensus on four generic characteristics of services: intangibility (cannot be held), heterogeneity (non-standardized), inseparability (interactive production/ consumption) and perishability (inability to inventory). These characteristics were first identified by Sasser, Olsen et al. (1978). According to Zeithaml intangibility forms the fundamental difference, universally cited by authors (Zeithaml, Parasuraman et al. 1985). However, a service is rarely completely intangible, heterogeneous, inseparable and perishable (Easingwood 1986). There is a continuum in which the above features play, to a greater or lesser extent, a role. For example, a Virtual Private Network (VPN) service product by Telco is not fully intangible: the Customer Premises Equipment (CPE, at the customer's location, but owned by Telco and part of Telco's proposition and management domain) is clearly visible for the customer[17]. The service may become heterogeneous when an engineer improvises to resolve an incident, and the service itself may be perishable, but much of the networking equipment can be stored for 'just-in-time' delivery. Also, goods may look very tangible at first sight, but with the above mentioned observations by Drucker and Gummesson (Drucker 1973; Gummesson 1995) the actual use of goods by the customer may differ substantially, hence even goods may become quite intangible for the delivering firm. Therefore, Shostack does not refer to a goods-service continuum but a tangibility-intangibility continuum (Shostack 1977). This all adds up to the need for an

[17] Sometimes the term Customer Premises Equipment is used to denote equipment that is owned by the *customer*. Such CPE could or could not form part of the service provider's service proposition and management domain. The consequences of these differences in CPE ownership and control will be described in Chapter 3.

integrative service perspective view of goods and services. However, the intangibility of the service output and service process poses a problem for the innovation process, as indicated in Chapter 1 with the introduction of 'the missing innovation objects'.

Scope of service(s)

The scope of the term 'service' ranges from broad economic perspectives of the service sector, via after-sales service as a by-product of manufacturing and in-company delivered internal services, to ICT-perspective notions like service-oriented architecture.

In the broad service sector perspective the term covers a wide range of activities. In the private sector, it includes areas such as wholesale and retail services, transport, communication, financial services, hotels, restaurants and business services. In the public sector there are service activities within, for example, education, health and governments. Several taxonomies have been made to classify different categories of services. Some taxonomies specifically cover the service sector (Lovelock 1983; Soete and Miozzo 1989; Silvestro, Fitzgerald et al. 1992; Evangelista 2000; Miozzo and Soete 2001). Others cover the combined areas of service and manufacturing (Pavitt 1984; Pavitt, Robson et al. 1989; Castellacci 2007). Most of the 21 sections of the high-level NACE categorization (EC 2006) include services activities.

Service as an after-sales by-product of manufacturing is one of the oldest notions of the term 'service' (Regan 1963; Judd 1964). In Porter's original value chain model, service is positioned as the utmost right primary activity, following marketing and sales (Porter 1985).

Within Telco, until recently processes and departments interacting with customers were called 'after-sales' processes and departments respectively. This clearly revealed that the company was still stuck in product delivery thinking and had not yet entered the service perspective era. If your product is a good, then one needs an after-sales department to provide after-sales services; if you consider your product as a service, then essentially most operational activities within the company are 'after-sales' since most of the service activities happen after selling the service proposition to a customer.

... a company with an 'after-sales department' is probably not (yet) a service perspective company...

The idea behind the notion of internal service is that everyone in the organization is a customer (Berry 1981; Grönroos 1981) and that everyone in the organization has a customer that they serve (Lovelock and Wirtz 2004). Already in the 1980s the importance of internal service was a core principle of total quality management (Deming 1986), and there is a common acceptance that the quality of internal service is a key influencer of, and contributor to, the external service quality (Gremler, Bitner et al. 1994). This extends the notion away from viewing internal service as just the services provided by the various internal functions, such as HR and IT. In a fully networked environment one could even question the need to differentiate between internal and external services. Johnston (2008) investigates internal service from a service management perspective and provides an overview of the literature on the subject.

From an ICT-perspective the term service is widely used in connection with the concept of Service-oriented Architecture (SOA) and a plethora of related notions like service-oriented computing, enterprise service computing, enterprise service bus, web services etc. Bieberstein, Bose et al. (2005, p. 4) define a service-oriented architecture as "a framework for integrating business processes and supporting IT infrastructure as secure, standardized components (services) that can be reused and combined to address changing business priorities". Although the term 'business services' in this definition suggests a broader scope than ICT-only, a connection between IT and the above-mentioned notion of internal service is seldom made in practice or in literature. Sanz, Becker et al. (2007) argue that new gaps are emerging between business communities and IT communities by using the same word 'business service' in different ways. Furthermore, business services form a category in the service sector perspective (Miles 2005). Business services in this typology range from manual services such as cleaning and other office and building services to administrative services such as accounting and law, to technical services such as computing and engineering.

... in a fully networked environment one could question the need to differentiate between internal and external services ...

The notion of 'service' in this study adheres to the service marketing-based definitions by Grönroos and Vargo & Lusch as given in Chapter 1, and includes the notion of internal services.

Telco and service (perspective)

Within Telco, the term 'service' was used for several purposes and with several meanings. It could imply the following:

- the product proposition and delivery to customers, as a synonym of 'product'
- the interaction process with customers to support service products like telephony
- the ('after-sales') process to support customers on goods-based products like telephone exchanges
- the output/transactions of applications like e-mail, voice (over IP), or instant messaging as opposed to the output/transactions of networking infrastructure
- the Telco internal process for managing network incidents; see Case 4-4
- the output of a process from one organizational department to another, in conformity with the notion of 'internal service'
- the IT-based meaning(s) as applied e.g. in 'web services' or 'service oriented architecture'
- the TMF NGOSS SID industry framework (NGOSS 2004) meaning of 'service'; see Case 4-3
- Telco as a 'service company', meaning a company that strives to adopt a service perspective. This notion of service has been described in Paragraph 2.2 as the third, service perspective, phase of the telecom landscape.

Within one interest area (e.g. product management or IT) the different meanings usually posed no problem since only one shared meaning applied. However, the consequence of these different meanings within Telco was that frequently confusion arose on the scope of 'service' during cross-department communication, especially on the interface between product management and operations and between process development and IT. As a result, although the term 'service' was used frequently within Telco, it did not play much of a meaningful role over the years.
However, the notion of service in 'Telco as a service company' has become increasingly important over the course of the past decade. Although customer focus is regularly confused with merely measuring 'customer satisfaction', Telco indeed seems to be progressing in adopting a service perspective. This is illustrated for instance by the convergence of various operations centers into one network operations organization in 2008/2009, which resulted in highly improved incident resolution processes. Another example is the (virtual) convergence of sales and customer service into one 'Sales and Service Square' on the corporate intranet in 2009. Until that moment sales was viewed as 'front-office' and customer service as part of the 'back-office', while in a service perspective context the combination of the two should be viewed as the front-office of the firm[18].

Within Telco nine different meanings of 'service' applied ...

2.5 ICT-intensive service

The biggest changes in service provisioning stem from the application of technology. ICT enables a larger variation in services and a better management of service production processes (De Jong 1993). The scope of this study is ICT-intensive service perspective firms. These are service firms that depend heavily on ICT for their core business processes. Examples can be found in areas such as media, telecommunication, banking, insurance, travel and logistics. A fast-growing area is also formed by web-based businesses: various configurations of manufacturing and service providing 'bricks and clicks' companies. Sometimes the term 'e-business' is used to denote a comparable category of services, but this term typically encompasses web-based customer interaction. Although web-based customer interaction may be important for ICT-intensive services, customer interaction may also be based on other media.
Likewise, in this study I(C)T services are not considered equal to ICT-intensive services. The term IT services relates to the customer-perceived output of a service provider, while ICT-intensive services are related to the internals of a service provider: 'I(C)T services' is about the product, 'ICT-intensive services' is about the process.

[18] This has been described extensively in Grönroos, C. (2000). Service Management and Marketing: A Customer Relationship Management Approach, Wiley.

The scope of ICT-intensive services is also slightly different from the 'information-intensive basic technological trajectory of firms' by Pavitt. This category seems to exclude some ICT-intensive 'Scale-intensive' firms (Pavitt, Robson et al. 1989, p. 97).
ICT-intensive services can be found in each of the four quadrants by Lovelock (1983); see Figure 2.4. They can be people processing services like airline services, possession processing services like logistic businesses, mental stimulus processing services like electronic media or information processing services like financial or telecom services. ICT-intensive services can also emerge from a service perspective by goods suppliers. ICT can be applied for different purposes. It can e.g. be used to enable new business models, support sales and customer interaction processes or increase productivity throughout the entire value chain. An important development is the rise of customer self-service capabilities, by which customers take over certain tasks of the firm via web-based access methods. ICT-intensive services broadly cover the scope of so-called production-intensive services like transportation or telecommunication services, but also include knowledge-intensive services like some IT services (De Jong and Vermeulen 2003).

ICT service is about the product, ICT-intensive service is about the process …

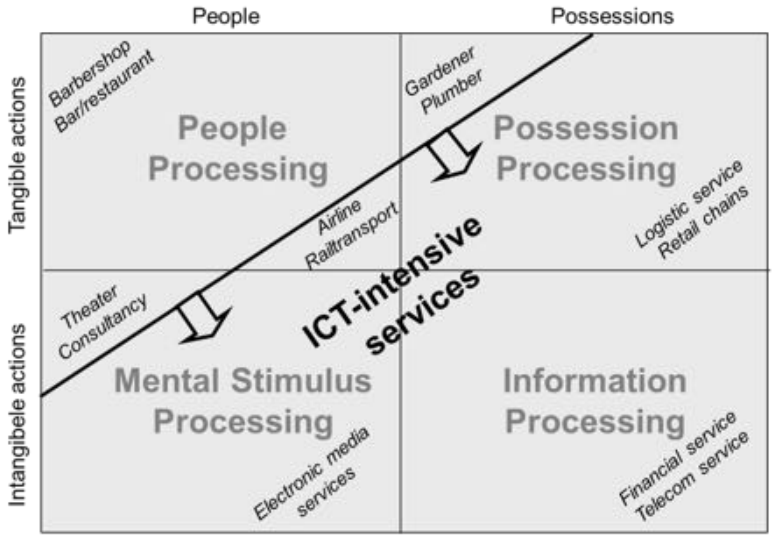

Figure 2.4 ICT intensive services in the classification by Lovelock (1983)

The technological taxonomy of services by Miozzo and Soete (2001) consists of three categories of firms: 1) supplier dominated (e.g. restaurants), 2) scale (production) intensive networks, in two variants: scale-intensive physical network services (e.g. transport and wholesale) and scale-intensive information networks (e.g. finance and communications), and 3) specialized suppliers/science-based (e.g. software, specialized business services).

ICT-intensive services as described in this study broadly cover the second category of services: scale (production) intensive networks in both variants.
ICT is an enabler for mass customization (Boynton, Victor et al. 1993; Pine, Victor et al. 1993; Peters and Saidin 2000; Winter 2002; Asperen, Pinchetti et al. 2005). ICT is not only directly important in the operational processes of mass-customized service providers. Increasingly, ICT is also indirectly important to support the innovation process with mass customization-related concepts like Product Lifecycle Management (PLM) (Ramani, Cunningham et al. 2004; Simpson, Marion et al. 2006).

Telco and ICT

Already for some decades, Telco can be viewed as an ICT-intensive service firm: ICT plays an important role in virtually all business processes. A popular acronym in the telecom service provider area is 'OSS': Operational/Operations Support System(s). An OSS is an IT system that supports core internal processes that deliver products and services to customers (Potter and Brady 2005). The term may cover both the service function capabilities and service management capabilities, but sometimes the term 'BSS' (Business Support System) is used to denote ICT in the customer-related processes of the service management capabilities[19]. This distinction between OSS and BSS was commonly made within Telco. Since 2006, Telco views and promotes itself as an ICT/multimedia service provider: ICT services are considered the main product of the company. A few years ago, Telco distinguished between Network IT, Product IT and Transactional IT. Network IT included IT that was directly related to the networking infrastructure, like specific network management applications. Product IT included IT that directly interacts (at the 'product' level) with customers, e.g. e-mail applications. Transactional IT included IT for supportive processes like customer order fulfillment and billing. Although it was useful to recognize broad categories of IT within Telco, the three categories were abandoned because of the blurring boundaries between the categories. For instance, should a web-based customer self-care application be called Product IT or Transactional IT? It directly interacts with the customer, and can also be supportive to transactional processes like order fulfillment. Likewise, the boundaries between IT and technical infrastructure became blurred, e.g. with the application of standard hardware servers to support e-mail applications.

Since 2006, Telco views and promotes itself as an ICT/multimedia service provider …

[19] In the literature, frequently the acronym 'OSS/BSS' is used to denote the combined area.

2.6 Service perspective innovation and operations

In Chapter 5, innovation and innovation management will be discussed extensively in the context of ISM firms. For this stage of the study it is necessary to position the innovation versus operations functions of a firm (Figure 2.5).

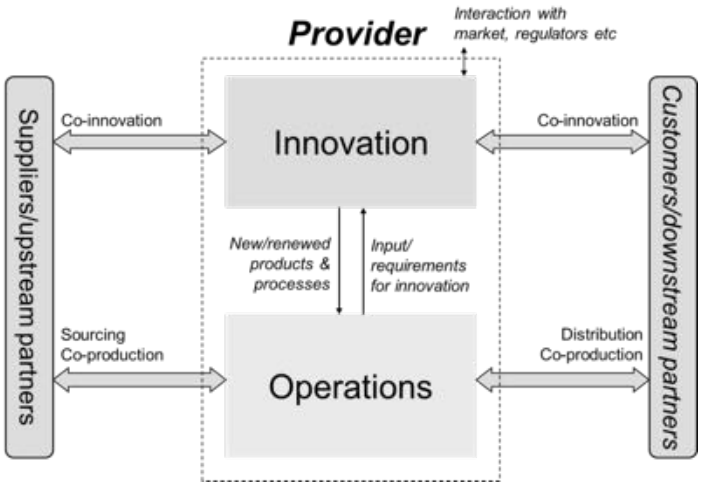

Figure 2.5 Positioning of innovation and operations

As mentioned in Chapter 1, innovation in this study is defined as "changing the value and satisfaction obtained from resources by the customer" (Drucker 1985, p. 33). Based on interaction with the market, customers, suppliers and regulators, innovation provides the prerequisites for operations (Edvardsson and Olsson 1996) by implementing new/renewed products and processes within operations. Eisenhardt and Martin view the product innovation process as the driver of one of the most important examples of 'dynamic capabilities': "specific organizational and strategic processes by which managers alter their resource base to match and even create market change" (Eisenhardt and Martin 2000, p. 1111). With a growing interest in customer value and alternative business models, the importance of the innovation process increases to enable this matching and creation of market change.

... the scope of innovation includes co-innovation with customers and suppliers ...

Just as there are multiple definitions of innovation there are many definitions of 'operations'. The scope varies between the relatively small scope of 'factory' production tasks only, as was quite common within Telco, to all recurring activities within a company, coinciding with the scope of a 'Chief Operating Officer'. O'Sullivan and Dooley offer a concise definition of 'operations': "Simplified to its most basic level, an organization can be said to consist of two core activities: operations and innovation. Operations are all the activities that provide an existing service or product to a customer, including manufacturing, human resources, and material planning. Operations

usually form the mainstream activities of any organization and are focused on the here-and-now needs facing the organization" (O'Sullivan and Dooley 2008, p. 28). Innovation provides the prerequisites for operations (Edvardsson and Olsson 1996) and operations provides input/requirements for innovation (vertical arrows in Figure 2.5).
In service perspective companies customers are co-producers of the firm. This concept has been described by Normann (1984, p. 21): "... the client plays an interesting complex role in the service organization, since he not only receives and consumes the service but also serves as a component in its production and delivery". Edvardsson and Olsson even go a step further by arguing "that the service company does not provide the service but only the prerequisites for various services. The company does not sell services but opportunities for services which are generated in partially unique customer processes with partly different customer outcomes" (Edvardsson and Olsson 1996, p. 147). For ISM firms, this phenomenon of co-production not only applies to the customers/downstream partners, but also to the suppliers/upstream partners. And partners may assume both a supplier and customer role at the same time, or switch roles over time. In this study, the scope of innovation includes co-innovation of the firm with suppliers and customers, while the scope of operations includes co-production with suppliers and customers.

Innovation and operations at Telco
Although Telco may not have achieved many ground breaking innovations, a number of important innovations have emerged during the last decade, both in the product and process area. Product innovations include an early implementation of mobile internet services and combinations of Internet Protocol (IP) based voice, internet and TV services in the consumer, Small office Home office (SoHo), and wholesale market. Process innovations include the development of state-of-the-art fixed and mobile broadband networks, and generic process platforms in e.g. Customer Relationship Management (CRM) and order fulfillment. Both customers and Telco profited from developing an easy to use do-it-yourself package for broadband internet. In the corporate market, Telco manages a number of large-scale and innovative networking and communications solutions for corporate customers and other large organizations. Finally, in the wholesale market Telco facilitates a large number of 'virtual network operators'.

... a number of important innovations have emerged during the last decade...

The above positioning of innovation versus operations also broadly applied within Telco, although the term 'innovation' sometimes has a somewhat narrower meaning. Regularly, 'innovation' seems to be predominantly geared to the tangible aspects (notably network equipment and IT), while the intangibles (customer experience, processes and organization etc.) tend to be relatively neglected. This phenomenon is related to the still pervasive technology orientation of the company (especially in the business and wholesale area), in which the service to a customer is often confused with the networking equipment that serves as an enabler of such a service. This technology orientation is also observable in the 'mental sequence' according to which many innovations have been guided: 1)

technology/proposition, 2) fulfillment and billing, 3) incident management, 4) broader service providing notion. Management seems to expect the innovation process to only implement technology (networking and IT) and related ('core') service function capabilities. The innovation process is not regarded as the full implementer of the service management capability-related processes. This task, including e.g. the development of Service Level Agreements (SLAs) between the internal 'chain' parties, is largely left to operations management once the service is in operation. Related to this issue, innovation roles and output are relatively clear in the service function capability (networking technology-based) area, but fuzzy in the service management capability and product area. An implication is that there are no hooks in the innovation process to implement the required levels of customization and productivity in the operational phase. This practice could have been workable in the old days with predominantly mass manual processes, but it is questionable whether it can be maintained in a highly automated, de-siloed environment with various actors in a value network.

... the innovation process is not regarded as the full implementer of service management capability-related processes ...

Within Telco's traditional product/technology oriented silos during the product supplier phase, all functions involved in service innovation/development and service operations within one silo could find each other blindfolded. Subsequently, there was no obvious need for strictly formalized/standardized innovation working methods, interfaces, and innovation process-supporting ICT-tooling. Now that these silos are gradually being torn down with the aim of enhancing productivity and customer focus while implementing NGN and related technologies and processes, it is not clear anymore how product innovation and process/technology innovation personnel should work together, or how (and by who) communication with suppliers and customers should be performed. Existing islands of information are barely connected, catalogs of products and production assets are poorly defined and maintained, documentation of requirements and specifications is not standardized and still paper-based, the role of data management is limited, and there is no transparent company-wide overview of the relationship between products and production assets. During various reorganizations, hardly any attention was paid to these innovation process-related aspects. In the operational processes this is reflected in sub-optimally functioning processes and IT, ambiguity as to 'chain responsibilities', a limited overview of cost components, and insufficient grip on overall customer satisfaction. Of course people do their best from their own perspective to tie ends together, but how can required company or customer segment-wide levels of service functionality, customization and productivity be developed and operationally implemented in such an unconnected 'de-siloed' environment? Despite all good intentions, the potential of a de-siloed mass-customized environment is not attained.

Other observations within Telco concerning the organization of the innovation process in relation to mass-customized service are the following:

Each innovation tends to be considered a one-off exercise, rather than the starting point of a continuous process of incremental, modular, or architectural innovations (Henderson and Clark 1990). This is reflected in the widely-used term 'roll-out', which stems from the networking infrastructure vocabulary. There seems to be limited interest in managing the normative specifications of the existing products and processes. Until recently, release management was only done at a low level of technology and ICT applications and/or was left to the suppliers. As a consequence, design knowledge of the existing products and processes is not readily available. 'Impact analyses' to assess the impact of changes to the existing products and processes at the start of an innovation trajectory tend to be lengthy and costly activities, requiring high levels of resources. More importantly, services are hardly designed with future innovation flexibility/agility in mind.

Firefighting is higher valued than fire prevention: more emphasis is put on ad-hoc problem solving initiatives than on preventing operational problems by means of a well-executed innovation process. A company-wide Lean Six Sigma program (Womack and Jones 1996; George 2003) that started in 2006 has no defined links with the innovation process, resulting in one-off successes that are not explicitly reused in other contexts. The adage 'first time right' seems to have an operational connotation only, instead of encompassing the notion that a first time right design, development and implementation could induce first time right operations.

... the above issues are certainly not unique to Telco ...

Although, within Telco, various governance models are available for modularization and 'de-siloing' as described in the cases, it seems hard to have this governance implemented on a company-wide scale. Consequently, a foundation for further innovation for mass customization and portfolio rationalization seems to be lacking.

Within Telco much customer-specific customization for large enterprises in the business market area applies, dubbed 'ad hoc innovations' by Gallouj and Weinstein (1997). However, there are few processes available to convert customer solution best practices into mass customization practices for broader application.

Finally, during the last decade, Telco management seemed to have relatively little interest in (the organization of) the innovation process. For example, measurement of innovation outcomes was mostly limited to measuring the elapsed project implementation time and burn-rate of investments.

Contacts with other telecom providers reveal that the above issues are certainly not unique to Telco. And above observations do not imply that Telco's management did not show any interest at all in the innovation process during the last decade.

Examples include:

- Broad application of a formalized NSD stage-gate process (Booz-Allen and Hamilton 1982; Cooper 1990) since the early-90s.
- The availability of an idea management system since the 80s: initially in the form of a physical idea box, currently in the form of a web-based system with an automated workflow.

- Long-lasting adherence to the industry standard NGOSS/eTOM framework (Case 4-3) and initiatives to implement corporate-wide product structure and supply chain modeling governance (Case 4-2 and Case 4-4 respectively).
- Diverse experiments with the organization of the innovation process during the last decade, including rapid/iterative development initiatives, cross-sector entrepreneurial teams and corporate venturing.

Telco was one of the first incumbents to implement 'All Internet Protocol' and 'Fixed Mobile Convergence' strategies, and to acknowledge the shift from a telecom infrastructure and product provider toward a customer oriented ICT multimedia provider.
Furthermore, diverse strategy and performance management-related methods have been introduced and applied within Telco during the last decades, including Total Quality Management (Dean Jr. and Bowen 1994), Business Process Redesign (Davenport and Short 1990; Hammer and Champy 2001), Activity Based Costing (Kaplan 1998), Balanced Scorecard/Strategy Maps (Kaplan and Norton 1996; Kaplan and Norton 2004)), Lean Six Sigma (Womack and Jones 1996; George 2003), Zero-Base Budgeting (Phyrr 1970), Rolling Forecasting (Arterian 1998; Montgomery 2002), Portfolio Management (Cooper, Edgett et al. 1997), Program Management (OGC 2003, 2007a), Strategic Buckets Approach (Cooper, Edgett et al. 2001; Chao and Kavadias 2008) and Technology Road mapping (Phaal, Farrukh et al. 2001). Some of these methods are still used within Telco. Given the corporate scope of these methods they contributed to some extent to Telco's transition to an ISM firm. However, many methods only lived for a short period of time and/or were implemented in a stand-alone mode, lacking grounding in an overall vision on (the organization of) the innovation and operational processes.
The above observations may explain Telco's limited overall success until now on the path toward an ISM firm, despite various rationalization, de-siloing, modularization, and governance initiatives, including organizational restructuring. This will be explored in the case study throughout the thesis.

Telco is one of the first incumbents to implement All Internet Protocol and Fixed Mobile Convergence strategies …

2.7 Mass customization and related concepts

Mass customization is a business approach in which mass production is combined with strategies to accommodate individual customer needs by offering and delivering customized goods and services. Davenport (1993) simply defines mass customization as 'the tailoring of process output to customer needs'. As a technological concept, mass customization was already foreseen in 1970 by Alwin Toffler (1970); the term mass customization comes from Stan Davis (1987). Pine (1993) describes in a number of cases (including Toyota and IBM) how mass customization can be deployed in business practice.

Hart (1995) defines mass customization as "the use of flexible processes and organizational structures to produce varied and often individually customized products and services at the low cost of a standardized, mass-production system" (p. 36). According to Pine there are five basic methods for mass customization: 1. customizing services around existing standardized products or services, 2. mass producing customized services or products that customers can easily adapt to individual needs, 3. moving production to the customer to provide point-of-delivery customization, 4. providing quick response, and 5. modularizing components to customize end products and services (Pine 1993, p. 9).
Already in the first publications on mass customization by Davis and Pine there was mentioning of 'products and services', but until the 1990s the emphasis was very much on manufacturing. Kaplan and Haenlein (2006) suggest that the notion of mass customization should be used exclusively for the production of goods and not for services. Their reasoning is that while mass produced low cost goods may need customization, services may need a lower cost level, but need not be customized at all because they are inherently customized. Instead, for services they propose to use Sundbo's term 'modulisation' (Sundbo 2002). Like many authors, e.g. (Bowen and Youngdahl 1998; Peters and Saidin 2000; Piller, Reichwald et al. 2000; Heiskala, Paloheimo et al. 2005; Sigala 2006; Santonen 2007; Von Hippel 2007), it is assumed that the concept of mass customization is equally valid for service and service perspective firms. Telecom providers often deliver mass services but the actual level of customization may be quite limited, especially if a customer requires a combination of multiple services. This shows that there may be room for customization for already 'mass' operating service firms.

In the current study a broad notion of mass customization will be used ...

In the current study a broad notion of the term mass customization will be used: every approach aimed at delivering the combination of customized goods/services at (nearly) mass cost. This includes strategies like modularization and platform thinking, and relies on concepts like agility, flexibility and lean thinking. Mass customization is thus treated as a business concept overarching e.g. manufacturing or (service) operations concepts.
Da Silveira, Borenstein et al. (2001) have researched the enablers of mass customization. They claim that agile manufacturing, supply chain management, customer-driven design and manufacturing and lean manufacturing are the processes and methods that enable mass customization. These enablers may include architectural approaches, like modularity or platform thinking as described in the next section. However, mass customization may also be enabled by operational customization approaches in the front-end processes, including e.g. web-based customer self-care combined with design tools or product configurators[20].

[20] A product configurator is '… software modules with logic capabilities to create, maintain, and use electronic product models that allow complete definition of all possible product option and variation combinations, with a minimum of data entries and maintenance' Bourke, R. (2000). Product configurators: key enabler for mass customization – an overview. Midrange Enterprise 8/2000. Note that such building blocks themselves may be considered a process platform in the notion of 'platform thinking' (refer to the section on mass customization supporting concepts further in this paragraph).

This research focuses on the architectural measures for mass customization, and the consequences for innovation management.
Before proceeding with these mass customization supporting concepts the two constituent elements of mass customization will be discussed: productivity and customization.

Productivity and service
According to Peter Drucker the greatest management challenge facing developed economies in the twenty-first century is to raise the productivity of knowledge and service workers. He acknowledges four key drivers for productivity: defining the task, concentrating work on the task, defining performance, and forming a partnership with the people who are to become more productive (Drucker 1991).
For many service providers, managing productivity is not high on the agenda. Productivity is defined as output (sales, production, profit or revenue) per given input (per employee hour worked, total investment, machine-hours) (Van Ark and De Jong 2004).
The measurement of output is in general much more challenging in services than in goods-producing industries. "Most measurement problems boil down to the fact that service activities are intangible, more heterogeneous than goods, and often dependent on the actions of the consumer as well as the producer" (Van Ark, O'Mahony et al. 2008, p. A2).

Within Telco productivity is on the management agenda …

Levitt (1972) long ago advocated a 'production-line approach' to service. The idea was that by industrializing service processes much profit can be achieved in productivity, while achieving a more homogeneous quality in service provision. It seems paradoxical that traditional services have better notes on industrializing than managed ICT services. Traditional service sectors, such as hospitality, entertainment and travel are able to deliver highly industrialized service, providing their clients with predictable functionality and quality, increase their operating efficiency, and improve their market coverage characteristics through franchising and licensing. On the other hand, managed services in the ICT sector struggle with packaging and industrializing the delivery of managed services (Leon and Davies 2008, p. 153).
Within Telco productivity is on the management agenda. Telco participates in annual benchmark studies by e.g. Oliver Wyman (formerly Mercer), in which operational efficiency forms one of the most important subjects. In 2008 Telco's national telecoms business was above peer average performance levels in terms of operational efficiency. In this study, the IT area formed one of the main opportunity areas for cost improvement. Even more on Telco's management agenda during the last decade has been the overall cost level. This level has decreased dramatically by personnel lay-offs during various organizational restructuring initiatives. In terms of traditional telecom productivity measurements like the number of staff per telephone line productivity has increased. However, it remains to be seen whether the company has become 'lean and mean' by these initiatives or rather 'lean without mean', since staff reduction was not always equally paired with the associated process and organizational change.

Customization and service

Customization should increase the value of a product for the customer. The success of mass customization depends on how customers perceive the additional costs and benefits of mass customization. To outperform mass production, the perceived costs related to the configuration process must be offset by the benefits (Broekhuizen and Alsem 2002, p. 313).

... with the rise of web-based customer self-care ... the requirements and opportunities for customization have increased dramatically ...

(Mass) customization does not represent the best strategy for all firms in all cases to increase the value to the customer. 'Mass customization may raise the benefits by closely matching a product to a customer's needs, while simultaneously reducing the sacrifices typically associated with a customized offering. (Squire, Readman et al. 2004, p. 469).

In the service process matrix, Schmenner classified services according to the degree of interaction and customization versus the degree of labor intensity (Schmenner 1986). In this scheme there is no mentioning yet of telecommunication services but they would probably have been classified as 'service factory' services, involving low interaction and customization and low labor intensity. However, with the rise of web-based customer self-care capabilities and convergence and blending of telecom and ICT services the requirements and opportunities for customization have increased dramatically. The same development applies e.g. to the financial service sector.

Mass customization supporting concepts

Mass customization is supported by concepts like platform thinking, modularity, agility and 'lean'. These concepts too are associated with both product and process aspects.

The application of 'platform thinking' in the innovation process offers a number of advantages to create a variety of products with efficient use of resources. It may simultaneously improve speed, cost, design quality, coherence, reference ability, and option value (Sawhney 1998, p. 56).

A *product platform* is a "set of subsystems and interfaces that form a common structure from which a stream of derivative products can be efficiently developed and produced" (Meyer and Lehnerd 1997, p.39). The concept is based on common architectures spanning multiple products that are implemented with common subsystems and subsystem interfaces. They explain how product platform strategies can be used to conquer new markets and expand old ones without developing entirely new products every time. Lehnerd described a classic example of product family and platform renewal at Black & Decker in the 1970s, resulting in substantial cost advantages combined with increasing product variety (Lehnerd 1987). A *product family* is a "set of products that share a common platform but have specific features and functionality required by different sets of customers" (Meyer and Utterback 1993, p. 30).

A *process platform* "entails a conceptual structure and overall logical organization of production processes to produce a product family" (Zhang 2009, p. 5). A process platform

involves three main aspects: 1) a common process structure shared by all process variants, 2) the derivation of specific process variants from the common structure, and 3) the correspondence between product and process variety (Jiao, Zhang et al. 2006, p. 237). A process platform is composed of the technologies, facilities, and processes for manufacturing a firm's products. Process platforms evolve primarily by increasing volume or capacity; they also are an opportunity for innovation to facilitate greater product variation during a product family's evolution (Meyer and Zack 1996, p. 45).

Meyer and De Tore extended the concept of product platform to services by introducing the concept of service(s) platform. They position *service platforms* as: common subsystems leveraged across markets (Meyer and De Tore 1999, p. 69). However, the term is also used to denote a somewhat more 'technical' meaning, like e.g. in 'e-mail service platform'. Finally, in the late 1990s the concept of *industry platform* was applied to describe a product platform-resembling concept as part of a technology 'system' whose components are likely to come from different companies. (Gawer and Cusumano 2002; Cusumano 2010). A well-known example is the 'Wintel' combination of Microsoft Windows and Intel industry platforms.

A second mass customization supporting concept is modularity. Duray, Ward et al. define mass customization as "building products to customer specifications using *modular* components to achieve economies of scale" (Duray, Ward et al. 2000, p. 610). Ulrich and Tung perceive *modularity* as 1) "similarity between the physical and functional architecture of the design" and 2) "minimization of incidental interactions between physical components" (Ulrich and Tung 1991). A fully modular architecture means that a change made to one component does not require a change to other components (Ulrich 1995). These concepts are highly developed within the automobile and PC industry.

In the literature, some authors state that modularity in service is easy to accomplish due to the intangibility characteristic which eases changing service modules (Baldwin and Clark 1997; Peters and Saidin 2000). However, Peters and Saidin observe that constraints do arise from concerns relating to consumer response and organizational capabilities. They state that "Process capabilities are also difficult to achieve. Little experience exists in including commitments and accountability (in addition to procedures) when implementing mass customization strategies. In the services setting, where it is often people providing the main source of added value, the human resource challenge of ensuring service capabilities also needs particular consideration" (Peters and Saidin 2000, p. 112). While it may be relatively easy to define and develop modular service products, it seems much more difficult to define and develop modular service processes, especially if these process modules encompass combined capabilities from human resources and technical resources.

... some authors state that modularity in service is easy to accomplish due to the intangibility caracteristic ...

A third concept related to mass customization is 'agility'. The term 'agile manufacturing' sprang to prominence in the USA in 1992 when the Agile Manufacturing Forum was set up (Gould 1997). Oxford dictionary defines agility as 'the gracefulness of a person or animal

that is quick and nimble'. Initially, the concept of mass customization was explained with the notion of agility: ‘variety and customization through flexibility and quick responsiveness’, but now it has grown to mean: ‘the (whole) process involved in giving customers exactly what they want exactly when they want it’ (Anderson and Pine 1997). Besides in manufacturing the term agility is used in the context of supply chains (Christopher 2000; Steindl 2005; Tuominen, Kitaygorodskaya et al. 2008) and software development (Fowler and Highsmith 2001; Steindl 2005). Related to agility is the notion of flexibility, the ability to adapt to environmental uncertainty and change (Slack 2005). Flexibility in production is the major requirement for mass customization processes (Fogliatto, Da Silveira et al. 2003). Wadha and Rao give an overview of the literature on both agility and flexibility and proposes the combine both terms as flexagility “to evolve a paradigm where flexibility (alternatives) becomes a platform to increase the system agility (responsiveness)” (Wadhwa and Rao 2003, p. 126).
Finally, a fourth concept related to mass customization is ‘lean’. Lean was developed by the Japanese automobile industry as ‘lean manufacturing’ (Womack, Jones et al. 1990). It aims to reduce performance trade-offs, make the value-adding processes flow and implement customer-pull, and to eliminate waste from the value chain of activities from product development to product delivery (Bowen and Youngdahl 1998, p. 211-212). Several authors have explored the application of lean manufacturing principles in a service context (Bowen and Youngdahl 1998; Ahlstrom 2004; Liker and Morgan 2006). Pine, Victor et al. (1993) view lean manufacturing as a possible subset of mass customization, but not the other way around. Furthermore they view Lean (by the writers also referred to as continuous improvement) as a preceding stage of mass customization.
Although usually the suffix ‘and services’ is used in the literature, all of the above concepts have originally emerged from the manufacturing sector. This also applies to some related logistics/supply chain concepts like ‘Customer Order Decoupling Point’ (COPD; Browne, Harhen et al. 1996; Rudberg and Wikner 2004) and ‘postponement’ (e.g. Feitzinger and Lee 1997).

Telco and mass customization
Within Telco, customization seems to be not high on the management agenda. However, customization happens on a large scale due to customer demand for customized products/services. This takes different forms for the various market segments. In the *consumer market* the basic service proposition is relatively stable: combinations (in telecom jargon: ‘double play’, ‘triple play’, or ‘quadruple play’) of fixed or mobile voice, internet and TV. However, within the basic proposition, customers want to be able to change easily between specific characteristics like internet speed or choice of TV channels, and pricing bundles. And it should be easy to connect and configure in-home networking related to the above services.
In the *business market* the distinction is made between small companies, mid-size companies and large corporate customers. The requirements by small companies coincide largely with those of consumers (combined dubbed ‘SoHo’: small office home office). Mid-size companies have various communication requirements including (virtual) private

networking and in-company communication solutions. They require the various propositions to be easily 'mixed and matched', including consultancy and systems integration. Large corporate customers usually expect even more customization and systems integration. The business case frequently justifies the implementation of partly bespoke solutions.

Wholesale customers, including traditional wholesale parties like other telecom operators and 'new' wholesale customers like retail chains delivering white-labeled mobile services, expect similar product features as the consumer and business customers. In fact some services/features must be delivered against consumer/business market conditions due to regulations. On top of these services/features wholesale customers expect customized features that ease their role as wholesale provider, including e.g. wholesale customer management and reporting.

Within Telco, the developments in the transformation from a utility provider and product supplier toward a customer oriented service perspective firm were not labeled as 'mass customization'. However, this actually was the paradigm that the company was striving at, although cost reduction arguments tend to prevail above customization arguments.

Within Telco, the developments in the transformation … toward a customer oriented service perspective firm were not labeled as 'mass customization'…

Especially during the last six to seven years, Telco has pursued multiple efforts to attain this new service operations vision in a 'Next Generation Network' (NGN) context, covering both the networking technology area and ICT application landscape (Cases 3-2 and 3-3). These efforts included the development of a new IP-based network infrastructure and several rationalization, modularization and 'de-siloing' initiatives, including governance measures.

Just as there was no explicitly formulated mass customization strategy there was only limited governance on using the various mass customization-related concepts within the innovation process. The antecedents and consequences will be clarified in the case study.

Horizontalization/de-siloing

Horizontalization is another concept that is related to mass customization. In this research, horizontalization is defined as an organizational approach that favors horizontal 'peer' relationships, with vertical decoupling between horizontal layers, above vertical 'hierarchical' relationships, with horizontal decoupling between vertical columns. The aim of horizontalization is usually to provide better 'fit' combinations of goods/services to the 'customer' of a horizontal layer, or to specialize on one particular component in the value chain. Horizontalization can be relevant at the level of a sector (e.g. the computer industry), within the organization of a firm, or at the level of (ICT) technology. At the firm or sector level, the term 'horizontalization' broadly coincides with terms like 'unbundling', 'layered approach', de-verticalization, and 'de-siloing'.

At the firm level, independent business units are an example of a vertical structure[21]. Decoupling between the vertical columns of a firm could take an extreme form, namely no coupling at all. The verticals form so-called silos that could function perfectly on an individual level, but usually have difficulties in a combined operation of multiple silos, e.g. at the firm level. This could lead to operational inefficiencies and unwanted competing offerings to the same customer, while combined offerings from multiple silos are poorly integrated for customers. To cope with these disadvantages several 'overlay' structures have been incorporated, like product management or a combined sales force. Porter discusses horizontal strategy to coordinate the goals and strategies of related business units of a diversified firm. He argues that an *explicit* horizontal strategy should be at the core of group, sector, and corporate strategy (Porter 1985, p. 365). Horizontalization takes this concept one step further by incorporating a horizontal organizational structure as the leading principle. According to Ostroff, a horizontal company provides a better way to cope with the watchwords of today's economy: speed, service, total customer solutions and flexibility (Ostroff 1999, p. 6). Hagel and Singer observe that most companies are engaged in three different kinds of business with different characteristics: Product Innovation, Customer Relationship Management, and Infrastructure Management. They suggest a specific horizontalization scheme to unbundle these three types of businesses into different companies (Hagel III and Singer 1999).

Horizontalization is supportive to mass customization …

Horizontalization is supportive to mass customization because it typically encompasses (un)bundling of customer interacting processes, facilitating customization, and (un)bundling of 'back-office' processes and technology, facilitating operational efficiency. Modularity seems to rely on horizontal structures because a horizontal structure implies standardized interfaces to the customers and suppliers of one layer. In this respect, a horizontal layer might even be regarded as a module itself. Additionally, modularity may induce horizontalization. Langlois and Robertson (1992) observe in two case studies that innovation in a modular system can lead to vertical and horizontal disintegration, as firms can often best appropriate the rents of innovation by opening their technology to an outside network of competing and co-operating firms. Baldwin and Clark (2000) show that modularity facilitated rapid innovation in the computer itself (as a modularized system) as well as in the computer industry as a whole (a modularized system of modularized systems). A substantial literature stream suggests that many products are becoming more modular over time, and that this development is often associated with a change in industry structure toward higher degrees of specialization (Fixson and Park 2008, p. 1296). Figure 2.6 shows in two business dimensions, the organizational model and the operating model, the main drivers and consequences of the shift from vertical integration toward horizontal integration (Van Hoek, Harrison et al. 2001).

[21] Note that within an independent business unit horizontal layering could also apply, although in that case the reach of such layering is usually limited to the corresponding business unit.

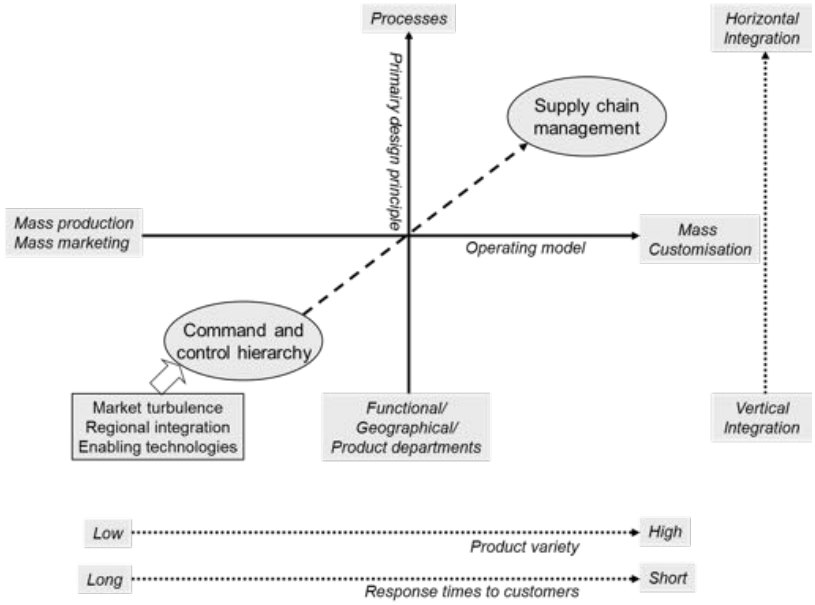

Figure 2.6 The shift toward horizontal integration (Van Hoek, Harrison et al. 2001)

The figure shows "how supply chain management represents a move away from traditional command and control, vertical hierarchy-based organization, toward one structured around processes rather than functional, product or geographical units. Added to that, is the move away from operations based on mass marketing and mass production toward mass customization, that aims to combine the efficiency of mass approaches with customizability of products and services to result in 'the best of both worlds'. The dotted arrows display how these dimensions impact the organization. First, traditional vertical integration is replaced with horizontal integration which involves extensive outsourcing and inter-functional integration. Furthermore, with companies moving toward mass customization the organization has to learn how to effectively cope with shortening response times to customers and increasing product and service variety. This can be attributed to the ever increasing need for instant customization in the market-place" (Van Hoek, Harrison et al. 2001, p. 127).

... a horizontally layered approach is viewed as the main answer to cope with ... a converged... environment ...

Horizontalization in the telecom industry

In the telecom industry, a horizontally layered approach is viewed as the main answer to cope with the challenges of a converged ICT/multimedia/internet-based environment (Hanrahan 2004). Already some decades ago, regulators forced telecom operators to 'unbundle' local access.

It is generally believed (e.g. Honda, Nakagawa et al. 1995, p.2) that "the telecom industry will follow the computer industry with undergoing a metamorphosis from a vertically integrated industry dominated by giant corporations, to a horizontally-fragmented structure with firms specializing in one or more layers in a three-layered horizontal functional model: transmission, network platform, and application platform". At the level of a telecom operator, a rationale for unbundling may also be to distinguish between highly dynamic application service development and less dynamic networking infrastructure development. Organizational separation of these tasks could be advantageous to both.
Fransman states that layer models in the telecoms industry roughly follow the following tripartite division: 1) 'pipes' on the lowest layer, 2) software/middleware on the middle layer, and 3) content, applications, and services on the top layer. He argues that a layer model may be particularly useful in illuminating at least six issues that are important in developing an understanding of the evolving structure of the telecoms industry: industry boundaries/subsectors, modularization and hierarchy, industrial organization (including issues of vertical and horizontal specialization and integration), the location of R&D, entry barriers, and the role of consumers/consuming (Fransman 2002, p. 474).
Another driver for telecom operators to horizontalize is the wish to rationalize the current portfolios of (usually technology oriented) products, networking infrastructure and IT infrastructure. In fact rationalization could be viewed as a combination of unbundling (of vertically and horizontally oriented 'building blocks') and re-bundling (of a smaller number of reusable building blocks) within horizontal layers.
Glass (2008) describes the situation at British Telecom as follows: 'In BT today, we build product stove-pipes using an increasingly complex web of systems and networks. New customer experience processes are developed over time for each product and solution. We re-develop customer experience for the same product when technology changes (e.g. Voice over IP). We rarely reuse anything because design and operational processes are not standardized. The unmanaged complexity inhibits agility, and makes us slow and expensive' (Glass 2008, p. 87). The situation at BT seems exemplary for most incumbent operators, including Telco.

Another driver ... to horizontalize is the wish to rationalize the current portfolios ...

Much is expected from next generation network (NGN) networking technologies, including internet protocol multimedia subsystems (IMS; Magedanz and de Gouveia 2006) and service delivery platforms (SDP; Ballard 2006). These technologies "claim to be able to sweep aside the stove-pipe solutions of the past by providing single platforms capable of supporting and enabling a large number of offerings. By promoting other technologies, such as service-oriented architecture (SOA), which can enable a more flexible use of available functionality, NGNs have also made it easier to address the telecom production line problem" (Bruce, Naughton et al. 2008, p. 16). However, it is questionable whether concepts/technologies like a standardized Service Delivery Platform are mature enough to provide a short term solution to the silo problem. Moreover this seems to reflect

an over-reliance on technology, while the real issue could prove to be a different approach to (innovation and operations) processes, roles and organization.

Telco and horizontalization/de-siloing

Within Telco at least six broad horizontalization perspectives, encompassing different layering approaches, can be identified: 1) NGOSS eTOM (case 4-3), 2) NGOSS SID (case 4-3), 3) Telco Product Structure (case 4-2), 4) Tripartite layering variants (Fransman 2002, see above), 5) Telco Supply Chain Model (case 4-4), and 6) Telco 2007 organizational horizontalization (Paragraph 2.3). Table 2-2 provides an overview of these horizontalization perspectives[22].

From a broad business view, all of the above horizontalization perspectives are more or less geared at the same objective: toward customer oriented services based on flexible and efficient technology and process capabilities, with standardized interfaces between the layers (Figure 2.7). However, as shown in Table 2-2, each approach has its own layered structure and its own set of sponsors within Telco, depending on the background of the approach and the background of the sponsors. Some of these approaches can perfectly live together without further required integration or governance by Telco. For example, the eTOM and SID framework (Case 4-3) have been designed in mutual coherence.

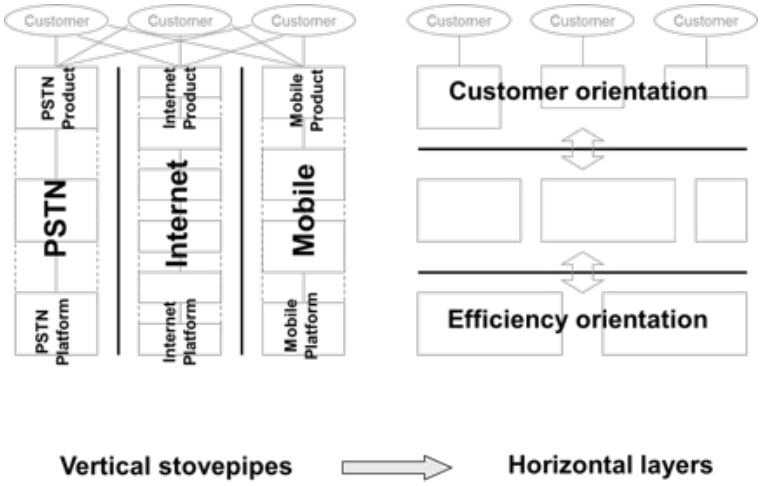

Figure 2.7 Telco's overarching horizontalization perspective

Furthermore, the tripartite (applications-middleware-'pipes') layering has value on its own to separate technology domains within the firm or to enable future industry-level horizontalization. However, for many Telco staff in the TI networking area the term 'de-siloing' solely denoted the transition from legacy networking technology toward a tripartite layered structure as given by Fransman (2002), with the Internet Protocol (IP) bridging

[22] The IT-based concept of Service Oriented Architecture has not been included in this list. Until now, the concept has hardly obtained a role outside the IT domain within Telco.

networking technology and application services. Or the term de-siloing was used in association with another technology oriented framework, the IP Multimedia Subsystem (IMS) framework. In this framework, a 'control' layer is used to separate applications (initially notably voice) from networking. Implementing these tripartite layering perspectives have already resulted in decreased investments and operational cost in network infrastructures, and will facilitate future rationalization efforts in this area.
However, if applied without a coherent horizontalization perspective at the business level including products, processes, data and organization, these technology oriented layering perspectives seem ill suited to get rid of product/technology-based silos because they leave products, processes, business roles and organization, and the associated data and information flows, essentially untouched (i.e. siloed).

... they are still embedded in processes, data, and supportive 'legacy' ICT ...

During the product supplier phase, Telco's various silos were clearly visible on the organization chart: innovation and operations tasks for a limited number of product/technology combinations (e.g. PSTN, internet, mobile, refer to Figure 2.7) were concentrated in one organizational unit or multiple closely-related organizational units. These organizational silos have gradually been broken down during the last decade. However, although these silos are not any more visible on the organization chart, they are still embedded in processes, data, and supportive 'legacy' ICT, and in the mindset of many professionals and their managers. This way, silos still partly exist a decade after they have been broken down organizationally, resulting in a fuzzy hybrid of vertical and horizontal structures. Of course networks keep running and services keep being delivered to customers, but the promises of modularization and horizontalization are hard to attain.
Telco's horizontalization perspectives that have been summarized in Table 2-2 all span the entire business of a telecom operator and have the potential to direct the transition toward a mass-customized operator. However, until now Telco did not succeed to integrate these perspectives into a set of coherent architecture governance guidelines. The relationship between the perspectives was not clarified and the layered models were only partly implemented over the years, with a limited role for non-technological layering approaches. For example, Telco's Product Structure was initially merely mapped onto Telco's Supply Chain Model with respect to application/networking 'signaling' for the (technical infrastructure-related) service function capabilities. The implications for the (processes and IT-related) service management capabilities and the organization were seldom made (while the distinction between business roles was the original intention of Telco's Supply Chain Model)[23]. Furthermore, the above Supply Chain Model was only partly implemented within the 2007 organizational restructuring (Case 4-4).

[23] An exception is provided in an article by Bastiaansen, H., A. Wisse, et al. (2001). Next-generation networks: Forcing operators towards new network design principles. J. Inst. Britisch Telecom. Engineer **2**(3): 20-25. This paper describes how business role design principles lead to a framework for designing new data/IP infrastructures for telecom service providers.

Table 2-2 - Overview of Telco's horizontalization perspectives

Layered model	Origin	Layers	Main Telco sponsors
NGOSS eTOM (case 4-3)	TMF	Customer Relationship Mgt Service Resource Mgt & Organization	Process architects/designers, IT architects/designers, Line management
NGOSS SID (case 4-3)	TMF	Product Service Resource	Process architects/designers, IT architects/designers, Data architects
Telco Product Structure (case 4-2)	Telco specific	Commercial Product Functional Product Technical Product	Process architects/designers
Applications - Middleware - Pipes tripartite variants	ISO/OSI	Applications/Content/'Services' Networking/Middleware Pipes/Transmission	Networking architects/designers, Line management
Telco Supply Chain Model (case 4-4)	Telco specific/ TINA-C	Service Provider Service & Network Integrator Network/Service Operator	Process architects/designers, Networking architects/designers, Line management
Telco 2007 organizational horizontalization	Telco specific	Customer Segments Operators (TI and IT)	(Top) Line management

A note should be made on the question whether a horizontalized, modular structure should at all times be preferred as opposed a silo structure. Silo-based organizations with co-organization of all product-related tasks within one organizational unit may be appropriate in some cases. It may be beneficial to apply such silos during concept development and introduction or during the decline phase of products to scale down operational costs. Cohn, Katzenbach et al. (2008) defend the concept of silos to provide the appropriate level of insulation for 'breakthrough innovators'. However it is important that these decisions are taken within an explicit mass customization strategy and an overall governance of a horizontalized modular structure. For product introductions this could, for example, mean that although processes are temporarily co-organized within one unit/program, modules and interfaces are well-defined from the start, enabling easy migration to a horizontalized/modular structure in a later stage.

Silo-based organizations … may be appropriate in some cases …

To conclude this paragraph, two smaller-scale portfolio rationalization initiatives in the business market from 2001 to 2005 will be described in the cases 2-1 and 2-2. Given the personal involvement in Case 2-1 the data is primarily based on the researcher's own observations and memoing; Case 2-2 is primarily based on semi-structured interviews. These illustrative cases should provide some insight in Telco's initial steps on the path to apply horizontalization and modularization principles to become a mass-customized service perspective operator. Furthermore, they provide a context for the eight governance-related initiatives in the various cases that form the basis for the conceptual framework that is developed during this research.

Case 2-1 – Portfolio Rationalization Business Market

Under the adage ‘portfolio rationalization’ multiple efforts have been pursued by Telco during the last decade to attain comparable goals in the business market division, including the scope of related operations and IT organizations: rationalize the product portfolio to better fit customers’ needs with a more limitative set of bundles of product offerings and at the same time simplify the operational processes, IT and network infrastructure to make operations more efficient. Furthermore, the efforts were aimed to get rid of multiple product/technology silos. The idea was to implement an environment in which product features and processes, IT and network infrastructure could be added, removed and replaced in a flexible way as modular building blocks. Product management became aware that technical network features were directly visible in the commercial product portfolio, while the functional need by the customers could be filled in with a much more limited set of products. Implementing a simpler portfolio, including the underlying processes, would result in a better fit on customer needs against much lower operational costs.

In 2001 a portfolio rationalization program called ‘Reference architecture Connectivity’ was started in Telco’s business market organization, with the aim to develop and implement reference architecture for the so-called ‘Connectivity’ product portfolio. This portfolio included a score of data communication services for the business market. The aim of the initiative was to provide reference architecture to guide the transition from a complex interwoven fabric of products, technology and processes toward a modular structure. A related aim was to rationalize the IT landscape, with the same rationale but with a much smaller business scope than the corporate-wide ‘IT Reference architecture’ program (Case 3-2). During this first ‘portfolio rationalization’ initiative the 1-Model, as will be described in Case 3-1, was used to show (product) management the negative effects of this technology thinking and the expected positive result if this could be replaced by ‘customer functions/value thinking’. Furthermore, there was some notion that the Product Structure concept (Case 4-2) could provide a foundation for this program. A dedicated program manager was appointed, and the program was populated with all relevant roles from both the business market organization and the related operations and IT organizations.

The program delivered reference architecture for the Connectivity portfolio area, but this mainly covered the service management capability area. The relationship with the Connectivity products themselves and the service function capabilities was hardly provided in this reference architecture. The program recommended to preventing further siloes and functional islands by introducing integral product portfolio (lifecycle) management and an architecture board to coordinate service function capabilities-related networking technology and service management capabilities-related processes and IT. Furthermore, a list of ‘quick wins’ was provided: a number of follow-up projects with a supposed positive business case on the short term, to be prepared outside the program. Although some product structuring had been applied, the program did not succeed in operationalizing the concept.

The program was ended early 2002, coinciding with a new business unit structure within the business market division. Some work was reused in the IT reference architecture program.

Discussion on Case 2-1 – Portfolio Rationalization Business Market

The portfolio rationalization initiative of case 2-1 had limited success because (product) management was too impatient and had unrealistic expectations with respect to the possible results, while actual involvement of product management was low. Each product manager protected the products/technologies for which profit & loss responsibility was assumed. Furthermore, there was a language problem between product management/marketers and technicians/process specialists: it was not clear at all what the scope of a 'product' or 'portfolio' was. Even on a product group level it was, by that time, not clear whether the business product portfolio consisted of 4, 5 or 6 main areas, let alone the individual products within these main portfolio areas. The boundary between requirements on 'products' and 'production/delivery' (networking and processes/IT) was quite fuzzy. This, together with unclear organizational responsibilities, ended in a confusion of tongues on the purpose, antecedents and consequences of 'portfolio rationalization'.

Although these initiatives started from product portfolio management, they were only worked out on a technology level. For product portfolio management the term portfolio usually equaled the underlying (network) technology and related ICT, and not the commercial offering/proposition. During these initiatives, it became clear that 'technology thinking' prevailed from networking technicians to (product) managers. To some extent, this was understandable as many product managers in the business market area were formerly networking specialists who could only make their next professional carrier step by moving into the product management area.

An example of 'technology thinking' is that it was not even always clear, both for customers and Telco customer services personnel, whether certain customer premises equipment was part of Telco's infrastructure and service offering or owned and managed by the customer. This could sometimes even result in selling equipment, and passing operational management responsibility to customers, that should have been part of Telco's network infrastructure to secure contractually agreed service levels.

... it was not clear at all what the scope of a 'product' or 'portfolio' was ...

The 'right' discussion between the two responsibilities, namely product management demanding solutions for customer needs on a functional level versus 'technology supply' by process innovation responsible staff did not really start off. Moreover, responsible line management usually showed limited commitment in such initiatives. They were reluctant to invest in a longer term program and were only looking for short term results for their own part of the organization.

The term 'portfolio rationalization' appeared in virtually all business plans and yearly operating plans during the last decade. However, this was seldom followed-up by an actual program to realize such a portfolio rationalization. Usually, the initiatives ended prematurely in the definition phase due to the above seemingly inextricable issues.

Case 2-2 – Modular Portfolio Business Market

The program named 'Modular Portfolio Business Market' was an initiative in 2003 to implement modular products and processes for the business market area. Although the original scope included multiple products, the main focus was put on a modular approach for the, by then for Telco, new Ethernet-based[24] data communication services area. The development of this portfolio had just started and there was a risk that a score of multiple offerings would emerge in a traditional silo-based approach. Some product managers had started the development of Ethernet services within their own silo, including silo-specific technologies and processes/IT. Without an intervention, this would have resulted in almost comparable offerings with, both internally and for customers, unexplainable differences in characteristics and pricing for multiple user groups. The aim of this Modular Portfolio Business Market program was to avoid such new silos by reusing the same networking equipment and processes. This would result in more cost effective solutions and a reduced time-to-market. Furthermore, customers could be offered an understandable product portfolio in terms of functions and pricing.
The program resulted in a functional description of the Ethernet-based data communication services. These descriptions have been used and extended in the 'IP-based Networking & Services' program (case 3-3). Furthermore, this program was one of the first applications of Telco's Product Structure initiative (case 4-2). The program did not lead so much to portfolio rationalization of existing products, but enabled a good starting point, and prevented the formation of new silos in the early stages of the Ethernet service product area.
The program was not formally ended, but the results were transferred in 2005 to the 'IP-based Networking & Services' program (case 3-3).

Discussion on Case 2-2 – Modular Portfolio Business Market

This Modular Portfolio initiative was somewhat more successful than the Portfolio Rationalization initiative of Case 2-1. Like in Case 2-1, the program suffered from a short-term management focus and unrealistic expectations. The ultimate goal of the program, a modular portfolio for the entire business market, was not accomplished but some progress was attained in 'functional thinking' as proposed with the 1-Model (Case 3-1). For the first time, it became transparently visible that various technologies provided comparable functions for customers. This appeared to be threatening for some product managers who could, with only rudimentary portfolio management in place, block the implementation of real changes in their products. The main reason for the relative success of this program as opposed to the Portfolio Rationalization initiative of case 2-1 was the active involvement of technical sales consultants and a clear customer requirement for an adequate Ethernet-based data communication services portfolio. Another success factor was formed by the limited scope of the portfolio without interference with legacy technology, including profit/loss

[24] Ethernet is a branching broadcast communication system for carrying digital data packets among locally distributed computing stations. Metcalfe, R. M. and D. R. Boggs (1976). Ethernet: Distributed packet switching for local computer networks. Communications of the ACM 19(7): 395-404.

protection by associated product management. The pitfall of this approach however was that there was a tendency to view this Ethernet-based portfolio as a brand new 'green field' area, while on a functional level, some 'legacy' portfolio offered comparable functions to customers.
This program too did not change the way of working necessary to prevent new silos. Although the Product Structure model (Case 4-2) was applied, a lot of discussions started among the various architects concerning the application of the model. It became clear that this model was not sufficiently operationalized to enable full use in the program.
Following these two smaller-scale initiatives from 2002 onwards, in most business/year plans within Telco's business and wholesale area there was mentioning of 'portfolio rationalization' goals. In most cases there was not even started a program; but even if a program was started it suffered from the same issues that have been discussed in the cases 2-1 and 2-2.
According to Leon and Davies "rationalizing a portfolio involves analyzing the available managed service components from different lines of business, removing overlapping ones, filling the gaps, and, where appropriate, adapting the ones that remain to optimize the range of end-to-end solutions that can be configured from those components, and then ensuring that those solutions align with the marketplace and the evolving needs of the client and that they are competitive" (Leon and Davies 2008, p. 159-160). They view rationalization as the fifth stage in a six stage scale toward industrializing a managed IT service firm: 1) Learning, 2) Capability building, 3) Organizational restructuring, 4) Resource dedication, 5) Rationalization, and 6) Transformation. By the time of these rationalization initiatives, from 2001 to 2002, Telco resided in the earliest stages of this scale. Although some of the above portfolio rationalization steps were partially executed during these two programs (as described in the cases 2-1 and 2-2) the foundations for rationalization seem to be lacking.

2.8 Summary

This research explores the challenges in managing innovation in ISM firms. It looks at specific challenge areas on the intersection of innovation management, mass customization and 'service perspective' in an ICT intensive environment. This chapter has provided a further foundation for the current study by giving an overview of the various sub-domains and the literature in these areas. Given the centrality of the theme, an extensive discussion has been provided on horizontalization or de-siloing. It has been shown for the telecom area that horizontalizion/de-siloing requires layering approaches that go beyond technological layering models. Two cases have described some early 'portfolio rationalization' initiatives within Telco. They have provided an illustration of the issues that inhibited successful execution of these initiatives. The definition/positioning of and distinction between product and process innovation, and consequently the scope and reach of the 'portfolio' to be rationalized, proved to be a recurring issue in these rationalization initiatives. In Chapter 3 this issue will be explored by discussing the first identified challenge area of 'product/process decoupling'.

3. Product, process, and business model

3.1 Introduction

In Chapter 1, three challenge areas emerged concerning innovation management for ICT-intensive mass-customized services. This chapter will discuss the first challenge area at the intersection of 'mass customization' and 'service perspective': the decoupling of product and process (Figure 3.1). Decoupling of product and process enables the lifecycle of product and process to be managed independently yet simultaneously and coherently in the innovation process, and enables the application of mass customization supporting concepts like platform thinking and modularity.

... but what do the terms 'product' and 'process' mean in a service perspective context? ...

This chapter explores the associated research sub-question (RSQ1): *What do the terms 'product' and 'process' mean in a service perspective context, and how can their lifecycles be decoupled in the innovation process to apply mass customization principles?* The subject will be discussed by reviewing the existing literature on this subject, and confronting this with (Telco) empirical material. One case (3-1) will describe a Telco-developed model that serves as a starting point for the development of the conceptual framework in this chapter. Furthermore, the chapter contains two cases (3-2 and 3-3) describing large-scale rationalization programs within Telco. They primarily serve to illustrate the main themes of this study.

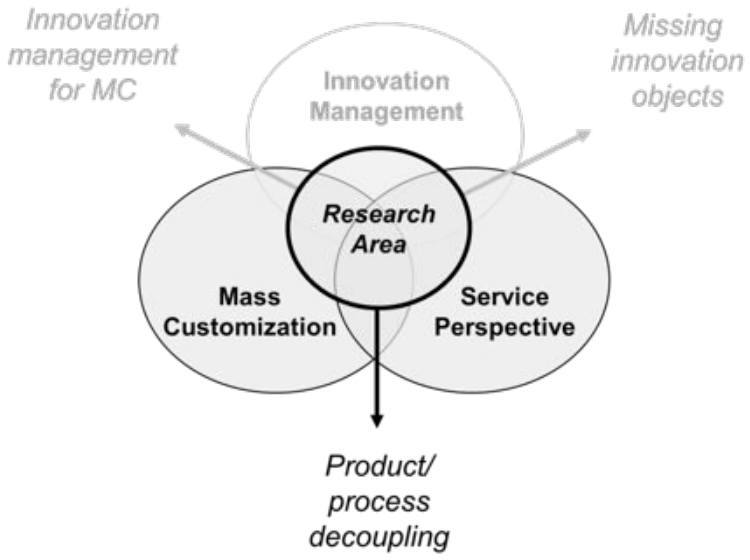

Figure 3.1 The first challenge area: Product/process decoupling

3.2 The product/process innovation dichotomy

Etymologically, the term 'product' stems from the Latin word *productum*, meaning 'something produced'. The term 'process' stems from the Latin *processus*, meaning 'process, advance, progress'. The main modern sense of a process as a 'continuous series of actions meant to accomplish some result' stems from 1627 (Etymonline.com 2009). In the literature, the terms product and process both have multiple definitions and meanings. Already in 1911, Schumpeter distinguished product and process innovations as two of five innovation 'cases', besides organizational, market, and input innovation (Schumpeter 1911). He defined product innovation as "the introduction of a new good – that is, one with which consumers are not yet familiar – or a new quality of good". Process innovation was defined as "the introduction of a new method of production, that is, one not yet tested by experience in the branch of manufacture concerned (or) a new way of handling a commodity commercially"; Schumpeter as quoted in Archibugi, Evangelista et al. (1994, p. 7). Ever since the product/process innovations dichotomy has been one of the most important frameworks with which to characterize innovations (Abernathy and Utterback 1978; Kotabe and Murray 1990; Noori 1991; Damanpour and Avellaneda 2009). The dichotomy has been used to explain the business cycle (expansion versus decline), the product cycle (development versus maturity), employment, productivity, firm management and appropriability and imitation (Archibugi, Evangelista et al. 1994). The distinction is also important because the innovations' adoption requires different organizational skills: product innovations require that firms assimilate customer need patterns to design, and then manufacture the product; process innovations require firms to apply technology to improve the efficiency of product development and commercialization (Ettlie, Bridges et al. 1984). The distinction between product and process innovation is relatively straightforward in a manufacturing context. In the car industry, for example, product innovation covers the overall design and various components of a car; process innovation covers how cars are produced by various production lines, including innovation of the supply chain. Even in manufacturing however, conceptual differences between product and process innovations are still not very clear, and classifications of innovations into the two types are not consistent (Archibugi, Evangelista et al. 1994; Edquist, Hommen et al. 2001). On the basis of the SPRU database on innovations in Great Britain, Simonetti found that only 3.1% of the innovations monitored can be unequivocally labeled as either products or processes, whilst as many as 96.9% of them fall into a grey zone (Simonetti, Archibugi et al. 1995). In a review of organizational and environmental determinants on product and process innovations Damanpour and Aravind (2006) found that, for most determinants, the results across the studies are mixed and inconclusive. They also show that most determinants do not differentiate between product and process innovations. They identify (p. 61) a number of reasons for the scarcity of empirical studies on the determinants of product and process innovation: the scope of product and process innovation is a confused issue in the literature

Already in 1911, Shumpeter distinguished product and process innovations ...

(Bhoovaraghavan, Vasudevan et al. 1996); differentiation is difficult for several researchers since product and process innovations are inextricably interdependent (Pisano and Wheelwright 1995); many do not define the terms but assume they are self-explanatory (Archibugi, Evangelista et al. 1994); methodologically, the use of proxy variables like R&D expenditures makes the differentiation difficult (Kraft 1990); strategically, many firms presume innovation success comes from new products, neglecting process innovations (Kotabe and Murray 1990).

The product/process innovation dichotomy in a service context

In a service context, even at a practical level the distinction between product innovation and process innovation is hard to grasp. Several authors argue that it is difficult or nearly impossible to make the distinction between product and process innovation for services (Davenport 1993; Bitran and Pedrosa 1998; Hauknes 1998; Uchupalanan 2000; Djellal and Gallouj 2001; Gallouj 2002; Van der Aa and Elfring 2002; Tether 2005; Miles 2008). In the service literature, the concepts of 'product' and 'process' lack unambiguous definitions, along with multiple views on the definition of 'service' itself. The International Standards Organisation (ISO 1991) defines service as a subset of product; others define service as (part of) the process. Table 3-1 shows some views on the relationship between the terms product, process and service.

... the distinction between product innovation and process innovation is hard to grasp ...

Table 3-1 - Conceptualizations of product, process and service in the literature

Author	Conceptualization of the relation of product, process and service
Schumpeter (1934)	Five 'cases' of innovation: product innovation, process innovation, organizational innovation, market innovation, and input innovation.
Lancaster (1966)	A product (in both manufacturing and service) is conceptualized as a set of service characteristics.
Edvardsson and Olsson (1996)	A service product consists of three basic components: service concept, service process and service system.
Oslo manual OECD (1997)	A distinction is made between product innovation, process innovation and delivery innovation.
Freiden, Goldsmith et al. (1998)	There are three types of products: goods, services and information.
Gallouj (1998)	In services, the product is equal to the process.
Hipp, Tether et al. (2000)	Distinguish between service innovation, process innovation and organizational innovation.
Boone (2000)	For many service products, the process is the product.
Den Hertog (2000)	Service innovation is conceptualized in terms of four dimensions: conceptual innovations, client interface innovations, service delivery system/organizational innovations, and technological options.

Author	Conceptualization of the relation of product, process and service
Edquist, Hommen et al. (2001)	Position product innovation, including both goods and services, versus process innovation, which includes both technological and organizational innovations.
Gallouj (2002)	In services, the term ‘product’ frequently denotes a process: a service package, a set of procedures and protocols, and 'act'.
Sundbo (2002)	Product innovation, process innovation, organisation innovation and market innovation.
Howells and Tether (2004)	Distinguish between product innovation, process innovation and organizational innovation.
Kaplan and Haenlein (2006)	Position product versus service, where ‘product’ implicitly has the meaning of (tangible) manufactured goods.
Flikkema (2007)	Conceptualizes service innovation as ‘technological innovation in service firms’, consisting of product innovation and process innovation in a technological context.
Van der Have, Toivonen et al. (2007)	A service product constitutes a process in its basic nature.
Bessant and Davies (2007)	Service innovation can take several forms: product innovation, process innovation, position innovation and paradigm innovation.
Voss and Zomerdijk (2007)	Distinguish between product innovation, process innovation and business model innovation.
Shelton (2009)	Distinguishes technology innovation, involving product and service offerings, process technologies and enabling technologies, from business model innovation, involving target customer, value proposition and value chain.

Gallouj and Savona describe the problem as follows: “We have mentioned that the difference between product and process still presents a certain degree of ambiguity as far as services are concerned, due to the characteristics of intangibility and co-terminality: close interaction between production and consumption of services. This makes it even more difficult to disentangle the nature of innovation in services, as the distinction between product and process innovations in services becomes less clear-cut” (Gallouj and Savona 2009, p. 158).

Because of the above fuzziness of the distinction between product and process in a service perspective context, and because this dichotomy is grounded in manufacturing logic, some authors have suggested using another model for services. For instance, Miles (2008) refers to the service innovation model by Den Hertog consisting of four dimensions: 1) new service concept, 2) new client interface, 3) new service delivery system, and 4) technological options (Den Hertog 2000, p. 4).

The importance of product and process innovation

Several authors emphasize the importance of giving equal attention to innovating product and process for the firm's performance (Capon, Farley et al. 1992; Damanpour and Gopalakrishnan 2001; Walker 2004; Damanpour and Aravind 2006). The managerial implication of these findings is that the synchronous development and implementation of product and process innovations could have positive performance consequences for the organization. Thus managers should avoid the tendency to focus on one type of innovation to the detriment of the other (Damanpour and Aravind 2006, p. 59).

Several authors emphasize the importance of giving equal attention to innovating product and process …

On the other hand, for mass-customized services the concepts of product and process should be clearly distinguishable to be able to independently manage their lifecycles. How can developers effectively co-innovate on mass-customized products and processes, and prevent the formation of functional or technical silos if the scope of these concepts is ambiguous across the actors in the innovation process? Droege, Hildebrand et al. (2009, p. 141) suggest analyzing whether the product/process unclarity for services is based on measurement problems for product and process innovations, or whether other concepts are necessary to grasp innovation in services. Possibly, measurement problems may be diminished by defining and positioning the product-process dichotomy more explicitly. A starting point and central issue in this research is the definition and positioning of the concepts of product and process innovation for service perspective firms, so as to form a clear foundation for innovating mass-customized services.

Product and process innovation within Telco

Within Telco, the term 'innovation' could refer to the renewal of both product and production areas, usually referred to together as 'PPODAT' (Product, Process, Organization, Data, Applications, Technical infrastructure). Figure 3.1 gives an overview of Telco's innovation areas in mutual coherence. Product innovation encompasses all innovation activities concerning the renewal of Telco's product proposition in the market. Process innovation encompasses the combination of two innovation areas: Technical Infrastructure (TI, including related IT applications), and Processes/Organization/Data (including the role of human resources and related IT applications). TI provides the 'core' service function capabilities, and Processes/Organization/Data provides the 'supportive' service management capabilities as categorized by Bruce, Naughton et al. (2008). In reality, within Telco the emphasis is very much on innovation of the 'hard' side: TI networking infrastructure and, to a lesser extent, IT applications (related to service function and/or service management capabilities). The 'soft' side, including innovation in processes, organization, data, and integration capabilities tends to be relatively neglected. Furthermore, the distinction between TI and IT is becoming blurred because 1) some TI

makes use of standard IT components e.g. an e-mail application making use of a standard hardware server) and 2) some IT directly interacts with TI[25].
The term 'process innovation' is not used within Telco to denote the entire 'how' area (lower part of Figure 3.2), but only to denote innovation activities in the 'processes' part of the of the service management capability area (lower right part of Figure 3.2).

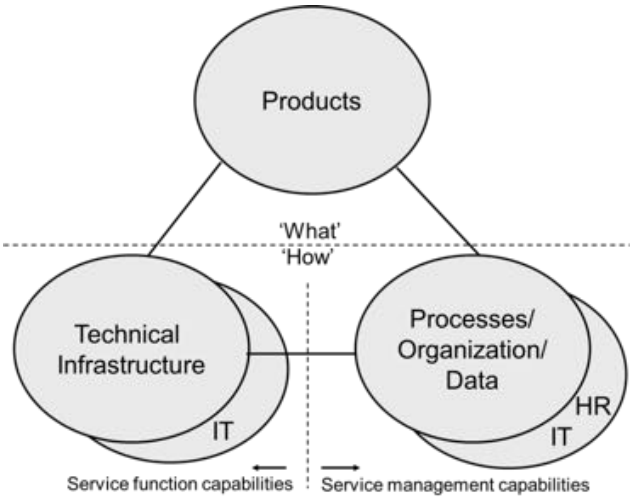

Figure 3.2 Product and Process innovation areas within Telco

Substantial process innovation activities apply to both the Technical Infrastructure for the 'core' service function capabilities, and to Processes/Organization/Data for the 'supportive' service management capabilities. Interestingly, during the current service provider era the use of the term 'product innovation' (relating to the upper part of Figure 3.2) also diminished, along with the status of product management roles within Telco. The latter is due to the increased focus on (serving) customer groups and markets at the cost of a product focus in the service provider era[26]. However, substantial product innovation is clearly still occurring during the current service provider era. This takes two forms: 1) 'real' product innovation, directly originating from business/customer needs and resulting in new/renewed propositions in the market, and 2) Technical Infrastructure innovation that is dubbed 'product innovation' or 'service innovation', but encompassing a limited focus on the product proposition for the customer. The second form

Product, Process, Organization, Data, Applications, and Technical Infrastructure …

[25] The Telco-applied distinction between Network IT, Product IT, and Transactional IT was described in Paragraph 2.3. In Figure 3.1 both Network IT and Product IT are related to Technical Infrastructure, while Transactional IT is related to Processes/Organization/Data.
[26] In the researcher's view, customer/market focus and product focus need not be mutually exclusive, like in customer-versus-product strategies (Andreasen 1985). In fact, especially in a 'mass' context customer/market focus may be attained *via* product (and process) focus, as will be shown in this chapter.

is due to the (mental) nexus of technologies and products that is still prevalent within the company.
Coherently managed product innovation and process innovation is crucial to remaining competitive in the market. The focus has shifted during the three eras of Telco's existence (Paragraph 1.3): from mainly process innovation (focusing on technical networking infrastructure) during the infrastructure provider era, via mainly product innovation during the product supplier era, toward combined product/process innovation focus during the current service provider era. However, within Telco a clear distinction between the concepts of product and process innovation has not been made until now. This inhibits the possibility of decoupling the two concepts and managing them independently yet coherently within the innovation process. Hence, this foundation for mass customization is lacking.

3.3 Positioning product and process innovation from a service perspective

The product-process innovation taxonomy by Edquist, Hommen et al. (2001, p. 12-19) will serve as a starting point for the (re)positioning of the two concepts for ICT intensive service perspective firms. This product/process innovation taxonomy was developed for a 'systems of innovation' (SI) perspective on employment. According to the authors, product innovations are new – or better – products (or product varieties) being produced or sold; it is a question of *what* is produced. Process innovations are new ways of producing goods and services; it relates to *how* products are produced. With respect to product innovations a distinction is made between material goods and intangible services and, regarding process innovations, between technological and organizational innovations. Technological process innovations are new goods that are used in the process of production; organizational process innovations are new ways to organize business activities such as production or R&D that have no technological elements as such (Figure 3.3). Although the diagram may suggest that the six categories form separate innovation areas, in fact they are closely related.

... a product innovation of one firm ... may become a process innovation for another firm ...

The authors emphasize that the location or perspective is important in determining whether a material artifact is a product or a process at different times. For instance, networking equipment may have been a product innovation for an equipment supplier like Cisco, but it may become a process innovation when applied in a networking platform by a telecom operator.
Edquist, Hommen et al. (2001) provided a sufficiently clear scope of the above innovation areas for the purpose of their research. However, in the literature the scope of these six areas varies substantially, as shown in Table 3-1.
Although the above taxonomy by Edquist, Hommen et al. explicitly includes services, it seems that the accompanying text (2001, p. 12-19) reveals a manufacturing background:

The clarification of product innovation as 'what is produced' does not always help to identify product innovation in a service perspective context. For example, within Telco all kinds of network signaling traffic is produced to manage the networking infrastructure. However, this traffic is by no means directly exposed to Telco customers. Therefore, innovation in such an area should be categorized as 'process innovation' rather than 'product innovation'.

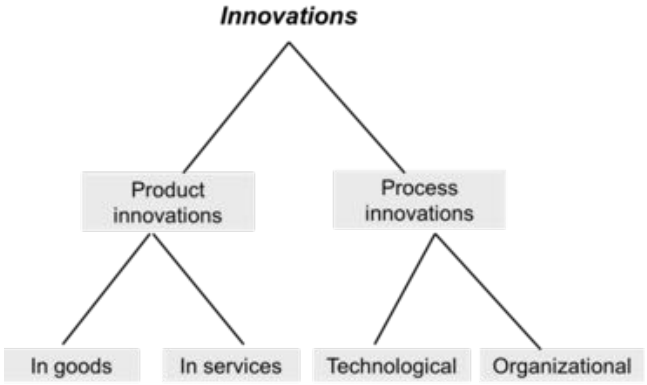

Figure 3.3 Taxonomy by Edquist, Hommen et al. (2001a)

The phrase 'intangible services' (versus material goods) suggests that services are always intangible, like the after-sales activities as a follow-up of goods delivery. Clearly, this is not always the case. For example, many Telco service products consist of elements that are highly tangible for the customer: devices like mobile phones, customer premises networking equipment etc. These tangible elements act as a 'platform' to enable the service to be (co)produced, and may also form an important part of the customer experience (e.g. in case of the mobile phone). 'Technological innovations' in the text by Edquist, Hommen et al. (2001) are also viewed from a manufacturing perspective. The phrase 'new goods that are used in the process of production' seems to underestimate the process innovation effort by a service provider, e.g. by applying new ways to implement goods in the service provider processes.

... many Telco service products consist of elements that are highly tangible for the customer ...

Despite these critical observations, the integrative approach of both product innovations (including goods and services) and process innovations (including technological and organizational innovations) makes this taxonomy a good starting point for further defining the concepts for the purpose of this research.

Table 3-2 illustrates some major product and process (innovation) aspects relating to a service perspective mobile phone product provider. In the table, a 'classical' mobile phone service is presented, including delivery of a handset by the same telecom operator. The given product and process aspects are related to the major customer events/lifecycles. This consumer market example is given because the familiarity with the mobile phone product.

In general, within Telco's consumer market area the distinction between product and process seems less an issue than in the business/wholesale area that forms the context of this study.

Table 3-2 Product and process (innovation) aspects of a mobile phone service

Customer event	Product aspects (customer perspective)	Process involved (firm perspective)
Orientate/buy	Phone service provider website/social media look and feel	Marketing communication/site development
	Phone service provider product package attractiveness	Product/marketing management/supplier management
	Handset supplier website look and feel	Supplier management
	Phone shop interior look and feel	Distribution channel management
	Phone shop sales staff behavior and knowledge	Distribution channel management/sales training
	Handset look and feel, supplier image	Supplier management
	Phone service provider image (incl relationship with brand)	Corporate communication alignment
Install/start-up	Handset package handling	Supplier management
	Handset manual/quick reference handling	Supplier management
	SIM card handling	Supplier management, marketing communication
	Phone service web/mail start-up procedure look and feel	Website/e-mail system development
Use	Phone service connection speed, coverage, voice quality	Networks, network management, capacity management etc.
	Handset 'after sales' friendliness/helpfulness (phone shop)	Distribution channel management
	Phone service web site look and feel/effectiveness	Website content development
	Phone service e-mail invoice look and feel	Collecting/billing/e-mail systems, marketing communication
Contract renewal	Phone service follow-up offer attractiveness	Product/marketing/distribution management
	Handset renewal ease	Distribution channel management
All events	Phone service customer support accessability/'servitude'	Customer support, incl. empowerment/training/tooling etc.
	Overall combined consistency of all product aspects	All processes/functions (product and process related)

Patterns of product innovation and process innovation

Another way to discuss the distinction between product innovation and process innovation is to look at the relationship between lifecycle patterns of both categories. In manufacturing, product innovation is seen as leading process innovation (Abernathy and Utterback 1975). Barras (1986; 1990) observed that in service innovation, product innovation was preceded by process innovation ('Reversed Product Cycle'; RPC), and Nightingale (2003) argued that it was enabled by infrastructural innovation. According to Gallouj and Savona (2009, p. 158), the explanatory power of Barras's RPC model is weakened because of some unresolved issues specifically related to the nature of service product and production processes. In a service environment, however, the same issues would seem to apply to the Abernathy/Utterback model. In a service perspective context, in which goods and services are mixed and matched, product and process innovation may occur in any order, or may be happening in parallel. Especially in a service perspective context, this points toward an iterative cycle between product and process innovation.

... this points toward an iterative cycle between product and process innovation ...

This is also supported by observations within Telco. Innovations may start as a product innovation, like the development of a 'triple play' package (combination of internet protocol-based TV, voice and internet access) or a process innovation, like the development of a new networking infrastructure or the implementation of a Customer Relationship Management process including supporting ICT. Product innovations in telecom services are predominantly 'technology push'. This not only applies to the initial product offering, but

also during the further product lifecycle: new service function (process) capabilities in the technical infrastructure are closely related to (possible) new product propositions in the market. This close relationship seems to be an important factor contributing to the difficulty distinguishing product innovations from process innovations within Telco. The relationship between product innovations and service management (process) capabilities is not so tight, but of is course still there: for example, a new product feature must be incorporated in the delivery and billing processes. Irrespective of how innovations are launched, they are followed-up by iterative cycles of product and process innovations.

... new service function capabilities are closely related to ... new product propositions in the market ...

What/how questions to support the distinction between product and process

In the literature, the product/process innovation dichotomy is usually associated with the distinction between respectively 'what' and 'how'. Just as the product/process innovation dichotomy itself, this what/how dichotomy is not described unambiguously in the literature. In the product/process innovation dichotomy that formed the starting point of this paragraph, 'what' is described as 'what is produced?' (Edquist, Hommen et al. 2001). This coincides with the original Latin meaning of 'something produced'. Others refer to 'what (value) does it offer for customers?' Abernathy and Utterback (1975) state that product innovations are new outputs or services that are introduced for the benefit of customers or clients. The value of the product for the market/customer is also the usual connotation in the marketing literature. Kotler (2003, p. 407) defines a product as "anything that can be offered to a market to satisfy a want or need. Products that are marketed include physical goods, services, experiences, events, persons, places, properties, organizations, information and ideas." In this thesis the latter 'value for the customer' notion of 'what' applies.
'How' is often described in terms of 'how are products produced?' However, the scope varies with regard to the boundaries of the process (inside the firm or encompassing supply chain or network partners and/or customers in the network), and the inclusion or exclusion of other aspects like organization, market, delivery process, etc. A specific issue in this respect is the dominance of a technological perspective on process innovation, related to an industrial organizations' perspective on firms. For pure goods manufacturers there is a strict delineation of the process between the firm and the customer: the firms' process ends with the delivery of goods/products to customers. The customer will use the good in his own process, but there is no direct coupling between the process of the firm and the one by the customer.
However, service providers co-produce together with their customers (Martin and Horne 1992; Den Hertog 2000). In the area of customer/firm co-production, the 'front-office' process 'interface' is experienced by the customer as a product component. This adds to the fuzziness of the product/process dichotomy in a service perspective context (Figure 3.4). Despite this overlapping product/process area of customer/firm co-production during the operational phase, it is the aim of this research to unambiguously define the concepts of

product and process in such way that they both can be managed as interconnected but distinctive innovation areas.

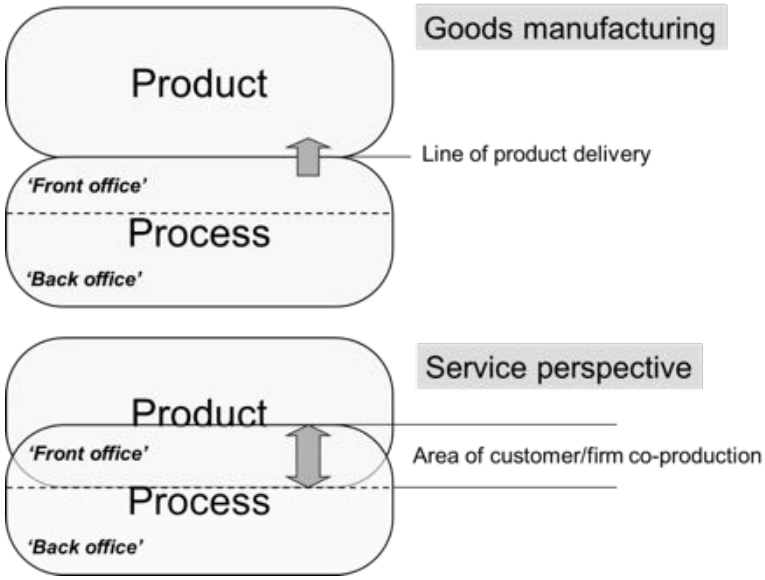

Figure 3.4 Product and process in manufacturing versus service perspective

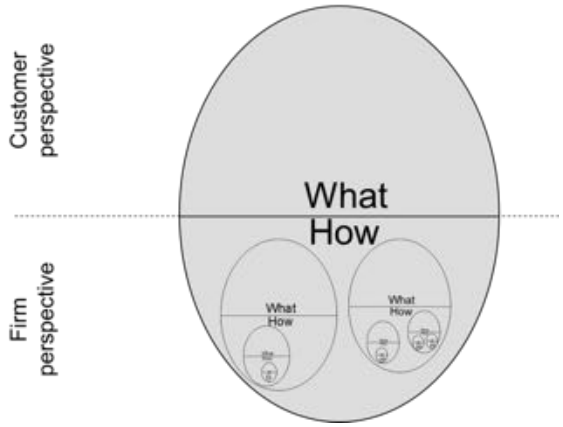

Figure 3.5 'What' and 'how' form a 'babushka' at different levels

Note that the what/how dichotomy has the characteristics of a set of 'babushka's': each 'how' may lead to one or more new 'what/how' combinations. For example, a business process poses 'what' requirements to an ICT application ('how'), which in turn poses 'what' requirements to ICT hardware infrastructure ('how'), and so on. In this thesis only the 'what' at the level of the external customer perspective is considered to define the

product. ‘What’ in the firm perspective represents ‘internal products’ to firm-internal parties (Figure 3.5).

3.4 Service perspective definitions of product and process (innovation)

For the purpose of this research the concepts of product and process (innovation) will be further clarified and operationalized for the level of the firm. The idea is to define product and process in such a manner that they, combined, form the full set of *innovation objects* at the firm level, in which the end result of *innovation aspects* (like marketing, positioning, concept, technology, revenue model etc.) comes together. Both service product and service process are themselves predominantly intangible, but the innovation process would be facilitated if the outcome of the innovation process, that combined form the prerequisites for Operations (Edvardsson and Olsson 1996), could be defined as ‘tangible objects’. In Chapter 4 the challenge of ‘objectizing’ product and process will be elaborated further[27]. Note that this research adheres to a broad notion of ‘innovation object’: e.g. process innovation will, in conformity with the innovation taxonomy by Edquist, Hommen et al. (2001), encompass both technological and organizational aspects.

… service product and service process are predominantly intangible …

What would it require to redefine the product/process (innovation) dichotomy in a service perspective context at the firm level? Such definitions must:

- unambiguously clarify the meaning of product and process, and their mutual relation, without overlap or gaps,
- be fully relevant to any combination of goods and services, and on any position of the tangible/intangible continuum, and
- remain relevant to extant literature for future reference (mainly in the goods area, but also in the services area).

To explore Telco’s efforts to deal with the difference between ‘what’ and ‘how’, the following Case (3-1) describes the so-called 1-Model. This model was developed to make Telco (product innovation) management aware of the peculiarities of innovating in a service perspective context, as opposed to innovating in a product supplier, technology-focused context. The model serves as a starting point for further developing the conceptual framework in this Chapter. The case data is primarily based on the researcher’s own observations combined with documentation, with input from semi-structured interviews.

[27] A related, but different concept is ‘service productizing’, a marketing-based concept to denote the transition from labor intensive bespoke service toward asset-based industrialized service. Leon, N. and A. Davies (2008). Managed service paradox. IBM Systems Journal **47**(1): 154.

Case 3-1 – 1-Model

During Telco's earliest portfolio rationalization effort for the business market in 2001 (Case 2-1), the researcher introduced a model[28] to support Telco in this program: the '1-Model'. The 1-Model, named after its 1-shaped form consisting of six blocks (Figure 3.6), was intended to make the organization aware of the problems associated with the ill-defined nature and subsequent nexus of the terms 'product' and 'process' and the associated technological focus. The model sought to induce a holistic view on the combination of product and production aspects. The researcher presented the 1-Model in 2003 in a paper of the 42nd European Telecommunications Congress FITCE'03 (Baken, Van Boven et al. 2003). The 1-Model has a similar scope as the 'Portfolio Theory' by Baken (2001, based on a Telco-internal report from 1995), that distinguished between a Commercial Portfolio, a Technical Portfolio and an Operational Portfolio.

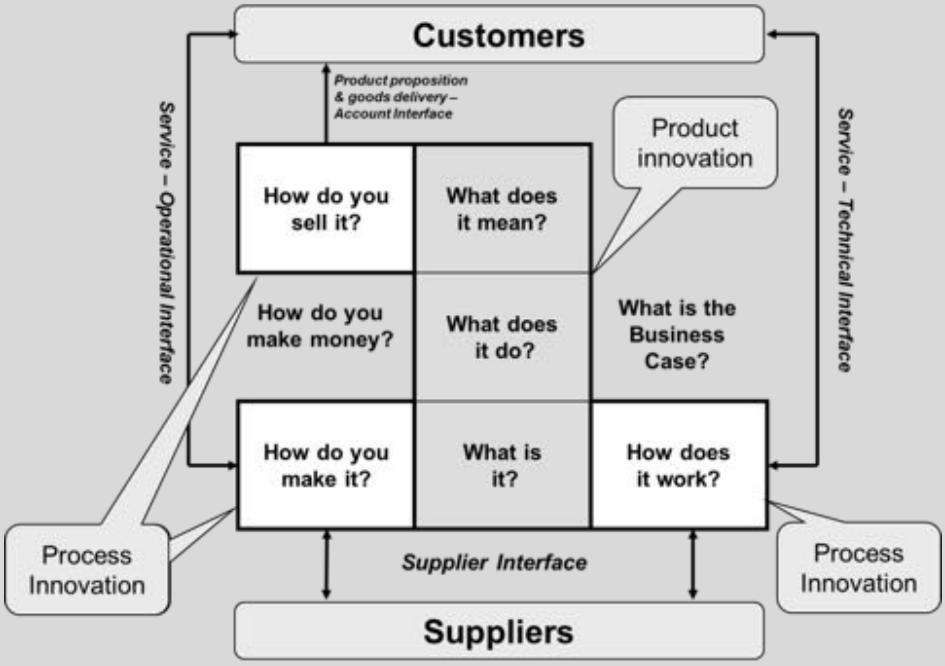

Figure 3.6 The 1-Model

The original purpose of the Portfolio Theory by Baken was to align internal (financial and business) planning concerning these three areas. The specific aim of the 1-Model was somewhat different: the 1-Model was mainly meant to 'force' product management and service developers to distinguish between the concepts of product and process by answering a pre-defined set of 'what' questions to identify the product and a set of 'how' questions to identify the process. The idea with the 1-Model was to make (product) management realize that portfolio rationalization can only be successful if it is clear what portfolio one is talking

[28] The 1-Model was co-developed with John Hoffmans, with input from some other collegues.

about. To clarify the use of the model in this text, the intention of the questions is illustrated by a (fictitious) telecom product called TravelVPN, a Virtual Private Network (VPN) Service for travel agencies with a central office and a number of remote offices. For a customer of a telecom operator, a VPN Service acts like a private (customer owned) data communication network, but the service is 'virtual' in the sense that the facilities are telecom operator-owned and managed, and shared with multiple other customers.
The 1-Model consists of three 'what' questions to characterize the product:

- What does it mean (for the customer; 'value')? – What are the business advantages from a customer/user point of view? For a travel agency, this could mean: enabling remote offices to prepare and book travel arrangements for customers, with guaranteed access to the central office during shopping hours. The TravelVPN service, as an integral part of the travel and booking applications, forms an essential tool to stay in business.
- What does it do (for the customer; 'function')? – What are the functions for the customer/user? For a travel agency this could mean that remote offices have 6x9 hour access to the central office with an availability of 99.995% during these hours and a maximum screen delay of 0.5 seconds. Via a customer self-care application the central office can, in real time, change a pre-defined set of service characteristics, like upload and download access speed to the Internet. Furthermore, the customer can call an especially designated telephone number in case of incidents or other questions or issues.
- What is it (for the customer; 'attributes')? – What are the physical ('tangible') characteristics or 'look-and-feel' of the service for the customer? For the travel agency this could mean that the (Ethernet) cables of all 10 PCs in a remote office can be plugged into a box (the 'router') that is located underneath one of the desks. These routers, known as Customer Premises Equipment, are owned by the telecom operator and form an integral part of the operator's network management domain to ensure that the service promises of the product proposition and contract can be met at all times. Travel agents only need to know where the 'reset' button of the box is located, in case of rare network outages. For the central office, the physical facilities are more or less the same as for the travel agencies. Furthermore, the central office should be acquainted with the web-based customer self-care application for configuration management, billing and reporting. Some telecom network services encompass network equipment that is owned by the customer. Sometimes, the customer has the option to put his own network equipment as a 'managed device' under the management control by the telecom operator.

This kind of 'what' information can typically be found under 'TravelVPN' in the telecom operator's product catalog and sales material. During service development, this kind of information is exchanged between product management/marketers and 'R&D' (technicians and process developers). The internal design of the network equipment does not form part of this information unless there is a specific reason to form part of the value, functions or attributes that will be perceived by the customer, e.g. to indicate which customer-owned

network equipment is certified to work together with this particular telecom operator service product.

To characterize the process part, the 1-Model consists of three 'how' questions:

- How do you sell it (as a provider)? – Distribution of the product/service. How is TravelVPN distributed to the market? Is this done by an internal marketing & sales department of the telecom operator or by an external distribution channel? Under what brand will the product be launched? How is marketing done for this product, e.g. in cooperation with travel organizations? Internet-based sales or via one-to-one account management? Etc.
- How does it work (for the provider)? – The 'core' service: the technology infrastructure (TI) including technology infrastructure-related processes and ICT. This includes the way the network is architected, designed, developed, and implemented, including contributions by external providers. This corresponds with the scope of the 'service function capabilities' of a telecom provider (Bruce, Naughton et al. 2008).
- How do you make it (as a provider)? – Customer interaction and back-office processes, including ICT, and including the role of external suppliers. How are the internal and external processes and IT architected, designed, developed, and implemented? How is the customer initially connected to the telecom operator network, how are network problems resolved and customer questions and issues handled, etc.? This corresponds with the scope of the supportive 'service management capabilities' of a telecom provider (Bruce, Naughton et al. 2008).

This kind of 'how' information typically cannot be found in the product catalogs, sales materials or contracts, but in the telecom operator's internal design documentation and external contracts with suppliers/partners that fill in part of the 'how' functions.
The very first and final question in the model is a combined what/how question: 'what is the business case?' and 'how do you make/spend money (revenue/cost model)?' Together they support the rationale for innovation: 'why innovate at all?'.
By answering these questions for the product/process portfolio in scope, it should be possible to define both product and process with the customer in mind and make the product and process portfolios transparent to all involved in the innovation process. This would make it possible to discuss 'rationalization' on both the level of product and process portfolios and on the combination of the two, without muddying the discussion by mixing up the concepts.
The 1-Model contributed to the specification and application of a Telco-broad Product Structure (Case 4-2). On several occasions in the course of this thesis, reference will be made to the principles of this model.

Discussion on Case 3-1 – 1-Model
In terms of this research, the application of the 1-Model can be viewed as a 'Conceptual Framework 0': the idea was that a clear distinction between product and process would facilitate the discussion on 'portfolio rationalization'. Application of the model was

supposed to lead to clear responsibilities for product and process innovation and ultimately form a foundation for the effective rationalization of product and process.
The 1-Model contributed to the awareness within Telco of the difference between product and process and the problems associated with their interconnection, but the application of the model had little direct impact on the first product rationalization initiative as described in Case 2-1. It did have such impact though on the second initiative (Case 2-2), in which it facilitated the specification of the Ethernet business market portfolio in functional terms. By clearly separating product and process and by applying the concept of 'Functional Product' (See Case 4-2 on Telco's Product Structure) a substantial contribution was made to an effective, customer value, customer function and customer attribute-based product portfolio in the Ethernet services area[29]. Without this initiative, multiple new technology-based silos would probably have emerged from the outset. The specifications were applied in the IP-based networking program (Case 3-3).

The 1-Model contributed to the awareness … of the difference between product and process …

There were two reasons why the 1-Model was successfully applied in the Modular Portfolio Business Market program as described in Case 2-2:

- the participation of a sales consultant who had the ability to incorporate the voice of the customer concerning this product area, and an architect who was able to apply the principles of the 1-Model and describe the portfolio in functional terms;
- the early development stage of the Ethernet product portfolio. During the timeframe of this case the planned product/technology silos had not yet been implemented.

In retrospect, the following remarks can be made about the design of the model:

- As opposed to the three 'what' blocks, the three 'how' blocks are not interconnected, while in practice there are several relations between these process parts. For instance, in a service perspective context there is no clear separation between 'how do you sell it' and 'how do you make it': marketing is not only done by 'formal' marketing roles within 'how do you sell it', but also by any customer-interacting staff within 'how do you make it'. "Marketing is an integral part of producing and delivering services, especially during the consumption (usage) process" (Grönroos 2000, p. 246).

[29] During the last seven to eight years the Ethernet-based portfolio became a mainstream portfolio for Telco, with multiple portfolio managers and other innovation drivers in the business and wholesale market. Unfortunately, the original 1-Model principles that had been applied during the 'Modular Portfolio Business Market' program as described in Case 2-2 were not sustained during the further development of the portfolio. The current situation is characterized by a complex mix of products and production assets, in which almost similar capabilities (especially in the service management area) are provided by diverse process setups and related IT systems.

- The position of the ‘how’ blocks with regard to the ‘what’ blocks is questionable. The block ‘how do you sell it’ is connected to ‘what does it mean’ because the meaning of a product for the customer should encompass the main selling arguments. This seems the most appropriate position for this block. However, the other two ‘how’ blocks are only connected to ‘what is it’, while a connection with ‘what does it do’ seems equally important.
- The six blocks in the 1-Model relate to the innovation process. In the model, customers and suppliers are directly connected to these innovation process components. It is not clear whether these interfaces relate to the innovation process or to the operational process (or both).

Despite the lack of a scientific foundation at the moment of conception, the 1-Model can be regarded as an attempt at a framework to analyze and design the ‘business model’ of a service perspective telecom business. During the conception of the 1-Model, ‘business model thinking’ in terms of earning money while ensuring “that the technological core of the innovation delivers value to the customer” was just starting to be introduced (e.g. Chesbrough and Rosenbloom 2002, p. 549). Existing models like Porter’s value chain (Porter 1985) and Abell’s business definition (Abell 1980) were predominantly geared to manufacturing. Already in 1999, an early version of the (e)TOM framework for the telecom industry was available (Case 4-3). However, the earliest versions only covered the operational processes of a telecom operator. Moreover, the eTOM framework is predominantly a business process (or even business functions) framework, and provides no support for product and business modeling.

... an attempt at a framework to analyze and design the ‘business model’ ...

Toward service perspective definitions of product and process (innovation)
In line with the 1-Model, as described in Case 3-1, the distinction between ‘what’ and ‘how’ will form the basis for (re)positioning product and process in service perspective firms. The product can be characterized by answering the question: ‘what is the proposition of the firm in the market and what is the intended customer experience with the outcome of the firm’? The process can be characterized by answering the question: ‘how will the firm distribute its product propositions to the market and co-produce the outcome with its suppliers and customers?’ This matches a broad service perspective scope of both product and process, in line with the model by Edquist, Hommen et al. (2001): the product includes all goods and/or services of the firm; the process includes all technological and organizational aspects to source, (co)produce and distribute the products. The product is described from a market(ing)/customer oriented perspective; the process is described from a firm in the chain/network perspective. This does not necessarily coincide with the distinction between external focus versus internal focus, however. According to Abernathy and Utterback (1975), product innovations have a market focus and are primarily customer driven, while process innovations have an internal focus and are primarily efficiency

driven. But does this distinction still apply in a networked service perspective context? A comparable question seems to apply to the above distinction between 'primarily customer driven' versus 'primarily efficiency driven' (Abernathy and Utterback 1975). Clearly, product innovations should have a market focus and should be primarily customer driven. Process innovations may have an internal focus and may be primarily efficiency driven. In a manufacturing environment this is usually the only focus and drive as the process is limited to the boundaries of the firm. But as service perspective firms co-produce with suppliers and customers, an external focus is required on the process as much as on the product. Customers of service perspective firms experience the product not only via physical artifacts, but also via the process by which goods and services are distributed. For the same reason service perspective 'marketing' is not only situated in the marketing department but forms an aspect of any customer-interacting role of the firm and its partners. Coping with this phenomenon, known as 'relationship marketing' (Berry 1983; Grönroos 1990; Gummesson 1994), has far-reaching consequences for the positioning of the process of a service perspective firm.

... an external focus is required on the process, as much as on the product ...

Within Telco, until recently the 'customer engineering' function was only viewed from an internal technical/cost-oriented viewpoint: human resources that install or repair network equipment on customer locations at the lowest possible cost. From this viewpoint, customer engineering activities should be avoided as much as possible, and the role can easily be outsourced or sold to external parties. Since 2006/7, the customer engineering role has been reconsidered from a more externally-oriented service perspective viewpoint. From this viewpoint, customer engineers are no longer predominantly viewed as a cost asset, but also as marketers and value-generating assets while interacting with customers of Telco. This makes the role much more 'core business for Telco' than before. While innovating the distribution, installation and maintenance processes, the customer engineering role should not only be designed from an internal efficiency perspective, but also – or even predominantly – from an external customer relation perspective. In terms of product innovation, the customer engineering role will be assessed in terms of *what* the customer should experience while interacting with the telecom operator's customer engineer:

- What *does it mean* for your customer: for example, the customer can start/proceed with his own core business as soon as possible after trouble-free engineering activities by the telecom operator (as perceived by the customer).
- What *does it do* for your customer: customer equipment connected, customer problems solved, customer questions answered, etc.
- What *is it* for your customer: a professional, knowledgeable and friendly person, evidently supported by a professional back-office organization. This perception is congruent with the image of the telecom operator in the market.

The above 1-Model-based product-related 'what' questions act as a starting point for the process requirements: *how* can the process optimally support the ('what') product requirements with adequate capabilities:

- How do you *organize the relationship with your customers/'downstream' partners*? How does the telecom operator engineer interact with the customer? What input is required from the customer, what ICT can be used by the customer (e.g. customer self-care), at what stages does the telecom operator actively approach the customer, which additional sales opportunities/propositions can be 'naturally' introduced in the process, at what moments, etc.
- How do you *organize you internal process*? How is the internal engineering process of the telecom operator organized? What support is provided by the telecom operator's back-office, by what processes, what ICT support is required, etc.
- How do you *organize the relationship with your suppliers/'upstream' partners*? How is the network with external suppliers/partners organized? What services and goods are externally sourced, how can the engineer easily have access to these suppliers/partners, etc.

These 'how' questions differ from the 'how' questions in the 1-Model: they now relate to a three components-based 'internal value chain' of a service perspective firm[30]. This way the questions should also be applicable to a manufacturing environment. Furthermore, the issues that have been discussed regarding the 1-Model 'how' questions are addressed.

Based on the above what/how distinction and scope, the following definitions emerge for 'product' and 'product innovation' in a service perspective context:

> ***Product is defined as the combination of all aspects that a customer experiences from a provider and its output during the entire customer lifecycle. Product represents the 'what' of the providers' proposition and the perceived value of the (bundles of) goods and/or services, including 'what' aspects of the interaction with the provider-controlled resources, from the perspective of the customer.***
>
> ***Product innovation is defined as changing the value and satisfaction of the Product as experienced by the customer.***

[30] This also coincides with the 'inputs, processes, outputs' triad in the 'Open Services Value Chain' by Chesbrough (2011, p. 35).

The product can be characterized by answering three 'what' sub-questions in mutual coherence:

- What *does it mean* for your customer ('value')?
- What *does it do* for your customer (functions)?
- What *is it* for your customer (attributes; look and feel)?

These three sub-questions are exactly the same as in the 1-Model (case 3-1). Together, they aim to holistically approach the full 'Gestalt' of the product (Monö, Knight et al. 1997, p. 33) and contribute to the overall customer value. As indicated in the definition of product, these 'what' questions span the entire customer lifecycle (see below).

For 'process' and 'process innovation' in a service perspective context, the following definitions emerge:

> ***Process** is defined as how Products are distributed and (co)-produced with suppliers and customers. Process represents the 'how' of all involved firm-controlled resources and capabilities, including the interaction with the customer-controlled resources, from the perspective of the provider. Process includes both technological and organizational aspects.*
>
> ***Process innovation** is defined as changing the Process with the aim of improving the value of the Product for the customer and/or the value of the Process for the provider (improving the combination of effectiveness and efficiency).*

The process can be characterized by answering three 'how' sub-questions in mutual coherence:

- How do you organize the relationship with your customers/downstream partners (distribution channels and customers)?
- How do you organize your internal technology/organization (internal operations)?
- How do you organize the relationship with your suppliers/upstream partners (sourcing)?

The remainder of this section will clarify specific terms and phrases from the definitions will be clarified.
The phrase *customer lifecycle* includes the entire 'customer touch zone', and refers to all stages in the relationship between a customer and a business: from the earliest (prospect) phase, via 'the customer moment' to the former customer/potential re-entry phase (Imhoff, Loftis et al. 2001).

The term *capability,* in this thesis, means 'what the process is capable of'. In line with the positioning of innovation and operation as discussed in Paragraph 2.6, these capabilities form the combination of capabilities that stem from the 'prerequisites for operations' (Edvardsson and Olsson 1996) realized by the innovation process, and the capabilities that are provided by the operational process itself. This includes the ability to deliver the predefined operational output as well as the ability (led by the innovation process) to integrate, build, and reconfigure internal and external resources/competences to address and shape fast-changing business environments. The latter category of capabilities is known as 'dynamic capabilities' (Teece and Pisano 1994).

... 'capability' in this thesis means: what the process is capable of ...

The term *organize* in these 'how' questions should be understood in the broadest possible sense: it includes all related human and automated processes in a certain organizational arrangement. The three 'how' questions have been slightly altered compared with the how questions from the 1-Model of case 3-1. They now clearly cover three areas of the firms' process role in the business value chain/web: distribution to customers, internal operations and sourcing from suppliers.

For ICT-intensive service perspective firms, the term *distribution* encompasses the following four elements:

1. The proposition of the firm in the market/to the customers, and after contractual agreement one or more of the following elements:
2. The delivery of goods (ownership transferred to the customer)
3. The delivery/co-production[31] of the 'core' service
4. The delivery/co-production of 'auxiliary' (facilitating and supportive) services[32].

For a telecom operator (including its external distribution channels) 'distribution' could, for example, encompass the following elements in the 'mobile phone' area:

1. Marketing and sales of mobile phone product/service bundles.
2. Delivery of mobile phone devices.
3. Delivery ('technical interaction') of mobile telephone service capabilities.
4. Interaction of the customer with customer support services.

The term *distribution* itself seems a remnant from the goods perspective era: it suggests a one-way distribution of products from a firm to its customers. In a service perspective

[31] 'Co-production' as described in Paragraph 2.6.

[32] Core service and auxiliary services as positioned by Grönroos, C. (2000, p.166). Service Management and Marketing: A Customer Relationship Management Approach, Wiley. The core service is the reason for why a company (offering service products) is on the market. It is realized by the service function capabilities. Facilitating services are mandatory for the core service; supportive services are additional services, not mandatory for the core service. In this thesis both the facilitating services and supportive services are realized by the service management capabilities.

context, 'distribution' can refer to one-way communication/delivery (for 'goods') and two-way interaction/co-production (for 'services') with customers. Aside from traditional distribution elements, the telecom operator example showed that customers are directly connected to the telecom operators' (networking) infrastructure and co-producing with the telecom operator on both the core and peripheral functions. Since the term distribution (channel) is used so widely, it is proposed here to extend the term for service perspective firms in the above way.

Internal operations includes all the firm's activities by human and technological resources related to sourcing, production and distribution. *Sourcing* includes all goods and services that are bought or hired from upstream partners in the supply web/chain.

It is reflected in the definitions of 'product' and 'process' that the product imposes requirements on the process: in that sense product innovation 'dictates' process innovation. For example, to provide the same 'look and feel' (product) in the above mobile telephony example, a strong alignment of the four distribution areas (process) is required during the entire customer lifecycle. However, product and process are decoupled in such a way that they may develop according to their own pace and dynamics to optimally comply with the business requirements of mass-customized operations.

The term 'distribution channel'... seems a remnant from the goods perspective era ...

Note that process innovation is not only geared to lowering the cost of operations, but also to modify the process to improve the intended customer value at the product level. Process change may include directly perceivable changes, but this may also include changes in strategic capabilities, e.g. to increase agility through modularity and reusability.

A new element in the above definition of process is the term *control* in the phrase 'firm-controlled … resources' and 'customer-controlled … resources. The term 'control' in this phrase refers to the ('service') responsibility for the resources involved, and/or the output of these resources. Of course, the firm controls its own resources. Such resources might be located at the firm's own premises (e.g. the telecom operator's own technical network infrastructure at the telecom operator locations) or the premises of the customer (e.g. the telecom operator-owned Customer Premises Equipment). Furthermore, this control by the firm may involve the following:

1. The sourcing of goods/services from external suppliers in the chain/network (by means of Service Level Agreements between a telecom operator and its suppliers/partners).
2. Resources that are owned by the customer[33], but are, for certain agreed upon aspects and duration, 'given in service' to the firm (e.g. customer-owned network equipment that is managed by a telecom operator).

[33] Including the customer himself up to the point that he is willing/prepared to let himself be 'controlled' by the provider. E.g. after agreeing on a hair-cutting plan, a customer gives a hairdresser control over cutting his hair; a theater visitor only to a certain extent passes control to a stand-up comedian to let himself be amused …

Revisiting the positioning of good and service

With the above definitions of product and process the positioning of *good* and *service* may be revisited so as to further clarify the distinction between product and process in a service perspective context.

The afore mentioned 'control' issues can also be clarified with the help of the three-fold service activities grid by Judd (1964, p. 59). This grid identifies three broad, yet mutually exclusive areas of services of which a more complete list might be built:

- Rented Goods Services – the right to possess and use a product.
- Owned Goods Services – the customized creation, repair, or improvement of a product.
- Non-Goods Services – no product but rather an experience or what might be termed experiential possession.

Judd's grid may have some disadvantages by taking goods as a starting point to define services, and by 'defining by exclusion'. However, while other typologies have become outdated due to ever-increasing lists of service products, this scheme still seems to be fully relevant in research. The scheme has been applied previously, e.g. by Lovelock and Gummesson (2004), to challenge the validity of the core service paradigm: the assertion that four specific characteristics - intangibility, heterogeneity, inseparability, and perishability (IHIP) - make services uniquely different from goods. They propose an alternative ('access/rental') paradigm, based on the premise that marketing exchanges that do not result in a transfer of ownership from seller to buyer are fundamentally different from those that do. Vargo and Lusch (2004b, p. 327) argue that "that the intangibility, heterogeneity, inseparability, and perishability characterizations fail to delineate services from goods adequately."

... the positioning of good and service may be revisited ...

To discuss all service perspective variants, from 'service-less goods' to 'goods-less services', the variant 'goods' is added to Judd's grid (Table 3-3). "A good may be defined as a physical object which is appropriable and, therefore, transferable between economic entities." (Hill 1977, p. 317). According to the same author, a good is an entity of which ownership rights may be established, and from which its owner(s) derive some economic benefit.

Note that 'resource ownership' in this table relates to the entities/artifacts that play a role in the (service) transaction from provider to customer. In case of 'Goods', ownership rights are transferred to the customer and the entity can be resold by its owner (Hill 1977). In case of 'Owned Goods Service' the customer already possesses ownership of an entity that is 'given in service' to the provider. In case of 'Rented Goods Service' and 'Non-goods Service' ownership remains with the provider. The table shows that the combination of resource ownership and resource control may support a characterization of the various good/service variants.

Table 3-3 - Goods/service variants and the relation with ownership and control

Good/service variant	Resource Ownership	Resource Control	Telco example	'Car transportation' example
Goods	Customer	Customer	Sold telecom equipment	Car
Owned Goods Service	Customer	Provider	Managed telecom equipment	Car repair
Rented Goods Service	Provider	Customer	Rented telecom equipment	Car hire
Non-goods Service	Provider	Provider	Managed telecom service	Taxi

And there is a relationship with the providers' process as is shown in the next example: Telecom equipment at the customer premises may equal 1) a product that was bought as a good, 2) a product that once was bought as a good, but that now has been given 'in service' to the provider (being part of a service process from the provider), 3) a product that was bought as a service from the provider, or 4) a part of the providers' process related to a product that was bought as a service; the equipment forms part of the providers' process (so called 'Customer Premises Equipment'[34]) to manage the entire network for the customer.

... the concept of 'service' ... has been clarified by differences in process characteristics ...

If financial product innovations on 'shared/delayed ownership' (like apartment time sharing) are left aside, these variants of goods/services by Judd still seem to have the potential to include all possible combinations of goods and services. These four discrete variants show that there is rather a continuum of tangible/intangible (Shostack 1977) than a continuum of goods/services (Rathmell 1966). And these two scales do not coincide: for example, a Non-Goods 'Managed telecom service' may comprise highly tangible customer premises equipment to transfer customers' data streams.

Another continuum is the 'commodity/experience continuum': from low interest commodity goods/services towards highly 'transformational' experiences (Pine and Gilmore 1998). Although the share of services is probably higher at the experience extreme, this continuum too does not coincide with either the goods/services scale or the tangible/intangible continuum.

With the earlier definitions and positioning of product and process, the concept of 'service' – equaling one form of *product* in the product/process innovation framework by Edquist, Hommen et al. (2001) – has been clarified by differences in *process* characteristics. Alternative definitions of services and goods, based on the positioning of product and process in this chapter, could thus be as follows:

A *service* is a *product* that is co-produced[35] with the customer via a mutual *process.* The provider (temporarily or permanently) controls resources that are used/experienced by the customer.

[34] Within Telco, the term Customer Premises Equipment (CPE) was sometimes also used to denote customer-owned equipment. This added to the product/process confusion described earlier.

[35] 'Co-production' as described in Paragraph 2.6.

A *good* is a *product* that is not co-produced with the customer via a mutual *process*. The provider has transferred both ownership and control of resources to the customer.

Note that the above definitions of service and good are not full definitions intended to replace existing definitions of 'service' and 'good'. Rather, they serve to further clarify the distinction between product and process in a service perspective context.

Earlier in this paragraph three requirements were given concerning service perspective definitions of product and process. Such definitions must:

- unambiguously clarify the meaning of product and process and their mutual relation, without overlap or gaps,
- be fully relevant to any combination of goods and services and on any position of the tangible/intangible continuum, and
- remain relevant for future reference to extant literature (mainly in the goods area, but also in the services area).

It has been made plausible that the definitions comply with the first two requirements. Furthermore, it is believed that they also comply with the third requirement because the definitions are not entirely new, but rather offer a refinement for application in a service perspective context. This has however not been tested in this study.
In the next paragraph the relationship between product and process will be clarified further by combining them in one coherent framework for application in a service perspective context.

3.5 Product-Process-Business model innovation framework

It is one thing to have defined and positioned product and process innovation, including revisiting the concepts of service and good in a service perspective context; but how can we achieve 'the right' product and process innovations given the strategic direction and business environment of the firm?

Business model innovation seems a logical extension of a product/process innovation framework …

Business model innovation seems a logical extension of a product/process innovation framework because it addresses some major strategic issues leading to 'doing the right innovations' from a broader business perspective. The term 'business model' emerged in the 1990s (Dietz 1994; Janszen 1998; Hamel 2000), and became widely used with the rise, and temporary fall, of 'e-commerce' in the late-1990s/early-2000s (Afuah and Tucci 2001; Chesbrough and Rosenbloom 2002; Markides and Charitou 2004; Osterwalder 2004). Sometimes the term e-business modeling is used interchangeably with the term business modeling (e.g. in Gordijn, Akkermans et al. 2000). Although the term 'business modeling' is frequently used

in relation to web-based e-business, business modeling is also applicable to other businesses than web-based e-business.
A business model is a conceptual model that contains a set of elements and their relationships that enables the expression of a specific firm's business logic. It is a description of the value a company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital to generate profitable and sustainable revenue streams (Osterwalder, Pigneur et al. 2005, p. 17/18). Although implicitly formulated with 'to generate profitable and sustainable revenue streams', in this definition the value for the firm itself seems somewhat underexposed. Another concise definition by the same authors puts equal emphasis on the value for others and the value for oneself: A business model describes the rationale of how an organization creates, delivers, and captures value (Osterwalder and Pigneur 2010, p. 14). This is also endorsed by Chesbrough who states that "at its heart, a business model performs two important functions: value creation and value capture" (Chesbrough 2007, p. 12). Before deciding what value *you* may create in the market, and how *you* will capture value, one must assess the options from a broader business scope beyond your existing business. Business model innovation is key to competing in the digital economy (Tapscott, Ticoll et al. 2000; Lee and Vonortas 2004) and is at the heart of disruptive innovation in organizations (Markides 1997; Osterwalder and Pigneur 2002; Osterwalder 2004; Francis and Bessant 2005; Markides 2006; Chesbrough 2007; Chesbrough 2010). Spring and Araujo (2009) found that the notion of the business model is useful as an integrating concept to rethink operations management research for service(s) and products.

Extending a product/process innovation framework with business model innovation
Voss and Zomerdijk (2007) have expanded the product/process innovation dichotomy with business model innovation to explain innovation in experiential services. They based their model upon a typology of services innovation as given in a report on innovation in Ireland (Forfás 2006, Figure 3-7 left side), but with some alterations. They extended 'new customer interfaces' to the full range of process innovations, and positioned the concept of business model innovation between product and process innovation. Furthermore, they added an ellipse to place the emphasis on the iterative character of handling product innovation and process innovation (Voss and Zomerdijk 2007, p. 126-127); see Figure 3.7 (right side). According to the authors, the three modes of innovation (product innovation, process innovation and business model innovation) are not sector specific, but may occur in any context. Hence, the model should also be applicable in a service perspective context. Business model innovation is included in their framework because "whilst much innovation in services is about product, service innovation can best be understood through a process innovation and business model innovation lens. Doing this helps to understand the problems in measurement of innovation, both of inputs and outputs, and will recognize and advance the innovations in services currently taking place" (Voss and Zomerdijk 2007, p. 128). Another concise statement on the goal of a business model is given by Gordijn, Akkermans et al. (2000): "the main goal of a business model is to answer the question: *who*

is offering *what (of value)* to *whom* and expects *what (of value)* in return". Markides (1997, p. 11) states that all companies have to decide three basic issues at the strategic level:

- Who is going to be our customer?
- What products or services should we offer the chosen customer?
- How should we offer these products or services cost efficiently?

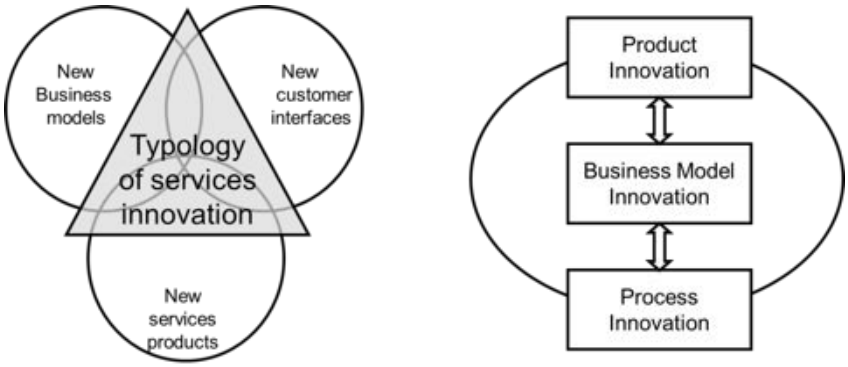

Figure 3.7 Models by Forfás 2006 (left) and Voss and Zomerdijk 2007 (right)

In their 'Business Model Framework' (BMF), Osterwalder and Pigneur (2002) attach a somewhat different meaning to the 'who' and 'how' questions. For Osterwalder and Pigneur, 'who' equals 'Customer Management' and covers all customer-related aspects, including the (distribution) channel. 'How' equals 'Infrastructure Management' and includes 'Capabilities', the 'Value Configuration', and 'Partnership(s)'. This is a broader scope than Markides' "to offer these products or services cost efficiently". Furthermore, they extended the questions with 'how much': how much can be earned by doing it and how much are the associated costs? This covers both the 'Revenue Streams' and the 'Cost Structure' in their framework.

Table 3-4 Mapping of BMF Areas/Components on Product and Process

BMF Area	BMF Component	Product	Process
What - Product Innovation	Value Proposition (VP)	x	
Who - Customer management	Target Customer (TC)	x	x
	Channels (CH)		x
	Customer Relationship (CR)	x	x
How- Infrastructure Management	Capabilities (CA)/Resources (RE)		x
	Value Configuration (VC)		x
	Partnership (PA)		x
How much - Financial Aspects	Revenue Streams (RS)/Pricing (PR)	x	x
	Cost Structure (CS)		x

Table 3-4 shows how the various components of the Business Model Framework (Osterwalder and Pigneur 2002) map onto 'product' and 'process' as defined in the preceding paragraph. It shows whether the BMF area/component has consequences for

product or process or both. Not surprisingly, the ‘what’ and ‘how’ categories from the BMF fully map onto product and process respectively. The ’who’ and ‘how much’ BMF areas have aspects that map onto both product and process.

Toward a Product-Process-Business model innovation framework

By adding business model innovation to the product/process innovation dichotomy as an integrating element, some major strategic issues can be systematically included in the framework. This could provide a link between the broad ‘positioning’ focus of business modeling and the firm implementation perspective of (business) process modeling. Likewise, business modeling could provide a link to product modeling. This way, business modeling could form a foundation for both product and process modeling. Although business modeling involves ‘how’/process elements, business modeling is not the same as process modeling (Gordijn, Akkermans et al. 2000). However, the two should be connected to be able to discuss their mutual relationship and to implement the chosen business model via the business processes.

Building further on the product/process innovation model by Edquist, Hommen et al. (2001) and the product/process/business model innovation model by Voss and Zomerdijk (Voss and Zomerdijk 2007), the following Product-Process-Business model innovation framework (PPB) is proposed to position product, process and business model innovation (Figure 3.8). Compared with the model by Voss & Zomerdijk (2007), business model innovation in this framework is not positioned as an additional innovation area besides product and process innovation, but as an area that overlaps with both product innovation and process innovation. It overlaps because business model innovation includes both product/‘what’ aspects as process/‘how’ aspects. However, there is no full overlap with product innovation and process innovation because business model innovation is ‘only’ concerned with conceptual modeling; it does not include other aspects of product and process innovation. Another reason for this partial overlap is that both product innovation and process innovation can also be performed without changing the business model. For example, reorganization as part of a process innovation can be done to substantially lower the operating costs without affecting the business model.

... business modeling could form a foundation for both product and process modeling ...

The outer ellipse in Figure 3.8 again represents the iterative cycle of product innovation and process innovation as introduced by Voss and Zomerdijk (2007). Product and process innovation are in accordance with the definitions provided in Paragraph 3.3. The scope of product and process is the result of answering the earlier ‘what’ and ‘how’ questions, respectively, for the scope of the service perspective firm.

Because the ‘what’ and ‘how’ questions in Paragraph 3.3 were formulated in a networked service perspective manner, they already encompass a broad business model innovation scope. The biggest what/how ‘babushka’ of Figure 3.5 in this respect represents the overall business space to which business model innovation is applied. It may even be argued that

there is no need for any further questions to encompass the full scope of business model innovation. To assess the customer value (related to 'what') one should implicitly know who your customers are. According to Peter Drucker "there is only one valid definition of business purpose: to create a customer" (Drucker and Maciariello 2008). The same applies to the 'how' part: in order to know how to cooperate with your customers you must know who your customers are. Likewise, one will not innovate if it is not known how much you may earn and how much it may cost you. However, by explicitly adding 'who' and 'how much' questions alternative business models may be explored. These 'who' and 'how much' questions can be formulated as follows:

... by explicitly adding 'who' and 'how much' questions alternative business models may be explored ...

- Who are your target customers? This is in compliance with the first part of the goal of a business model by Gordijn, Akkermans et al. (2000).
- How much (and how) will you earn and how much will it cost you? This question includes how the actors in the value network will earn (revenue model) and how costs will be distributed in the value network (cost structure).

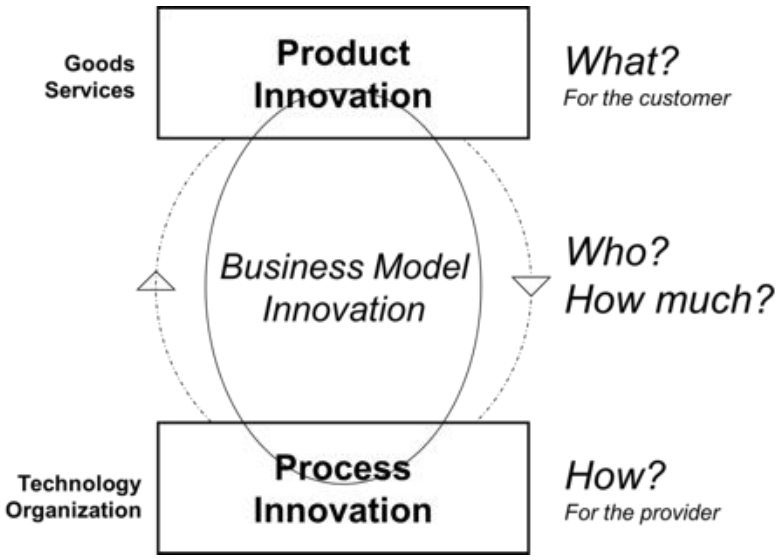

Figure 3.8 Product-Process-Business model innovation framework (PPB)

Business model innovation is not about looking at the renewal of a particular product, process, or customer segment, but is an integrated exploration and explication of the above 'who', 'what', 'how', and 'how much' questions so as to (re)consider 'what business are you in' and 'how do you perform that business' including your position in the supply chain/network. For example, by just considering one element Dell Computers would not

have come up with their innovative combination of a supply chain model ('how'/process) and pre-production financing by their customers ('how much'/revenue and cost model). The above 'who', 'what', 'how', and 'how much' questions should also be asked from the perspective of the other possible actors in the chain/network to thoroughly understand the business model options. Another way to achieve thoroughness is to start the thinking process at different points, each time starting with a different question (Markides 1997, p. 12). For future reference and reconsideration it is important to articulate both the process and the end result of business model innovation. The above integrated exploration process may be facilitated e.g. by applying Osterwalder and Pigneur's Business Model Framework (2002) to analyze the various business model elements. The end result of this exploration for the firm is the chosen and documented business model: a particular product/process combination for defined target customers with a defined revenue/cost model serving the chosen business model. This forms the starting point for (further) business process modeling and incremental/modular product and process innovation: at this stage, product and process are only broadly defined to understand the chosen business model. Within the chosen business model, (product and process) innovation can continue to be performed iteratively until an alternative business model is chosen. The business model should be reviewed and, if necessary, reconsidered or reformulated on a regular basis.

Table 3-5 - Summary of Product-Process-Business model innovation (PPB) questions

Question		Result	
Who?	Who are your target customers?	Target customers defined	Business model defined
What?	What is your proposition and what should be the perceived value of the goods/services for your customers? • What does it mean for your customer (business value)? • What does it do for your customer (functions)? • What is it for your customer (attributes; look and feel)?	Product defined	
How?	How will you position yourself in the value chain/network; how will you distribute and (co)produce your product with your partners? • How do you organize the relationship with your customers/downstream partners (distribution channels and customers)? • How do you organize your internal technology/organization (internal operations)? • How do you organize the relationship with your suppliers/upstream partners (sourcing)?	Process defined	
How much?	How much (and how) will you earn and how much will it cost you?	Revenue and cost model defined	
Why/when?	Why and when should you innovate (corporate strategy and business case)?	Go/no go for innovation	

To complete the range of innovation-related questions, a fifth question could be added. This question is not specific for business model, product or process innovation, but is relevant to all innovations:

- Why and when should you innovate? This question remains relevant throughout the firm's existence and includes both corporate strategic and financial considerations, and the specific (business) case and timing for any particular innovation. The answer to this question forms the cornerstone of any innovation.

Table 3-5 gives a summary of the various questions that form the foundation for the Product-Process-Business model innovation framework of Figure 3.8. Appendix D clarifies how existing firm level innovation types in the literature map onto the PPB framework as presented in this chapter.
Chesbrough and Rosenbloom (2002) define a business model as a blueprint for how a business creates and captures value from new products/services. The PPB framework provides a way to explicate and manage such a blueprint in relation to product and process as defined in this chapter.
In Figure 3.9 the PPB framework is positioned as the first building block for Mass-customized Innovation in the research model, thus forming the first conceptual framework of this research: Conceptual Framework 1 (CF1).

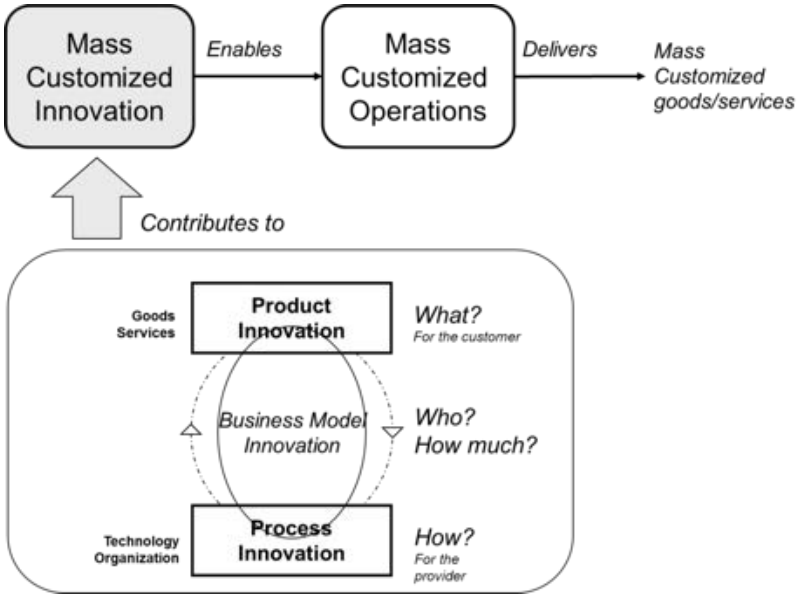

Figure 3.9 - Conceptual Framework 1

The role of technology
A much-debated issue in the literature is the role of technology in business model innovation. Clearly technology plays an important role in some business model success stories (e.g. Google and Apple with their web-based models), but there are examples where technology only played a minor role in the success of business model innovation (e.g. Rolls Royce and GE Aircraft selling flight hours instead of selling jet engines, or Ryanair targeting different traveler groups and developing a value network with underutilized regional airports). In a study on Xerox technology spin-off companies, Chesbrough and Rosenbloom (2002) found that discovering a viable business model is critical to creating value from technology.

Following the previously discussed positioning of product, process and business model innovation, technological innovation is viewed as one form of process innovation (next to organizational innovation). Technology is either exposed to the customer in a mutual process (via the product in the form of a 'service'), or ownership is transferred to the customer (via the product in the form of a 'good'). In this reasoning, technology (as part of the process) only becomes valuable if it creates value for the customer (via the product), and if sufficient value can be captured by the firm and partners involved (through a viable business model and supporting processes).

... technology only becomes valuable if it creates value for the customer and captures value for the firm ...

The role of strategy

Before concluding this theoretical discussion on business model innovation in relation to product innovation and process innovation, the role of 'strategy' must be clarified. Although the above PPB questions (Table 3-5) must be approached from a strategic level, even a full and integrated answer to these questions does not lead to the entire firm strategy. The overall corporate strategy of a firm includes overarching strategic aspects like branding, financing, or human resource strategies. For the same reason, in this study 'competitive strategy' (as e.g. described by Chesbrough 2007) is seen as overarching business model innovation.

Figure 3.10 visualizes this positioning of corporate strategy and operations in relation to the PPB framework. Innovation and Operations represent the core functions of a service perspective provider. Both the operations and innovation roles are connected to upstream partners/suppliers and downstream partners/customers in a combined value chain/network.

Business model innovation within Telco

Within Telco several business models apply in parallel, including various revenue model/cost structure combinations. These models vary from traditional legacy telecom operator models, including usage-based pricing revenue models, to business models with 'Internet-like flat fee' revenue models. However, management of these models is predominantly done at the disparate levels of product and process; explicitly developing and documenting the business model is still in its infancy. Hence, an explicit link between Telco's business models and product/process models is also lacking[36].

The dilemmas associated with the choice between traditional telecom business models and internet-based 'over-the-top' business models could lead to competing business models within one company, and this phenomenon will probably increase in the future (Markides and Charitou 2004).

[36] There is more to be said on the development of Telco's business process model; this will happen in a number of case descriptions and the accompanying interpretations.

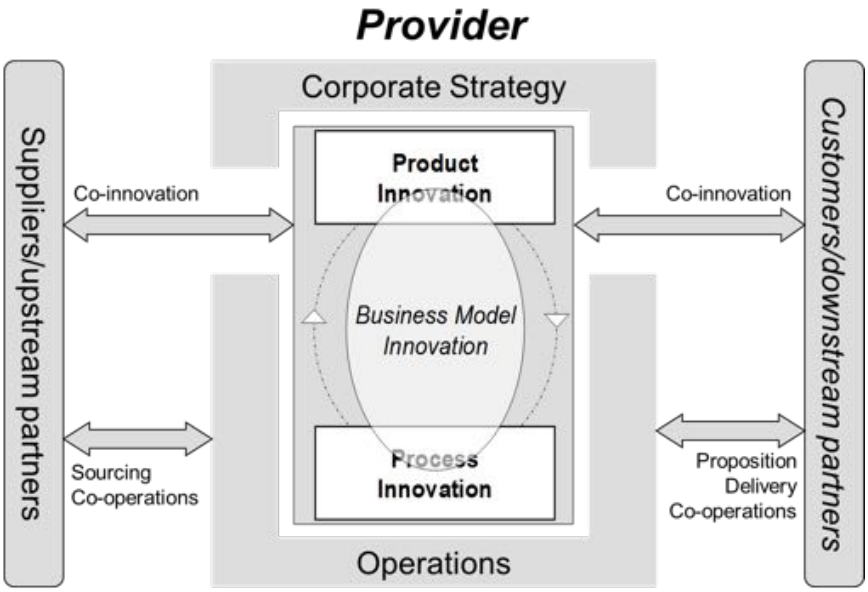

Figure 3.10 PPB and the positioning of corporate strategy and operations

To conclude this paragraph, two strategic long-term 'technology transition' programs at Telco corporate level will be discussed:

- Case 3-2 on the corporate transition toward 'IT Reference Architecture'
- Case 3-3 on the corporate transition toward 'IP-based Networking & Services'.

Both programs were initiated by Telco top management to lower the cost of operations and to cope with changing future market conditions. These programs had much more impact than the two smaller-scale product modularization/rationalization initiatives described in Cases 2-1 and 2-2. However, they also struggled with some of the same issues. Just like the two smaller-scale rationalization programs, these two cases primarily serve as an illustration of how Telco pursued the transition toward a mass-customized operator.
As the researcher was not an (initiating or contributing) actor in these two cases, the case data is primarily based on semi-structured interviews and documentation.

Case 3-2 – IT Reference Architecture

The product supplier era left Telco with hundreds of, usually product/technology silo-based, and often poorly interoperating, IT applications. Each new product was supported by its own product-specific service management capability-related ICT, directly or indirectly leaving serious integration efforts to front-line customer support personnel and customers. The magnitude of the issue became even clearer during the preparations and measures to cope with the so-called Y2K/millennium-bug in 1999.

In 2002, Telco senior management made a clear statement concerning the preferred IT reference architecture. Cost reduction was the main driver; targets on IT cost and the number of IT systems were set for all concerned (senior) managers. A benchmark study by Oliver Wyman (formerly Mercer) in 2004 showed that, in comparison with a number of other legacy telecom operators, Telco resided in the worst quartile concerning IT cost. An underlying driver was a need to reduce complexity and enhance manageability of the IT landscape. Lead times and cost for IT development and integration were increasing, along with the number IT development requirements.

The idea was to replace multiple legacy applications by a limited number of 'best of breed', and 'commercial-of-the-shelf' (COTS) applications without special software development upon Telco's needs. Furthermore, there was a notion of modularity/agility at the level of IT, to be resolved with a service oriented (SOA) based Enterprise Architecture Integration (EAI).

A so-called 'reference architecture' was worked out and a number of programs were started to rationalize IT for key telecom operational processes like trouble ticketing, network configuration and order management. A limited set of IT-suppliers were selected to deliver and implement the associated applications. The scope of the effort was Telco corporate-wide, but with a focal point on the wholesale and operations division. There was a notion of decoupling IT from the product portfolio and de-siloing. However, the ability to support mass-customized operations, with associated aspects like modularization and innovation agility, was not explicitly stated as a requirement for the new IT reference architecture.

The TMF eTOM framework (Case 4-3) formed, together with Telco's supply chain model (Case 4-4), the cornerstone of program governance. Apart from a vertical function-based grouping, the eTOM framework allows for a horizontal grouping of processes, at the highest level between customer processes (eTOM Customer Relationship Management) and network/support processes (eTOM Service & Resource Management and Operations). Governance was enforced by organizing the IT organization according to this framework, and played an important role during the first two years, underlined by strong senior management attention. Later on, the role of governance diminished until in 2007 a formal CIO-role was installed, coinciding with the formation of a separate IT division.

The program showed mixed results over time. The number of IT applications has decreased, but not with the speed and broadness as originally anticipated. However, in a comparable benchmark by Oliver Wyman (formerly Mercer) in 2007, Telco ranked among the best-in-class concerning IT cost and 'operational excellence'. During the program several reusable components were implemented, like a common network information management 'module' for multiple technical infrastructure platforms, serving multiple processes.

The pressure to rationalize the IT landscape and to increase agility remains high. From 2008 onwards the program goals have been included in the 'IP-based Networking & Services' program (Case 3-3). The IT Reference Architecture initiative could from then on be viewed as the process/IT-component of the IP transition program.

Discussion on Case 3-2 – IT Reference Architecture

Because the initiative was not organized as one overarching program, but rather as a set of separate programs per operational process/IT area in a constantly changing organization, the role of governance was even more important. In general, governance was most prominent on the choice of IT suppliers and applications, but less strict on the process and data architecture, and how IT should support these processes and use the data. Although (top) management showed to have a long breath during this long-term initiative, it proved not easy to develop and sustain consistent governance during almost a decade.

Common issues concerning SOA/EAI and COTS (common-off-the-shelf) implementation became apparent, e.g. additional cost/lead time to build SOA 'adapters' for legacy applications, and 'COTS' software not being as common-of-the-shelf as originally anticipated. Additionally, service orientation was more geared at fine-grained IT-level services than coarse-grained business-level services. Some main legacy applications proved hard to be replaced due to their monolithic nature and 'hard wired' connections with other legacy applications and networking infrastructure. And there remained a tendency to rebuild old processes in new IT. This prevented the COTS and SOA/EAI vision to become fully true.

A general stumbling block was also formed by a structural undervaluation of the role of data management and modeling. If, for example, the data object 'customer' has a different meaning per process/IT application, rationalization of IT becomes a major challenge. This also induced 'virtual rationalizations' in the sense that a uniform reference architecture component name could disguise a number of different underlying IT instances serving multiple versions of more or less the same process but using different legacy data models.

The program was most successful in cases where IT rationalization was approached from a process perspective …

In general, there was little emphasis on the interface with product management, while product rationalization itself had not been very successful in the business and wholesale area (Cases 2-1 and 2-2). There was also limited involvement by product management because of the pure networking scope of the first Reference Architecture initiatives. Without rationalization on the product side and few limitations on the amount and scope of product requirements (also a governance issue), it is hard to rationalize supporting processes and IT.

The program was most successful in cases where IT rationalization was approached from a process perspective, where the (functional and organizational) scope was limited, and where high involvement of the operational departments occurred. From the outside, a process perspective could be recognized by the fact that one was, for example, talking about supplier independent 'Network Information Management' instead of the IT brand name 'Cramer'. A successful example of a limited scope/high operations involvement program was an incident management solution based on a Telco-wide trouble ticketing system. Another success factor in this case was the fact that there was limited extant process support for this process area.

The innovation process was not adapted to handling reusable modules. The Telco NSD stage-gate process (Case 5-1) was still geared to one-off 'roll-out' projects, not to incremental/modular innovation of reusable components. Despite the emergence of some process modules, like reusable 'delivery/production lines', release management was hardly done on a process level, but mainly conducted at the level of IT applications and systems. Furthermore, a clear assignment of roles was frequently troubled by internal struggles associated with 'asset ownership'. With the formation of the IT department in 2005 process demand management partly moved from 'the business' to the IT department, but process (innovation) responsibility was not clearly positioned as part of this reallocation. Consequently, innovation management responsibility for the new process components developed along historic lines: sometimes an operations department took responsibility, sometimes an innovation department, and sometimes the IT department. This in turn made it difficult to implement a coherent process/IT landscape because of the growing interdependence of components in a modularized, horizontalized structure.
Two years after the start of the IT Reference Architecture initiative of Case 3-2, another large-scale initiative was started in the process area. Initial focus of this initiative, that became a formal company-wide program, was on the service function capability (networking infrastructure) area. Case 3-3 describes this initiative: IP-based Networking & Services.

Case 3-3 – IP-based Networking & Services

In 2004 a clear implementation strategy was started by Telco corporate management to replace multiple legacy network infrastructures by an Internet Protocol (IP), Ethernet and fiber optical switching-based infrastructure. Primary initial driver was an opportunity to substantially reduce capital and operational expenditure in various legacy network platforms, and subsequently allow for market conformant pricing. The Internet Protocol has emerged as the world standard for telecommunication services. The challenge for telecom operators is to successfully blend traditional telecom-grade quality standards with the new IP-based opportunities. The world-wide ubiquity of IP-based networks, applications and devices offers the potential of much lower capital expenditure cost. Operational expenditure on IP-based next-generation networks is also reduced because implementation and maintenance requires less manual interaction. Configuration and maintenance can be performed highly automated, within Telco frequently referred to as 'zero touch'. Telco embraced these Next Generation Networks (Chapter 2) developments as one of the first telecom operators with a large-scale replacement strategy of multiple legacy network infrastructures by a limited set of new platforms. The effort was set up as a highly visible company-wide program with top management support. Unlike the IT Reference Architecture program of Case 3-2 the IP-based Networking & Services program was set up as a 'real' large-scale transition program.
Because of the ultimate Telco-wide scope of the program, a big issue was how to interface and/or integrate with the regular line organization and infrastructure (or even replace it). It was decided that the program should not act like a new green field operator alongside the

regular organization. Instead, the program was more thought of a stage-director guiding the rest of the organization in the pursued direction. Because of the high visibility and new technologies involved everybody was eager to be involved in this new effort.
To better support migration of customers and rationalization of products and platforms, early 2007 the program was reorganized on Telco corporate level with stronger ties in all parts of the organization. Another reason for this restructuring was a requirement to put more emphasis on developing processes/ICT and the associated organizational change. Although various blueprints were developed on this subject actual implementation of processes/ICT lagged behind networking infrastructure roll-out.
The program resulted in a substantial roll-out of fiber and Ethernet-based networks, although not completely according to the original plans. An important reason is that the program was deliberately moderated and adjusted in accordance with market conditions; e.g. customer/line loss on legacy services appeared to be much slower over the years than originally anticipated.
In 2009 the program was dismantled as a formal corporate program, and was continued as separate line organizations with units like Operations, and 'Roll out'. Parts of the program were integrated with the existing line organization. The program name was reused to denote a wider business scope: "… refers to the transformation of Telco to an ICT-multimedia organization which offers its customers all needs for communication. The new organization will be fully based on IP-service using a new fiber-network" (Telco Annual Report 2009).

Discussion on Case 3-3 – IP-based Networking & Services

Although the main goals of Telco's earliest portfolio rationalization initiatives of the Cases 2-1 and 2-2, and the transition toward IP-based Networking & Services of Case 3-3 were comparable, two factors were quite different. For the latter initiative there was a clear and enduring commitment by top management and it was expected and accepted that results could not be expected overnight.
Despite the name of the program, IP-based Networks & Services, 'IP' until recently only played a minor role during its existence: the program was mainly occupied with the roll-out of a fiber infrastructure and Ethernet-based services. One important reason for this single sided focus may be the cost and effort of a large-scale roll-out of a fiber infrastructure which acts as a foundation for IP services. The program resulted in a number of innovations in the technical network infrastructure. However, the main issues in this roll-out were, apart from funding and regulatory issues, not so much in the area of technical infrastructure, but in the development and integration of IT, the availability of attractive service products on top of this infrastructure, and the timely migration of customers from the existing services and infrastructures to the new ones. It is one thing to roll-out a new network infrastructure aside the existing ones. To switch off legacy platforms, customers should either be stimulated to switch to other product offerings that make use the new platforms ('commercial migration') or they should be migrated smoothly

The program resulted in a number of innovations in the technical network infrastructure …

to another platform while keeping exactly the same service product ('technical migration'). These scenarios require a well-coordinated combined effort of marketers, network technicians and process/IT specialists. Since the IP transition program was originally organized within the technical/operations department there was not much emphasis on product marketing aspects and the interaction between the various stakeholders by that time.

Development of processes/IT received less attention during the entire program duration, and it was not always clear who should perform these innovations. Traditionally the operational processes were designed and implemented by operations management. However, with higher degrees of automation, the IT department tended to take over this role. Occasionally, product management discussed their requirements directly with IT development, bypassing departments responsible for process development (if available at all). Since the IP program operated outside of the regular operations departments, this bypassing was not even always visible from the outside. An additional dilemma is whether to automate legacy processes or to fully redesign processes. Legacy processes should not be blindly automated; on the other hand automation should not be done without a process vision.

... both programs suffered from some common issues ...

The above unclarity in innovation roles also induced unclarity in the operational service provision. If some processes are fully designed and implemented by IT management, does this mean that IT management is also responsible for the overall service quality as experienced by Telco's customers? Since these processes must be integrated within other processes and networking services, and most processes still have a manual component, this is probably not the case: responsibility for the overall service quality in the market should not be assigned to 'IT' but 'the business'.

To conclude the discussion on these two long term technology programs it can be stated that both programs were more successful on the path to mass customization than the smaller-scale programs that have been described in Cases 2-1 en 2-2, mainly due to a much higher management attention and investment level. The programs resulted in a number of reusable modules based on a horizontally layered architecture, both in the service function capability area as well as in the service management capability area. These reusable modules offer the potential for a higher degree of customization against lower pricing/cost levels. However, just as the smaller-scale programs, both programs suffered from some common issues:

- Overall strategy and business goals of the programs were not sufficiently documented, operationalized, and explicitly adapted in the course of the programs.
- Single sided focus on technology (networking and IT), much less focus on products, business processes, integration issues and organizational change.
- Lack of an overall business architecture (Versteeg and Bouwman 2006), and implementation governance geared at a coherent fabric of horizontally layered reusable components.

- No adaption of the innovation process and roles, organization and supporting ICT tooling during the transition from product/technology silos toward such a horizontalized fabric.

These issues are predominantly related to the innovation process, but an additional overarching issue was that the innovation process itself was not regarded as 'the full implementer' of the operational processes. The expected and accepted role of 'innovation' was, apart from product marketing aspects, usually limited to the 'hard side' of service development: technical telecom infrastructure and ICT applications/hardware.

3.6 Summary

This chapter has discussed the first of three challenge areas in managing innovation in ISM firms, and the associated first research sub-question (RSQ1): *What do the terms 'product' and 'process' mean in a service perspective context, and how can their lifecycles be decoupled in the innovation process to apply mass customization principles?*
In two cases two strategic long term 'technology transition' programs were discussed. They illustrate how Telco pursued mass-customized operations, and clarify the main issues during this transition. It was shown that by redefining product and process the concepts can be unambiguously identified for application in a service perspective environment.
The definitions are based on the 1-Model, a model that was applied in portfolio rationalization trajectories in the business market area in 2001 to 2003, and existing definitions and models from the literature. Furthermore, business model innovation has been applied as an integrating 'tool' to assess product and process innovation in a broader business context. These mechanisms have been combined into the first conceptual framework of this research: Conceptual Framework 1 (CF1) based upon the Product-Process-Business model innovation framework (PPB).
This framework forms the foundation for an innovation management system for ISM firms, and forms a starting point for both Chapter 4 that discusses the challenge of 'the missing innovation objects', and Chapter 5 that discusses the challenge of 'innovation management for mass customization'.

4. A web of business components

4.1 Introduction

Up to this point, the relationship between product innovation and process innovation has been discussed from a strategic business perspective. Business model innovation has been positioned as the starting point and integrator of product and process innovation. The concepts of product and process innovation have been redefined for application in a service perspective context. This has resulted in the first conceptual framework (CF1): the Product-Process-Business model innovation framework (PPB).
This chapter will extent the layering principles of Chapter 3 with structuring principles to further operationalize the relation between product, process and business model in a service perspective context. The aim of this chapter is to address the second challenge of the 'missing innovation objects' by responding to the second research sub-question (RSQ2): *How can the end result of the innovation process be defined in terms of 'tangible' objects for the actors in the innovation process (*Figure 4.1)?

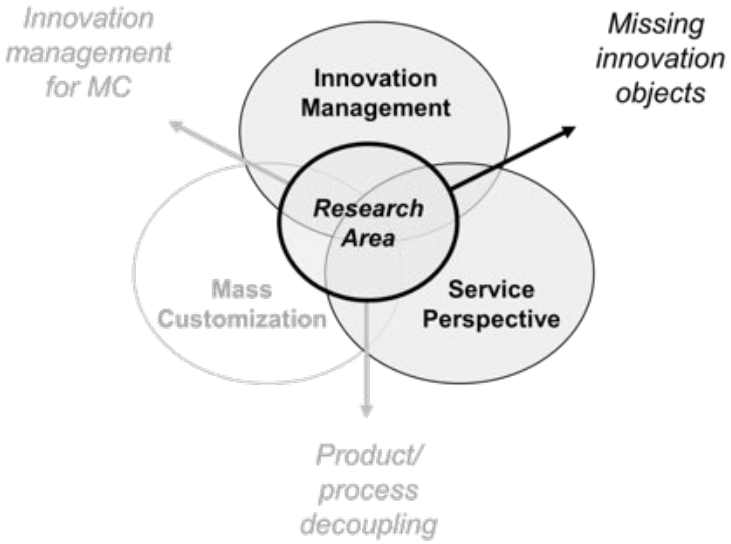

Figure 4.1 The second challenge area: missing innovation objects

By having 'tangible'/'perceivable' innovation objects/units available, the various actors in the innovation process would be facilitated in the innovation process. This might enable modularization and horizontalization[37] in an ISM context. This chapter will discuss the literature and four Telco cases that relate to this challenge area. All cases in this chapter are

[37] As described in Paragraph 2.7.

related to governance on product and process modeling and aim to contribute to the development of the conceptual framework.

4.2 Componentization at the business level

In an article on research opportunities for the service area, Menor, Tatikonda et al. (2002) give the following research opportunity: “Developing techniques for more effective and efficient 'tangibilizing’ of service concepts” (RO6, p. 145). This opportunity is introduced as follows: “The intangibility characteristic places an onus on service developers to ‘tangibilize’ the service concept/offering so that it is not abstract; that it is understood in a consistent, shared fashion by all parties in development; and that all parties in development can work to the same goal, rather than different perceptions of the goal of the given service development effort. In physical product development this is dealt with through the use of prototypes (which may be 3D physical mock-ups, electronic drawings, or hard-copy schematics). In New Service Development (NSD) the idea of a ‘blueprint’ (Shostack 1984; Shostack 1987) or other specific means to describe the service concept may need to be especially emphasized.” (Menor, Tatikonda et al. 2002, p. 145). Bitner, Ostrom et al. state that “Service blueprints allow all members of the organization to visualize an service and underlying support processes, providing common ground from which critical points of customer contact, physical evidence, and other key functional and emotional experience clues can be orchestrated” (Bitner, Ostrom et al. 2008, p. 69-70). Strategies like service blueprinting (Shostack 1984; Kingman-Brundage 1989; Bitner, Ostrom et al. 2008) strive to look ‘inside the box’ of service concepts to make them better perceivable for the actors in the innovation process. The current study explores an alternative strategy concerning ‘tangibilization’, building further on the concept of the ‘business component’. This could be viewed as a complementary strategy to service blueprinting. Service blueprinting looks into the service process itself starting with the interaction between the customer and the providing firm; business componentization as intended in this chapter approaches the issue from a supply chain/network perspective of cooperating components coherently delivering value to customers, the firm and other stakeholders of the firm. Business componentization is not new, but in the literature the concept, along with the related concept of ‘business service’, is usually more oriented toward an IT perspective than a true business perspective (Sanz, Becker et al. 2007).

Business componentization … a complementary strategy to service blueprinting …

The notion of ‘component’ may be defined at multiple levels, from fine-grained hardware parts or software code, to more coarse-grained business levels. Both levels have their value for different applications. Fine-grained technical-oriented components may be useful for (software) engineers or process developers for the detailed design of hardware or software, but these components have less value at a business/management level. A coarse-grained business-oriented approach in components allows managers to identify the components that

satisfy their business requirements, and subsequently assemble them into full-scale business applications (Jain, Chalimeda et al. 2001).
In pure manufacturing environments the identification of the business components is basically a 'no-brainer': the product components are the propositions to be offered and goods to be delivered to customers; the process components are (combinations of) the production assets (machines etc.) that produce the goods to be proposed/delivered. Of course, even in a manufacturing context the full identification/specification of component data in a Product Lifecycle Management (PLM, e.g. Grieves 2006)[38] sense is not a trivial task. However, in a service perspective environment the identification of business components is even less clear. Service products may be highly intangible, and frequently the scope is not clear at all. The same applies to the service process, which is composed of a combination of manual and automated processes in which the customer acts as a co-producer (Martin and Horne 1992).

Business componentization: from ICT orientation toward business orientation
Originally, business componentization stems from the ICT world as a logical consequence of object-oriented programming (Sims 1994; Szyperski 1999; Fellner and Turowski 2000; Herzum and Sims 2000). Component-based development (CBD) is defined as "a software development approach where all aspects and phases of the development lifecycle, including requirements analysis, architecture, design, construction, testing, deployment, the supporting technical infrastructure, and also the project management, are based on components" (Herzum and Sims 2000, p. 11).

Business componentization
Table 4-1 gives some definitions of 'business component' from the literature. Some definitions are clearly geared to an IT-related application, incorporating terms like 'software' or 'information system' (Kozaczynski 1999; Fellner and Turowski 2000; Herzum and Sims 2000). Sometimes, a relationship with IT is not apparent from the definition, but the concept is still assumed to be related to software engineering (Barbier and Atkinson 2003; Andronescu and Muntean 2006).

'Business component' in the literature is usually related to software engineering ...

Like the term 'service', the terms 'component' and 'componentization' have both business and ICT connotations in the literature. A language gap between the ICT and business realms appears to be widening with increased confusion on the status and scope of notions like Service Component Architecture (SCA) and Composite Business Services (CBS) (Sanz, Becker et al. 2007).
According to the same authors "Componentization and services as understood by business practitioners have little to do with their IT siblings. Business components and business

[38] A concise discussion of Product Lifecycle Management, and its relation with innovation management in ISM firms, is offered in Chapter 6.

services are the foundation of a Service Oriented Enterprise view of industries and companies. The economic importance and implications of a deep form of the 'service orientation' concept goes well beyond software concerns and much further than componentizing or reusing IT services" (Sanz, Becker et al. 2007, p. 7).

Table 4-1 Definitions of 'business component' in the literature

Author	Definition
Kozaczynski (1999)	A component is a part of a system that is (at the same time) a unit of design, construction, configuration management, and substitution. A component conforms to and provides the realization of a set of interfaces in the context of well-formed system architecture.
Fellner and Turowski (2000)	A component is a reusable, self-contained and marketable software part, which provides services through a well-defined interface, and which can be deployed in configurations unknown at development time. A business component is a component that implements a certain set of services out of a given business domain.
Herzum and Sims (2000)	A business component is the software implementation of an autonomous business concept or business process. It consists of all the software artifacts necessary to represent, implement and deploy a given business concept as an autonomous, reusable element of a larger distributed information system.
Barbier and Atkinson (2003)	A business component models and implements business logic, rules and constraints that are typical, recurrent and comprehensive notions characterising a domain or business area.
Cherbakov, Galambos et al. (2005)	The notion of componentization allows an enterprise to deconstruct, analyze, and then reconstruct into value nets, in which partnerships with customers and suppliers operate in a network supported by real-time information flows and integrated IT systems. The process of deconstruction/reconstruction is realized through business components, that correspond to distinct business functions.
Andronescu and Muntean (2006)	A business component is a component that offers a certain set of services of a given business domain.
Sako, McKenna et al. (2006)	With component business modeling, a tool to map complex business processes in terms of reusable mix-and-match business components, IBM aims to bring standardization to business services, improving the efficiency of transformational outsourcing and further growing its service business.
Tian, Ding et al. (2006)	A business component is a logical view of part of an enterprise that includes resources, people, and systems necessary to deliver some value.
Sanz, Becker et al. (2007)	A Business Component is a part of an enterprise that has the potential to operate independently, in the extreme case as a separate company, or as part of another company. A business component is a logical view of part of an enterprise that includes the resources, people, technology and know-how necessary to deliver some value.

A recent development lead by IBM is to position business componentization truly at the level of 'the business' instead of at the level of ICT. The Component Business Model® (CBM; IBM 2004) is a method used by the IBM business consulting community to methodically create a structured representation of the business as an organized collection of business components (Cherbakov, Galambos et al. 2005; Sako, McKenna et al. 2006). CBM offers a concept of aggregating large chunks of company activities according to a number of well-identified capabilities in the enterprise and three levels of accountability involved in the business operations. It views an enterprise as a set of non-overlapping business components to identify opportunities for innovation and improvement (Sanz, Becker et al. 2007).

According to Chesbrough CBM "provides a pro-active way to actually experiment with alternative business models, by enabling firms to simulate various possibilities before committing to specific investments in reality. It also has the great virtue of explicitly visualizing the processes underlying a business model. Thus, theoretical considerations of

configuring elements of a business model here can become far more concrete" (Chesbrough 2010, p. 359).[39]

The aim of business componentization in this study

The following, integrally provided, citation from Cherbakov, Galambos et al. (2005) perfectly[40] describes the purpose of the business component concept for this research: "The notion of componentization allows an enterprise to deconstruct, analyze, and then reconstruct into value nets, in which partnerships with customers and suppliers operate in a network supported by real-time information flows and integrated IT systems. The process of deconstruction/reconstruction is realized through business components, which correspond to distinct business functions. In the on-demand environment, the component-based firm links its components efficiently and seamlessly both internally and across the firm's boundaries with best-of-breed components provided by external partners. Nonetheless, componentization by itself is not sufficient. Interactions between business components need to be seamlessly and tightly integrated across the value net. The need for flexibility across the value net requires that the component network be flexible; that is, the enterprise can 'in-source' an outsourced component and vice versa; replace, on demand, a current partner with a different partner; change the terms of the contract between the two components, and so on. The key to seamless integration between business components is service orientation. As defined above, each business component serves a unique purpose and provides one or more business services for consumption by other business components. The component that consumes a business service offered by another business component is oblivious to how the provider creates the business service. Service interactions between business components are governed by business-level agreements and contracts, which cover items such as cost structures, service levels, and so on" (Cherbakov, Galambos et al. 2005, p. 654).

... the identification of tangible/perceivable 'objects' ...

The idea of business componentization in this chapter is to enable the identification of tangible/perceivable 'objects' that represent the outcome of the innovation process in ICT intensive service perspective mass-customized firms[41]. This study aims for a coarse-grained business-oriented notion of business components to provide a framework spanning the entire scope of the Product-Process-Business model innovation framework (PPB) as

[39] In the literature, even the term 'business modeling' sometimes seems closely associated with IT. The concept of business modeling is sometimes limited to web-based 'IT only' businesses (and/or equated with 'e-business modeling'). Furthermore, business modeling is sometimes equated with process modeling. Gordijn, Akkermans et al. (2000) explain why this should not be done.

[40] If the sub-phrase 'supported by real-time information flows and integrated IT systems' does not mean that other information flows and manual processes are excluded from the scope.

[41] The concept of business componentization is not about the 'tangibilization' of services (as discussed in Paragraph 2.4). Service tangibilization is about making intangible service concepts more tangible for customers, i.e. by adding tangible elements to the proposition. The idea of business componentization is about tangibilizing the innovation 'artifacts' from an innovation management perspective.

presented in Chapter 3. The assertion is that the ability to identify and handle business components, both in the product and process area, is a pre-condition for modular innovation: to be able to handle product and process modules in the innovation process, the scope of such a module should be clearly defined[42].

... should encompass the entire scope of product, process and business model ...

The aforementioned Component Business Model (CBM) approach provides a method to model business components at the business process level. In the researcher's view the notion of business component should not only encompass the business process area, but the entire scope of the product, process and business model as depicted in the PPB framework of Chapter 3. Furthermore, a business component should be relevant as an object of design, implementation, and deployment. Therefore, the following definition of 'business component', based on the definition of 'component' by Kozaczynski (1999, see Table 4-1)[43], is proposed:

> ***A business component is a reusable part of a greater system that is an object of design, implementation and deployment. A business component conforms to, and provides the realization of, a set of standardized interfaces in the context of a well-formed business system architecture.***

Compared with Kozaczynski's definition, the words 'business', 'reusable', and 'standardized' have been added. Although the original definition stems from the component-based software engineering area, even without the addition of the term 'business' in the above definition the scope could well relate to the full scope of the PPM framework, including product, process and business model. According to Kozaczynski a 'component' seems to be the only concept that may be a unit of design, implementation and deployment (at the same time; Kozaczynski 1999, p. 74). This enables the use of the concept in both innovation and operations contexts. The terms 'reusable' (part) and 'standardized' (interfaces) have been added to emphasize the main characteristics of business components; 'unit' has been replaced by 'object' to emphasize the 'tangible' character. Although the term 'service orientation' is not mentioned in this definition the notions of reusability and 'standardized interfaces in the context of a well-formed business system architecture' clearly point at service orientation in which each business component provides a service to one or more other business components.

[42] 'Modularization' itself (e.g. how to define the appropriate modules in a certain business context) is not discussed here. The aim of this study is rather to provide an infrastructure for managing innovation in a modular environment.

[43] The original definition by Kozaczynski (1999) uses the phrase 'design, construction, configuration management, and substitution'. In the same proceedings, the author gives the alternative triad 'design, implementation, and deployment'. This alternative triad is applied in the above definition because it seems less IT oriented than the phrase in the original definition.

The above definition of business component will form a foundation for the remainder of this chapter.

Business components within Telco

Before further exploring the concept of business component for each of the areas of the PPB framework two Telco cases will be discussed that relate directly to this subject: Case 4-1 on Technical Infrastructure Platform and Case 4-2 on Product Structuring.

Within Telco, two types of business components have been applied for decades: 'Product' (or 'Commercial Product') and 'Technical Infrastructure Platform'. Case 4-1 outlines these concepts, notably the 'Technical Infrastructure (TI) Platform. The case data is mainly based on the researchers' observations, with input from semi-structured interviews.

Case 4-1 – Technical Infrastructure Platform

Products are Telco's market propositions as found in the external catalogs and sales materials. Since the 'product supplier age' of the 1980s (Paragraph 2.2), product managers are responsible for the (potential) market performance of their product(s). Products may relate to physical goods like private telephone exchanges or to pure services like telephony, or combinations of the two. For most products, some form of release management is applied to plan and implement new versions. Furthermore, product portfolio management is applied to ensure a balanced approach across various products. New products or major product extensions are introduced by means of an NSD stage-gate process (Case 5-1), which are usually implemented via innovation programs/projects.

An important rationale for the existence of TI platforms is the high level of capital investments in this area. Reuse and modularity are mandatory to obtain a sustainable business case; these principles have even been intensified with the program for a corporate transition to IP-based Networking & Services (Case 3-3). An example of a TI platform is the 'Alcatel Lucent SDH Platform'. Typically, the term 'TI platform' is used to denote a combination of:

- a certain technology, in this case 'SDH': Synchronous Digital Hierarchy
- the supplier that delivers the technology, in this case Alcatel Lucent
- a number of related specific networking device types from that supplier
- the networking device-related network management systems (Operational/Operations Support System, 'OSS')
- the architecture and design rules by which networks are built and can be expanded
- the capabilities or (normative) output ('service') that the TI Platform delivers.

Most TI platforms have been assigned to a so-called Development Manager role (Case 5-3 and Chapter 5). The Development Manager is responsible for the (potential, normative) performance of the TI platform to the product level. This includes the core function (e.g. data transport), performance/quality parameters (throughput, latency etc.; sometimes called 'non-functional quality parameters) and financial performance (return on investment, operational cost level), as well as the contributions by the various suppliers/partners. On a number of TI platforms some form of release management is applied to plan and implement

new versions of the platform, usually based on a new device/software version by the supplier (Case 5-2). Similar to products, new TI platforms or major TI platform extensions are introduced by means of an NSD stage-gate process (Case 5-1) and innovation programs/projects. Given the usually close relationship between product features and platform features these innovations are regularly combined into one NSD project, though the number of generic TI platforms, serving multiple other TI platforms or products, is increasing.
Explicit 'portfolio management' at the level of a portfolio of multiple TI platforms is only rudimentarily institutionalized. This is primarily done at the architectural level.
In the 'fixed' telecom networking area some 40 TI platforms can be identified. This number has increased by a few TI platforms during the last decade due to the implementation of 'IP-based Networking & Services' (Case 3-3). Plans and measures have been taken to switch off some 10 TI platforms that will reach end-of-life during the coming decade.
In the 'services and content' area (e.g. TV, e-mail, sms, voice mail), some 35 TI platforms can be identified, delivering multiple services. However, in this area the concept of 'platform' is somewhat less visible in the organization. The Development Manager role in this area is usually not fulfilled by a single responsible functionary, but by combination of consultants and architects. Finally, in the 'fixed' telecom area a number of service management Capability Platforms can be identified, but in daily use the concept of 'platform' is limited to the 'fulfillment area', which contains some 33 'production streets' in 4 main areas and the 'billing area' with a limited number of 'mediation/billing streets'.

Discussion on Case 4-1 – Technical Infrastructure Platform
Both Telco's '(Commercial) Product' and 'TI platform' have to a large extent served as business components as depicted in this paragraph. The notion of TI platform already started in the product supplier era with a one-to-one connection with the service management capabilities and Products. Many TI platforms outlived a large number of reorganizations and provided a stable knowledge base: some TI platforms have already existed for ten to fifteen years.

The notion of TI platform already started in the product supplier era …

Traditionally, for many products a direct association with the TI platforms applies: TI platform capabilities can be made available to customers as product features. However, some TI platforms act as a generic enabler for other TI platforms that are directly related to products. This applies, for example, to TI Platforms in the so-called 'transmission' and 'core networking' areas. These enabling TI platforms are reused by multiple product-related TI platforms. And with developments like IP networking and the IP Multimedia Subsystem (IMS; Magedanz and de Gouveia 2006) TI platforms increasingly serve multiple products[44].

[44] Related to these developments the distinction between TI and IT becomes increasingly blurred.

Hence, Development Managers in this area already have experience with reusable business components. The same applies to some product-related TI platforms that are reused by multiple products.
How do service management capabilities like fulfillment, assurance, billing, and capacity management fit into this combination of products and TI platforms? The simple answer is that until recently, service management capabilities hardly fit into this picture at all. As indicated earlier, the scope of 'innovation' within Telco is mainly limited to TI networking, including the consequences of TI changes at the product level. To a large extent the service management capabilities are either viewed from an IT-only perspective, or they are viewed as an issue to be resolved by the department responsible for operations during the operational lifecycle phase. In general, departments and staff that innovate and operate service management capabilities are much less visible in the organization than departments and staff that innovate and operate service function capabilities. In the service management innovation area there are various roles/functions like process specialists and process managers, but there is no role comparable to the Development Manager role in the service function capability area. Furthermore, the process responsibility relationship between the Wholesale & Operations department, the internal IT department and the customer segment organizations is unclear, both concerning innovation and operations responsibilities; this will be further elaborated in Case 4-4.

... there is no role comparable to the Development Manager role in the service function capability area ...

Only during the last four to five years has this picture started changing, due to the proliferation of reference architecture IT (including high capital investments) in service management capabilities, and the implementation of a 'service company' vision in which the (customer-related) processes play a major role. People started talking about 'fulfillment streets' and 'billing streets'. Although the scope of these 'streets' may still vary across IT-only, process, department, or combinations of these, it clearly indicates a need to componentize the service management process area comparable with the 'TI platform' in the TI-based service function capability area. This development is also driven by the requirement to rationalize the existing IT landscape: standardization and modularization of processes form a pre-condition for rationalization.

4.3 Structuring a web of business components

To further define and position product and process-related business components requires discussing the relationship between the two components. The aim is to combine product and process business components into one coherent business component structure spanning the scope of the PPM framework.
In the literature, 'product platforms' are a well-known concept for designing manufacturing products based on reusable components (Meyer and Lehnerd 1997). A product platform

forms the basis for a product family (Meyer and Utterback 1993). The structure of a product (family) is represented by a product structure (Van Veen 1992), sometimes alternatively named 'product architecture' (Ulrich 1995). The act of modeling the product(family) is usually referred to as 'product modeling' or 'product family modeling' (Meyer and Utterback 1993; Erens and Breuls 1995; Jiao, Tseng et al. 1998).
What a product platform is for product design, a process platform is for (production) process design (Meyer and Zack 1996; Jiao, Zhang et al. 2003). Process platforms are an opportunity for innovation to facilitate greater product variety during the a product family's evolution (Meyer and Zack 1996, p. 45). Planning of process platforms is conducive to the synchronization of product and process variety (Jiao, Zhang et al. 2006). Similar to a product family, a process family comprises a set of similar production processes that share a common process structure. The structure of a process family is represented by a process structure, sometimes alternatively dubbed 'process architecture' (Sanchez 1999). The act of modeling the process(family) is usually referred to as 'process modeling' (Davenport 1993; Gordijn, Akkermans et al. 2000).
Some of the above concepts have been extended/applied in a service environment. Meyer and De Tore, for example, extended the concept of product platform to services by introducing the concept of service(s) platform. They position service platforms as: common subsystems leveraged across markets (Meyer and De Tore 1999, p. 69). Given the ambiguity of the definitions of product and process as discussed in Chapter 3, however, in a service perspective context the combinations of product and process with suffixes like platform, family, structure, architecture, and modeling also seem to lack a clear-cut meaning. Thus, the term 'product platform' is sometimes limited to incorporating common (physical) components in the (goods-based) product, and sometimes it includes the relation to common production processes. Moreover, what does the term product platform mean in a pure (non-goods) service product environment?

... what does the term 'product platform' mean in a pure service product environment?

Structuring product and process business components within Telco
Within Telco, three governance initiatives have a relationship with componentizing and structuring product and process components: Product Structuring (Case 4-2), the application of the TMF NGOSS/eTOM framework (Case 4-3), and Business Process and Supply Chain Modeling (Case 4-4)[45]. First, the implementation of Telco's Product Structure initiative will be discussed. As the researcher actively contributed to the governance initiatives of Cases 4-2 and 4-4 the case data for these cases is based on personal observations, next to data from semi-structured interviews and documentation. The data of Case 4-3 is primarily based on documentation and semi-structured interviews.

[45] Until now business model innovation has not explicitly been part of Telco's modeling efforts.

Case 4-2 – Product Structure

The Telco Product Structure (PS) initiative has been a long-term effort within Telco to model the relationship between the (business) components of Telco's service offerings. Despite its name, the Product Structure encompasses both the product and process area (service function and service management capabilities) as depicted in Chapter 3 of this thesis. The ultimate goal of the PS effort was to provide a framework for modularity and the 'de-siloing' of products, technical infrastructure and ICT/processes. The earliest initiatives stem from the 1990s and the model got its current state in 2003 (Figure 4.2).
Initially, the effort aimed to extend so-called 'network line models' to include non-technical service elements. The line models were a graphical representation of the network structure. They modeled the relationship between network components and the physical and logical links that interconnect the network components. In the Telco Product Structure this element was called 'Technical Product' (TePr). But until 2002, the product (proposition) component and the customer were still missing in the model and there was no relation between the TePr and Telco's product proposition to end customers. Inspired by the 'function thinking' of the 1-Model (Case 3-1), the notion of a 'Functional Product' (FuPr) was added. The FuPr decoupled the TePr from the (commercial) product proposition: the Commercial Product (CoPr; Figure 4.2).
Another element named 'Operational Provisions' (OP) was added to complement the Technical Product with operations-related (service management) processes like incident management and billing. The idea of the FuPr was that this should encompass all service characteristics that are 'functionally' important to customers. The 'Commercial Provisions' would then add commercial characteristics like positioning, branding, pricing etc. FuPr connected the TePr/OP with the CoPr. The FuPr inherited technical features from the TePr and operational features from the OP. This principle was mirrored in the CoPr: the CoPr inherited functional characteristics from the FuPr, and commercial characteristics were added via the Commercial Provisions element.
The PS model played an important role in modeling the interrelationship of products with processes/ICT and technical infrastructure. It was applied for cost modeling purposes in the late-90s (Case 5-3). It was furthermore used, for instance, to define a new order management application in the early 2000s. Although the terminology of the model was not used entirely consistently, it provided a common language in the innovation process for product management, process/ICT developers and technical infrastructure developers. In one specific area, namely transmission services, an initial version of the model was successfully used for a couple of years to model the 'technical portfolio' and for maintaining the related catalog. Yet a broad application of the PS model, and the associated promise of enabling modularization and de-siloing, did not happen until 2005 due to the absence of a real business need.
From 2005 onwards, the model began to play a role in the IP-based Networking & Services program (Case 3-3). The PS model had been worked out as one of the main blueprints for the program. In this blueprint PS was combined with another model, Telco Supply Chain Model (SCM); see Case 4-4. The SCM is an adapted version of the Service Architecture

framework by the Telecommunications Information Networking Architecture (TINA) to support the rapid and flexible deployment and management of a wide range of multi-media, multi-party services in a multi-vendor telecommunications environment. This combined framework formed the basis for the main structure of the 2007 organizational restructuring in which Telco's fixed and mobile divisions were merged (Paragraph 2.3).

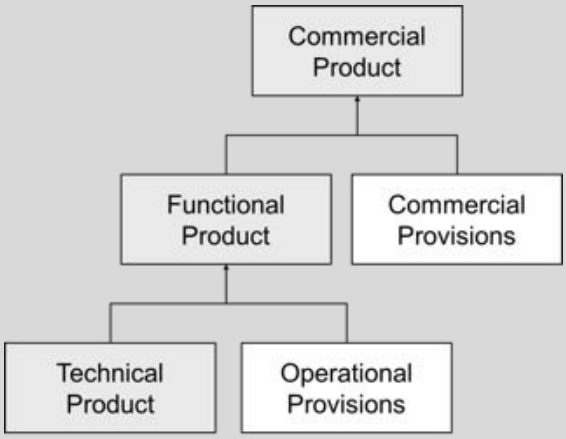

Figure 4.2 Telco Product Structure

From 2007 onward, a business need emerged within Wholesale & Operations to build up a catalog of Functional Products. This need was boosted by the emerging requirement to have a clear interface and business relation between the operations department and Consumer, Business and Wholesale segments. Within the operations department, multiple catalogs were produced by different organizational units of the same organization. This ambiguity was due to the fact that one unit, responsible for strategic portfolio management, was working on a future reference portfolio, while the other was responsible for the current operational portfolio with Service Level Agreements (SLAs) between operations and the customer segments.
Additionally, the relationship between the FuPrs and CoPrs, and the relationship between FuPrs and contributing TI Platforms and processes/IT was not documented.
From 2009 onward, some PS principles and related interface standardization were applied for the design and development of service management processes/IT, notably in the area of the Service and Network Integrator supply chain role (Case 4-4). However, a full scale application of the Product Structure model has not happened until now.

Discussion on Case 4-2 – Product Structure
An important reason for the slow take-off in the application of the Telco Product Structure model until 2005 is apparently the absence of a real business need in still predominantly silo-based operations, and the technical roots of the PS model. For almost a decade, the

model remained predominantly in the domain of (corporate) architects and found little interest among (top) management.

The basis of the model is formed by the Technical Product, from which the structure builds up, via the Functional Product, toward the level of the Commercial Product. This clearly illustrates the predominant technology perspective of the model. The term 'Technical Product' itself could easily wrong-foot an outside observer of the model: the Technical Product is not a product at all, but denotes the technical infrastructure/resources that form the Telco-owned resources to provide the service to customers. The TePr-FuPr-CoPr 'chain' at the left side of the model (grey boxes in Figure 4.2) clearly shows the prevalent view within Telco that the notion of 'product' is almost exclusively associated with the core TePr-related (service function) capabilities. The supportive (service management) capabilities (white boxes in Figure 4.2) are not modeled as independent value creating building blocks/components, but rather as a set of auxiliary parameters to the TePr-FuPr-CoPr chain. This is reflected in the 'intangibility' of some elements of the PS model. Both the Technical Product and Commercial Product can be identified respectively as the (very tangible) technical infrastructure and ICT resources, and the (external) product catalog of Telco. This does not apply to the Operational Provisions, Commercial Provisions and Functional Product, however. The Operational Provisions building block encompassed the characteristics of the service management capabilities, but these were not 'componentized' in the TePr or FuPr. Furthermore, the Technical Product building block suffers from the same issue as 'resources' in the NGOSS SID framework (Case 4-3), namely that the granularity may vary from fine-grained 'technical' resources to coarse-grained business levels.

A business need to provide a decoupled interface between departments…

Some recent successes concerning the application of Telco's Product Structure model can be attributed to the following:

- A business need to provide a decoupled interface with clear output definitions between Telco's operations department within Wholesale & Operations and the consumer, business, and wholesale customer segments; this requirement specifically emerged after Telco's fixed-mobile organizational restructuring in 2007. In this restructuring, the operations and IT units within the already existing customer-segments-based divisions were carved out into separate units serving multiple customer segments; see Paragraph 2.2. This development relied on the operationalization of the relationship between the PS model and Telco's Supply Chain Model (SCM, Case 4-4). Although the main organizational structure was based on these principles, the corresponding governance was only loosely implemented (Case 4-4). This remained an issue in operationalizing the interface between W&O and the customer segment organizations.
- A business need to provide a foundation for end-of-life planning on legacy networking platforms; a program was launched in 2009 to actively plan and manage the phasing-out of a number of legacy platforms. This induced a need to componentize all PS elements: not only the CoPr and service function capabilities (networking part) of the

TePr, but also the TePr-related service management capabilities/systems and FuPr. Furthermore, to relate lifecycle decisions on one component to related components required being able to show the mutual coherence between the components. This way answers could be obtained, for instance, to the question 'what IT systems are related to a certain legacy technical infrastructure platform for which end-of-life is planned?'

- Recently (in 2010), a business need emerged for standardized interfaces based on the Functional Product building block of the Product Structure model to model processes/IT for multiple service products in the fulfillment process area, mainly in the Service & Network Integrator area (Case 4-4). However, these efforts remain largely in the process/IT area without an explicit interface with (but most certainly with impact on) product innovation. Given the complexity and development lead times of IT, IT is somewhat taking over the role of TI in enabling and inhibiting features of Telco's product portfolio.

Toward business components in each of the three PPB areas

Based on by Telco's Product Structure model of case 4-2 and the 1-Model of Case 3-1, the aim is to define a business component architecture spanning each of the three areas of the Product-Process-Business model innovation framework. For the goal of this research — defining and implementing the outcome of the innovation process of ISM firms as tangible/perceivable business components — such business component architecture should meet the following requirements:

1. The business components should be sufficiently 'coarse grained': each business component should be sufficiently relevant at the business/management level. At the same time, any single business component should not encompass a complete 'business', but should rather enable a manageable level of dedication and specialization.
2. It should be possible to clearly determine and maintain the scope and boundary/interface of each business component to enable innovation management (and subsequently operations) at the level of business components.
3. It should be possible to weave product, process, and business model components as reusable artifacts into a horizontalized, service-oriented, decoupled fabric in conformity with the PPB framework.

This way it may be possible to clearly assign innovation management responsibility to each business component, to define business components in each of the three PPB areas, and to apply principles of reuse and service orientation throughout the entire business system. In the literature, various concepts have emerged that could potentially form a foundation for (business) componentizing products and processes as described in this paragraph (see Appendix E). This list was compiled by searching for terms that have some connotation of an 'artifact' at the business level. The same component concept in this table could have

The business components should be sufficiently 'coarse grained'…

multiple meanings; e.g. one concept may have both an IT and a business connotation; or the scope of a component may or may not comprise the human resources that are involved in the operational processes.
Most component-related concepts from the literature do not fully satisfy the above requirements. The first requirement of 'coarse grainedness' is not always met. For instance, in IT-centered literature, service orientation and business component concepts frequently refer to IT level concepts only. Likewise, the term 'resource' in the NGOSS SID framework (Case 4-3) may refer to a coarse grained level (e.g. a networking platform), but it may also refer to fine grained assets that are not directly visible at a business/management level.
The second requirement is best met by concepts that originate from the goods area, e.g. product platform in a pure manufacturing context. When it comes to the terms 'service' or 'process' at the business level, the scope and boundary of these concepts in the literature seem less clear.
The third requirement seems equally hard to meet. Jiao, Zhang et al. (2006), for example, propose the concept of process platform[46] planning for coordinating product and process variety. They relate process platforms with product platforms, but not in the above intended coarse-grained way of interrelated business components. Furthermore, the reach of the above component-related concepts seems to never encompass the full scope of 'product' as defined in Chapter 3 of this thesis; briefly put: the goods/services product as experienced by the customer (including proposition and customer perceived co-production aspects).
For the business model area of the PPB model, it seems even harder to find an existing concept that meets the previously described requirements for a business component. Chesbrough and Rosenbloom (2002) denote the entire business model as a blueprint (for how a business creates and captures value from new products/services), but the scope of the entire business model seems too coarse-grained for the intended purpose of 'business component' in this thesis.
The following three business component variants are proposed on each of the three areas of the PPB framework: Product Bundle, Value Package, and Capability Platform. Combined they form a proposed 'Web of Business Components' (WBC, Figure 4.3).

The three business component variants in the WBC are defined as follows:

> ***A <u>Product Bundle</u> (PB) is defined as a business component delivering (normative) customer-complete (bundles of) propositions/products, directly or indirectly via other Product Bundles, to one or more customer segments. In the Operations domain, products are distributed to/co-produced with customers via one or more Capability Platforms (CPs).***

[46] The concept of 'platform' has been introduced in Paragraph 2.7.

A <u>Value Package</u> (VP) is defined as a business component representing a (normative) value-complete output, based on a combination of Capability Platform-originating business services, to one or more Product Bundles. Each Value Package contributes to one or more Product Bundles, and may additionally be contributing to one or more other Value Packages for bundled VPs.

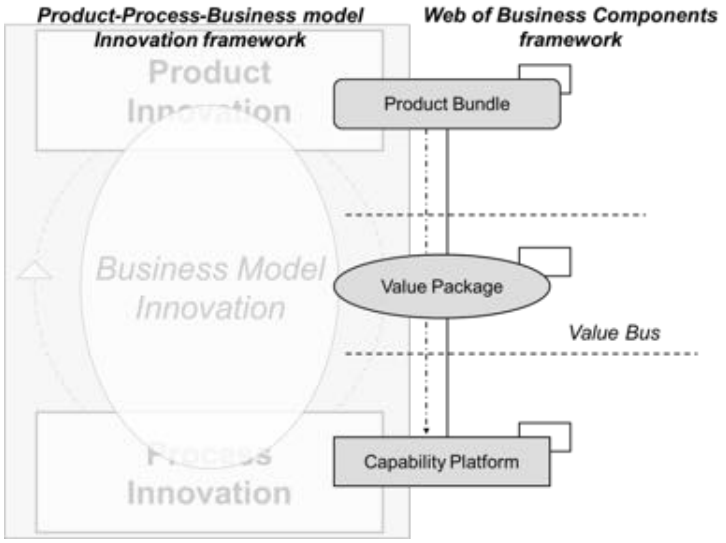

Figure 4.3 Web of Business Components related to the PPB framework

A <u>Capability Platform</u> (CP) is defined as a business component consisting of a combination of human and technical resources and associated processes and data, delivering a set of (normative) business services, directly or indirectly via other Capability Platforms, to one or more Value Packages.

The WBC framework builds on the strict positioning and definition of product and process, enabled by business model innovation, within the Product-Process-Business model innovation framework (PPB) as discussed in Chapter 3. The PPB product area is componentized by means of Product Bundles; the PPB process area is componentized by means of Capability Platforms. Value Package components act as a bridge at the PPB business model area between the product and process

... Value Package components act as a bridge ... between the product and process level...

area-related components. The components within the WBC are mutually interconnected via standardized interfaces to enable reuse of components between the three WBC layers and within each layer. The three business component variants, PB, VP and CP, form a trinity at the level of one ISM firm: each ISM firm entails a complete Web of Business Components with at least one business component on each of the three layers. This differs from the notion of business component in CBM® (IBM 2004), in which each business component "is a part of an enterprise that has the potential to operate independently, in the extreme case as a separate company, or as part of another company" (Sanz, Becker et al. 2007, p. 3). Compared with the CBM approach, CPs relate to operations-related business components in the CBM framework[47]. Resources or services that contribute to a CP within a WBC may be bought, hired or insourced (by providers that have their own WBC), but the ISM firm remains responsible for its own CPs in conjunction with its VPs and PBs. A CP may encompass only a few ISM firm internal activities, but can never be fully outsourced. Compared to Telco's Product Structure model of Case 4.2 the WBC framework can be regarded as a business componentized replacement of the PS model.

A Web of Business Components: application and example

Before further discussing the three business component variants and their mutual coherence in a Web of Business Components, the notion of the WBC will be outlined and a practical example given from the telecom sector.

Figure 4.4 shows how a WBC may be formed by a combination of PBs, VPs and CPs. Typically, they combine to form the shape of a 'diabolo': the number of VPs will be much smaller than the number of associated PBs and CPs because the VPs represent the limited number of core business functions/business models of an ISM firm in the market.

... the combination of PBs, VPs and CPs form the shape of a diabolo ...

Figure 4.5 shows an example of how a telecom provider could model a 'triple play' environment, offering single or bundled products based on internet access, voice and television, by applying the WBC framework. At the PB layer several PBs can be identified, offering single internet propositions to the business and consumer market, and generic voice and television services in three variants. Furthermore, the telecom provider offers one combined 'All-in-one communication' proposition that bundles the 'Silver' variants of the three other PBs and relies on a 'Triple Play' VP.

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Figure 4.5 shows an example of how a telecom provider could model a 'triple play' environment, offering single or bundled products based on internet access, voice and television, by applying the WBC framework. At the Product Bundle layer several PBs can

[47] Notably on the 'Execute' and 'Control' layer of CBM® (IBM 2004).

be identified, offering single internet propositions to the business and consumer market, and generic voice and television services in three variants. Furthermore, the telecom provider offers one combined ‘All-in-one communication’ proposition that bundles the ‘Silver’ variants of the three other PBs and relies on a ‘Triple Play’ VP.

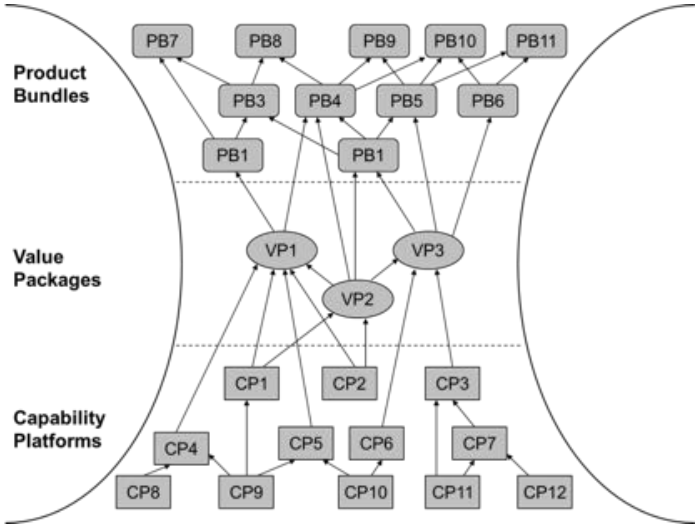

Figure 4.4 Web of business components

At the Value Package layer three different VPs have been modeled: Internet Access, Voice and Television. Each VP contributes to multiple PBs based on capabilities by multiple CPs. The Internet Access VP contributes the same VP to both the business and consumer market PBs. The Integrated Services VP contributes to the ‘All-in-one communication’ PB with some specific integration features (that may also be reused in other PBs, e.g. a future Triple Play variant based on ‘Bronze’ PBs). At the Capability Platform layer various CPs can be identified. CPs related to the (core) service function capabilities and CPs related to the (supportive) service management capabilities are treated in the same way: both may contribute to one or more VPs or to one or more other CPs.
The figure shows two CPs that rely on contributions by (internal or external) suppliers. The dotted-line arrow from ‘Internet Gold’ to ‘BM Channel’ represents the distribution of this PB via a distribution channel CP: ‘BM Channel’.
This fictitious yet fairly realistic example shows how a telecom operator could offer a wide range of propositions in the market with a relatively low number of reusable components in a modular, horizontalized fabric.
Note that this example is only used as an illustration for a typical incumbent telecom provider, and only shows a limited number of business components and relations. For example, the ‘Television’ VP could contribute to television-related PBs in multiple market segments, and could be made available on multiple devices based on both fixed and wireless/mobile networking technologies.

Each arrow in Figures 4.4 and 4.5 represents a normative output contribution to the component at the end of the arrow, including functional and financial performance levels. These normative output contributions directly translate to operational SLAs for the corresponding business components in the Operations domain.

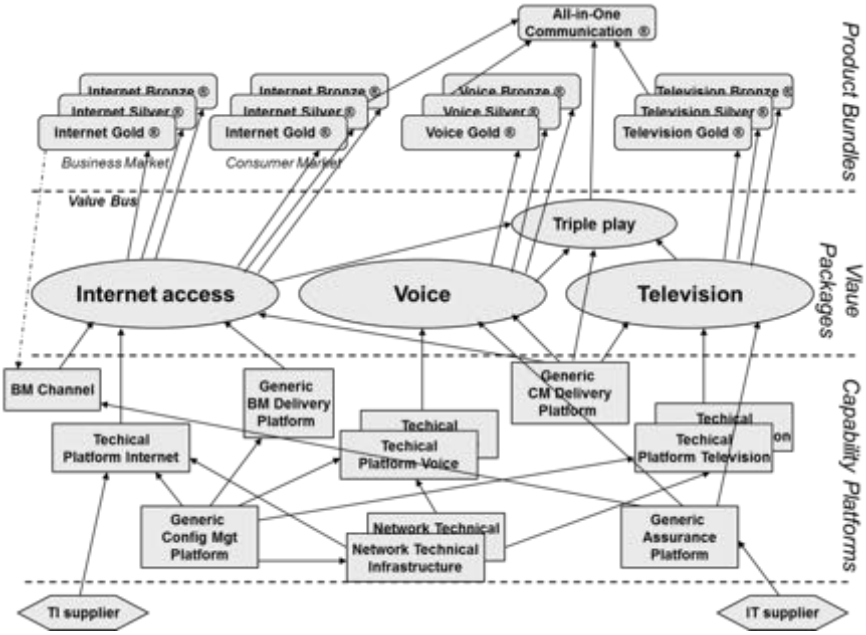

Figure 4.5 A Service perspective Web of Business Components: telecom example[48]

A Web of Business Components: overall concept and discussion

As defined earlier in this paragraph, 'business component' may refer both to innovation domain-related business component lifecycle management, design and implementation, as well as to operations domain-related deployment. This is shown in Figure 4.6[49].

'Business component' may refer both to the innovation domain … and operations domain …

The three WBC business components have different meanings in the 'innovation domain' and 'operations domain'; in the case of a Product Bundle the business component represents the combination of goods and services that are

[48] The trademark signs in the picture only serve an illustrative purpose; they are not intended to represent real trademarks.

[49] This figure is inspired by Grieves (2005), who introduced the concepts of 'virtual space' and 'real space' as the main elements of the so-called Mirrored Spaces Model (MSM), a foundation for a discussion on Product Lifecycle Management (PLM). These virtual and real space concepts are usable in a pure manufacturing environment, but seem less applicable in an ISM environment in which 'real space' concepts like service, value and process have quite a 'virtual' connotation.

proposed and (in case of goods) delivered to, and/or (in case of service) co-produced with customers. An example in a telecom environment could be 'Business Internet Gold', representing a premium internet proposition for business customers. The combination of all PBs corresponds to the external product catalog of the firm as can be found on the external corporate website and in sales material.

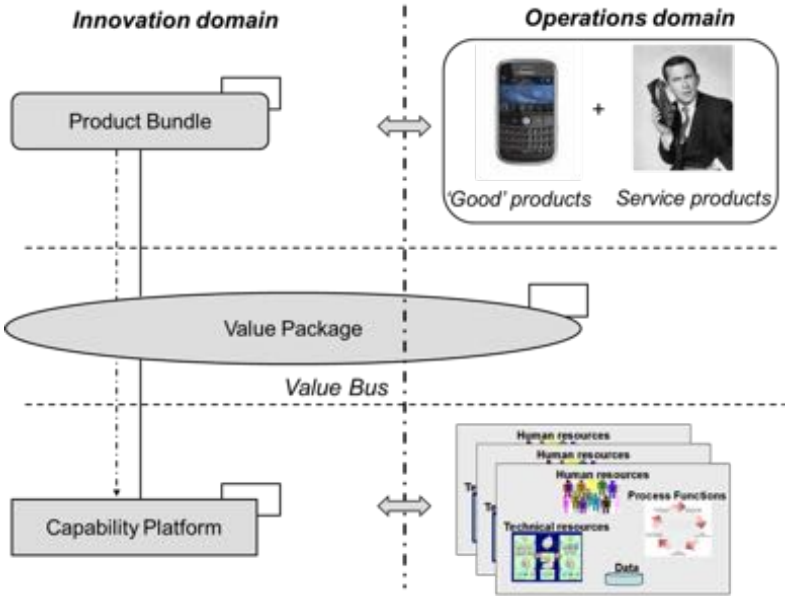

Figure 4.6 The WBC has relevance in both the innovation and operations domain

In case of a Capability Platform the business component represents the combined human and technical resources, both internal and external to the firm, that co-operate to perform process functions by processing data and processing/applying (other) resources. An example in a telecom environment could be 'E-mail Platform', mirroring a systems environment that processes the e-mail of telecom operator customers. Another example could be 'Consumer Market Fulfillment Line', mirroring an operations entity (combination of human and technical resources) that processes customer sales orders for the consumer market. The combination of all CPs forms a firm-internal repository of business components combined covering the entire operations function of the firm.

The main purpose of the VP… is to 'enforce' reasoning from the perspective of 'value' and 'business models' …

The main purpose of the Value Package business component is to 'enforce' reasoning from the perspective of 'value' and 'business models'. By introducing the VP business component, a product/process 'neutral' business view may facilitate optimal value creation,

delivery and capture in terms of business model innovation. Hence, via the intermediate VP layer business thinking and integration may be encouraged on both the product-related PB layer and the process-related CP layer, while avoiding unwanted mixing and matching of product and process characteristics. At the same time, the VP itself may be viewed as the componentization of a business model blueprint, including detailed specifications to interconnect the PB and CP layer. A VP has no specific 'artifacts' in the operations domain. It represents, both in the innovation domain and operations domain a (VP) catalog item with associated normative specifications to be able to interconnect the CP and PB layer. An example in a telecom environment could be the VP 'Internet Access', representing a complete set of product characteristics that 'only' need commercial bundling at the PB layer to become fully relevant for customers. Although a telecom operator offers and delivers a vast number of PBs to various customer segments, the number of VPs can be quite limited. Thus, there may be dozens of mobile devices in the PB catalog that relate to only one VP 'Mobile Device'. In case of mobile voice services there may be tens of PBs in the product catalog, while only two VPs, relating to different business models, could suffice: e.g. 'Mobile voice Pre-paid' and 'Mobile voice Post-paid'. Multiple VPs may be combined in one integrative VP. However, each VP should also have a direct link to one or more CPs: a VP that would only link to other VPs should be substituted by one or more CPs.

A VP has no specific 'artifacts' in the operations domain ...

The dotted line from the PB layer to the CP layer denotes the distribution of products via product distribution-related CPs. A dotted line is used here because the relationship is only relevant in the Operations domain.

Choice of WBC business component terms

The term 'Product Bundle' (PB) has been chosen to emphasize the 'bundling' function in the (PPB) product area. Bundling is normally used to denote "a form of versioning of products in which two or more distinct products are offered as a package at a single price" (Shapiro and Varian 1999, p. 73), but here it represents a generic strategy of bundling service and goods-based combinations of products. The term 'Value Package' (VP) has been chosen to emphasize the 'packaging' of value on this layer, both for customers and the firm and other participants in the value network. 'Value' refers to the business model-related meaning of value as discussed in Chapter 3, and includes both value creation/delivery as well as value capturing. Finally, the term 'Capability Platform' (CP) has been chosen to tie together two vital concepts: 'Platform' as the logical 'ribbon' around a combination of (human and technical) resources and associated processes and data; 'Capability' as the (normative) output of such a 'Platform'.

Business components have two faces

The term 'normative' (output) in the definitions of three business component variants denotes the fact that the components work together in a service-oriented way in which the CP layer provides a service to the VP layer, and the VP layer provides a service to the PB

layer. This resembles the notion of 'services' in a service-oriented (SOA) IT architecture, but forms a more coarsely grained business-level variant than the usual notion of SOA. These services are 'normative' in the sense that they are described by Innovation in terms of the norms for the actual performance by Operations. Since the business component concept applies both to the innovation and operations domain, the term 'normative' is put between brackets. The norms vary per layer but typically include characteristics like the number of customers or units, and financial parameters like revenue or cost. They may also include the operational limits as imposed by the current architecture/design, and related to this the freedom for Operations regarding the boundaries within which it may deploy and change the operational processes and systems.

... business components have two faces ...

Hence business components have two faces: they represent the logical 'ribbon' around the elements that make up the component, and they represent the normative output that is delivered by such a business component to another business component. The 'ribbon' face of the business component is most prominently apparent at the CP layer, where it represents the grouping of human/technical resources and associated processes and data. At the VP and PB layers, the ribbon 'merely' represents the packaging of value (VP), respectively the bundling of products (PB). The two faces of business components result in two equally important organizing principles for each component: internal coherence within the business component, and external coherence related to the normative output of the business component. To ensure the optimal reuse of business components, the scope of each component should be as large as possible to prevent unnecessary complexity, and as small as necessary to enable reuse.

Product Bundles

The Product Bundle business component is a representation of a customer-complete proposition/combination of products. The term 'customer-complete' points to a combination of 'what' characteristics that together form a bundle of attributes, functions, and customer perceived value of the intended overall customer experience with the combination of the proposition and (goods and service-based) products as defined for 'product' in Chapter 3. The specification of PBs is based on the customer-related part of the contributing VPs (and the optional contribution by other PBs), and is augmented with proposition-related aspects like branding, commercial conditions etc.

Value Packages

The Value Package business component in the PPB Business model innovation area fulfills a central role in the WBC framework since it connects the CP fabric to the PB fabric vice versa. The business component is dubbed 'Value Package' because, by bridging product and process, it covers the value that is created for and delivered to customers, as well as the value that is captured by the provider. The VP is a representation of a value-complete combination of capabilities. The term 'value-complete' points to completeness for both customers and the providing firm. A VP combines the capabilities from multiple CPs to

enable a complete set of product characteristics that 'only' need commercial bundling on the PB layer to become fully relevant for customers. Furthermore, the term 'value-complete' points to the combination of capabilities from multiple CPs to enable the intended value-capturing by the providing firm.
Given this central bridging role of the VP layer, this layer is dubbed 'Value Bus': it forms a value oriented business variant of the 'enterprise bus' in an IT-related and service-oriented architecture (SOA) context. The WBC could in this respect also be called 'Value Oriented Architecture'. The specification of a VP consists of a 'value creation/delivery' part describing attributes, functions and value for the customer, and a 'value capture' part for the providing firm (and its suppliers/partners). Related to this, it is made clear what CPs contribute to the VP (and what they contribute), and to what PBs the VP contributes (and what it contributes). Finally, it describes the optional contribution to one or more other VPs.

... the VP makes the product agnostic for the process, and vice versa ...

Note that the primary role of a VP is not to integrate multiple VP-contributing (platform) capabilities: this integration will be performed on the CP layer, e.g. by an integrating CP business component. Design and development on the VP layer should only be conducted in terms of attributes, functions and customer/provider value, not in terms of technology or commercial attributes. The VP layer makes the product agnostic for the process, and vice versa. Thus, product thinking is avoided in the PPB process area, and process thinking is avoided in the PPB product area. Cobblers in both the product and process area are 'forced' to stick to their last, avoiding unwanted interference between the two areas.
By applying Value Package-centric thinking the decision whether to deliver value by means of a goods-based product, a services-based product, or a combination of these may be postponed to the last possible moment during concept development. This decision may ultimately be based on how optimal value can be created, delivered and captured during the operational phase.

Capability Platforms
The Capability Platform is a WBC business component consisting of a combination of human and technical resources and associated processes and data, delivering a set of (normative) business services, directly or indirectly via other CPs, to one of more VPs. Here, the two faces are most prominently visible: 'Platform' as the logical ribbon around resources and associated processes and data, and 'Capability' as the (normative) output of the Platform. In the strategic management literature, the concept of 'capability' has been studied for many years. Ethiraj, Kale et al. (2005) provide an overview of this literature in a study on the software service industry. However, 'capability' is simply implied here as the (normative) output in the form of 'business services' that the CP is capable of (of delivering). This coincides with the 'real' business level notion of 'business services', and the associated relationship between business components and business services as discussed by Nayak, Linehan et al. (2007). The same authors make the distinction between business

services at the level of business components, and (business) service functions. Business services bundle one or more business service functions, are publicized by means of a catalog, form the basis for service agreements between the provider and consumer, and can be owned by the provider. Business service functions are not independently publicized in a catalog, are indirectly discovered through business services, and do not encompass independent ownership (Nayak, Linehan et al. 2007, p. 731-732).
Resources and/or (business service) functions may be either home-grown (make) or be sourced from external providers/partners (buy, hire, outsource or out task). Thus, a WBC may be modeled on CPs that rely on any combination of internal and external contributions. The combination of CPs forms the catalog of the various Operations process platforms/lines of the ISM firm. These process platforms/lines could relate to both customer-facing front-office functions, or to internal back-office functions. Furthermore, they encompass the combination of (core) service function capabilities, (supportive) service management capabilities (including capabilities to capture the intended value for the provider), and (good) product manufacturing capabilities.
The CP enables the ISM firm to think of operations as a web of independently yet coherently interoperating modules. Within this concept, ICT used in CPs is not viewed in isolation, but as a resource contributing to providing the required capabilities of a CP. This could facilitate bridging the gap between business processes and IT. CPs may also play an important role in (in/out) sourcing decisions. As indicated earlier, a CP itself cannot be outsourced, but virtually all CP process functions and/or resources may be externally sourced. By managing the CP as an independent module, both in Innovation and Operations, the providing firm has a continuous up-to-date insight into the price/performance of each CP and its business services, including the price/performance of all sourcing partners' contributions.

... the CP itself cannot be outsourced...

Just as functions/resources contributing to CPs may be externally sourced, the business services delivered by each CP may be exposed, via new or extended VPs and PBs, to (external) customers of the firm. This becomes relevant during business model innovation in which formerly internal resources/functions may be applied to directly deliver value to customers, with shifting roles for the customers themselves. Chesbrough (2011) describes how the Taiwanese semiconductor company TSMC applied such business model innovation in an open services innovation model.

Relationship with platform concepts in the literature
Within the given definitions and positioning of product and process in Chapter 3, the concept of 'product platform' in the literature (Meyer and Lehnerd 1997) is not directly related to the product area but rather to the process area. Such a product platform is more related to the 'how' for the provider than to the 'what' for customers, and is only indirectly relevant to the PB as proposed and delivered to customers. Product platform flexibility may induce more customization options for customers, while lower product platform cost may

facilitate a lower price for customers but these are not direct relations. Product platforms in a pure manufacturing context should rather be viewed from a CP point of view as defined in this chapter: they form a standardized combination of physical resources that are relevant for the production processes providing a set of capabilities to the VPs. For example, in the case of electrical appliances (like drilling or sander equipment) the electrical motor product platform is used in the production process of one or more CPs contributing to multiple VPs such as consumer appliances and professional appliances.

… 'product platform' in the literature is related to the process area …

The scope of 'service platform' in the literature (e.g. Meyer and De Tore 1999) usually encompasses the same scope as the above product platform, but may also include the VP as defined in this chapter. This was also the practice within Telco: the term 'E-mail Platform', for example, could imply the technical capabilities at the CP layer, but the term could also include the full scope of a VP. Following the reasoning of the WBC as proposed in this chapter, a better name for the VP associated to the CP 'E-mail Platform' would be 'E-mail'. Such a VP 'E-mail' would encompass not only the (technical) service function capabilities of the E-mail Platform but also the service management capabilities related to e.g. customer (self-)care. Given the ambiguity of the concepts of product platform and service platform in relation to the PPB framework of Chapter 3, the alternative business component concepts of the WBC framework are proposed as a foundation for innovation management in ISM firms.
Finally, the concept of 'process platform' is closely related to the 'Capability Platform' as proposed in this paragraph. According to Meyer and Zack, a process platform is composed of the technologies, facilities, and processes for manufacturing a firm's products. Process platforms evolve primarily by increasing volume or capacity; they also are an opportunity for innovation to facilitate greater product variation during a product family's evolution (Meyer and Zack 1996, p. 45). Nevertheless, the term 'Capability Platform' is proposed in the WBC framework because the concept of process platform in the literature is not always applied in the intended meaning of coarse-grained process layer-related business components. Another reason to propose the term Capability Platform is to equally emphasize the (normative) output (Capability), and the logical 'ribbon' around a set of resources and associated processes and data sets that provides this capability (Platform). British Telecom, a telecom operator with a number of years of experience in the area of platforms and capability-based architectures, has made a number of contributions to the literature on this subject (Wittgreffe, Trollope et al. 2006; Dames 2007; Glass 2008).

The WBC forms a data model

The WBC framework forms a data model in IT terms (Figure 4.7). The three components in the framework correspond to three data objects. The lines between the components/data

objects represent so-called n:m relations[50]: both upward and downward in the model, each business component/data object may be related to one or more other business components/data objects.

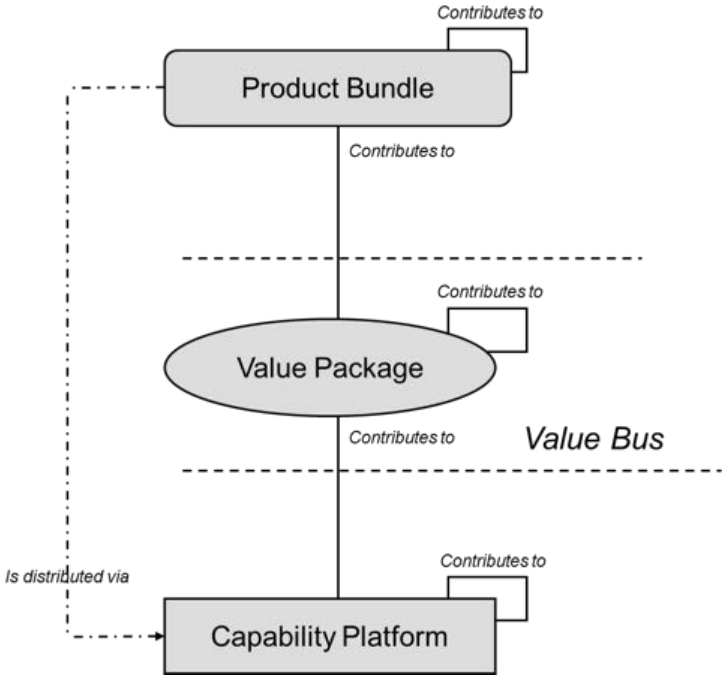

Figure 4.7 - The WBC forms a data model in IT terms

Note that the lines between the business components are bi-directional and do not have arrows as in the examples in Figure 4.4 and 4.5: upward they represent the innovation domain (or 'Computer Aided Design') view of business components contributing to the above layer; downward they represent the operations domain (or 'Computer Aided Manufacturing') view of business components that are directed[51] by the above layer. The dotted-line arrow from the PB layer directly toward the CP layer does not represent a formal relation between these two data objects; rather it serves to visualize the 'distribution' relation discussed earlier.

Thus, reuse and integration is enabled both per layer and within layers …

Furthermore, each component/data object may be recursive in a hierarchy of components/data objects; this is visualized by the rectangle on the upper right side of each

[50]In conformity with the IT-related term 'cardinality'. The term cardinality refers to the number of cardinal (basic) members in a set.

[51]In the ICT, and notably the 'web services' field, this kind of direction is usually described using the related terms 'orchestration' and 'choreography' (Peltz 2003).

component. Thus, components on each layer may be reused by multiple components of the above layer. Aside from reuse per layer, components on each layer may be recursive to enable reuse within each layer. A CP, for example, may provide capabilities to multiple other CPs. At the PB layer this mechanism enables a PB to be applied either directly as a full proposition to customers, or to be bundled with other PBs into a (further) bundled proposition. At the VP layer the reuse mechanism could be applied to model multiple integration levels for VPs, e.g. to integrate two VPs that are provided by two organizational units. Thus, reuse and integration is enabled both per layer and within layers.

WBC and the organization of innovation and operations

Chapter 5 will provide a detailed discussion on the innovation process and innovation management related to the WBC. It will be explained how the two may reinforce each other. Operations may also be organized along the lines of the WBC business components. This could facilitate the recognizability of the web of business components of the firm and its value web, and could further facilitate the identification of the business components in the innovation process. However, this is not mandatory apart from the requirement that the operations organization should be clearly mapped upon the corresponding business components, i.e. the normative component performance can be assigned to corresponding operations-responsible roles.

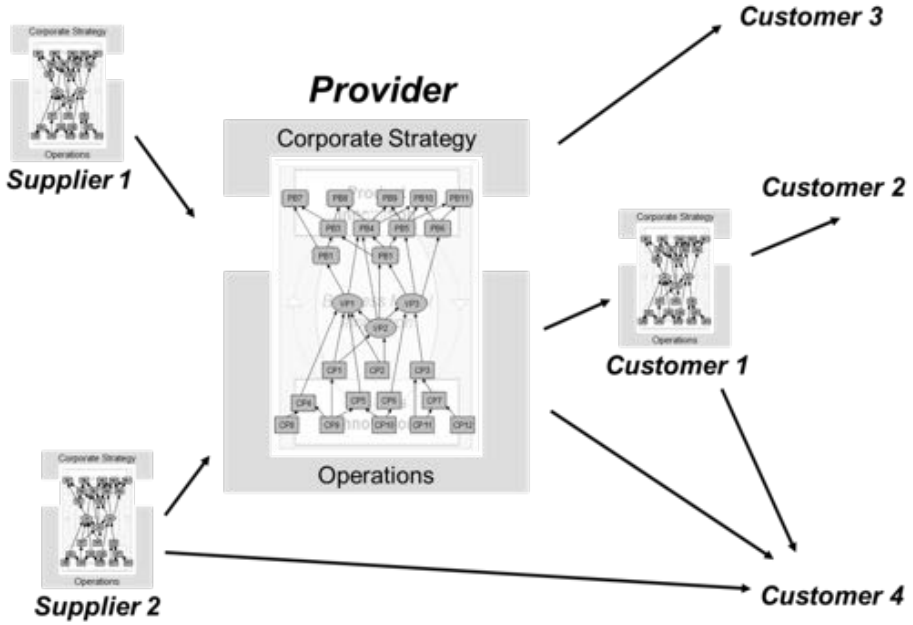

Figure 4.8 A Web of Business Components with suppliers and customers

A WBC in an extended enterprise context

Figure 4.8 shows how the Provider WBC may be mapped onto the PPB framework in an extended enterprise context with multiple suppliers and customers.

Suppliers contribute resources and/or process functions to the Provider CP. The figure shows two kinds of customers: 'retail customers' 2, 3 and 4 and a 'wholesale customer' 1, who in turn serves customer 2 and 4 as retail customers. The direct customers of the Provider (1, 3 and 4) receive PB propositions and goods-based products, and co-produce with the Provider via CPs for the service-based product parts of the PB. Customer 4 is served by Supplier 2, Provider and Customer 1. Customer 4 could be expected to act as the integrator of three different suppliers of three interdependent PBs. In a telecom environment, this is a realistic scenario: e.g. Supplier 2 could be an equipment supplier, the Provider could be the access network provider, and Customer 1 could be the internet service provider.

... it is important to carefully assess their position in this value network ...

From the perspective of the Provider it is important to carefully assess their position in this value network by developing a viable business model in which value is created by all parties involved, while at the same time enough value is captured for the Provider to maintain a sustainable business. The Provider VPs play a crucial role in this game, since they should provide a foundation for both the CPs and PBs that enable the chosen business model.

4.4 Telco and the Web of Business Components

This paragraph will relate the WBC to the application of the TMF NGOSS/eTOM framework, and will clarify how Telco applied business process modeling and supply chain modeling in relation to the earlier discussed product structuring. The aim of this paragraph is to provide further insight in how the WBC architectural framework may facilitate the management of the innovation process, and consequently the operational process.

The TMF NGOSS/eTOM framework of the TM Forum is one of the most important reference standards for both product suppliers and service operators in the telecom industry (TMF 2004). In the next case (4-3) the application of this eTOM framework within Telco will be discussed.

Case 4-3 – TMF NGOSS eTOM framework

The TM Forum was founded in 1988 as the OSI/Network Management Forum with the goal of accelerating the availability of interoperable network management products. This is also reflected by the term NGOSS, meaning New Generation Operations Software and Systems, recently referred to as 'Frameworkx'. Founding members included AT&T and BT on the service provider side, and suppliers such as Northern Telecom and Hewlett-Packard

on the equipment side. By early 1989 it had approved its first OSI/NM Forum Protocol Specification and by 1990 it had 85 members from 13 countries.
The TM Forum has continued to adapt as the technological and business landscape has developed. In 2010, the TM Forum has more than 600 members, runs the industry's leading OSS/BSS Conference and Exposition, and its standards are being adopted by the UN body, the International Telecommunications Union (ITU). The Enhanced Telecom Operations Map® (eTOM) is the ongoing TM Forum initiative to deliver a business process model or framework for use by service providers and others within the telecommunications industry (Figure 4.9). Its predecessor, the Telecom Operations Map (TOM) was first published by the TMF in 1998 and was superseded by the eTOM in 2001. The goal of TOM was the creation of an industry-owned framework of business Processes. Since 2004, eTOM is also an ITU-T Recommendation (M.3050).

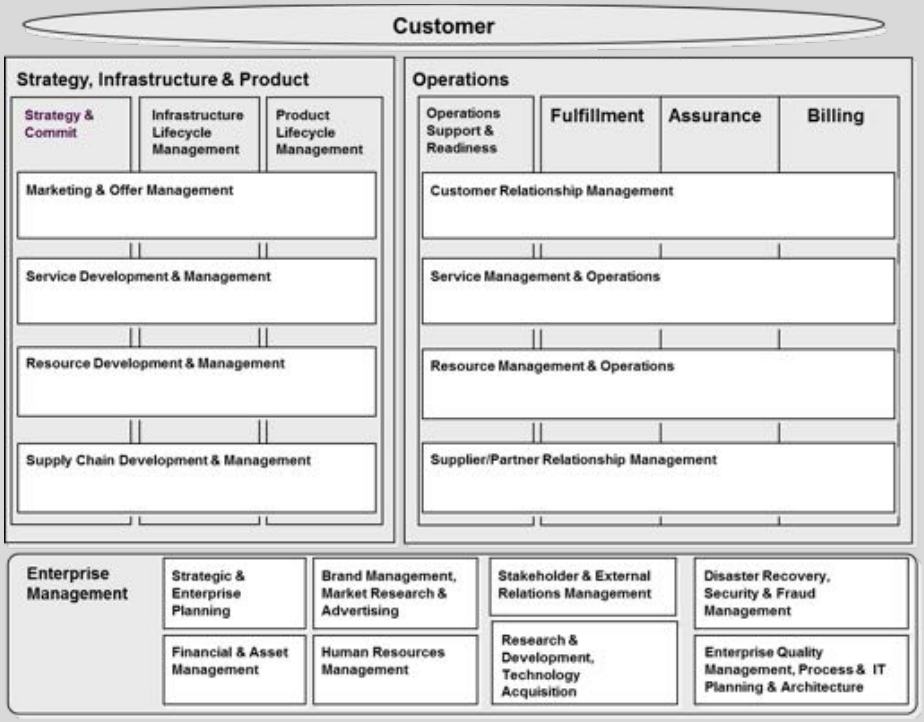

Figure 4.9 TMF eTOM framework

Originally the eTOM framework consisted of three blocks, representing the operations functions of a telecom operator: Fulfillment, Assurance and Billing ('FAB', Figure 4.9). Later on, the innovation processes part of eTOM framework, called 'Strategy, Infrastructure and Product' (SIP) has been added. SIP also grouped into three sub-parts: Strategy & Commit, Infrastructure Lifecycle Management and Product Lifecycle Management. The original rationale for this set-up is the different lifecycle lead times for strategy (tens of years), infrastructure (years), and product (weeks/months to

instantaneous). Although the innovation process is clearly positioned in the framework, this is one of the least worked out parts of eTOM. Note that the framework only models the service management capabilities, not the (core) service function capabilities. Within Telco, the latter category of capabilities was usually dubbed as 'Continuous Delivery' (CD; Case 4-4).
Operations Support & Readiness (OS&R) provides a tactical component to the pure operations (FAB) processes and forms the interface between the operations part and the SIP innovation part of eTOM. The Enterprise Management block consists of a number of generic business functions of the firm, not directly related to the SIP and Operations business functions.
Other important building blocks of the NGOSS framework are the SID and the TAM models. The NGOSS Shared Information/Data (SID) model provides the industry with a common vocabulary and set of information/data definitions and relationships used in the definition of NGOSS architectures. It enables business, system, implementation, and runtime viewpoints to be related with each other; is has the function of a 'framework of frameworks' within NGOSS. The Telecom Application Map (TAM) provides a view of typical Telecom Applications that is complementary to the eTOM and SID. Other recent components of the NGOSS (Frameworkx) are the Lifecycle Model, aimed at defining the use and deployment of NGOSS within an organization, and Contract Specifications for the contract that is used to define the service to be delivered. In line with the ongoing convergence of telecommunications, ICT and media, the NGOSS/eTOM framework is gradually more positioned to cover this entire converged area. The framework should now also be usable by Independent Software Vendors (ISV's), ICT systems integrators and media companies.
Telco started in 1998 with the application of the predecessor of the eTOM model: the Telecom Operations Map (TOM). This was a version without the innovation processes and generic processes like HR and finance, only covering the operational (FAB) processes of a telecom operator. Telco initially developed a special version of the TOM model (called 'TOM+') to better suit Telco's specific requirements, but this model was abandoned with the advent of the TMF eTOM model in 2003/2004.
Telco mainly used the eTOM framework as a checklist for the development of processes and IT and to provide a common language, both internally and externally with providers of networking equipment and applications, for service innovation and operations. The eTOM framework was specifically used for the development of a service-oriented Enterprise Application Infrastructure (EAI) by identifying a limited number of eTOM-based (SOA) service domains. Furthermore, eTOM was applied to define roles in Telco's Supply Chain Model (Case 4-4). The SID was used for various data modeling efforts, e.g. in the Ethernet service area.

Discussion on Case 4-3 – TMF NGOSS eTOM framework
According to Tian, Ding et al., the ('level 2' core processes) of the eTOM framework (Case 4-3) could be viewed as a framework of business components in the process area, in this case specific to the information and communications industry (Tian, Ding et al. 2006). The

eTOM framework is probably the most cited reference model of the telecom industry (e.g. Dickerson 2004; Potter and Brady 2005; Brenner, Garschhammer et al. 2006; Bruce, Naughton et al. 2008).
How did the NGOSS eTOM framework support the innovation process to provide mass-customized operations within Telco? NGOSS eTOM is one of the few governance structures that survived within Telco over the years. Originally, the framework was driven by corporate architects, but this has diminished due to downsizing of corporate departments and outsourcing of R&D. More importantly, over the years the framework gradually became a mainstream reference model for Telco as a whole. The horizontal bars in the framework, that have been added in the third version of the model (TMF 2004), mark the transition from separate functions like Fulfillment and Assurance to an integrated horizontalized approach on four layers. This indicates that efforts have been made in the framework to enable support for integrated innovation and operations approaches, including a single interface with customers (via the Customer Relationship Management; CRM layer) and suppliers (via Service & Resource Management & Operations; SRMO layers).

For the … innovation process the eTOM framework did not provide much guidance …

For the development of the innovation process within Telco, the eTOM framework did not provide much guidance. Within the eTOM framework the innovation-related Strategy, Infrastructure and Product (left part of the model) is also one of the least worked-out areas.

Mapping of the WBC framework on NGOSS SID
To explain the intention of the WBC framework the eTOM-related NGOSS SID (Shared Information/Data model, also called Frameworkx information model) framework is even more important than eTOM. While the WBC forms a high level data model for ISM firms, the SID framework is a unified reference data model for the telecommunications area. Figure 4.10 shows the relationship of the WBC framework with NGOSS SID. The grey boxes on the right side show the relevant high level SID data objects: Customer, Product, Service, Resource, and Supplier/Partner. It is beyond the objective of this study to give a detailed overview on the exact mapping of the SID data objects with the WBC data objects. An important observation however is that each WBC data object bridges two main SID data objects. For example, WBC Capability Platform bridges SID Resource and SID Service. The SID object ‘Resource’ may be anything ranging from a software application, a network device or a human being. SID ‘Service’ represents the output of a resource. Given the multiple granularity of SID Resource a SID Service could also vary between fine-grained technology-related services and coarse-grained business level services. SID distinguishes between ‘resource facing services’ and ‘customer facing services’.
If applied in combination with the SID framework, the WBC CP business component bundles a set of coherent SID Resources to provide a coherent set of SID Services. Similar SID object bridging roles apply for the WBC VP and PB. This emphasizes the intention of the WBC framework to provide a coherent framework that spans the entire product and

business process area by linking business components in both areas, including the value web contributions by customers and suppliers.

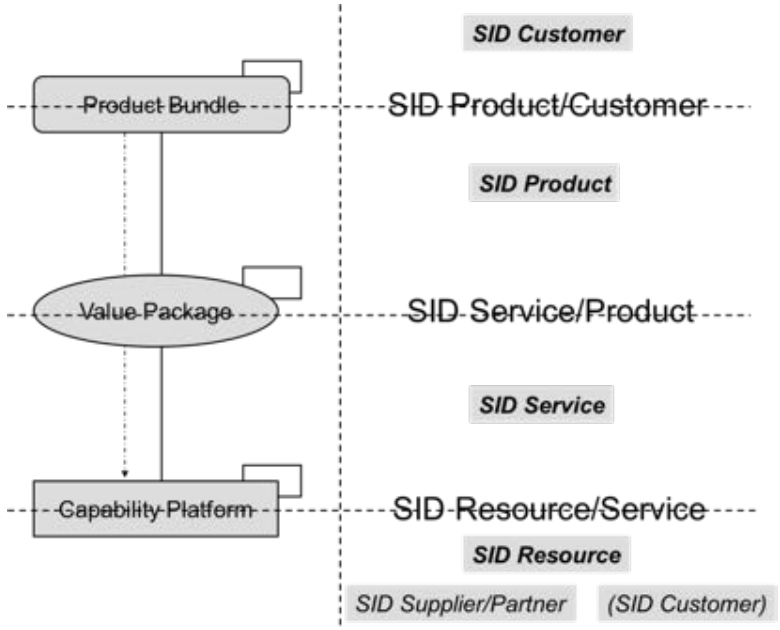

Figure 4.10 Relation between the WBC framework and NGOSS SID

Another observation relates to the SID object 'Customer'. In initial versions of the NGOSS SID framework the role of the customer was entirely lacking. Later on the 'Customer' data object was added to the framework, in line with the ambition for an increased customer focus in the entire telecom industry. The positioning of the Customer object in the horizontal SID layers varies in different versions: sometimes it is positioned above 'Product'; sometimes it is positioned between 'Product' and 'Service'. As mentioned earlier in this case, the eTOM framework only models the service management capabilities, not the (core) service function capabilities. This could explain why 'Customer' is not related to 'Resource' in the NGOSS SID framework. Since Capability Platforms in the WBC framework perform both (core) service function and (supportive) service management capabilities the SID 'Customer' data object is also directly related to SID 'Resource'. Resources of the customer and resources of the provider (and resources of the suppliers) co-produce on the delivery of the providers' (service) product. This corresponds with the dotted line/arrow from WBC PB to CP. Likewise CPs co-produce with the (resources of the) supplier. In this respect 'Customer' and 'Supplier/Partner' should be treated on the same par, both directly related to SID Resource, as indicated in the Figure 4.10: SID Supplier/Partner in a sourcing/co-producing role; SID

The WBC framework provides a bridging role for SID objects …

Customer in a delivery/co-producing role. Thus, the customer comes into picture both on the top ('product'/PB) end of the WBC framework, as well as on the bottom ('process'/CP) end.
Note that it has not been the intention of this discussion to suggest a change in the NGOSS SID framework, but rather to clarify the issues related to business componentization in ISM firms, combining (core) service function and (supportive) service management capabilities contributing to a full service perspective product.
For telecom service providers, the WBC could be viewed as a complementary framework to the SID. TM Forum's Information Framework (SID) "allows easier, more effective integration between software applications. It enables implementation and procurement of TM Forum Frameworx-conformant service oriented solutions by providing concepts and principles needed to define a shared information model, model entities, business-oriented UML[52] class models, reusable modeling patterns, guidelines for extending the Information Framework" (TM Forum website, accessed April 2011). The WBC adds an approach to componentize SID Product, Service and Resource to enable effective innovation management in an ISM context.

For telecom providers the WBC could be viewed as complementary to SID ...

Telco business process and supply chain modeling and the WBC
The aim of the next and last case in this chapter (4-4) is to explain some issues concerning business process and supply chain modeling supported by means of the WBC framework. A network utility provider, a telecom product supplier and an ICT service provider as described in Paragraph 2.2/2.3 are in fact different enterprises requiring partly different sets of business processes. The next case will elaborate on the development of Telco's business process models over the years. Furthermore, Telco's efforts concerning supply chain modeling will be related to the WBC framework.

Case 4-4 – Business Process and Supply Chain Modeling

During the network utility provider period the foundation was laid down for the Telco specific Generic Process Model (GPM). This model was refined in 1999 and 2002 and was used as a basis for the architecture and design of Telco's operational processes and organization. The main processes in the GPM model were Stock Management, Initial Delivery, Billing & Accounting, Service, Maintenance, Continuous Delivery, and Development. The aim of Stock Management (alternatively called Capacity Management) was to provide a sufficient amount of network infrastructure so that Initial Delivery could use this infrastructure to deliver a network connection (originally typically a telephone jack) to the users. The Billing & Accounting process provided for initial and recurring

[52] Unified Modeling Language. UML is a language used to specify, visualize and document the artefacts of an object-oriented system under development. Quatrany, T. 1998, Visual Modeling with Rational Rose and UML (Reading, MA. Addison-Wesley).

billing of the users but was not worked out in the model. Service was a predominantly Telco-internal process to handle network and user originating incidents, and Continuous Delivery (CD) was aimed to arrange that there is always a line tone if a user picks up the telephone horn. This complies with the (core) 'service function capabilities' meaning that is applied throughout this thesis. The Maintenance process should keep the networks running. The Development process divided Telco's NSD process into three sub-processes: Strategy & Project Selection (NSD phase 0/'pre-0' and 1), Develop Changes (NSD phase 2, 3, and 4), and Implement Changes (NSD phase 5; refer to Case 5-1).
GPM did not cover Sales & Marketing and Product Management processes as they were out of the (operations) scope of the framework. Further customer support processes (apart from the above 'Service') were completely out of scope.
In 2005 GPM was extended to eleven process chains to support the IP-based Networking & Services program (Case 3-3), and during the organizational restructuring of 2007 there was an attempt to develop a new eTOM (Case 4-3) based business process model, recognizing five main process areas, originating from the Mobile business area. However, these attempts did not result in a Telco-wide operationalized process model to replace the original GPM model.
Until now there has not yet emerged a single view on how Telco's overall business process model should look like as a successor of GPM. In the meantime the GPM framework is still relevant for some parts of the processes, especially for the network operations area. Regularly, the eTOM operations functions Fulfillment, Assurance, and Billing are applied to denote the operational processes[53]. Furthermore, the use of ITIL-based processes (OGC 2007b) has emerged with the proliferation of IT-based services and increasing customer requirement for an 'ITIL talking' supplier.

Telco's Supply Chain Model (SCM)
Another Telco initiative, only partly related to the above area of business process modeling, was the development of the so-called Business Role Model (BRM), later on dubbed: Supply Chain Model (SCM). This was started in 1999 to model Telco's position as a company with regard to regulated services and to provide a reference model in a fully competitive ICT/multi-media environment. The model was also used in combination with the Product Structure model (Case 4-2). Figure 4.11 shows the main structure of Telco's Supply Chain Model. The model is derived from the so-called TINA Business Model[54] (TINA-C 1997). The TINA Business Model is part of a larger TINA framework so as to improve interoperability, portability, and reusability of software components and independence from specific technologies, and to enable sharing of business roles amongst various stakeholders. The following roles reflect the major business areas of a complex

[53] The innovation-related eTOM functions Strategy & Commit, Infrastructure Lifecycle Management, and Product Lifecycle Management, are seldomly used within Telco.
[54] Although it describes the parties involved in service provisioning and their mutual relations, the TINA Business Model is not a business model in how it has been discussed in Chapter 3 of this thesis, but rather a model of a telecommunications/ICT services eco-system that could form the basis for business modeling in this area.

telecommunications/ICT services eco-system: consumer, retailer, broker, third party service provider, content provider, and connectivity provider.

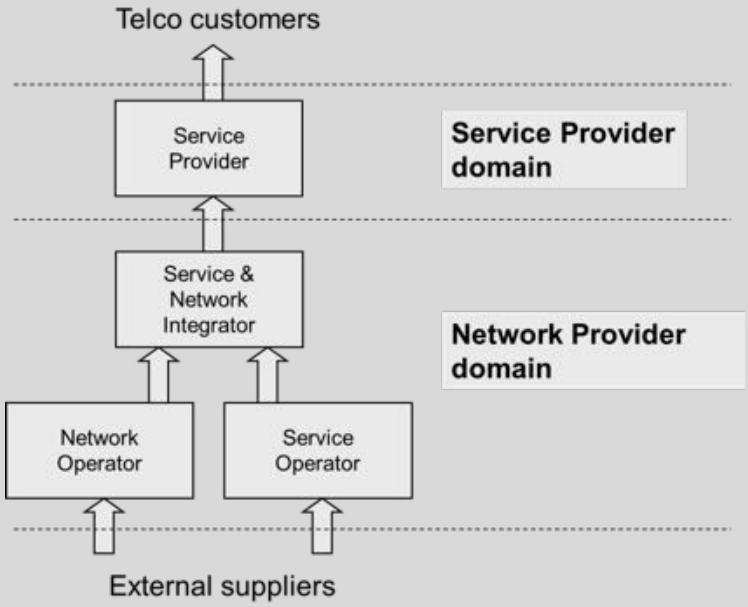

Figure 4.11 Telco Supply Chain Model

Telco has embraced this framework to model its internal supply chain roles. In Telco's Supply Chain Model four major roles can be identified: Network Operator, Service Operator, and Service & Network Integrator (together forming a Network Provider), and Service Provider. The Service Provider (SP) role is responsible for direct interaction with the market and customers. This includes both marketing & sales and customer service functions: the 'front-office' of the service management capabilities. The main focus of the SP is on market and customers. The Network Provider (NP) role is responsible for efficiently operating the networking assets to provide the service function capabilities. Furthermore the NP acts as the 'back-office' for the service management capabilities by the SP.

Within the NP the Network Operator (NO) is responsible for networking-related services (roughly until and including Internet Protocol based networks), while the Service Operator (SO) is responsible for application services on top of these networks. The split is made in the model because of the many operational differences between the NO and SO. Generally spoken, the NO environment is characterized by high investments and long lead times, while the SO is characterized by much lower investments and short lead times. The Service

& Network Integration (SNI) supply chain role is responsible for the integration of NO and SO capabilities. [55]
During the large-scale reorganization in 2007, in which the mobile and fixed divisions were integrated, the SCM served as the main guiding principle for the high-level corporate structure. Three SP-based segments were formed per market: wholesale, consumer and business. Furthermore existing operations units were combined into one NP, and IT services were concentrated in one overall IT unit.
Although the SCM is not always applied in a strict sense, as will be explained in the discussion, currently the SCM still serves as a main framework on the application of business roles and responsibilities in the organization.

Discussion on case 4-4 – Business Process Modeling
Telco's Generic Process Model (GPM) model was developed in the product supplier era as discussed in Paragraph 2.2/2.3. A remarkable example of the product centric view is the fact that product management and sales were until recently regarded as the front-office communicating with customers, while the operations departments (including most customer care units!) were seen as the back-office or 'factory' of the company. This 'product thinking' was reflected in the GPM 'Initial Delivery' process, until far in the 2000s regarded as the most important process (next to Continuous Delivery). GPM 'Service' was viewed as a predominantly internal process to solve (network) incidents. This is understandable from a network utility provider standpoint in which connecting the infrastructure to users is one of the main customer processes. The importance of the delivery process is equally understandable from the viewpoint of a (manufacturing) product supplier: in this process the (physical) product is handed over to the customer. However, for a service provider connecting the customer for initial use this Initial Delivery process is just the first activity in a, hopefully long lasting, service relationship. Note that the Initial Delivery process in the GPM model was renamed 'Production' in 1999, but currently both terms are still in use for this process, along with the eTOM term 'Fulfillment' (Case 4-3).

... for a service provider Initial Delivery is just the first activity in a, hopefully long-lasting, service relationship ...

How does the innovation process fit into this picture? In general the modeling of the innovation process itself has had relatively little attention by Telco management. This could be explained from the originally limited view within Telco on the scope of innovation, namely the renewal of network infrastructure. In the original GPM there was no serious role for the NSD process. From the '99 version onward the Telco defined New Service Development stage-gate process (Case 5-1) was included in the GPM framework as three

[55] Even in one SCM framework the term 'Service' has two different meanings: the output of applications like e-mail ('Service' in Service Operator) versus the service product toward customers ('Service' in Service Provider).

GPM Development sub-processes, but the integration in the overall business process architecture was limited to some operational change management processes.
Due to the absence of (strong corporate governance on the application of) a company-wide business process model, the GPM framework tends to be 'misused' in a broader context than just networking. For example, if a customer changes its own service product characteristics by means of a customer self-care application should this be viewed as part of the GPM Delivery process or not? If corporate governance on the use of business process models is weak different parts of the organization can device their own model and terminology. This impedes company-wide cooperation during the development of new services and forms a hindrance to further 'de-siloing' and rationalization initiatives of the company.

Discussion on case 4-4 – Supply Chain Modeling
The names of the building blocks of Telco's Supply Chain Model (SCM) suggest a complete operational scope per building block, including product, 'technical infrastructure' (TI) service function capabilities as processes/IT-based service management capabilities like fulfillment and assurance. In reality however, by many Telco staff the SCM was viewed from a TI-only perspective. At the same time, process architects mainly viewed the SCM from a process-only perspective, without looking at the connection between TI and processes/IT. Furthermore, by some enterprise architects the SCM building blocks were viewed from the standpoint that each block should act as a fully independent telecom operator including all eTOM functions. This extreme position did not increase the acceptance of the framework by (top) management. Although the SCM provides a logical framework to discuss the main business roles of a telecom provider in a larger eco-system, things become fuzzy during the application by various Telco user groups. Depending on the background of the user the SCM may relate to product, process or business model aspects, resulting in a Babylonian confusion of speech when the user groups come together. This is well illustrated by the application of the Service & Network Integrator (SNI) role. Depending on the applicant, the SNI may represent a business role, a product integrator, a service function capability process integrator, a service management capability process integrator or an IT system.

... the meaning of the SCM building blocks varied per Telco user group ...

Figure 4.12 shows the implied mapping of Telco's Product Structure (PS) framework (Case 4-2) and Supply Chain Model (SCM) framework. Although this was broadly recognized as a logical mapping of the two frameworks, it has never been fully operationalized this way. This was partly due to the limited operationalization of the PS framework itself; furthermore the operationalization of the SCM framework was only facilitated by the organizational structure from 2007 onward, with the formation of three Service Provider customer segments (consumer, business and wholesale) and separate Network Provider operations and IT units. Only in the regulated wholesale product area the SCM model has been implemented to some extent.

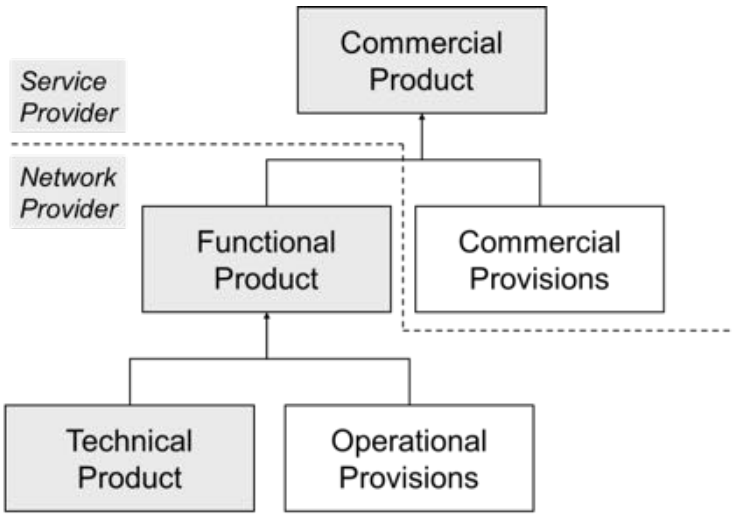

Figure 4.12 Modeled relationship between Telco Product Structure and Supply Chain Model

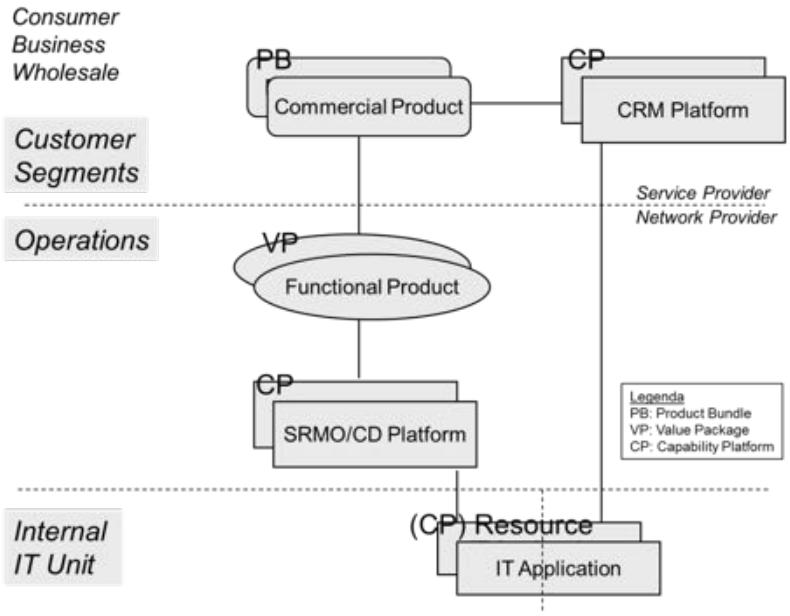

Figure 4.13 Broad operationalization of the relationship between Telco Product Structure and Supply Chain Model in the Telco organization from 2007 onward

Figure 4.13 shows how the combination of SCM and PS frameworks have to some extent been operationalized within Telco during the last three years, following the major organizational restructuring in 2007 as described in Paragraph 2.3. The three customer segment Service Providers are responsible for the Commercial Product base within their segment. The scope of this Commercial Product is broadly in conformity with the Commercial Product of the original PS framework. The Commercial Product has been componentized in the sense that the original 'Commercial Provisions' (Figure 4.2) are included in the scope. This componentized Commercial Product equals the Product Bundle in the WBC framework.

In line with this organizational structure Customer Relationship Management (CRM) Capability Platforms are fully positioned within the customer segments. In reality, several CRM-related roles (e.g. customer engineering) reside within the operations organization, requiring additional coordination between the segments and operations.

At the operations level Functional Products (at the Value Package layer of the WBC framework) may be regarded as a componentized version of the original Product Structure-based Functional Product (including 'Operational Provisions'). However, the implementation of the Functional Product within Telco is still in its infancy. The concept is still not well understood by management, and multiple organizational units maintain multiple Functional Product catalogs covering the same or a slightly different area. For example, sometimes the FuPr is considered to include only TI-based service function capabilities, sometimes it is thought to include both the service function and service management capabilities. The confusion is worsened by the fact that release management on Functional Products has not yet been implemented: e.g. one Operations unit maintains the current catalog of normative services contributed to the customer segments, while another unit maintains a future reference catalog of the same or a slightly different FuPr scope. These differences are ill understood and ill communicated in the organization. This induces a lot of confusion both internally within Operations and externally to the customer segments and the internal IT unit.

... there is hardly any linkage between the Functional Product and the service management processes ...

Below the level of Functional Product – SRMO (Service & Resource Management and Operations, delivering the Operations-related service management capabilities) and CD (Continuous Delivery, delivering the service function capabilities) Platforms – the situation is equally unclear. As discussed earlier, the platform concept is still only recognized in the TI-based service function capability (CD) area. In the service management capability area (e.g. encompassing fulfillment and assurance) platforms are still hardly acknowledged in the organization. Related to this, there is hardly any linkage between the Functional Product and the service management processes. Additionally, in contrast with the organizational model the customer segments themselves perform some SRMO processes (especially in the business market area). This even further confuses the picture, e.g. concerning IT demand management toward the internal IT unit.

The positioning of Wholesale & Operations

A specific issue is the positioning of the Wholesale & Operations unit, both internally W&O and externally to the other organizational units. From its conception in 2007 onward, the mission of the W&O organization has been to provide both SRMO Operations in a supply role toward the customer segments (including the wholesale segment) and offering and delivering wholesale products (with the application of CRM processes) to Telco customers. The confusion arose by the fact that W&O was sometimes managed as one W&O organization, and sometimes as two disparate 'W' and 'O' units. During a restructuring in 2009 this internal W&O issue was largely resolved by the formation of a clear wholesale customer oriented segment within W&O. This was largely induced by regulatory guidelines to ensure the same service levels toward external and internal service providers. However, this did not resolve the overall positioning issue of W&O. Especially concerning the 'O' role it is not clear whether this is a 'network provider' with full responsibility for the services it delivers to the customer segments (including the wholesale segment) or 'just' an extension of the retail segments. This is reflected by the fact that only few business cases emerge at the level of W&O operations capabilities. This ambiguity has led to unclear roles internally W&O, toward the other customer segments, and toward the IT unit. From the perspective of the customer segments, a general view prevails that W&O Operations is responsible for TI (Continuous Delivery networking; service function capabilities), while the internal IT unit is responsible for IT. In this view Operations is not concerned with processes and IT at all. However, is this were true, who develops and integrates the (SRMO) processes to obtain the required propositions/services for customers? Note that this view substantially differs from the implied current model as presented in Figure 4.13: If W&O Operations would be fully responsible for the services toward the segments this should include the SRMO-related processes and the corresponding IT capabilities of the IT unit. The above issues clearly inhibited the Functional Product concept to be fully operationalized.

Service organizations should be cautious to separate marketing and production/delivery activities …

Telco Customer Relationship Management Capability Platforms

Note that, other than in the CP-VP connection in the WBC framework, the CRM Platforms are not connected to the Functional Products but directly connected to the Commercial Products. Functional Products thus only cover SRMO/CD capabilities. With a clear separation of roles between the Customer Segments and Operations this still could result in a workable situation. However, given the fuzziness concerning process/IT roles and the above W&O positioning this different approach of CRM versus SRMO CPs could add to the confusion in this area. Moreover, there may be an intrinsic problem concerning this separation of tasks in a service perspective context. Service organizations should be cautious to separate marketing and production/delivery activities due to the role of the customer as part of the system. This introduces uncertainty in the information processes and puts additional emphasis on the innovation process to reduce this uncertainty (Lievens and

Moenaert 2000a, p. 47). There are some signs that Telco has recognized this issue. In the current transformation toward an ICT service provider Telco has become aware that a customer centric approach means that the service processes should be aligned in a way that the total customer experience is managed in all respects. In such a company the front-office is formed by all customer facing roles and processes, including sales and customer care. In 2009 this new approach could, for example, be observed by the emergence of a combined 'Sales & Service' site on Telco's corporate intranet.

4.5 Conclusion

The aim of this chapter was to discuss the second challenge of the 'missing innovation objects' on the intersection of 'innovation management' and 'service perspective' by responding to the second research sub-question (RSQ2): *How can the end result of the innovation process be defined in terms of 'tangible' objects for the actors in the innovation process?*

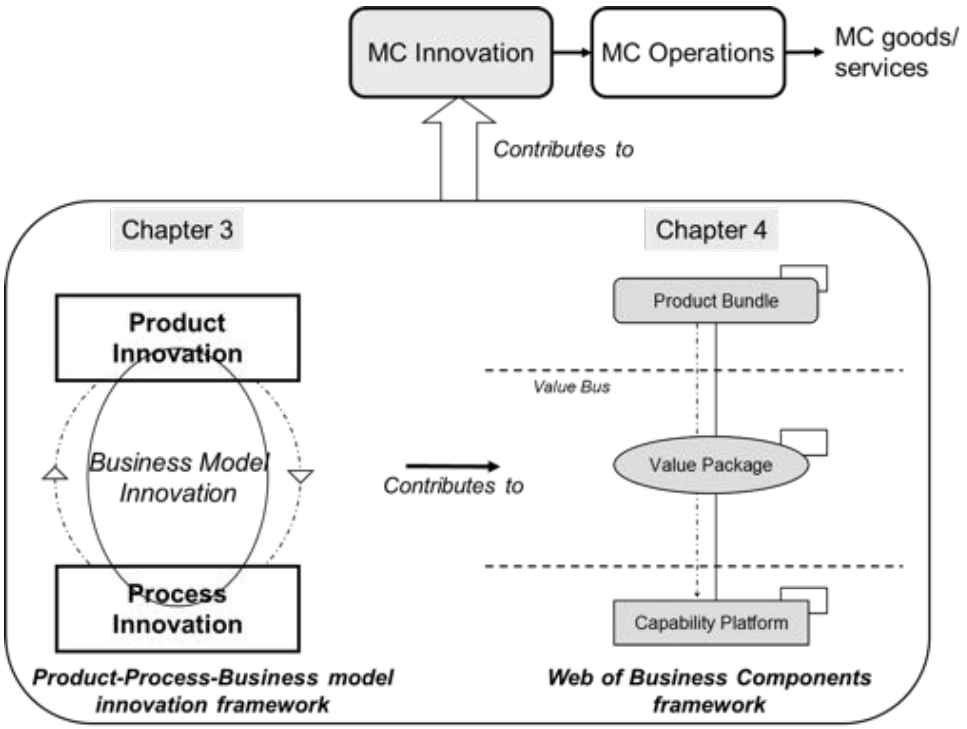

Figure 4.14 Conceptual Framework 2 (CF2)

Figure 4.14 shows how the conceptual framework has developed during the Chapters 3 and 4, resulting in Conceptual Framework 2 (CF2). In Chapter 3 it has been shown how the Product-Process-Business model innovation (PPB) framework contributes to mass-customized innovation. The Web of Business Components (WBC) framework of Chapter 4 relies on the PPB of Chapter 3; the combination contributes to MC Innovation by providing a foundation for componentizing product and process into three distinctive layers.
It has been shown how the PPB of Chapter 3 may act as a foundation for the operationalization of a product/process structure via a coherent framework: the WBC. The strict positioning of the product and process concepts of the PPB, enabled by business model innovation, has been used to define product and process elements as reusable business components. These business components are defined and implemented in the innovation process and deployed in the operational process. In Figure 4.14 the PPB and WBC have been combined into one picture (Conceptual Framework 2).
Within the WBC framework, the process is represented by Capability Platforms relying on internal or external resources in the overall value web. The product is componentized in Product Bundles representing the product propositions of the ISM firm in the market.
The Value Bus, consisting of Value Packages, acts as a product/process neutral zone avoiding product peculiarities in process components and process peculiarities in product components, and enabling modularity, integration and reuse on each horizontal layer in a 'Value Oriented Architecture'. At the highest level Value Packages could also be viewed as the business model blueprints of the company; i.e. distinct combinations of VPs form the catalog of business model blueprints. Telco has been advanced in introducing a number of industry standard and Telco specific frameworks during the last decade. It has been shown in the various cases in this chapter to what extent Telco succeeded in applying (combinations of) these frameworks on the path to effective innovation management in an ISM context.

The Value Bus … acts as a product/process neutral zone …

However, business componentization requires more than a framework based on the combination of product structuring, supply chain modeling, and telecom reference governance models. Along with the development of the WBC framework, other approaches have been discussed to implement and maintain a business component-based environment. Table 4-2 provides an overview of these enablers, with reference to the Telco cases in this chapter.

Table 4-2 Business componentization enablers within Telco

Business componentization enabler	Examples	Componentization effect	Discussed in
Horizontalization and modularization models and governance (standardization on objects/structure/layers/interfaces)	Telco Product Structure, Telco Supply Chain Model, NGOSS eTOM, NGOSS SID	Foundation for reusable modular business components and 'networks' in a horizontalized structure	Chapter 4, Case 4-2, 4-3, and 4-4
Firm-defined naming of business components instead of applying generic or supplier-originating process/technology/IT names	Telco examples: Wholesale Billing Street, Ethernet TI Platform	Focus on the level of business components instead of focus on the level of process flows, technology or IT	Chapter 4, Case 4-1
Listing and specifying business components in catalogs	Telco examples: Functional Product catalog, IT and TI Platform repositories	Facilitates 'account management' at the level of business components (expectation mgt, performance measurement, reporting etc.)	Chapter 4, Case 4-2, 4-4
Assigning innovation responsibility of business components to (line) organizational domains or supply chain roles	Telco examples: Functional Product responsibility at the Network Provider	Ownership, empowered innovation responsibility at the level of business components	Chapter 4, Case 4-4

In the next chapter the third challenge area in managing innovation for mass customization in ISM firms will be discussed: the role and organization of the innovation process itself.

5. Continuous innovation management

5.1 Introduction

In the preceding chapters, two subjects were discussed relating to two challenge areas in managing innovation for mass customization in ISM firms: the distinction between the concepts of product and process innovation (Chapter 3), and the challenge area of the 'missing innovation objects' (Chapter 4). Some organizational issues were already discussed in Chapter 4 concerning the mapping of business components onto supply chain roles within Telco.
This chapter discusses the third identified challenge area in managing innovation in ISM firms and third research sub-question (RSQ3): *What are the challenges in managing innovation for mass customization?* This includes the role of the innovation process itself, and how it could be managed in a mass-customized environment (Figure 5.1).

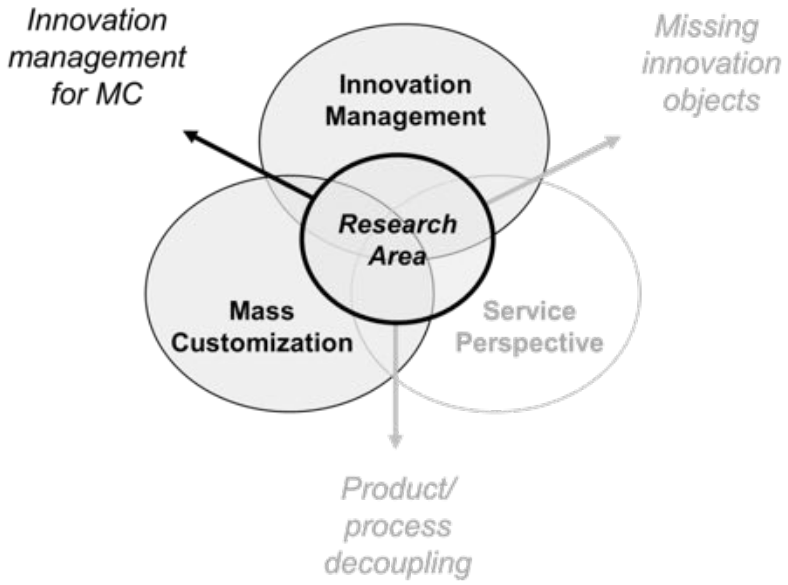

Figure 5.1 - The third challenge area: innovation management for mass customization

This includes questions like: what does the innovation process look like, what are the various activities, what roles can be identified, and what are the challenges of organizing the innovation process in an environment with reusable business components on multiple horizontal layers, including the role of suppliers and customers in the entire 'value web'?
In this chapter three innovation management-related cases are discussed. As in Chapter 4, all cases aim to contribute to the development of the conceptual framework.

5.2 Service perspective innovation management

This research relies on Peter Drucker's definition of innovation: "Innovation is changing the value and satisfaction from resources obtained by the customer" (Drucker 1985, p. 33). This definition encompasses the entire scope of product, process and business model as discussed in Chapter 3, and includes both radical innovation as well as incremental, architectural and modular innovation that (partly) builds on the existing (Henderson and Clark 1990).

Although research on service innovation is increasing, the area is still underdeveloped in comparison with product innovation[56]. Page and Shirr found that from a data set of 815 articles on New Product Development during 1989-2004, only 52 articles included services aspects and that only 21 articles focused on new service development (Page and Schirr 2008). The number of publications on service innovation has only started growing substantially since 1990 but the field is still in its infancy. Until the eighties of the last century it was thought that the service sector as a whole is not innovative at all, or that innovation in services could be attributed fully to the upstream (goods) suppliers of the service provider.

Until the nineties, service innovation was investigated by applying concepts from product innovation in the manufacturing area (e.g. Pavitt 1984). Most scientists assume that innovation in services is indeed important, but that it has other characteristics than innovation in manufacturing. De Jong, Bruins et al. (2003) give an overview of these differences. Besides a different approach to R&D it is emphasized that service innovation is easier to imitate (Atuahene-Gima 1996a) or that technology plays a less important role than in manufacturing (Cooper and de Brentani 1991). Also, the shortage of properly trained personnel and the important role of organizational development in service innovation is mentioned (Sirilli and Evangelista 1998a).

... it is questionable whether there is a need for a specific definition for service innovation ...

The literature offers specific definitions for innovation in services. De Jong, Bruins et al. (2003) give an overview of some of these definitions. For example, Menor, Takitonda et al. define a new service "as an offering not previously available to a firm's customers, resulting from additions to or changes in the service concept" (Menor, Tatikonda et al. 2002, p. 138). However, it is questionable whether there is a need for a specific definition of service innovation. Although there may be some peculiarities in innovating services, the scope and aim do not differ from innovating goods. This is also endorsed by Drejer (2004) who assumes that Schumpeter's approach to innovation (Schumpeter 1934) is broad enough to include service innovation.

[56] 'Product innovation' as usually applied in the literature, to denote innovation in the manufacturing area.

The innovation process is defined as "the development and implementation of new ideas by people who over time engage in transactions with others within an institutional context" (Van de Ven 1986, p. 591). Innovation management is defined here as follows:

> ***Innovation management is defined as a management process that manages the innovation process.***

The term innovation management (or 'the management of innovation') as used in this study indicates that innovation is regarded as a management process that co-ordinates all aspects of innovation. Innovation management is considered a dynamic, non-linear process with many actors and an important role for implicit knowledge and intangible factors, as described by Janszen (2000). It is a complex system whose effects cannot simply be explained by the sum of the individual components. What is required instead is a holistic approach to innovation management. The development process forms a subset of the innovation process. The development process for services is usually dubbed 'New Service Development' (NSD), as a variation on the term New Product Development (NPD). The term New Service Development/NSD originated from the marketing area (e.g. Shostack 1977; Kotler 1979) and has been described by many authors (e.g. Scheuing and Johnson 1989; Fitzsimmons and Fitzsimmons 2000; Menor, Tatikonda et al. 2002; De Jong and Vermeulen 2003; Edvardsson, Gustafsson et al. 2005). As do the terms product innovation and service innovation, NPD/NSD has multiple meanings and scope in the literature. In this research NPD/NSD is understood as a 'systemic' (planned/co-ordinated) process from (NPD/NSD) strategy formulation toward commercialization[57]. Within the service perspective (Grönroos 2000) and the synthesized service/goods innovation (De Vries 2004) approach of this research the terms NPD and NSD are regarded as interchangeable. For the remainder of this thesis the term NSD will be used. Usually, goods-based NSD applies a variation of the stage-gate model (Booz-Allen and Hamilton 1982). Most studies suggest variations of this model for service-based NSD (Johne and Storey 1998). Often the number of stages is reduced to only two stages. This applies for example to the model of Zaltman, Duncan et al. (1973) with the stages 'initiation' and 'implementation', and for De Jong, Bruins et al. (2003) with the stages 'search' and 'implementation'.

In the telecommunication services area … a formalized NSD process is also quite common …

This research explores the challenges in managing innovation in ISM firms. Following the discussion in Chapter 3 and 4 this encompasses innovation management in a PPB-based Web of Business Components.

[57] This is in conformity with the scope of the 1982 version of the Booz-Allen and Hamilton model that includes 'NPD strategy formulation.

The organization of the service innovation process

Vermeulen and Van der Aa (2003) note that the organization of the innovation process is one of the key success factors for innovation in services. This is also demonstrated by studies of De Brentani (1991) and Edgett & Parkinson (1994). They show that successful service firms build upon strong inter-functional cooperation and coordination; organizational factors form the leverage for success. However, relatively little research has been done on the organization of innovation by service providers. Johne and Storey (1998) and De Jong and Vermeulen (2003) give an overview of the main literature in this area. Many service providers have an ad hoc process without any formalized approach (Martin and Horne 1993; Gallouj and Weinstein 1997; Sundbo 1997; Kelly and Storey 2000; De Jong and Vermeulen 2003). Only in some service sectors a formalized NSD process is applied, e.g. in financial services (De Jong and Vermeulen 2003). Also in the telecommunication services area, a formalized NSD process is quite common (Van Riel and Lievens 2004; Riedl, Leimeister et al. 2009). This also applies to Telco. Case 5-1 offers a discussion on Telco's New Service Development (NSD) process. The data for this case is primarily based on documentation and semi-structured interviews.

Case 5-1 – New Service Development process

In 1995 Telco started with the introduction of a New Service Development (NSD) process within the Operations unit. The process aimed to improve the steering of the innovation funnel of the renewal and improvement projects portfolio. By introducing a standard method and a common language the comparability of projects was to be dramatically improved. With the NSD process, management acquired a tool with which to review and approve projects individually and in coherence with related projects. The scope of Telco's NSD process included both product and process aspects.

Telco's NSD process was based on the stage-gate model by Booz, Allen & Hamilton and Cooper (Booz-Allen and Hamilton 1968; Booz-Allen and Hamilton 1982; Cooper 1990). The process consists of six stages/phases: Initiation & Global Analysis, Detailed Analysis, Definition, Development, Preparation & Test, and Implementation (Figure 5.2).

The Initiation stage (Phase 0) is sub-divided into three sub-stages to enable early funneling. An optional eighth 'After-care' stage is added to assure after-care support by the project team members for the line organization. Each stage is concluded by a gate in which specific information and documentation should be available. A so-called 'Project Action Committee' (PAC), by members of senior Telco management, makes a go/no go decision per tollgate. In 1999 this NSD process was widened to include all innovation activities within Telco; it still serves as a common method for the steering of all innovation projects within Telco.

From its introduction in 1995 onward, various small alterations have been made to the process. A 'light' version was conceived to support smaller renewal and improvement projects, and some (sub) stages and gates were abandoned over the years.

For the steering of individual projects, since the 1980s Telco applied a home-grown project management method that was integrated in the NSD process. In 2006 this method was replaced by the de-facto industry standard Prince2 (OGC 2005).
Since the major organizational restructuring in 2007, in which the Fixed and Mobile businesses were integrated, the NSD process was organized per main segment (five PACs). Furthermore, a corporate-wide rolling forecasting process (Arterian 1998; Montgomery 2002) was added to the NSD process to improve transparent insight into the overall innovation funnel and planning. In 2008, a corporate-wide initiative was launched to improve innovation management within Telco by centralizing capital expenditure (Capex) decision making. Within this initiative, portfolio and technology road mapping (Phaal, Farrukh et al. 2001) were introduced to enable a better translation from corporate strategy to the innovation project portfolio. Some principles of Zero Base Budgeting (Phyrr 1970) were applied to encourage a fresh assessment of innovation opportunities to prevent 'automatic' history-based investment schedules.

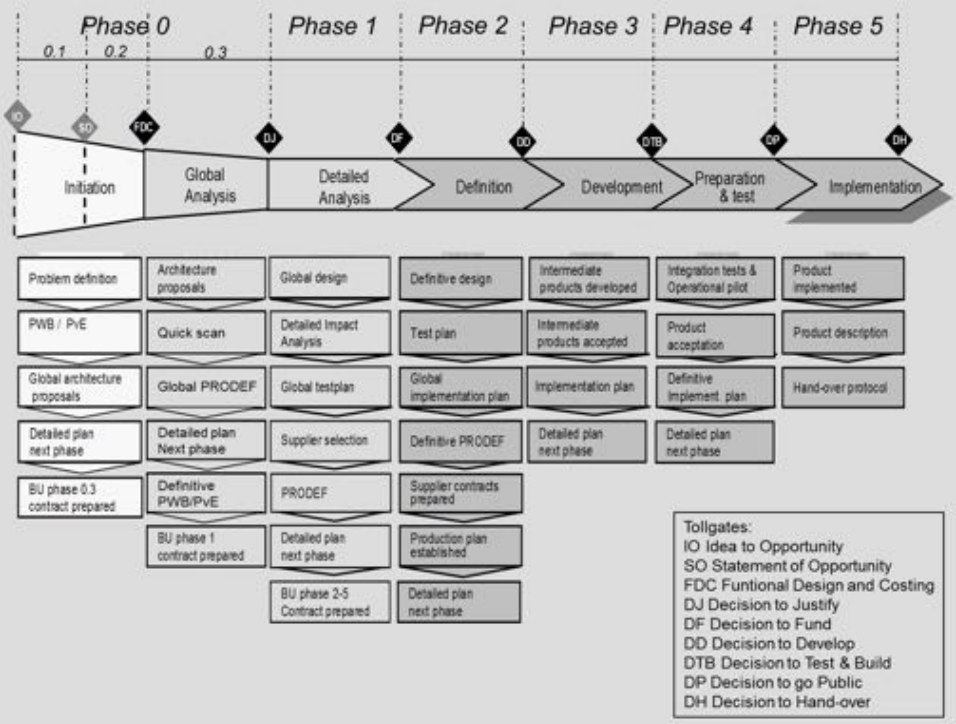

Figure 5.2 Telco's NSD process

Until 2007, the NSD process itself was maintained by a corporate staff department, but after an organizational restructuring this was abandoned. From 2007 to 2010, the method was formally maintained within the Business Market division; in practice, however, corporate-wide maintenance has been lacking, resulting in multiple segment specific adaptions.

Discussion on Case 5-1 – New Service Development process

Telco's NSD process has been a stable factor in Telco's innovation management approach since its implementation in 1995. The method has contributed substantially to decision-making on innovation opportunities in a well-structured way. However, the following issues deserve some commentary from the perspective of innovation management in ISM firms:

1. The relationship between the corporate strategy and NSD projects.
2. Innovation funneling seems to be confused with project management.
3. The scope of NSD projects seems to be restricted to the development of service function capabilities.
4. The NSD process has not been adapted to modular product/process development.
5. The NSD process suggests a linear development process, while in reality the process has a non-linear, iterative, character.
6. NSD projects are regarded as a one-off exercise, not as the starting point for further innovation.
7. The alignment of multiple NSD projects to achieve coherent market introductions.

Ad 1. The relationship between the corporate innovation strategy and NSD projects. NSD strategy formulation does not form an integral part of Telco's development process. In that sense, Telco's NSD process conforms to the 1968 version of the stage-gate process by Booz-Allen & Hamilton, and not to the 1982 version that includes strategy formulation. Although some attempts have been made in the late-90s to include ('pre-0') NSD strategy formulation as part of three development sub-processes (Case 4-4) this has never been operationalized in this way. Development goals are set during the yearly Business Planning and Year Planning process, including overall innovation capital expenditures (Capex) and operating expenditures (Opex) targets per business area. Of course, strategy formulation is done in several ways, but this is not included in the overall 'systemic' NSD approach. The PAC, the senior management innovation decision committee, has a limited role in the 'pre-0' front-end of the NSD process, but mainly in the back-end: innovation management via the NSD process is predominantly executed on a per-project basis with limited explicit linkage to an NSD strategy. As a result the NSD process until now had a limited contribution to the successful translation of mass customization-related corporate strategy toward a successful implementation of innovations in that area.

... strategy formulation is not included in Telco's overall NSD approach ...

Since 2007, a number of measures have been taken to provide a better linkage between the corporate strategy and NSD project, including rolling forecasting, road mapping and the centralization of innovation investment decisions.

Ad 2. Innovation funneling seems to be confused with project management. Although the NSD process is intended to manage an innovation funnel, many Telco staff view the NSD process as a project management method. This notion seems to be amplified by the fact that

some of the early tollgates were discarded over the years. Especially since the corporate financial issues during the early 2000s uncertainties 'have been reduced' by expecting a sound business case already at the first tollgate (IO) and by stressing the main investment tollgate (DF: Decision to Fund). By skipping the initial tollgates the fuzzy front-end has de-facto largely been removed from the process, transforming the innovation funnel into a seemingly 'cylindrical pipe'.

Ad 3. The scope of NSD projects seems to be restricted to the development of service function capabilities. Although Telco's NSD process explicitly includes (documentation) requirements on process, organization and data architecture issues related to (supportive) service management capabilities, the emphasis very much seems to be on (core) service function capabilities (TI networking) only, and the TI-related product features.

Ad 4. The NSD process has not been adapted for innovation management in a horizontalized environment with modular business components on each layer. The transition from product/technology silos toward modular products and processes in a horizontalized structure has induced another kind of NSD project. In a silo-based environment one integrated NSD project in one organization could be sufficient to develop all aspects for a coordinated market introduction. With modular products and processes multiple projects in multiple organizational domains could be needed to develop all aspects of an innovation. For instance, one project could prepare the integration of the product in an existing PB, another project could integrate the requirements into a new release of a TI platform, and a third project could integrate the requirements into new releases of service management CPs. The NSD process was originally designed to guide the one-off roll-out of new product introductions in the market. This is reflected, for example, in the Decision to go Public (DP) tollgate. This tollgate seems logical for a market introduction of a product-related innovation, but hardly seems appropriate for the introduction of a release of a new back-office process. The NSD process has not been adapted over the years to accommodate this alternative application. In a de-siloed environment many innovations are concerned with process innovations or the introduction of a new TI network platform, not necessarily immediately accompanied by a market introduction. Moreover, these innovations are often concerned with new releases of the same platform or product. Telco's NSD process and documentation involved have not been adapted to cope with other innovations than 'one-off roll-out of new product introductions in the market'.

The NSD process has not been adapted to … a horizontalized environment …

Ad 5. The NSD process suggests a linear development process, while in reality the process has a non-linear, iterative, character. Telco's NSD process has not been adapted to iterative development methods that have become applied within Telco. E.g. the NSD process has not been aligned with new iterative IT originated development methods like Rational Unified

Process® (RUP, Kruchten 2003). Basically, the NSD stage-gate process seems well designed for classical 'waterfall'-based development philosophies, but less for iterative methods like RUP. Although the NSD process and iterative methods may well be combined, at least some adaptations are needed, e.g. to divide investment decisions into smaller chunks in accordance to RUP 'iterations'. More generically, linear and (seemingly sequential) stage-gate methods result in long development lead times, communication problems and increased costs (Wheelwright and Clark 1992; Pisano 1997). According to De Jong, Bruins et al. (2003) especially in a rapidly changing environment (such as an ISM firm in its network) linear models are less useful. This is also endorsed by Akamavi (2005) who observes that an iterative process is recommended for NSD.

Ad 6. NSD projects are regarded as a one-off exercise, not as the starting point for further innovation. What is the end result of an innovation? Each NSD project ends with a hand over (tollgate DH) to the operations organization. However, this also marks the start of a process of continuous improvement and (incremental and modular) innovation on the products and platforms involved. To be able to perform incremental/modular innovations knowledge about the existing situation should be preserved. One of Telco's most important NSP deliverables is the so-called 'product wish description' (PWD), to be formulated in phase 0 of the NSD process. According to the NSD process, this document ultimately results in a 'product description' (PD) during the implementation phase. However, frequently the PD is lacking altogether, and referral is made to the last version of the PWD. However, if retrievable at all, does this document describe exactly the 'as is' situation of the business components involved, or does it encompass 'to be' aspects? Even if there is a formal PD document at 'DH', this document only applies to the initial version of the service set-up. It does not include innovations that are made after the NSD project has finished.

NSD projects are regarded as a one-off exercise …

Ad 7. The alignment of multiple NSD projects to achieve coherent market introductions. Another issue of having multiple projects in multiple organizations in a modular environment is: how to ensure that the outcome of these projects leads to a timely and coordinated market introduction? With the implementation of 'business releases' in 2007, the business market segment aimed to introduce a clear heartbeat for the introduction of customer-complete functionality to the market. Each business release had a turn-around time of approximately eight months, but the development of further releases of the same innovation could overlap. On the basis of a pre-defined roadmap and a joint architecture, senior management mandated the 'right' innovations. Toll gates of multiple NSD projects were synchronized, and projects were bundled into a limited number of large-scale programs. This business release approach in the business market segment was abandoned in 2010 due to insufficient coherence between the innovation projects and coordination overhead, causing many timing problems during realization. From that moment,

coordination was predominantly restricted to the last phase of innovation projects to enable coordinated implementation in operations.

All of the above issues have consequences for the subject of this research. To cope with the above challenges the NSD process needs (like any other process) continuous monitoring and adjustment to changing circumstances. However, although the maintenance of Telco's NSD process has formally been assigned there is limited management attention and funding for this task. Already in 1995 Telco introduced a stage-gate NSD process, but the process has, like other innovation management-related issues, not been adapted to support the transition during the last decade from a vertical silo-based operator toward an ISM firm with modular business components.

The need for continuous innovation management: the Telco case

Although Telco's NSD process is organized as a continuous process with yearly strategic planning and bi-weekly 'PAC' meetings to decide on the tollgates of the various innovation projects, the process is not continuous from the perspective of the product and process business components involved. Once an NSD project is completed, the associated products and platforms are 'out of sight' of NSD innovation management procedures until a new NSD project, involving (parts of) the same products or platforms, is launched. But even if such a project is started, it may not be clear that the project is actually aimed at releasing a new version of the same product or platform as was developed by an earlier NSD project. The name of a project, for example, may provide no clues in this direction: there is limited governance on the naming of products and platforms within Telco, while release management practices at the level of products and platforms are scarce.

... each innovation requires a 'reengineering' effort to reconstruct/understand the existing situation ...

With Telco's current innovation management system, in which knowledge of existing business components and their mutual chain coherence is not continuously preserved and transparently communicated in a standardized way, continuous innovation in a modular horizontal structure is hard to accomplish: each innovation requires a 'reengineering' effort to reconstruct/understand the existing situation. Within Telco this phenomenon became apparent though by lengthy and costly 'impact analyses' at the start of each new innovation project (NSD phase 0 and 1, refer to Case 5-1); one can only start to assess the impact of changes if one knows the existing situation. There are examples of impact analyses with a duration of a full year and an associated cost level. This clearly has a negative impact on the time and cost to market. Moreover, how can it be guaranteed in the operational phase that agreed customer contracts can continuously be met by operations if it is not continuously clear how the contributing business components cooperate in one coherent web/chain, including the role of customers and suppliers? Within Telco this became apparent by 'unexpected' network outages of legacy network platforms for which the operational knowledge and interest at a tactical level had diminished over the years, as well as substantial rework, temporary customer support desks, and operational

firefighting after new product introductions. Thus, the lack of continuous innovation management within Telco fired back to the operational performance.

The growing need for continuous innovation management

A web of horizontally layered business components requires an innovation management system in which knowledge of the design and business performance of the current operations setup is continuously preserved and transparently communicated company-wide, both at the level of individual business components, and at the level of the overall chain architecture. This is a prerequisite for effective and efficient operational performance to customers because the innovation process provides the prerequisites for operations (Edvardsson and Olsson 1996). With increasing levels of operations automation, the output of the innovation process delivers even more than the prerequisite for operations: it directly translates into operations performance once the innovation process has delivered. Furthermore, it seems to be a prerequisite for innovation agility. Each business component in the current operations setup will sooner or later be replaced by a next release with better performance and new features in response to a fast-changing environment. In the current study, an innovation management approach that supports the above way of thinking referred to as 'continuous innovation management'.

... it directly translates into operations performance once the innovation process has delivered ...

5.3 Modeling innovation as a continuous innovation management process

Continuous innovation management implies that each business component in the Web of Business Components is continuously managed during the entire lifecycle[58] of such a business component. The concept of a product lifecycle stems from the 1950s (Patton 1959; Levitt 1965; Cox Jr 1967; Polli and Cook 1969). Hayes and Wheelwright (1979a; 1979b) introduced the product-process lifecycle matrix as a tool for assigning processes based on the stage of the product lifecycle. The product lifecycle represents the expected sales volume or market share with respect to the stage of product development. According to traditional marketing theory, a product lifecycle typically consist of five stages: idea generation, introduction, growth, maturity and decline. Product Lifecycle Management (PLM, e.g. Grieves 2006) denotes a recent approach, initially used within manufacturing, to enable a company to manage its products all the way across their lifecycles in the most effective way. It aims to help companies get products to market faster, provide better support for their use, and manage end-of-life better. The remainder of this paragraph will

[58] The term 'lifecycle' is sometimes also associated with the fast growing area of 'sustainability'. Although the concepts in this thesis may well be applicable in a 'sustainable' context, this is not an explicit interest of this study.

discuss some further issues on lifecycle phases; the relationship with PLM will be discussed further in Chapter 6.

Modeling continuous innovation management in the literature
Many authors stress the importance of a continuous process for service development (Verganti and Buganza 2005; Sigala 2006), or the role of knowledge/learning in service innovation (Dougherty 2001; Aranda 2002; Blazevic, Lievens et al. 2003; Dougherty 2004). NSD processes are usually modeled from a one-off perspective in line with the various lifecycle stages from conception to mature product. Although sometimes a 'return arrow' is added to emphasize the continuous character of the innovation process, this has seldom been translated into a 'cyclical' innovation process. Tidd (2005), for instance, has included a 'learn' phase in the innovation process; according to Bessant and Davies (2007) this phase is implied as an optional phase to reflect on previous phases and to review experiences of success and failure. Although such a 'post mortem' learning phase clearly seems beneficial, it does not cover the intention of 'continuous innovation management' as depicted in this paragraph: a continuous process with the aim of effectively innovating a web of business components during their entire lifecycle.

Modeling continuous innovation management within Telco
Case 5-2 will discuss how Telco has applied release management at the level of technology and the overall business processes during the last decade. This will provide insight into some initiatives within Telco to formalize 'continuous innovation management', and will offer a foundation for further conceptualization. As the researcher personally initiated the 'LCM' approach described in this case, the data for this case is mainly based on observations by the researcher, combined with semi-structured interviews and documentation.

Case 5-2 – Release Management on Processes

Within Telco, apart from the New Service Development (NSD) process for 'new' innovations (Case 5-1), until 2003/2004 there was a complementary process in use for incremental innovation of IT, called 'Standard Release Management' (SRM). The SRM process was formally introduced in 2001 as part of a corporate organizational restructuring. It was meant to manage releases of IT systems by bridging business user and (IT) supplier requirements and subsequently identifying, scoping, developing and implementing new application releases within the operations organization. The process proved valuable both within NSD projects to manage IT system-related sub-projects, and during the operational phase after an NSD project to manage subsequent releases of IT systems once the main development trajectory had finished. Funding in the operational phase was on a fixed budget per year basis; this limited the number of releases per year and amount of changes per release.
Although telecom network infrastructure (TI) has a lot of characteristics of IT, the above SRM process was not applied in the networking area. However, 'platform thinking' (Case

4-1) and release management had been common practice over the years within this area. A key role in this process was that of Development Manager (Case 5-3). Although not guided by a formalized process such as the SRM process, TI platform Development Managers planned and managed releases of TI platforms based on the input by and alignment with product management, customers, operations and suppliers.
What if the SRM process, and the comparable (albeit less formalized) release management process that was used for telecom infrastructure platforms for the service function capabilities, could be adapted to the level of service management capabilities?
In 2003 the notion of Life Cycle Management (LCM) was introduced by the researcher within the Network Innovation department of the Wholesale division. The idea was to (re)apply the SRM process at the level of business processes (including IT and TI) and to learn from the practices of TI platform release management in the networking area. Goal of the introduction of LCM within this Telco department was to promote a mindset of continuous innovation management, and to prevent lengthy and costly impact analyses by naturally including knowledge management in the innovation process. The term 'Life Cycle Management' was derived from the broadly accepted eTOM (TMF 2004) framework (Case 4-3): the term lifecycle management is used in this framework to denote the innovation process-related part on the left side of the eTOM model ('Strategy, Infrastructure, and Product'; see Figure 4.9). Initially, the above 2003 LCM approach within Telco only comprised of the non-project innovation activities at the front-end and back-end of the innovation process: search and selection of the 'right' innovation projects and maintenance of the design of the 'formula' in the operational phase. However, it remained unclear how to relate non-project activities with innovation projects. Therefore, the LCM approach was re-scoped by the researcher to include three sub-processes that included all innovation activities: Direction, Development and Formula Maintenance (Figure 5.3).

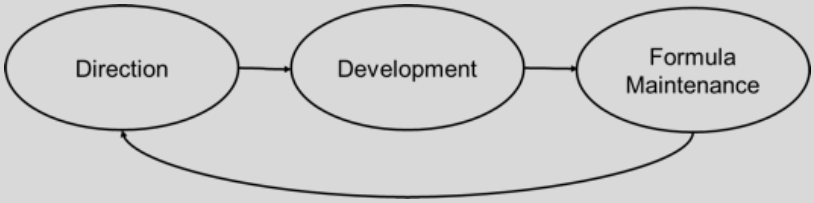

Figure 5.3 - Telco 2003 LCM initiative: three innovation sub-processes

'Direction' was meant to govern, search and select innovation initiatives, and 'Formula Maintenance' was meant to make sure that the business requirements were constantly met by (the design of) the processes. The second 'Development' phase corresponded to the extant (NSD guided) project phase in which development and implementation took place. LCM was implemented in three variants: 'Service LCM', 'TI Platform LCM', and 'Process LCM'. Service LCM was performed by Service Development Managers (Case 5-3) who acted as an interface to the commercial Product Managers of the Business Units.

The above LCM approach and associated (Service and Platform) Development Manager roles lasted with varying intensity and success in the networking operations organization until 2007. In 2007 Telco's mobile and fixed divisions were merged as part of an overall fixed/mobile convergence (FMC) vision. The LCM approach with the three sub-processes Direct, Develop and Maintain Formula was applied to model the innovation process at corporate level. However, in the course of 2007 the new organization was formed without any governance from this initiative due to other priorities and different views on the scope and pace of fixed/mobile convergence in the organization.

Discussion on Case 5-2 – Release Management on Processes

The notion of release management originates from the software industry. Van der Hoek, Hall et al. (1997, p. 159) define software release management as "the process through which software is made available to and obtained by its users". The software is usually made available in the form of a distinctive 'release' or 'version'.

... in the service management capability area release management was only conducted at the level of IT systems ...

The above Standard Release Management process was a standardized method to manage subsequent releases of IT systems within Telco. An important characteristic of this SRM process was that it was managed by the business user organization of the IT system, not within IT departments. This facilitated the inclusion of user requirements and fit with the process in which the IT system was functioning. The SRM process was formally abandoned with the formation of a centralized IT unit in 2003. From that moment, IT releases were managed by the IT department, which had a much lower involvement with the business user organization. This widened the gap between business and IT.

Despite the existence of an NSD process (Case 5-1), innovation within Telco was largely viewed as (a series of) one-off initiatives. People talked about 'NSD rockets' to denote the sequence of stages and gates of an innovation project; but who prepares the launch of a rocket (search, select, and plan the right innovation projects) and where do the rockets land after their successful launch? Aside from a hand-over to the operations organization, who keeps the design up-to-date and manages the subsequent versions of the deliverables of an innovation project during the operational phase? Given the extant release management process on TI platforms this posed relatively few issues for technological innovations in the service function capability area. However, in the service management capability area, release management was only conducted at the level of IT systems, not on the overarching level of business process modules.

As a consequence of the above one-off paradigm lengthy and costly 'impact analyses' were conducted to assess the impact of incremental/modular innovations and improvements on existing processes and integration with TI platforms. Knowledge could only be reused if specific project staff was re-assigned to new projects in the same knowledge area. And while there was an urgent need to rationalize and modularize process platforms, all too often the wheel was invented all over again, resulting in even more silos instead of less. An

important reason for this practice lay in how innovation was funded within the organization. Innovation staff was supposed to spend as many hours as possible on designated innovation projects. Also, targets were only set at the level of innovation projects. Apart from working on these projects there was little room for other innovation activities such as scanning the market, experimenting, aligning new initiatives with existing ones, sharing knowledge or maintaining the design of existing process modules.
The above 2003 LCM initiative in the networking area of Wholesale & Operations succeeded only partly in transforming the innovation process into a continuous innovation management process. The idea was that Service LCM approaches TI Platform LCM and Process LCM as 'black boxes'. However, since the Service Development Managers often originated from the TI platform area they often acted more like TI Platform Development Managers than Service Development Managers overlooking the entire product scope. Furthermore, the concept of Functional Product as a way to structure the normative output toward the product-oriented business units (Case 4-2) was not yet operationalized. Process LCM, and the associated Process Development Manager role, did not take off because of the low status of processes within the organization and different views on who should innovate the business processes. Furthermore, no effort was made yet to componentize processes (other than in the service function capability/TI networking area); this inhibited clear scoping and distribution of responsibilities.

... management was much less interested in 'Formula Maintenance' ...

Although the 2003 LCM initiative did not fully reach the intended goals, it resulted in a growing awareness among management of the need for an alternative cyclical innovation management system. A remarkable effect was, however, that management was initially very interested to be involved in 'Direction' and 'Development', but much less in 'Formula Maintenance'. Although it was emphasized that Formula Maintenance should be concerned with the business requirements and maintenance of the design of business components, and that Direction in a modular operations setup is not possible without Formula Maintenance, this sub-process continued to be associated with the low profile and (for innovation managers apparently) low interest operational maintenance. Furthermore, funding of non-project activities remained an issue. Both the Direction and Formula Maintenance sub-processes were rightly viewed as non-project-based activities; they remain relevant throughout the entire lifecycle of the business components involved. However, in the case of cost-cutting targets, these non-project activities were first on the list to be abandoned. In the service function capability area the Development Manager function/role (Case 5-3) usually combined Direction and Formula Maintenance activities. Sometimes the Development Manager also acted as the project manager during 'Development' of TI networking innovations. Only these Development activities were unconditionally appreciated by management. Along with this 'funding' issue the meaning of the term 'lifecycle management' (LCM) could vary widely: sometimes it referred to the intended combination of 'Formula Maintenance' and 'Direction', sometimes the term was used to denote a 'residual' financial bucket related to small (hard to fund) platform changes.

And there were other reasons why the above notion of lifecycle management in the service management capability area never fully took off. Operations management tend to regard process innovation as their own task. Historically, this could be explained by the predominantly manual character of Telco's operational processes until the 2000s. But highly automated operations requires specialized process/IT skills. Process developers within the innovation department frequently felt hired by Operations only to write operational 'work instructions' or to act as a last resort for process issues. This caused a knowledge gap for innovation staff because the detailed design of the actual business processes was only known (if known at all) by operations. Furthermore, it proved difficult to define the scope of the innovation responsibility in the form of 'process platforms' that were common practice in the telecom infrastructure area in the form of 'TI platforms'. This was probably one reason why the function/role of Development Manager (Case 5-3) was quite successful in the service function capability area, but did not take off in the service management capability area.

One way to recognize the practice of lifecycle/release management is to look at the use of release naming and numbering. In the networking area, most platforms were uniquely named with a Telco defined platform name. Since a platform definition encompasses the specific way Telco deploys supplier equipment, with specific 'design rules', this seems the best possible practice. Sometimes, however, the name of the supplier and/or supplier product was used. This could point to a lower level technology focus instead of an overarching business process focus. Furthermore, network platform release numbering was sometimes equal to the release numbering of the commercial product. This usually pointed to the existence of a specific product/technology silo, in which product and technology had a 'hard wired' connection.

... during the last five to six years, a number of so-called 'delivery streets'... emerged

As pointed out above, in the service management capability area few platforms/modules could be recognized. Only during the last five to six years, a number of so-called 'delivery streets' or 'production streets' emerged in the service management capability area. The scope of these entities could vary with the applied IT, the process, and the organization in which the process was running, or a combination of these. Process platform names and release numbering sometimes corresponded to the name/release numbering of the underlying IT application. This usually pointed to a sub-optimal dependency on IT planning instead of business process planning, where one would expect business process planning to be in the lead. However, the emergence of the above 'streets' including early attempts to apply release numbering clearly indicated a requirement for release management at the level of business components in the service management capability area.

In the course of 2008 the term 'lifecycle management' could not be used anymore within Telco in the above meaning because the term was used to denote a highly visible corporate program to rationalize legacy TI and IT platforms in the transmission network and telephony area. Ironically, the term lifecycle management was now used to refer to a one-

off program to manage the end-of-life of Telco's main legacy platforms as opposed to a continuous process to manage the entire lifecycle of all products and platforms.
To conclude this discussion on release management on processes within Telco we might observe that there seems to be a clear and growing need to incorporate a continuous innovation management vision in the organization. However various factors have inhibited the full implementation of such a vision until now. Only in the service function capability (TI platform) area the vision has been fully implemented and sustained in the form of TI platform release management and the associated TI Development Manager role (Case 5-3).

Conceptualizing 'open-loop' innovation management
To discuss the conceptual differences between traditional or 'open-loop' innovation management and continuous innovation management, first the open-loop model will be explained. An example of such a model is Telco's NSD process with six stages as described in Case 5-1. This NSD process is a typical example of an open-loop process that is widely applied in manufacturing. However, a large number of stages seem to suggest a linear process. In reality the process is more organic due to the intangible and simultaneous nature of services (De Jong, Bruins et al. 2003). Janszen (1994), for example, proposes an NSD process consisting of four stages with feedback loops between the stages. As a starting point for the discussion on continuous innovation management in this paragraph, an activity-stage model consisting of only two stages as proposed by De Jong, Bruins et al. (2003) will be discussed (Figure 5.4).

As a starting point … an NSD process of two stages will be applied …

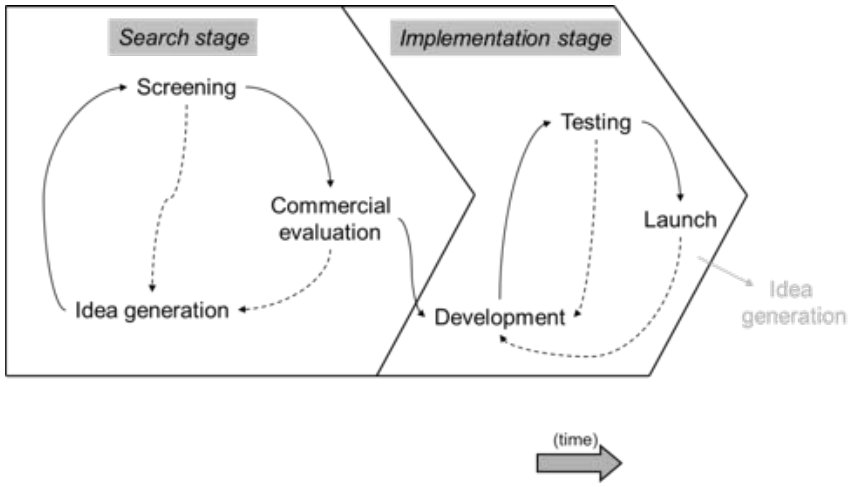

Figure 5.4 The non-linear two-stage NSD model by De Jong, Bruins et al. (2003)

This non-linear two-stage NSD model consists of six activities and allows for overlapping activities and recurring relations. In the search stage the organization generates ideas and determines the objectives for further development. In the implementation stage, the most promising ideas are transformed into concrete results. The authors observe that the model may also be applicable to manufactured products and service/manufacturing combinations. They also state that more formally managed types of innovation processes may also be supported by the model (De Jong, Bruins et al. 2003, p. 33-35).

... 'open-loop' in this section refers to the characteristic ... that innovation is completed ... without a formalized hand-over to to the innovation proces ...

The term 'open-loop' in this section refers to the characteristic of existing NSD processes that innovation is completed with the hand-over of implemented project results to operations without a formalized hand-over to the innovation process (without feed-back of business component-related knowledge into the innovation process). In this section a new concept is introduced to formalize such feed-back in the context of a web of business components as discussed in Chapter 4.
In Figure 5.5, the same model but without the six activities shown in Figure 5.4, is positioned in the innovation-operations dichotomy of Paragraph 2.6. It furthermore indicates the relationships with customers, suppliers, and other external stakeholders (e.g. research institutions).

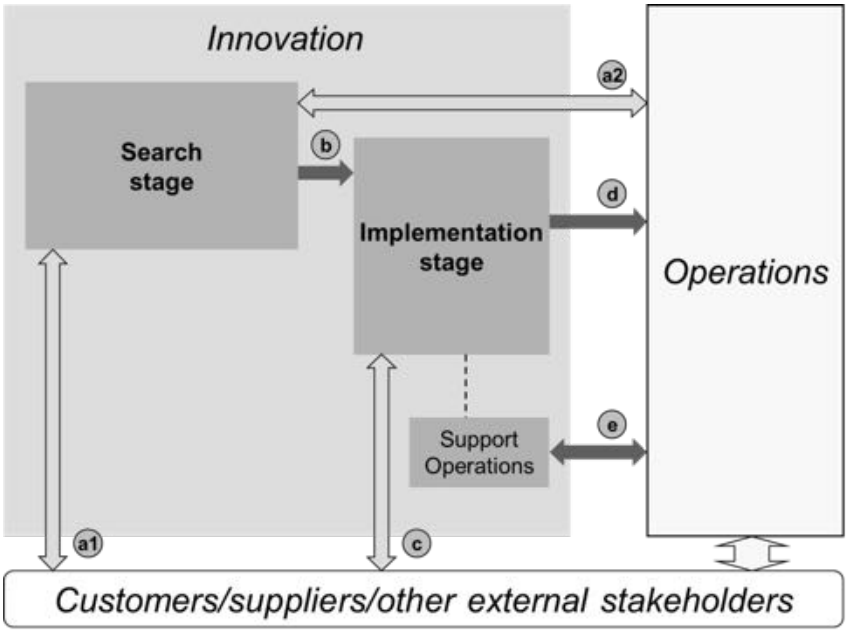

Figure 5.5 An 'open-loop' innovation management process

Note that Innovation and Operations denote corporate roles for respectively changing the prerequisites for Operations, and using/deploying these prerequisites to create and deliver value for customers and capture value for the firm (and the other supply chain partners). These innovation and operations roles need not coincide with organizational structures with correspondingly named organizational units.

The search stage covers the ('pre-project') ideation process of the fuzzy front-end (FFE; Smith and Reinertsen 1991) and the business case and business planning phase of innovations up to the point that a particular innovation has been selected, and until a (business, project, program) plan including investment decision has been taken for further 'roll-out'. This coincides with the Decision to Fund (DF) tollgate in Telco's NSD process (Case 5-1). The search stage sub-process cooperates with the supply chain stakeholders (a1) and operations (a2) during the various activities of the ideation process. This includes e.g. idea management, experimentation, concept development with customers, suppliers and other external partners, and Request for Information/Proposal (RfI/RfP) trajectories with suppliers. The search stage may be performed in a closed or open innovation environment, and may include extensive customer and supplier involvement.

If the search stage is concluded successfully, i.e. encompassing a positive (business) case for the innovation involved, the output of the search stage is an assignment (b) for the next phase, 'implementation stage', to develop and implement the innovation within Operations. Typically, the implementation stage is organized as a project responsible for delivering a more or less well-defined output. Such a project may already be prepared/started during the search stage. This implementation stage sub-process is much less 'fuzzy' than the search stage: although the innovation may still be discontinued during this phase for various reasons, the intention is clearly to finish this trajectory with a successful handover of the results to Operations (d). With this handover Operations accepts the results from the implementation stage, indicating that the operations setup will be able to meet the business requirements that formed the starting point for the implementation stage. Included in this handover is usually an agreement on temporary support by the implementation (stage) project during the operational introduction phase. However, after this initial introduction phase, the implementation (stage) project organization for this innovation will probably be dismantled, and the associated staff will at least partly be put on other (innovation) projects. If unexpected problems or new requirements emerge after introduction of the innovation, Operations will call on Innovation for support (e). However, since by then the implementation project is probably dismantled knowledge preservation can be an issue. Consequently, such support cannot be guaranteed, and may only be provided on an ad-hoc basis by staff that has formerly been involved in the implementation stage sub-process for this innovation. A comparable ad-hoc approach would be needed in case new/renewed features or incremental innovation is needed during the post-introduction phase.

During the post-introduction lifecycle stage … support … may only be provided on an ad-hoc basis …

Open-loop innovation management within Telco

The above conceptualization of the innovation management process describes common practice within Telco, as described in Case 5-1 on Telco's New Product Development process. The combination of Telco's NSD process phases 0 and 1 broadly covers the scope of the Direct sub-process. The phases 2 to 5 of Telco's NSD process cover the scope of the Implementation sub-process.

During handover from the implementation (stage) project to Operations, the ongoing development, maintenance and support of TI networking infrastructure-related parts of the innovation is usually managed by the TI platform Development Manager involved (Case 5-3), including release management on TI platforms (Case 5-2). Thus, concerning TI Platforms a closed-loop applies. If IT development is involved, since 2003 technical and functional maintenance after introduction is managed by Telco's IT department. However, this only applies to the IT application level, and not to the processes and data sets that are executed/supported by this IT. Since 2008 a separate IT unit within Wholesale & Operations (W&O) is responsible for process/IT alignment of the W&O area with Telco's IT department, acting in a demand mode toward the (Telco internal) IT department. This has somewhat improved the above issue, albeit that the responsibility of this W&O IT unit is limited to (new) reference architecture processes/IT (Case 3-2), leaving aside all other 'legacy' IT. Thus, after the implementation (stage) project has been completed (tollgate 'DH' in Telco's NSD process), innovation can only support the operations organization at the level of TI, while some support can be provided on IT. Support at the process layer (especially in the service management area) and integration can only be provided on an ad-hoc basis. Only limited measures have been taken by Telco to secure process and integration knowledge to be used for further (incremental) innovation and ongoing operations support during the entire lifecycle. This issue is worsened by the common practice within Telco that the operations departments themselves perform part of the process innovation, especially if there is little role for TI or IT. This is done after the implementation (stage) project has finished in the post-introduction phase. This practice is especially apparent during growth/up scaling. While this is understandable from an Operations perspective, Innovation may not be aware of specification changes associated with these changes. Usually, these innovations are poorly documented and not integrated into an overall process design. This is partly due to the absence of a clear owner for such a design. Furthermore, as indicated earlier, an 'outside' innovation role for process and organizational innovation is frequently not recognized/acknowledged by Telco (operations) management.

Thus, concerning TI Platforms a closed-loop applies.…

Note that the earlier mentioned business releases approach in the business market segment (Case 5-1) does not provide a solution for this continuous innovation management issue, since the business release process did not encompass measures and roles to secure knowledge on business component releases for future (re)use.

From open-loop toward continuous innovation management

Aside from the above cultural issues a structural change to the NSD process seems to be required to transform the innovation process from an 'open-loop' approach to a 'cyclical' continuous innovation management process. In a business component-based environment[59] of an ISM firm business components are designed to be contributing toward multiple other business components, and to be reused in future alternative WBC configurations involving incremental and modular innovation. To enable such reuse design and normative/actual performance knowledge of business components need to be preserved and continuously managed. Another rationale to 'close this knowledge loop' stems from the simultaneity of production and consumption due to their inseparability (co-production of provider and customer) in operational service delivery. Akamavi (2005) addresses this issue in a study on a research agenda for the financial services sector. He observes that the above inseparability implies interdependency of production and consumption between customers and (business) functions, and among functions. He refers to Grönroos (2000) who revealed already in 1990 that front-line personnel in operations performs interactive marketing (while co-producing), next to the marketing role of formal marketing departments. Cooperation between the different functional departments during the innovation process could be essential considering the divided responsibility for the ultimate customer requirements for new financial products (Akamavi 2005, p. 372). In the researcher's view, this observation equally applies to Telco and possibly other ISM firms. As a consequence knowledge on the customer performance and behavior should be continuously fed in from Operations to Innovation. Thus, both from the innovation perspective and the (related) operations perspective a 'business component maintenance' function seem to be required as integral part of the NSD process.

... it is proposed to extend the NSD process with a third formal stage ...

Therefore, it is proposed to extend the NSD process for ISM firms with a third formal stage: the maintenance stage. In Figure 5.6 the two stage model of Figure 5.3 by De Jong, Bruins et al. (2003) is extended with such a maintenance stage to form three sub-processes: Search, Implement, and Maintain. Maintain consists of four activities: Business Component Maintenance, Support Search, Support Implement, and Support Operations.

The three activities of the Search sub-process have been extended with release-related activities, intended to inventory (ideas/requirements), scope and plan subsequent releases of the business components involved. During the Implement sub-process, which activities are basically the same in a business component-based environment, new sets of business components or new releases of existing sets of business components are developed, tested and launched. During the concluding launch activity of the Implement sub-process, the prerequisites for Operations are handed over to Operations, while the prerequisites for (further incremental) Innovation are handed over to Business Component Maintenance

[59] Business component as defined in Chapter 4 in three variants in the 'Web of Business Components': Product Bundles, Value Packages, and Capability Platforms.

within the Maintain sub-process. This Business Component Maintenance activity forms the basis to support Search (mainly) during Idea generation/Release inventory, to support Implement (mainly) during Development, and to support Operations during operational deployment of the business components.
Figure 5.6 builds further on the NSD process of Figure 5.4. As in Figure 5.4, the detailed activities per sub-process have been left out of the figure, while the relations with Operations and the external stakeholders – customers, suppliers, and other external stakeholders – have been made visible. Instead of 'Search' the term 'Direct' is proposed for this sub-process to emphasize a somewhat broader scope than 'searching'. 'Direct' is intended to cover both meanings of the word: 1) direction: a 'stage director' guiding the organization through the initial phases of the innovation process, and 2) directive: deciding on the 'go/no go' of innovation initiatives, including the ultimate plan that concludes this sub-process. Furthermore, the Direct sub-process is proposed to include formulation of NSD strategy, in conformity with a number of NPD/NSD models that include some form of strategy formulation as the first step of the process (e.g. Pessemier 1977; Booz-Allen and Hamilton 1982; Bowers 1986).

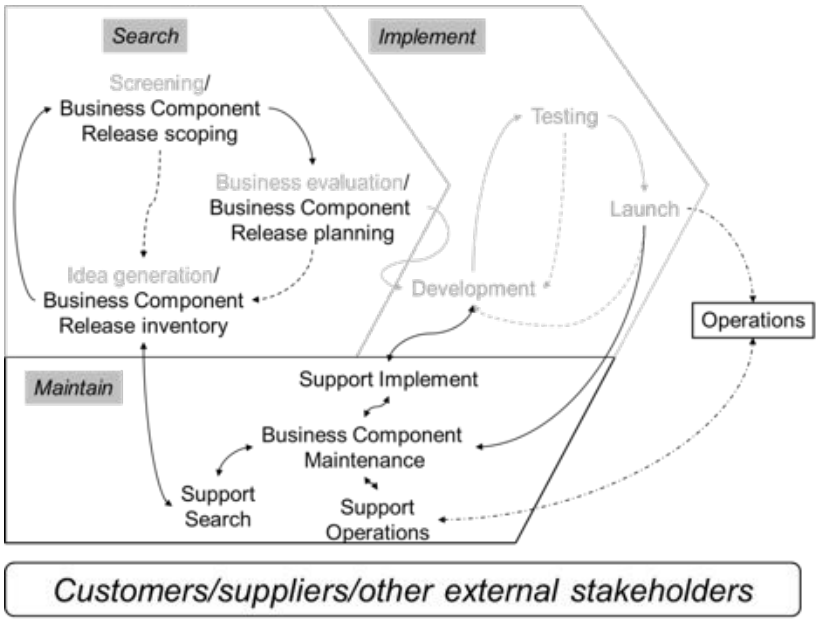

Figure 5.6 – Two stage NSD model extended with a third stage: Maintain

The Maintain sub-process corresponds to the 'Formula Maintenance' sub-process as discussed in Case 5-2. Maintain guarantees that the implemented business component, corresponding to an operational product or process, continuously meets the normative output documented for this business component. The term 'maintain' again refer to the business component level. The aim of Maintain is to monitor the business performance of a

deployed business component and to maintain this business component on delivering its normative output during its entire lifecycle. It could be viewed as the 'Check' in a Plan-Do-Check-Act cycle (Deming 1986) at the level of business components. Note that Maintain is not responsible for the operational performance of the real life operations setup that is represented by the business component, but rather to manage the business component from an innovation management perspective (including the normative performance of the business component).

The aim of 'Maintain' is to monitor the business performance of a deployed business component…

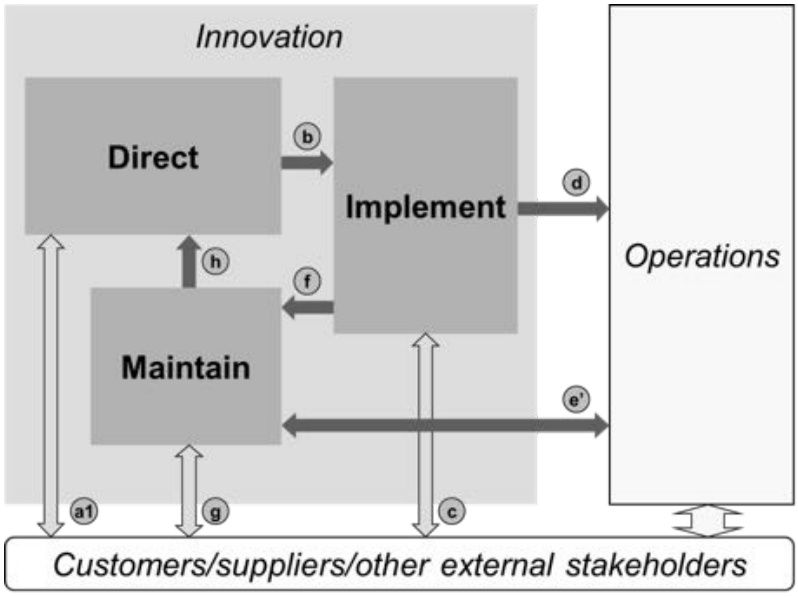

Figure 5.7 Continuous Innovation Management

In Figure 5.7, the open-loop innovation management of Figure 5.5 is extended with the above Maintain sub-process. The Maintain sub-process starts with the acceptance/handover of the business component from Implement. The Implement sub-process in this innovation management process not only concludes with a handover to Operations (d) for operability, as described above, but also includes an acceptance/handover to Maintain (f) for 'innovate-ability' or 'changeability'. The 'real' deliverables (working systems, instructed operators, operational user documentation etc.) are handed over to Operations (d), the associated 'virtual' deliverables (normative output and other specifications of business components) are handed over to the Maintain innovation sub-process (f). The latter acceptance/handover indicates that Maintain is capable to take (from that moment) innovation responsibility for the business components involved. This handover will typically happen when Implement

can ‘prove’ to Maintain that the design of the business component is capable to operationally perform according to the normative specification, and that the business component has been adequately documented to perform the Maintain sub-process during the entire lifecycle of the business component.
After acceptance of the business component by Maintain, Maintain is responsible for

- Maintaining the corresponding catalog item of the business component: naming, release information, specification (normative output and design), and maintaining and optimizing the current operational (release of the) business component to secure the actual business performance against the specified normative business performance. This includes the coherence of the business component with related business components, both within the same layer and with business components in the other layers, including supplier contributions (g).
- Supporting Implement during development/implementation of new business components and subsequent releases of business components.
- Supporting Operations in meeting the normative output of the business component, including ongoing instruction/training in the deployment of the business component; assisting Operations in executing small changes (within the limits of the current design) etc. (e’).
- Collecting and discussing change requests and requirements from Operations, both to meet the current normative output, and as part of the definition and specification of innovations planned by Direct (e’).
- Feeding Direct with advices on required changes and business component release management to maintain and improve the business performance of the business component (h).

In continuous innovation management, the Direct sub-process does not only direct and plan for one-off innovations, but continuously collects input from the Maintain process to scope, analyze, plan and monitor (Implement) progress of new releases of the business components. Note that the scope of this kind of release management goes far beyond the usual scope of IT release management: it combines input from customers, operations, suppliers, other supply chain stakeholders, and market/technology intelligence to direct innovation at the level of business components. The Implement sub-process is least changed in this continuous innovation management process compared to the open-loop process. The only difference with the two stage open-loop approach is that Implement is now driven by the release planning of business components. This poses additional emphasis on practices (e.g. program management) to manage the dependencies between the various business component releases.

… the scope of release management goes far beyond the usual scope of IT release management …

Table 5-1 summarizes the main characteristics of the three innovation sub-processes. Note that all three sub processes include contributions by and interaction with external partners,

notably by suppliers and customers. The Direct sub-process includes, for example, selection of supplier goods and services and customer pilots. Via RfI/RfP trajectories suppliers are selected and supplier contracts made. In the operational phase new supplier products/releases are included in the business component release planning. Implement includes sourcing of supplier goods and services in conformity with the contracts made by Direct and implementation within Operations. Customers are e.g. involved in early product testing and introductions. On the supplier side Maintain includes regular supplier contacts to discuss the operational performance of the supplier goods/services delivered. On the customer side Maintain includes customer panels to discuss the overall product performance with customers. The table also shows the main competencies for each of the sub-processes.

Table 5-1 - Main characteristics of the three innovation sub-processes of CIM

	Direct	Implement	Maintain
Goal	Translate the corporate strategy to innovation goals. Direct the ideation process and search, select and plan business opportunities to be developed and implemented	Develop and implement planned business opportunities into effective prerequisites for operations. Provide a foundation for continuous innovation	Secure the normative output and specifications of operational business component releases. Support Operations during deployment and support 'Direct' on business component release planning
Release management role	Inventorise, scope and plan business component releases. Plan and monitor development and implementation progress on business components/releases	Develop and implement business components/ releases in Operations and 'Maintain'	Maintain current operational business component releases
Main focus	Doing the right innovations	Doing the innovations right	Secure the business performance of the implemented innovations/releases
Main output	Viable innovations/releases Mandate for 'Implement'	Prerequisites for Operations Normative output and other business component specifications for 'Maintain'	Support Operations (e.g. with small changes within the 'formula') in Operations Support 'Implement' Support 'Direct'
Main competencies	Business orientation/integration Entrepreneurial skills Management skills Creativity	Execution power Design skills Organisational change skills	Operational insight Customer and service orientation Quality assurance skills

Continuous Innovation Management on the Web of Business Components

Figure 5.8 shows the continuous innovation management framework applied on all three layers of the WBC, including the relation with Operations and external stakeholders.

... strategic innovation includes all innovation activities that go beyond the 'business-as-usual' innovations ...

Although some innovation tasks may be done per PB/VP/CP layer, e.g. operations support on a particular CP, most activities require coordination between the three layers to enable a coherent output (Figure 5.9). The left column, Strategic innovation, includes all innovation activities that go beyond the 'business-as-usual' innovations, e.g. actively exploring a complete new business model, a new process architecture, a new branding structure etc. This column should drive the search for radical and architectural innovations. It encompasses strategic level processes

including business modeling, strategic (business component) portfolio management, road mapping, scenario planning, and business planning.
The Innovation & Business Component Lifecycle Management column encompasses the (tactical level) Direct and Maintain processes. It includes most of the fuzzy-front-end of innovation, starting off with NSD strategy formulation, ideation, prototyping, customer interaction etc. This column also includes, mutually aligned, component release management and operations support. This 'tactical' Innovation & Business Component Lifecycle Management column forms the core area of continuous innovation management since this function is responsible for continuously and coherently innovating the entire web of business components.

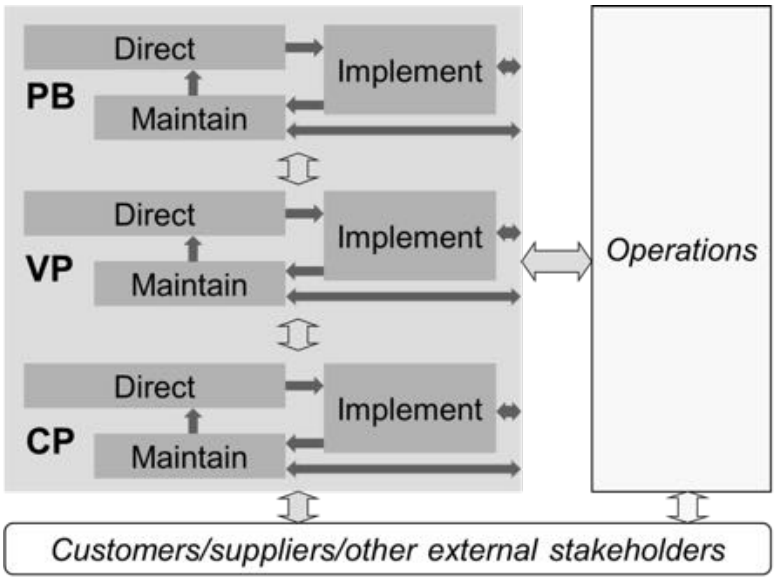

Figure 5.8 Continuous innovation management on a Web of Business Components

The Implementation column realizes coherent innovations within Operations. This includes the initial business component set-up as well as implementations of new releases of business components, usually managed by a project organization. For most Implementation projects alignment between the three layers is required to enable a coherent market launch of a new product and/or a coherent process implementation. The application of program management seems an adequate method to realize such alignment. Within Telco's business customer segment, from 2008 until 2010 the notion of 'business releases', implemented by means of innovation programs, was applied as a way to coordinate related development and implementation activities (Case 5-1). Although not yet geared at business components, this proved a good way to manage related activities in various projects and organizations to obtain a coordinated market launch for new products. In the vertical structure of Figure 5.9 business release management is mainly performed in the Innovation and Business

Component Lifecycle Management column (guided by Strategic Innovation), while program management is specifically relevant in the Implementation column.

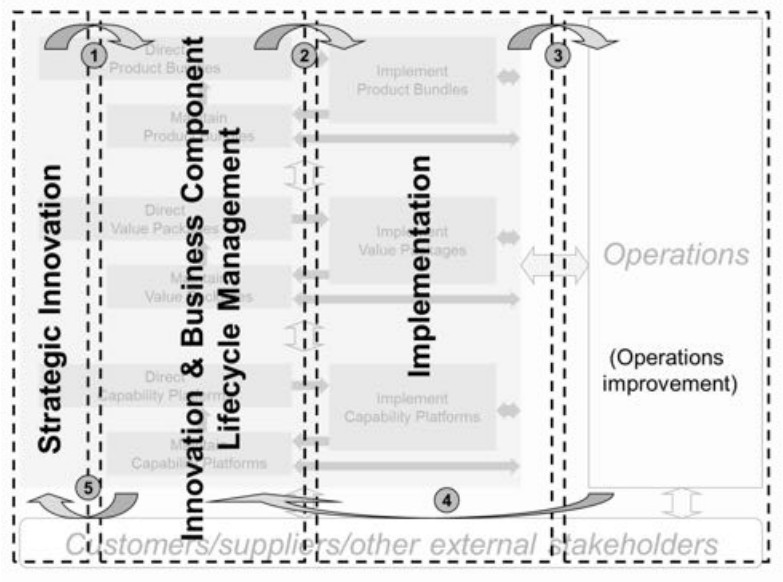

Figure 5.9 Different modes of innovation

The arrows in Figure 5.9 re-iterate the cyclical character of the innovation process in ISM firms. They represent a tactical feed-back loop as well as a strategic feed-back loop. Arrow 1 denotes the strategic direction to direct the 'right' innovations by 'Innovation & Business Component Lifecycle Management'. Arrow 2 denotes the mandate to implement the right innovation programs/projects. Arrow 3 denotes the implementation of the innovations within Operations, and preparation of the hand-over of business components to Maintain. Arrow 4 denotes the feedback from Operations to the innovation process, and Arrow 5 shows the feedback toward Strategic Innovation. Apart from (continuous) operations improvement[60] within Operations (outside of the innovation process) there are two continuous loops: a tactical loop from Innovation & Business Component Lifecycle Management toward Operations vice versa, and a strategic loop from Strategic innovation, via Innovation & Business Component Lifecycle Management toward

... the arrows ... represent a tactical feed-back loop as well as a strategic feed-back loop ...

[60] The term 'operations improvement' is used here to denote changes within Operations themselves (within the design rules of the business components involved, posed by Innovation) to improve the performance of Operations. The term 'continuous improvement' is not used for this purpose because the scope of this term usually has a more paradigmatic meaning, and varying scope: e.g. between TQM programs (Davenport 1993) and 'continually innovating process capabilities (Boynton, Victor et al. 1993).

Operations, and vice versa. Note that all columns in Figure 5.9 include input/feedback from the supply chain stakeholders and the larger external environment.

The role of the innovation sub-processes during the business component lifecycle phases

In the literature various lifecycle schemes have been described, e.g. Plan, Design, Build, Support, Dispose (Grieves 2006). Many lifecycle schemes have been devised for application within manufacturing. This is reflected e.g. in stages like 'engineering', 'manufacturing' and 'after-sales' (service) following 'sales' (of goods). Some lifecycle schemes only cover the operational phase, excluding pre-operational and post-operational phases. This is e.g. the case in the 'classical' product lifecycle scheme: introduction, growth, maturity, and decline. Other schemes do include pre-operational and post-operational phase, like the above scheme by Grieves. Lusch, Vargo et al. propose a 'service life cycle management' (SLCM) framework by applying a service-dominant logic consisting of the phases: "service conception, delivery, continuing conversation and dialog among the service provider and recipient and perhaps the service community, on-going service evaluation, and co-creation of revised service offerings to include providing a framework to decompose the network" (Lusch, Vargo et al. 2010, p. 28).

For the purpose of this research a generic seven-stage lifecycle scheme will be applied ...

For the purpose of this research a generic seven-stage lifecycle scheme will be applied that may be used at the level of lifecycle stages of business components (releases). It includes the pre-operational phases Conception and Development, the operational phases Introduction, Growth, Maturity, and Decline, and the post-operational Phased-out phase. The exact implications of these stages may vary for each type of business component, e.g. 'growth' for PBs may relate to market(ing) aspects, while for CPs it may relate to sizing/scaling issues.

In the Conception phase, finishing with a decision to invest in a business opportunity via a new/renewed business component, Direct is in the lead. Implement is involved to prepare the Implement phase, and Maintain may already be involved to infuse operational knowledge concerning a comparable or earlier version of the business component. In the Development phase Implement is in the lead. Direct stays involved to mandate the assignment and monitor progress. Maintain comes into picture to prepare the Maintain role. The Development phase is finished if the business component is successfully implemented in Operations and Maintain. Subsequently the operational phase of the business component starts with the Introduction phase.

During Introduction of the new/renewed business process all sub-processes are involved to successfully introduce the business component. During Introduction improvements will probably be executed by means of the existing (Implement) program/project organization.

In the Growth phase Maintain monitors the actual business performance against the normative performance of the business components during the rapid growth of the number

of customers and CP usage. To cope with new requirements during the Growth phase both Direct and Implement have a role to conceptualize, develop and implement innovations. During the Maturity phase Maintain still has an important role to monitor the actual business performance against the normative performance. Direct plans the preferred Decline path for the business component and Implement implements (mostly minor) releases with incremental innovations. The Decline phase requires Direct to prepare, and Implement to manage the phasing-out of the business component involved. This could take the form of disposing of hardware, selecting a new supplier to replace a CP for a VP that remains in business, or planning and managing the migration of customers from one environment to another. During the Decline phase Maintain has an important role to monitor continuity in the business performance during this transition period to phasing-out of the business component.
After a business component (release) has been phased-out (Phased-out phase), in many cases its role has been taken over by another (release of the) business component. In any case it is beneficial to preserve the basic knowledge of the business components by the Maintain sub-process for eventual future use. Although business components clearly face an end-of-life, this is not the case for most of the roles involved in the innovation sub-processes. Thus, generic knowledge of the various business components may be reused while conceptualizing and developing new/replacing business components etc. This is another way in which the innovation process is transformed into a continuous process.

Innovation sub-processes are decoupled from lifecycle phases
The three CIM sub-processes (Direct, Implement, and Maintain) are decoupled from the lifecycle phases. They only initially (during the conception of new business components) equal these phases: while implementing an entirely new service with various business components the initial focus is on Direct, then focus shifts to Implement, and finally a hand-over takes place to Operations and Maintain. With an 'open-loop' approach to innovation (no changes at all after initial 'roll-out') there would be no need to differentiate between lifecycle phases and innovation sub-processes. Even the need for a separate Maintain sub-process with a feedback loop into Direct could be challenged if component maintenance would not be related to ongoing innovation direction and planning. In reality the developments go in the opposite direction: in a constantly changing environment the initial roll-out is just the start of a series of innovations over the years. This effect is amplified if the number of business components decreases as a result of ongoing modularization and rationalization: with fewer components the mean number of changes per business component will increase given a certain overall innovation volume. Note that the need for changes in the various business components may decrease by a smart definition, design and development of modules.

The three innovation sub-processes are decoupled from the lifecycle phases …

Once a modular fabric of business components is operational all three innovation sub-processes may be executed in parallel on (combinations) of the various business

components involved for ongoing incremental/modular innovation. And the lifecycle of each business component may vary. This explains the requirement for decoupling of innovation sub-processes and business component lifecycle phases.

Innovating in an environment with reusable business components

With the Web of Business Components and Continuous Innovation Management frameworks in place, the character of the innovation process may change dramatically. Given reusable components in each PPB area, new innovation opportunities are, as a first step in the innovation process, be assessed on reusability per layer.

With the WBC and CIM frameworks in place, the character of the innovation process may change dramatically …

The next section provides an illustration of how innovations emerging in each of the PPB areas may be managed by Continuous Innovation Management in an ISM firm. In Figure 5.10 reuse is visualized by using the metaphor of 'boxes and switches'. A box denotes a CP. A switch represents the capabilities that can be chosen by the customer (either directly, e.g. via a web-based product configurator, or indirectly by the ISM firm). Switch values represent the variants or parameters that may be chosen for each capability.

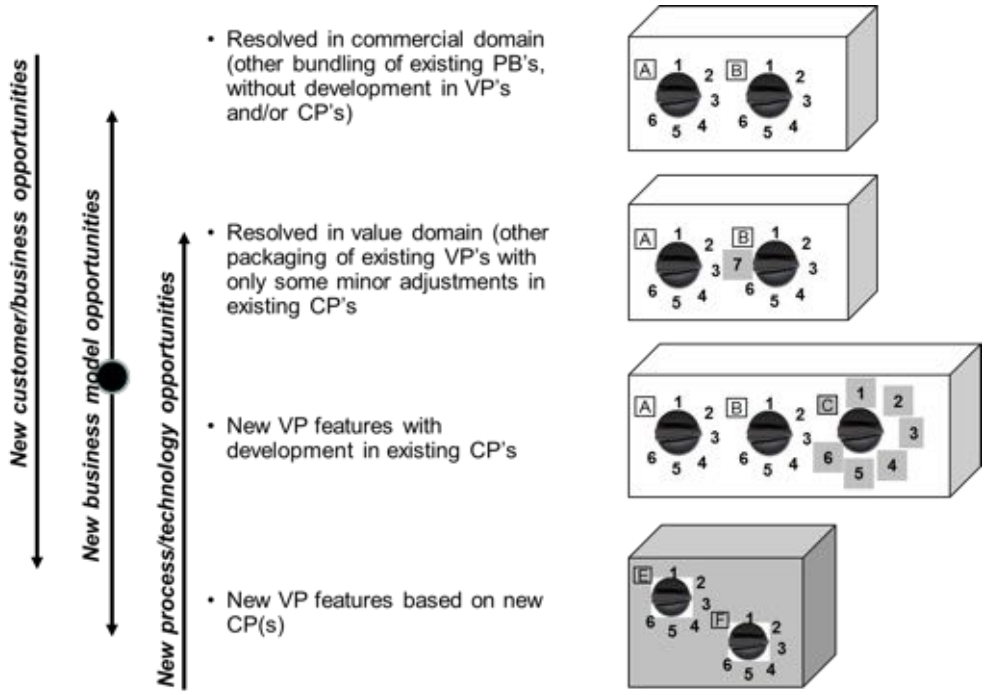

Figure 5.10 Innovation based on reusable components on multiple WBC layers

Innovations may emerge from three directions: they may either come from new customers or business opportunities ('north bound' in the figure), they may come from new processes or technology ('south bound'), or they may come from business model opportunities. If a new opportunity emerges from a new customer or business need it may be possible that the opportunity could be fully met in the commercial domain by an alternative PB. If this is not the case, a new VP feature could be provided by an alternative configuration of one or more CPs. If this is not possible, a new VP feature could be provided by some development in one or more CPs. If all of the above steps were not possible it may be necessary to develop a completely new VP with one or more new CPs. A new opportunity emerging from a new process or technology capability, or a new opportunity for business model innovation should likewise be discussed in terms of reusability on each layer: it could result in either of the above options.
The above assessment on each of the layers (PB, VP, and CP) is done by reviewing the release planning of each of the business components involved, including timing aspects of the various releases. Such an assessment could either result in alternative releases for one or more existing business components or mark the start of an ideation process for a new innovation. At a strategic level there may be innovation opportunities that could/should potentially sweep away individual business components or complete chains of business components.

Continuous innovation management within Telco
Within Telco, until now continuous innovation management (CIM) at a business component level, including the Maintain sub process, only applied to some extent to areas where some form of business components, including related continuous innovation roles, already existed: (external) Telco products and TI platforms. Thus, until now the VP layer and the (non-TI-based) service management capabilities of the CP layer were hardly subject to a continuous innovation management process.

... until now CIM only applied ... to areas where some form of business components already existed ...

As discussed in Chapter 4, recently some progress was made in operationalizing VPs within Telco in the form of Functional Products (Case 4-2). Some catalogs with proposed Functional Products have emerged, and various departments are picking up responsibility to maintain the catalogs. However, these initiatives are still in its infancy: multiple catalogs exist, and naming and versioning of Functional Products vary among the catalogs. Moreover, even the term 'Functional Product' itself has not yet a common meaning within Telco. The scope still varies between merely the service function (TI platform-based) capabilities and the full package of (both service function and service management) capabilities as delivered toward the three customer segments.

5.4 Continuous innovation management roles and organization

A continuous innovation management process can only be successful if the various roles, and the organizational embedding of these roles, are clear. In Paragraph 5.3 three innovation sub-processes (Direct, Implement, and Maintain) within the Continuous Innovation Management framework have been identified and described from the perspective of the business component. Already some remarks have been made on organizational aspects concerning the three sub-processes. This paragraph will discuss the roles related to the sub-processes, as well as how the sub-processes could be organized.

The innovation sub-processes Direct and Maintain are central to the continuous character …

Much has been written on innovation roles or 'key person' concepts for innovation processes (Allen 1970; Witte 1977; Galbraith 1982; Hauschildt and Schewe 2000; Hauschildt and Kirchmann 2001). It is beyond the scope of this study to discuss the literature on this subject. This paragraph will concentrate on the main requirements concerning innovation management roles related to the Continuous Innovation Management framework.

The innovation sub-processes Direct and Maintain are central to the continuous character of the Continuous Innovation Management concept of this chapter. Associated innovation management roles seem to call for a positioning as line organization roles because they are relevant during the entire lifecycle of the business components that are to be directed and maintained. The Implement sub-process is typically performed by a temporary program/project-based organization.

Continuous innovation management roles within Telco

In the next case (5-3) the Telco function/role of Development Manager (DM) will be discussed. This is an interesting role because the Development Manager combines the Direct and Maintain sub-processes (and sometimes even parts the Implement sub-process), and proved pivotal within the networking (service function capability) area during some 15 years. In the case, the DM role will also be compared with the Technical Product Manager (TPM) role, another Telco role with some aspects of continuous innovation management. Just as in Case 5-2, the researcher personally contributed to the concepts described in the case, notably the 'Development Manager' role. Consequently, the data for this case is primarily based on observations by the researcher, combined with a document review and semi-structured interviews.

Case 5-3 – Development Manager role

Within an international data networking services subsidiary of Telco, in 1994 the function of Development Manager was developed[61] as the process counterpart of the Product Manager. During Telco's transformation from network utility provider to product supplier,

[61] By the management team of the development department of this subsidiary, including the researcher himself.

product management became an important role, geared to define, develop and manage the product portfolio to be offered on the market. The motive to define the Development Manager function was to free the Product Manager from the ‘how’ aspects of the service offerings and to establish a close enduring relationship with operations and the suppliers. Although there was still a one-to-one relationship between de Product Manager and Development Manager within product-based silos, a clear separation of responsibilities between the ‘what’ and the ‘how’ of a certain product group applied. The Development Manager was responsible for the design, development and implementation of the process set-up (service function and service management capabilities) and for subsequent development of these capabilities during the operational lifecycle phase. Furthermore the Development Manager was responsible for the initial supplier contacts during the Request for Information/Proposal (RfI/RfP) phase and supplier management concerning further development of purchased goods and services. In the operational phase the Development Manager remained responsible for the design of the entire service production set-up and the interface with product management and operations.

When the above-mentioned subsidiary became part of Telco in 1999, the Development Manager function was sustained for the related product area of the former subsidiary. During a reorganization in 2002 within this area, the function was further developed in the data networking operations area to accommodate for generic processes for multiple products. To function in a de-siloed set-up, the Development Manager function was developed into three variants: Service Development Manager, Platform Development Manager and Process Development Manager. The Service Development Manager was responsible for the delivery of the appropriate service capabilities (resembling Value Packages in terms of Chapter 4 business components) to product management against an agreed cost level. This Service Development Manager role is crucial for the translation of the ‘what’ by product management into the ‘how’ of the processes, but the processes themselves are still somewhat handled as black boxes. The Service Development Manager interfaces with Platform Development Managers and Process Development Managers to innovate respectively the intended service function and service management capabilities. The Platform Development Manager and Process Development Manager open up the black boxes; they are responsible for the continuous development of the platforms and processes, including related IT. The three functions were accommodated in three separate departments within one innovation department to clearly separate interest/knowledge areas. Of these three variants only the Service Development Manager and Platform Development Manager role became operational. Although some process (chain) managers tried to pick up the Process Development Manager role, this never came off the ground.

The Development Manager function was formally abandoned after 13 years during a corporate function rationalization in 2007. However the role is still applied, notably in the service function/TI platform area. From that time, the role was mainly performed by ‘architects’ and ‘consultants’.

Technical Product Manager role

In 1998, within Telco itself a somewhat comparable function was implemented, called Technical Product Manager (TPM). The function was established during the implementation of multiple business unit-related operations units within one large Operations department (Paragraph 2.3). The Technical Product Manager was bundled as the key role within a so-called 'Front-Office' that was formed just a little later. The Front-Office was a special department within Operations that formed the central entry point to the various operators (within Operations) for business unit (BU) product management. The Front-Office was organized in accordance with the Business Unit structure. The idea was that this Front-Office should act as a bridge between the two parties to enable better steering of 'factory' priorities based on cost allocation and facilitate 'profit & loss' responsibility for the Business Units. Until the formation of the Front-Office, Operations was a predominantly internally oriented technology unit. The Front-Office was concerned with innovation activities as well as (tactical level) operations, managing the Service Level Agreements (SLAs) between the Business Units and Operations. Note that these contacts only related to TI-networking-related service function capabilities, not to the service management capabilities (eTOM Fulfillment, Assurance and Billing; Case 4-3). Although initially the business units were reluctant to accept an additional party in the chain from business unit to operator, they gradually became enthusiastic by the notion that they would have some 'switches' to manage the factory for their business.

An important planning tool for the Front-Office was the so-called 'product diabolo', a cost modeling tool based on Telco's Product Structure model (Case 4-2). In this product diabolo commercial Telco products were related to functional products that were in turn related to so-called 'half manufactures' that represent the 'technical products'. Within Operations itself attempts were made to apply Activity Based Costing (Turney 1990) to assign operations costs.

In the year 2000 the above Front-Office organization was (after some 1,5 year of existence) abandoned, coinciding with an organizational restructuring involving an alternative business unit and operator structure. Technical Product Managers were relocated to the business units and the individual operators. Some became Commercial Product Manager (sometimes de- facto continuing in a technical role). Others remained Technical Product Manager, with varying responsibilities depending on their landing place. Within the W&O organization that started with the corporate restructuring of 2007, a department called Technical Product Management was formed, responsible for monitoring the SLAs between the customer segments and W&O concerning the TI-platform-related service function capabilities. This department did not have any formal responsibility for innovation-related activities.

Discussion on Case 5-3 – Development Manager role

The original Development Manager function that was conceived within Telco's subsidiary in the 1994 was intended to cover all service function and eTOM SRMO-related service management capabilities (Case 4-3). During the transition of the Development Manager function from the data networking services subsidiary to Telco in 1999 the function

organizationally landed in an innovation department that was related to service function capabilities only: service management capabilities were left to multiple IT departments and operations. The scope of the function did not anymore include the entire process area, but became limited to the TI platform-based service function capabilities. Although this specialization was understandable given the much broader scope of the SRMO process area of Telco compared with the former datacom business subsidiary, this development implied a step back in the value of the Development Manager for the organization.

The Development Manager is a high professional at the level of middle management …

The Development Manager is a high professional at the level of middle management. The function combines professional and managerial skills to (predominantly informally) manage the 'Innovation & Business Component Lifecycle Management' task (Figure 5.9) that encompasses both the Direct and Maintain sub-processes for the assigned platform areas. In many ways the Development Manager resembles the 'chief engineer' that forms one of the cornerstones of Lean Manufacturing in Toyota's Production System (TPS). The development of a 'chief engineering system' to integrate development from start to finish is presented as one of the people principles of lean product development. Liker and Morgan (2006) describe this as follows: "The chief engineer is the master architect with final authority and responsibility for the entire product development process. The chief engineer is the overarching source of product and process integration. The chief engineer is not just a project manager, but a leader and technical systems integrator. The chief engineer is not a manager in the traditional sense. The chief engineer is an engineer in the ideal sense. The chief engineer is the chief architect and systems integrator. They have a remarkable combination of technical depth, systems awareness, market savvy, and leadership skills. At the end of the day it truly is "the Chief Engineer's car" (Liker and Morgan 2006, p. 12/13). In the same article Liker and Morgan argue that service companies may have an additional concern to implement 'lean' principles in that service professionals are knowledge workers that, more than factory shop workers, expect autonomy and creativeness in their work.
In the researcher's experience the most effective examples of Development Managers within Telco were highly respected by the engineers and service developers (and line management) as the informal leaders of their 'platform' area just because they combined high professional and managerial skills in an inspiring and non-threatening way[62]. In many respects they acted as an entrepreneur in their area. Ideally, the Development Manager has a balanced attention for all his/her direct stakeholders, notably product managers, operations and suppliers. The required attention is dependent on the lifecycle of the business components involved. And of course, the actual attention is also somewhat dependent on the personal interest of the Development Manager: business oriented Development Managers tend to prefer contacts with product management, marketing and

[62] These skills relate to all three 'promoter' roles as proposed by Hauschildt and Kirchmann (2001, p. 41-42): technology promoter, process promoter and power promoter.

customers while operations oriented Development Managers spend more time/attention with operations and suppliers.
Although the function of 'Development Manager' disappeared in a corporate function rationalization initiative in 2007 most former Development Managers still present themselves and are still regarded as 'Development Manager' despite their new function name. This again shows the persistence and strength of the role in the organization. And this persistence may facilitate a future revitalization of the role in the service function capability area-related CPs, and the extension of the Development Manager role to service management area-related CPs. However, the functions 'architect' and 'consultant' that performed the Development Manager role in a later stage, do not intrinsically have the flavor of 'continuous innovation management' as depicted in this chapter. Especially the function of consultant seems to represent a role that may be hired for a one-off assignment. And both roles do not encompass a continuous 'management' responsibility to Maintain and Direct business components from an innovation perspective.

Comparing the Technical Product Manager to the Development Manager role
The Technical Product Manager may be discussed in the two given variants: 1) within Operations Front-Office during 1998-2000, and 2) dispersed in two main organizational categories in the organization, both within Operations and within Business Units (from 2000-2007) or Customer Segments (from 2007 onwards). The Technical Product Manager during the Front-Office period could be viewed as a role residing on the VP layer, and performs both the innovation-related Direct and Maintain and a 'tactical' operations role. In the operations role he/she manages the Service Level Agreements (SLAs) related to the Operations-related CPs as well as the Business Unit-related PBs. However, during this period the level of business componentization as discussed in Chapter 4 was relatively low. Furthermore, the scope was (again) limited to the TI-Platform-related service function capabilities. Although the Front-Office was organizationally located in Operations Technical Product Managers could operate relatively independent on the interface between the business units and the operators. The Front-Office had an important role during the yearly budgeting process for both innovation prioritization and ongoing operations. The task was much more difficult during the year, especially on the innovation part of the Front-Office task. The Technical Product Managers were squeezed between the interest of the business units, requiring swift reaction on market/customer requirements and short time-to-market for new features, and the operators that were expected (by Operations management) to efficiently provide a stable base of network-related service function capabilities. In fact this charter was never accepted by business unit management. As a result the business units regularly viewed the Front-Office a blocking factor for innovation and looked for direct contacts within operator staff, trying to by-pass the Front-Office.

...the scope was (again) limited to the TI-Platform-related service function capabilities ...

After the Front-Office organization ended in 2000, Technical Product Managers dispersed all over the organization. As governance on the role diminished the role could be filled-in in many different ways, depending on the landing place. In general the responsibilities of the role became fuzzier. Sometimes the Technical Product Manager acted as an assistant to (Commercial) Product (Portfolio) Management to direct the innovations within the operator. However, this had varying success since the operator was too far away, both organizationally and mentally, for the Technical Product Manager. Sometimes the function was renamed Commercial Product Manager, even if they had little affinity with and knowledge of product management and marketing. Note that in general this role differed in one crucial aspect from the Development Manager: while the Development Manager was empowered to be responsible for the development of all 'how' aspects of the service this role could hardly be assumed by Technical Product Managers in the Business Unit. Both the Development Manager function/role and Technical Product Manager function/role include both 'promoter' and 'gatekeeper' aspects (Hauschildt and Schewe 2000). An important difference between the two roles is that a promoter role is associated to one specific innovation, while the gatekeeper role is not associated to a specific innovation. The gatekeeper acts as a continuous factor using his/her relationships, information and communication networks to adopt multiple innovations (sponsored by one or more promoters per innovation project) (Hauschildt and Schewe 2000, p. 99-101).

... the Development Manager proved to be crucial in the transition from product/technology siloes toward modular business components ...

Especially the Development Manager proved to be crucial in the transition from product/technology siloes toward modular business components in a horizontalized structure by means of a continuous innovation management process. The main role of the Development Manager was a gatekeeper role acting as a continuous factor in a combined Direct/Maintain role during the entire lifecycle of a (capability) platform. Additionally, most Development Managers acted as a technology promoter, and some also (temporarily) assumed the role of process promoter or power promoter (Hauschildt and Kirchmann 2001, p.41-42).

Horizontalization and the consequences for innovation roles within Telco

In Chapter 2 the concept of 'horizontalization' has been discussed. Figure 5.11 shows this transition within Telco from vertical silos toward a layered horizontal structure[63]. In the past, notably in the product supplier era (Chapter 2), product and technology were combined in vertical silos. Each silo could quite adequately bring single products to the market, but there was limited communication between the silos. Hence, customers were required to integrate products from various silos for their own business application.

[63] To explain the main consequences for organizational roles, in this section a broad simplified view is given on the organizational developments related to horizontalization.

Horizontal overlay structures, by organizationally combining functions from various silos, could provide some integration for customers. However, the potential of such overlay structures to provide truly integrated service products to customers was often limited to providing combined service products to large corporate companies via temporary program/project organizations.
The horizontally layered modularized structure on the right side shows a future WBC-based vision aiming at the combination of customer orientation and operational efficiency. Customers may receive integrated solutions from customer oriented organizational units on the top end. This layer corresponds with the PB layer from the WBC. The lowest layer shows the cost efficient and flexible CPs, both in the service function and service management area. This layer corresponds with the CP layer. The middle layer, corresponding with the VP layer, connects the upper and lower layers in such a way that the intended value creation, delivery and capture forms the foundation for both the PB and CP layer, and optimal component reuse is induced in all layers by applying standardized reusable modules. Although some other, notably technology-related, horizontalization perspectives still exist within Telco, this horizontalization perspective seems to be the main challenge because it combines all product and process-related aspects of both the service function and service management capabilities[64].

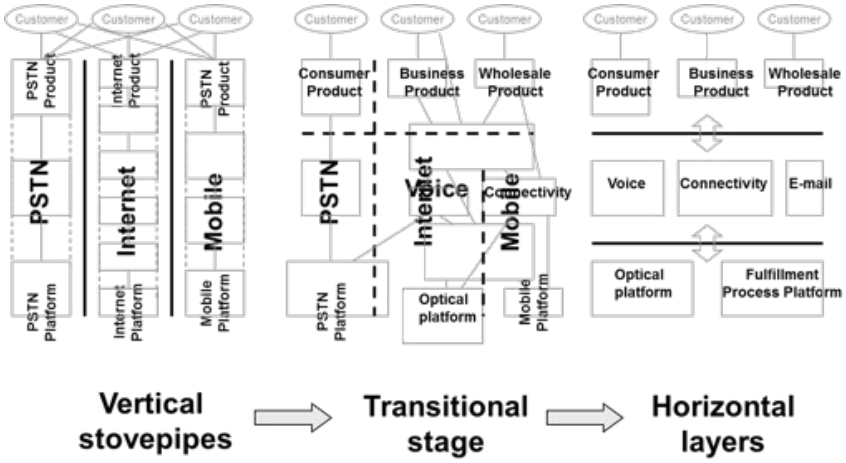

Figure 5.11 Transition from vertical silos to horizontal layers

Currently, Telco seems to be in the midst of a transition between these two extreme scenarios (middle scenario of Figure 5.11). Some silos have been dismantled, and some horizontal structures have been implemented. Although most silos cannot easily be distinguished anymore – most organizational silos have been abandoned – most silos are still deeply embedded in the legacy IT and data structures. Some, but certainly not all, required product integration for customers has been established. And some CPs (aside from

[64] In contrast to horizontalization variants like the tripartite 'applications-middleware-pipes' (Fransman 2002) which have a complementary rationale, but are limited to the service function capability area (Paragraph 2.7).

the service function capability area) provide generic capabilities for multiple VPs or other CPs (e.g. segment-based customer self-care; generic fulfillment production lines). However, it has not been agreed how this hybrid silo/horizontal fabric should work together on a generic level, both during innovation or during operations. The consequences for the innovation process, including the consequences for the prerequisites for Operations, have been extensively discussed in this thesis. At the Operations level itself, it is hard to guarantee service levels. Of course, operations does its best to deliver the agreed service levels to customers by operating the existing processes and systems, but this is not embedded in an overall chain structure.

Telco innovation roles in the three stages

How does this translate to innovation roles? Figure 5.12 shows the consequences for innovation roles in the three phases. The innovation roles are represented by (black, grey, and white) 'caps' in the figure. This discussion specifically covers the 'Innovation & Business Component Lifecycle Management' area of Figure 5.9, with the main innovation roles related to the Direct and Maintain sub-processes as discussed in Paragraph 5.3.

In the vertical silos of the product supplier era (Figure 5.12, left) innovation within each silo was entirely managed by the associated Product Manager. Although most operations within Telco have always been organized in separate operations units (often in a one-to-one relation with the corresponding business unit, refer to Chapter 2), in the product supplier era the Product Manager acted as the de-facto manager of all innovation activities within the entire silo ('black caps' in Figure 5.12, left). In terms of the three innovation sub-processes of Chapter 4, the Product Manager managed Direct, Implement (usually via project organizations), and Maintain. However, these innovation sub-processes could not yet be distinguished by that time. Another innovation management role was the Technical Infrastructure (TI) CP manager, dubbed Development Manager ('grey caps' in Figure 5.12, left; refer to Case 5-3). Service management capabilities-related IT was usually managed by an IT (release) management responsible role, but usually this role was not responsible for the processes that relied on this IT (Case 5-2).

... in the product supplier era the Product Manager acted as the de-facto manager of all innovation activities ...

Given the limited scope of most silos this worked out quite well in many cases. Innovation management practices differed substantially across the various silos, but this posed no serious problems as long as customers did not expect integrated offerings.

In the future layered vision (Figure 5.12, right) the silos have vanished[65], and the three business component layers (Capability Platforms, Value Packages, and Product Bundles) of the WBC can be clearly distinguished. Business component managing roles on each layer cooperate, with clear interfaces between the roles, within a web of innovation responsibilities. Each role is responsible for innovation and lifecycle management on a

[65] As explained in Paragraph 2.7 there could be good reasons to apply silos in certain circumstances.

predefined set of business components within the respective layer. This responsibility covers both the Direct and Maintain sub-processes, although the latter sub-process could also (partly) be positioned within Operations-related organizational units (depending on the lifecycle phase and innovation dynamics as discussed earlier). In this setup Product (innovation) Managers are not any more responsible for complete vertical product/technology silos but 'only' for a set of Products/Product Bundles in the PB layer. The 'white caps' in the figure represent the VP Managers responsible for one or more VPs in the VP layer. The 'grey caps' represent the CP Managers. All operational processes and resources, both in the service function and the service management capability area, have been 'packaged' into CPs.

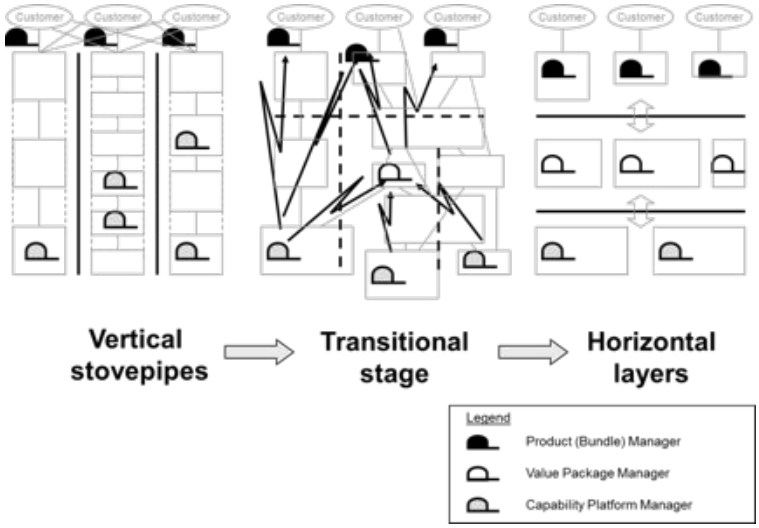

Figure 5.12 Shifting innovation roles

The current 'transitional' stage (Figure 5.12, middle) is characterized by a hybrid of silos and preliminary 'modules' with fuzzy boundaries and roles. Some Product Managers from the (consumer, business, and wholesale) Segments still try to act as a silo manager, but their number is limited. Most Product Managers from the customer segments try to fill in their role like a future PB (product) manager but have difficulties in finding counterparts in the preliminary VP and CP layers within Wholesale & Operations. Furthermore, the position of product management has devaluated substantially in the transition from the product supplier era to the service perspective era during the last years.
At the CP layer, the role of Development Manager has been extensively discussed in Case 5-3. Within W&O, CP (innovation) Managers can only be distinguished in the form of TI platform Development Managers in the service function capability area, not yet in the service management capability area.
In Case 5-3 two examples have been given of functions/roles with some characteristics of a VP Manager: Service Development Manager and Technical Product Manager. The role of

VP (innovation) Manager has not yet been operationalized. For example, an unambiguous set of VPs has not yet been defined. This means that no single W&O functionary is responsible for the normative output of an entire VP, based on the combined output of service function and service management CPs, that is delivered by W&O toward the customer segment organizations. The responsibility for parts of the VPs is currently dispersed across a wide range of persons and departments. Sometimes, such a preliminary VP Manager role has even been limited to maintaining internal accounting procedures between the W&O and the customer Segments. Alternative coordination mechanisms (e.g. business releases, refer to Case 5-2, and program management) are being implemented to cope with the above problems but they do not solve the above issue due to the absence of a clear horizontalized product/process framework (including process, roles and tooling) for modular business components on each layer.
Note that the above future vision with repositioned innovation roles represents a way Telco could proceed on the path to adapt the innovation process in a way that could be supportive to become an ISM firm. Currently, this seems a viable way forward; however this has not yet been decided by Telco management.

Organizational positioning of continuous innovation management roles
In this section focus will be given to the organization of a combined Direct & Maintain responsibility in the Innovation & Business Component Lifecycle Management column of Figure 5.9. This forms the main role of the Continuous Innovation Management framework as discussed in this chapter.
Given the Web of Business Components framework, there are three scenarios to organize business component Direct & Maintain sub-process ownership in a horizontalized structure (Figure 5.13). In the first scenario innovation management responsibility concerning the three business components is organized into three disparate organizational domains: OD1, OD2, and OD3. In the second scenario PB and VP business components are both managed by organizational domain OD1', and the CP business component is managed by OD2'. In the third scenario the CP and VP business components are both managed by OD2'', while the PB business component is managed by OD1''. The three-layered scenario 1 seems best suited to secure distinctive innovation responsibilities for the three types of business components. However, this scenario does not fit well with the common approach within companies to distinguish between two main domains: a customer-facing 'front-end' organization, and an efficiency oriented 'back-end' organization. Introducing a separate organizational domain between the frontend and backend may induce additional overhead because each domain tends to work in a 'demand-supply' mode with another domain. On the other hand, a separate layer seems well suited to implement an independent 'Value Bus' with VP (innovation) management responsibilities. Such an independent layer could also best act as the (portfolio) manager of the various business models of the firm. Within Telco, the Front-Office as discussed in Case 5-3 had

... there are three scenarios to organize business component Direct & Maintain sub-process ownership ...

some characteristics of this scenario. Although the Front-Office unit was formally part of the overarching Operations organization it could act quite independently from the business units, representing the PBs, and the operators representing the CPs.
In scenario 2, PBs and VPs are managed within the same organizational domain. There is no clear example of this scenario within Telco. Some resemblance is shown in the later Technical Product Manager function/role in the Business Units or customer segments, after the Front-Office period. However, most Technical Product Managers in this organizational setting acted either as an assistant to commercial product managers or assumed a CP-related role as a 'demand role' toward Operations. In neither case a real 'value integrative' VP perspective was applicable.

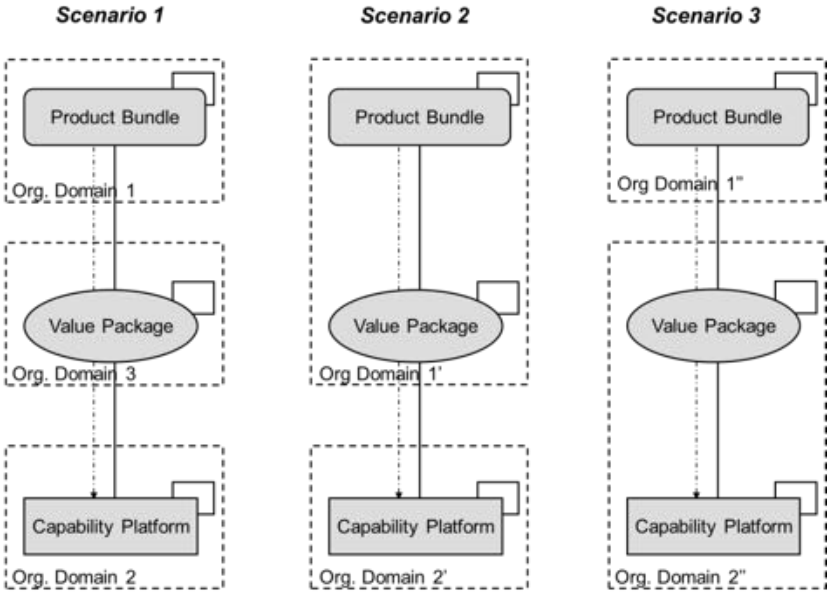

Figure 5.13 Organizational position of innovation roles

In scenario 3, VPs and CPs are managed within the same organizational domain. In scenario 3, the VP manager acts as an integrator for CP capabilities that are produced by the same organizational domain. This way the VP manager may provide an effective account management role toward PB managers. A prerequisite for good functioning is that the role really represents the VP layer including all underlying CP capabilities toward the PB layer. Another prerequisite is that product (bundle) considerations should be well involved in the development of VPs. If this is the case adequate value may be added in both directions. This is a scenario that could emerge within Telco during the coming years. It would be based on a combined Telco Product Structure/Supply Chain Management framework, such as proposed in the WBC framework. Currently, this situation has not been reached yet due to insufficient operationalization of the WBC framework within Telco. Internal politics of multiple departments claiming the same role have, for example, resulted in multiple

disparate Functional Product catalogs (Case 4-2). Furthermore, Functional Product owners do not yet assume responsibility for the service management capabilities and the integration with the Technical Infrastructure-based service function capabilities (only for the service function capabilities themselves).
The above scenarios have been discussed from a combined Direct & Maintain innovation management responsibility. Furthermore, Organizational Domains in Figure 5.13 could or could not include operations responsibility. If operations is organized separately from innovation within an organizational domain, the Maintain role could also be positioned in the operations organization. This applies predominantly for the CP layer. Note that Maintain remains part of the innovation process in any case. The advantage of this alternative positioning of Maintain is the close relationship with operations staff. This may be advantageous during more mature lifecycle phases of CPs and/or for CPs with relatively low innovation activities.

Other roles in the Continuous Innovation Management framework
The above section concentrates on roles related to the Direct and Maintain sub-processes of the Innovation & Business Component Lifecycle Management column of Figure 5.9. This column encompasses the core activities to transform 'open-loop' innovation management into Continuous Innovation Management. However, there are also innovation management roles in two other columns of Figure 5.9: Strategic Innovation and Implementation.

Portfolio management is also required at the PB and CP layers …

Strategic Innovation encompasses business modeling, business component portfolio management, portfolio & technology road mapping, scenario planning, and business planning. These activities will mainly be driven by roles in the VP layer, notably by functionaries like portfolio managers, strategists, business architects and senior line management. Portfolio management is also required at the PB and CP layers. This task encompasses the continuous creation, changing, combination and phasing-out of business components geared at an optimal portfolio to serve the portfolio in the northbound layer ('customers') while making optimal use of the portfolio of the southbound layer ('suppliers').
The Implementation column realizes coherent innovations within Operations. This is typically done in the form of temporary project and program organizations with related roles like project manager and program manager. Another important role is the MSP[66]-related business change manager role, who secures embedding of new capabilities in the operational organization (OGC 2003, 2007a). And of course all relevant design, development, and implementation professional roles work together in the project/program.

[66] Managing Successful Programmes.

5.5 Summary

This chapter has discussed the concept of innovation management as a cyclical process. This concept has emerged by analyzing the third challenge and associated research sub-question (RSQ3): *What are the challenges in managing innovation for mass customization?* By organizing the innovation process as a cyclical 'lifecycle management' process on individual and combined product and process layers, a foundation has been formed for continuous innovation in an ISM environment.

Innovation management has been modeled into three sub-phases: Direct, Implement, and Maintain. These sub-phases have been related to the three Web of Business Components layers: Product Bundles (PB), Value Packages (VP), and Capability Platforms (CP). By including the Maintain sub-process as an integral part of the innovation process, NSD is transformed from an 'open-loop' approach to a Continuous Innovation Management (CIM) framework. With Continuous Innovation Management knowledge on existing business components is continuously fed back into the innovation process so as to enable innovation management in the context of an ISM firm with modular business components in a horizontalized Product-Process-Business model structure.

The importance of continuous innovation management roles has been discussed, as well as the organizational positioning ('ownership') of these roles.

Chapter 6 further integrates the concepts of Chapter 3 to 5 into a coherent innovation management system for ISM firms.

6. Service perspective Lifecycle Innovation Management

6.1 Introduction

This chapter further integrates the results of this study into a final conceptual framework. First, the case study will be wrapped up with a discussion on the development of supportive concepts within Telco, as described in the various cases. This should further facilitate the understanding of the development of the conceptual framework. A separate paragraph illustrates how the concepts as developed in this study may be used to apply Product Lifecycle Management (PLM) concepts and ICT to support ISM firms.

6.2 Transition of Telco toward an ISM firm

To conclude the series of cases in this thesis, this paragraph provides an integration of the various ISM-supporting concepts that have been discussed in the various cases. A combined picture of the coherence between the cases further facilitates the understanding of the development of the conceptual framework. Furthermore, a reflection will be given on how Telco until now has proceeded on the path to becoming an ISM firm.

Case – Integration of ISM-supporting concepts

Figure 6.1 shows how the various ISM-supporting concepts within Telco, as described in eight cases, have evolved during this thesis[67]. Although the relation between the supporting concepts and the four rationalization cases (Case 2-1, 2-2, 3-2, and 3-3) could also be plotted in this figure, this would not add much to the understanding.
The left side of the figure shows seven ISM-supporting concepts that originated in the 1990s, and one (the 1-Model; refer to Case 3-1) that was conceived in the early 2000s. The arrows to the right show the evolution of the concepts and the mutual relations as discussed in the various case descriptions.
Although not shown in this figure, some of the eight supporting concepts on the left were already related from the start: on the Technical Infrastructure Platform from Case 4-1, Release Management was performed as described in Case 5-2, and this was done by the earliest Development Manager role of Case 5-3. The arrows in Figure 6.8 denote the following:
(1) The TI Platform delivering the (technical infrastructure-based) service function capabilities was extended toward the service management capabilities within a componentized Product Structure model.

[67] The sequence numbering in this figure is solely intended for reference purposes. It does not represent any difference in priority or importance in the relationships.

(2) The Supply Chain Model formed the foundation for the horizontal layering of the componentized Product Structure, and for the Fixed Mobile Convergence-related (FMC) organizational restructuring (3).
(4) The original, networking-related 'line-model-based', Product Structure was expanded with the Functional Product based on the notion of the 1-Model (5).
(6) Some principles of the TMF eTOM framework were applied to the FMC organizational restructuring.

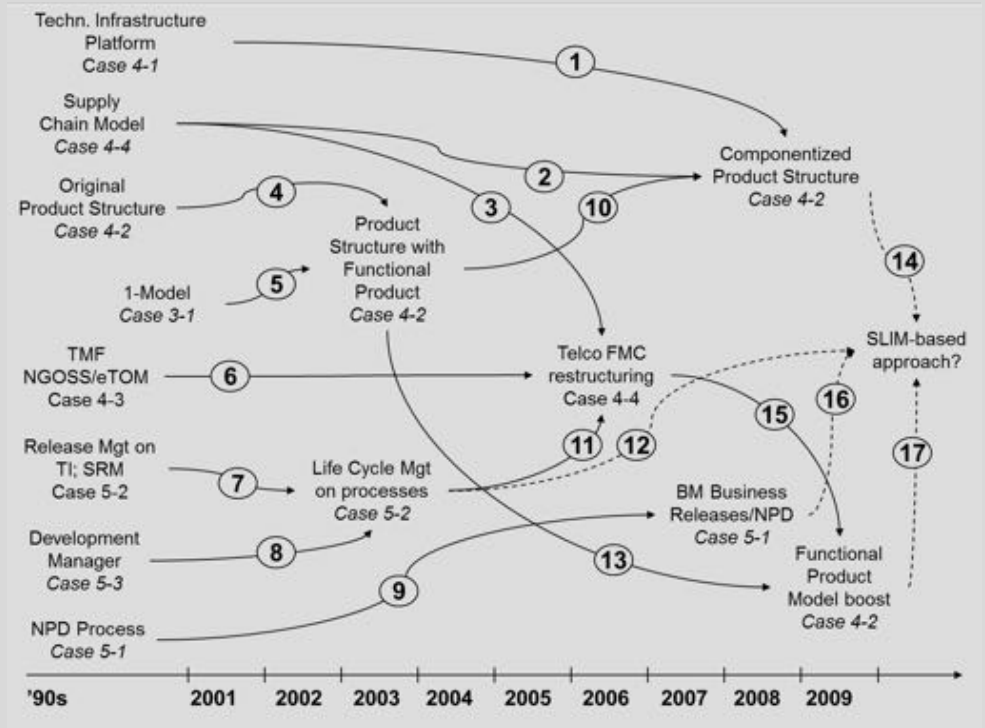

Figure 6.1 – Evolution of ISM-supporting concepts

7) Extant release management procedures on (technical infrastructure-based) service function capabilities formed a foundation for the initiative 'Life Cycle Management on processes'; this initiative also relied heavily on the Development Manager role (8).
(9) The extant NSD process was adapted to enable a coordinated market introduction via the Business Releases working method in the business market area.
(10) The Product Structure with Functional Product, formed (together with 1 and 2) a foundation for a componentized Product Structure.
(11) The cyclical innovation process of 'Life Cycle Management on processes' was applied in the definition of the innovation process within the FMC restructuring initiative.
(12) There are early signs (e.g. visible by the growing role of release management) that Telco management is aware that a SLIM-based approach is required.

(13) Product Structure with Functional Product was applied in an effort to promote the Functional Product Model in support of product rationalization within Wholesale & Operations; this boost was also induced by some management awareness that the FMC organizational restructuring-based W&O organization needs a clear catalog of (Functional) Products for the three customer segments (15).
(14) The componentized Product Structure was used in a project to plan the end-of-life of various legacy products and platforms. Furthermore, it was considered to be used in a project to classify all Telco assets in support of a W&O-wide business continuity initiative.
(16) The extant NSD process needs to be adapted for a componentized, horizontally layered environment.
(17) The Functional Product Model boost may induce an understanding of a possible SLIM-based approach.

Recent developments (from 2009 onward) within the Wholesale & Operations unit indicate some movement to operationalize a structure in conformity with the presented business component framework (WBC) in which Telco's Supply Chain Model and Product Structure have been integrated into one coherent framework.
Management seems to become aware of the above symptoms and possible improvement directions. In 2010, a data model based on the WBC data model was applied to support a strategic program to plan the end-of-life of large-scale legacy networking platforms. Furthermore, the framework has been applied to support cost modeling for a number of product/platform combinations. Some progress has been made within the Wholesale & Operations department to operationalize the concept of Value Packages by means of a 'Functional Product catalog'. Additionally, the implementation of a Business Continuity Framework requires up-to-date insight into the coherence of the production assets, with security classifications associated with each production asset. However, without further measures, the organization runs the risk of having produced yet another asset inventory. To transform these initiatives into a sustainable process, the implementation of Product Lifecycle Management (PLM) based on the SLIM model is currently being considered. Paragraph 6.4 will briefly introduce the relationship between the SLIM model and PLM.

Discussion on Case – Integration of ISM-supporting concepts
It has been made clear throughout the thesis how (combinations of) supporting concepts have contributed to the transformation of Telco into an ISM firm, and what factors within these concepts enabled or inhibited this transformation. Although Telco made substantial progress on the path to an ISM firm during the last decade as described in Chapter 2, most measures directly relate to the operations environment. To continuously innovate 'mass-customized prerequisites' for operations, the implementation of a comprehensive ISM-supporting innovation management system like the SLIM framework would be required. Until now, this is only partly the case as shown in the various cases. For

... most measures directly relate to the operations environment ...

example, the 2007 Fixed Mobile Convergence reorganization was inspired by Telco's Supply Chain Model with a Network Provider (W&O) serving multiple Service Providers (Case 4-4). However, this model has never been fully implemented with respect to the corresponding organizational roles.

To better support Telco's corporate strategy with 'the right innovations', and to reduce complexity with a targeted set of innovation projects, various initiatives have been launched during the last three years, mainly geared to centralizing innovation decision making. As part of the Fixed Mobile Convergence-related reorganization in 2007 a 6Q Rolling Forecast process on innovation projects was uniformly implemented across all segments. In 2008 'program management' became the predominant way to manage innovation projects in mutual coherence, and in 2009 innovation-related 'Capex' decision making (based on strategic 'buckets' of related product portfolio) was centralized at corporate level. However, this hardly solved the above problem since the gap between a broad top-down service-perspective strategy and a bottom-up process in which large numbers of innovation projects emerge basically remained untouched. The 6Q Rolling Forecast process initiated in 2007 developed differently across the segments already in the early stages, and was abandoned by the Wholesale & Operations organization in 2009. Program management somewhat improved the development and implementation of the selected innovations, but had limited effect on the preceding direction and planning of the 'right innovations' in line with corporate strategy. Finally, financial 'buckets'-based governance until now remained largely in the strategic/finance realm, without an adequate translation to the innovation practice. A comprehensive development toward an ISM firm has until now been inhibited by a combination of short-term financial targets, limited governance/discipline on working methods, organizational politics, and the still prevailing technology orientation. An expression of this technology orientation is the earlier observation that within Telco the innovation process itself is usually not regarded as the full implementer of operations, but rather as the developer of networking and IT technology. Innovation does not cover the full scope of product, process and business model in mutual coherence, as modeled in the Product-Process-Business model innovation framework (PPB). Mentally extending Telco's scope of 'product' from only service function capabilities (core 'networking' functions) toward the combination of service function capabilities and customer exposed service management capabilities ('customer service' in the broadest sense) would probably also induce a scope extension in the corresponding process area.

... it has not been clearly defined how Telco should innovate and operate in a de-siloed, horizontalized, environment ...

It has been shown in this thesis that there is an incongruence within Telco between the pace at which existing product/technology silos have been dismantled during the last decade, and the pace and strength at which enabling working methods have been implemented. Specifically, it has not been clearly defined how Telco should innovate and operate in a de-siloed, horizontalized, environment. Hence, the organization is currently facing a hybrid of

partly dismantled silos and partly implemented modular structures. A hybrid silo/modular setup is predominantly documented/visible at a fine-grained operational level, usually paper-based in various formats, and sometimes only deeply embedded in the technical infrastructure. This adversely affects the quality and cost of operations, as well as the required agility for mass-customized innovation. The number of (proces) 'chain managers' within Telco seems to have increased dramatically during the last decade, while corresponding salary scales have also increased over the years. These high-level professionals are supposed to take responsibility for the entire Telco internal 'process chain' for certain service products. In reality they can neither assume innovation nor operations responsibility for these process chains given the above hybrid silo/modular fabric and fuzzy responsibilities. At the same time the function/role of Development Manager (Case 5-3) seems to be under constant pressure. After the function was formally abandoned in 2007, it remained active as a role. However, without a formal function, during each reorganization the role must be conquered again.

The number of 'chain managers' ... seems to have increased dramatically ...

Table 6-1 Telco's path toward an emerging service perspective firm

	Initial service perspective	Emerging service perspective
Period	2000 - 2005	2005 - 2011(?)
Lifecycle focus	Pre-launch period	Launch date
Innovation focus	Technology projects	Project deliverables
Operations focus	Technology	Core (TI-based) service + customer satisfaction
Release management focus	Technology release management	One-off release on coordinated initial launch date

Table 6-1 summarizes Telco's path toward an emerging ISM firm by showing the differences in focus regarding some main aspects. In Paragraph 2.3 it was stated that the current service perspective phase started around the year 2000. Although early signs of a service perspective were emerging already during the early-2000s, until 2005 the focus of innovation projects was predominantly on the roll-out of technology projects, while the predominant operations focus was on core (TI-based) service and associated service function capabilities. Of course innovation projects during this stage were expected to deliver at a certain predefined moment, but at a generic level little was done to assure that various related projects would deliver in a well-coordinated manner toward a synchronized market introduction. Furthermore, a silo-based environment hardly needs such measures since all project deliverables relate to one and the same silo. Release management during this period was mainly geared to the technology level (IT and TI; Case 5-1). During this phase, the focus was basically on the pre-launch (technology project) lifecycle phase.

The current, 'emerging service perspective' phase, started around 2005 and will most probably still be ongoing throughout 2011. During this phase the lifecycle focus will shift from the pre-launch period to one single date: the launch date by which multiple related innovation projects should deliver a co-ordinated output for a synchronized (market) introduction. Release management focus shifts from a technology level to the scoping, development and implementation of 'business releases' as a mechanism to accomplish such a synchronized market introduction (Case 5-1). Operations focus shifts from a technology-only focus toward the combination of service function capabilities, including initial fulfillment, and a focus on customer satisfaction. Customer satisfaction and retention have become clearly visible on the management agenda, e.g. by introducing the Net-Promoter Score (NPS, Reichheld 2003) method in 2009, and much effort has been devoted improving the customer support organization. However, these efforts were predominantly implemented directly within operations; hardly any role was acknowledged for the innovation process to guide and secure these developments in a sustainable way.

... ICT-intensive firms seem well positioned for mass customization ...

According to Pine (1993) component modularization forms the last and most difficult stage of a five-stage path toward mass customizing products and services. Boynton, Victor et al. (1993, p. 57) state that "mass customization companies attempting to move from mass production to mass customization must pursue a path (the authors call this the 'right path') through a stage of process re-engineering and development (continuous improvement) before they can apply those processes to mass customizing products or services". Although a large amount of process re-engineering took place over the last decade, it is questionable whether Telco can be designated as a 'continuous improvement' company. It is hard to find organizational change process-related literature on the transition of telecom operators toward an ISM business approach. Most literature on 'Next Generation Networks' (NGN; Chapter 2) is limited to networking technology-related issues.
Especially ICT-intensive firms seem well positioned for mass customization. In an interview on the state of mass customization Joseph Pine argues "that the biggest trend is the realization of everything implied by the principle that anything that can be digitized can be customized" (Pine 2007). This applies to most of Telco's business. However, it remains to be seen if the Telco organization is fully aware of the consequences of a transition toward an ISM firm.

6.3 Integration; final conceptual framework

This paragraph further integrates the frameworks that have been developed in Chapters 3, 4 and 5: respectively the Product-Process-Business model innovation (PPB), Web of Business Components (WBC), and Continuous Innovation Management (CIM) framework. In the course of the thesis various linkages between these frameworks have already been discussed. Conceptual Framework 2 (CF2), that has been presented in Chapter 4, shows the

relationship between the PPB en WBC frameworks. In Chapter 5, the relationship between CF2 and the CIM framework has been further explored.
In Figure 6.2 the concepts of Chapter 3, 4 and 5 (respectively PPB, WBC, and CIM) are combined into one coherent innovation management system. The '+' signs in the figure denote a positive contribution from one framework to the other. PPB contributes to both the WBC and the CIM by providing a three-layered structure of business components (R2) and innovation management responsibilities (R1). WBC enables CIM by providing the innovation management processes and roles with a coherent and 'tangible' fabric of business components (R3). CIM enables WBC by providing a cyclical innovation process and clear innovation roles to facilitate a continuously up-to-date coherent fabric of business components (R4). As made clear in the cases, the relationships R3 and R4 represent a 'chicken and egg' relationship: innovating business components in an ISM context require clear innovation management process/roles, and innovation management process/roles in an ISM context require a web of business components. It has been shown in this thesis that this issue can be solved by operationalizing the combination of CIM and WBC based on a mutual PPB. The combined framework is dubbed 'Service perspective Lifecycle Innovation Management' (SLIM). This SLIM model, positioned as an innovation management system for ISM firms consisting of three interdependent sub-frameworks, forms the overarching theoretical contribution of this thesis.

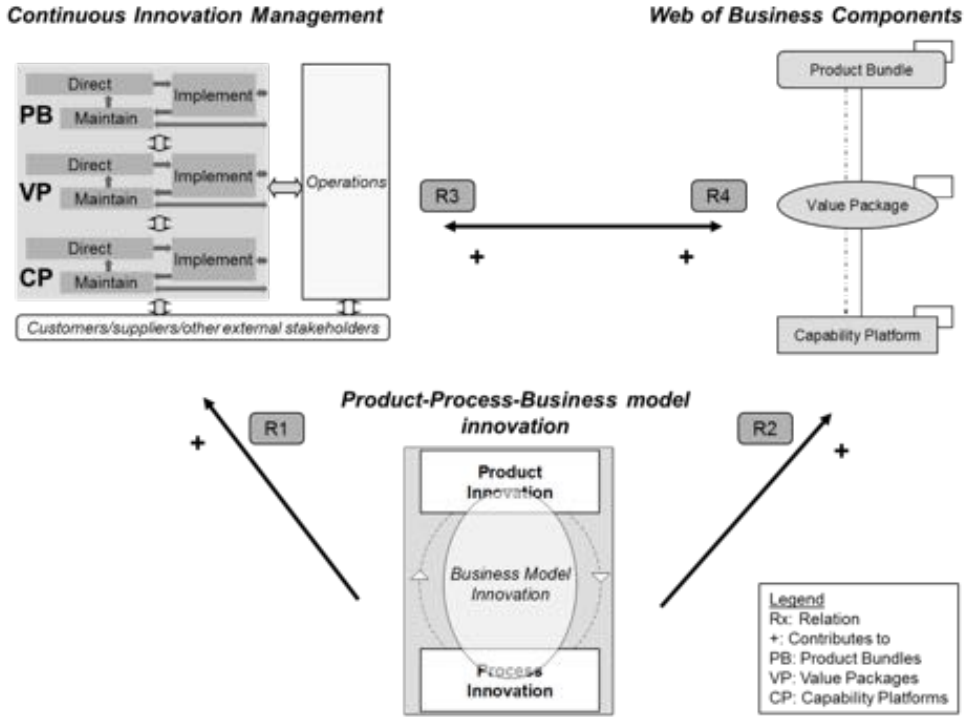

Figure 6.2 Service perspective Lifecycle Innovation Management (SLIM)

In Figure 6.3 the SLIM model has been positioned in the final conceptual framework: Conceptual Framework 3 (CF3). In this framework, R5 represents the overall contribution of the SLIM model to mass-customized innovation that provides mass-customized prerequisites for mass-customized operations. Apart from contributing indirectly to the operational process by enabling MC Innovation to provide and maintain the MC prerequisites for Operations, the SLIM model can directly support MC Operations (R6) for operational business components. This applies to two levels: 1) operations level support concerning day to day operations and small changes, and 2) tactical level support to maintain and adapt inter business component Service Level Agreements (SLAs). This is facilitated by continuous up-to-date insight in the various WBC-based 'chains' of business components, and ownership of the various business components both at the level of innovation and operations.

... the SLIM model can also directly support MC Operations for operational business components ...

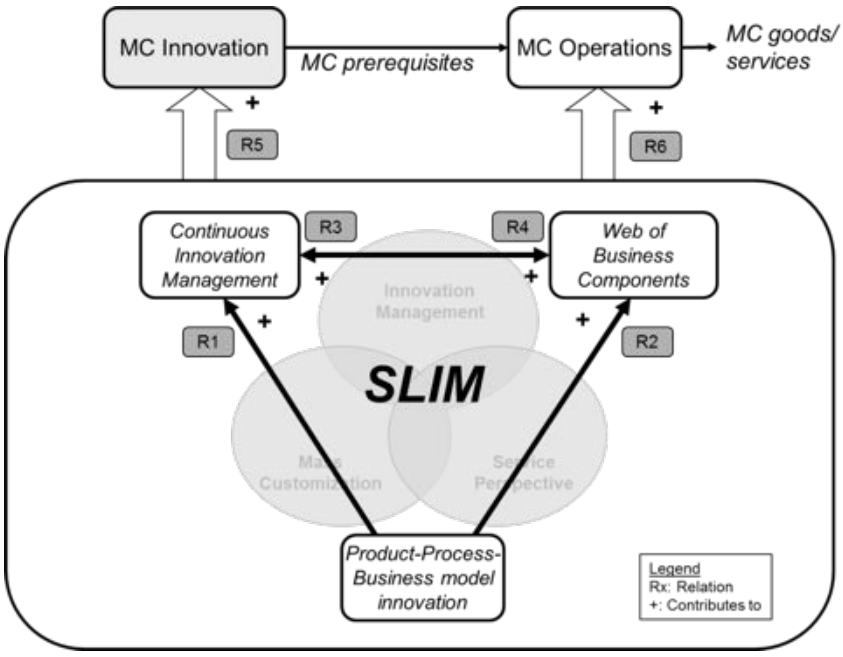

Figure 6.3 Final conceptual framework (CF3)

The CIM framework is replicated on each of the three layers of the WBC framework. The three innovation management layers do not function independently (Figure 6.4). Although each layer entails strict innovation responsibilities per layer, the layers function in close co-operation. This co-operation applies on three levels: 1) at a Strategic Innovation level to select 'the right innovations' given the firm's strategy, combining strategic elements of the

Direct sub-processes of each layer; 2) at the (tactical) level of Innovation and Business Component Lifecycle Management, combining Direct sub-processes and Maintain sub-processes of each layer; and 3) at the level of Implementation programs/projects to develop and implement the planned innovations that combine business components of each layer.

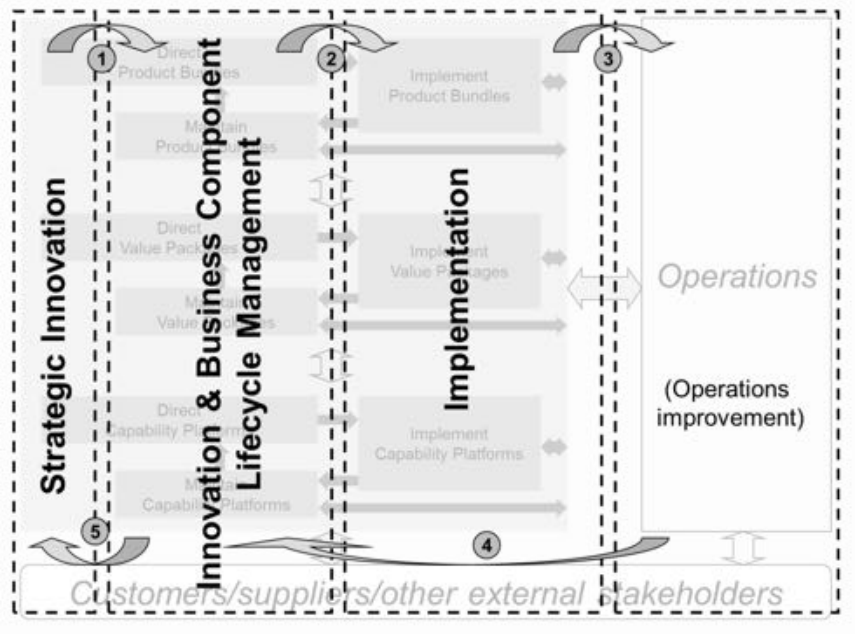

Figure 6.4 Different modes of innovation

Apart from (continuous) operations improvement within Operations (outside of the innovation process) the figure contains two continuous loops: a tactical loop from Innovation & Business Component Lifecycle Management toward Operations vice versa (Arrows 4-2-3), and a strategic loop from Strategic innovation, via Innovation & Business Component Lifecycle Management toward Operations, and vice versa (Arrows 4-5-1-2-3).

... the innovation process has to some extent been 'industrialized' ...

The metaphor of 'boxes and switches' served to show (in Paragraph 5.3) how the character of the innovation process may change dramatically by implementing the combination of WBC and CIM frameworks as presented in this thesis. Instead of a 'one-off roll-out' for each innovation, the innovation process has to some extent been 'industrialized' by transforming the process into a cyclical process in which reusable business components in each of the three PPB areas form the starting point for an innovation opportunity.

The WBC is based on existing literature on business componentization (e.g. Kozaczynski 1999; Cherbakov, Galambos et al. 2005) and empirical material from the Telco cases. Table 6-2 provides an overview of the business componentization enablers that have been

discussed throughout this thesis, with reference to the Telco cases. It summarizes the factors that may facilitate business componentization at the (PPB) layers of service perspective products, processes and business models.

Table 6-2 Business componentization enablers

Business componentization enabler	Examples	Componentization effect	Discussed in
Horizontalization and modularization models and governance (standardization on objects/structure/layers/interfaces)	Telco Product Structure, Telco Supply Chain Model, NGOSS eTOM, NGOSS SID	Foundation for reusable modular business components and 'networks' in a horizontalized structure	Chapter 4, Case 4-2, 4-3, and 4-4
Firm-defined naming of business components instead of applying generic or supplier-originating process/technology/IT names	Telco examples: Wholesale Billing Street, Ethernet TI Platform	Focus on the level of business components instead of focus on the level of process flows, technology or IT	Chapter 4, Case 4-1
Listing and specifying business components in catalogs	Telco examples: Functional Product catalog, IT and TI Platform repositories	Facilitates 'account management' at the level of business components (expectation mgt, performance measurement, reporting etc.)	Chapter 4, Case 4-2, 4-4 Chapter 5, Chapter 6
Assigning innovation responsibility of business components to (line) organizational domains or supply chain roles	Telco examples: Functional Product responsibility at the Network Provider	Ownership, empowered innovation responsibility at the level of business components	Chapter 4, Case 4-4
Applying release management at the level of business components (instead of release management at the level of IT or project deliverables)	R1.0, R1.1 etc.with distinct specification per release	Focus on the level of (the normative output of) business components instead of on projects or technology	Chapter 5, Case 5-2
Assigning innovation responsibility for (one or a few) business components to distinct functionaries	Telco examples: Product Manager, Development Mgr	Ownership, empowered innovation responsibility at the level of business components	Chapter 5, Case 5-3
PLM concepts and IT tooling including electronic catalogs, workflow, release mgt support etc.	Product Lifecycle Mgt, Product Data Mgt based concepts/tooling	Company-wide accessibility/visualization of business component coherence; facilitating business component-based innovation and operations	Chapter 6, Paragraph 6.4

How value becomes available to customers

Figure 6.5 shows how value becomes available to customers of the providing ISM firm. As discussed in Paragraph 5.3, innovation initiatives may either come from new business opportunities (like new customers), or they may come from new processes or technology. Via PPM business model-related VPs the intended customer and provider value is imposed on both the PBs (1a) and CPs (1b). During Implementation, this Web of Business Components is implemented in Operations (2). In the operational phase, contractual and other value promises (3a) originating from the VPs are delivered by Operations in the form of goods-based products (3b) and service-based products (3c). For the customer this results in ‘moments of truth’ (Carlzon 1989) on combinations of goods-based products (4a) and service-based products (4b). The dotted lines (3a, 3b and 3c) do not represent ‘real’ flows of promises, goods and services, but rather indicate the ‘mental’ flows emerging from the Web of Business Components. Value promises (both contractually and other promises toward customers) issue from the VPs. Goods-based products are produced by CPs, and are delivered to customers via PBs. Service products are PBs that are co-produced with customers via the CPs.

Arrow 5 represents the continuous support by Innovation toward Operations, as well as the continuous feed-in from Operations to Innovation to continuously sustain the (normative)

performance of the business components in operations and to provide input for continuous innovation from customers/downstream partners, suppliers/upstream partners[68], and Operations themselves.

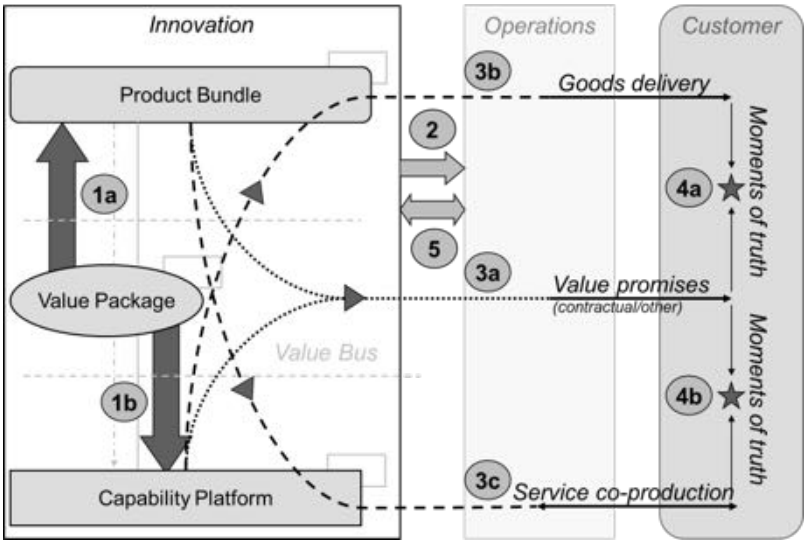

Figure 6.5 – How value becomes available to customers

6.4 SLIM-based Product Lifecycle Management

This paragraph explains the relationship between the SLIM model and Product Lifecycle Management (PLM) concepts and (ICT) tooling. The application of ICT to support the innovation process seems indispensible for ISM firms to direct, implement and maintain a complex web of business components. The paragraph might be regarded as a managerial integration of the SLIM model-based concepts as developed in this study. The subject of PLM will not be discussed extensively, but rather serves to illustrate how the SLIM model may form, via PLM-related concepts and tooling, a foundation for ISM firms.
PLM facilitates mass customization "by enabling to rapidly and cost-effectively deliver customized product offerings that satisfy the needs of individual customers and targeted market segments" (Gecevska, Chiabert et al. 2010, p. 333). Stark (2005) describes PLM as follows: "Product Lifecycle Management is the business activity of managing a company's products throughout the lifecycle in the most effective way. PLM is holistic, addressing numerous elements such as processes, data, people and applications. This distinguishes it from atomistic activities focused on one particular element, such as Product Data Management (PDM). PLM is a 'joined-up' paradigm. It joins up many previously separate

[68] Not shown in this figure. In line with Figure 3.10 suppliers/upstream partners may relate to the ISM firm in the same way the ISM firm itself relates to its customers/downstream partners.

and independent processes, disciplines, functions and applications – each of which, though addressing the same product, had its own vocabulary, rules, culture and language" (Stark 2005). According to CIMdata, an independent consultant and source of information on PLM, Product Lifecycle Management:

- Is a strategic business approach that applies a consistent set of business solutions that support the collaborative creation, management, dissemination, and use of product definition information
- Supports the extended enterprise (customers, design and supply partners, etc.)
- Spans from concept to end of life of a product or plant
- Integrates people, processes, business systems, and information.

According to Stark (2005), PLM helps companies get products to market faster, provides better support for their use, and manage end-of-life better. PLM meets these needs, extending and bringing together previously separate fields such as Computer Aided Design (CAD), Product Data Management (PDM), Sustainable Development, Digital Manufacturing, Enterprise Resource Planning (ERP), Life Cycle Assessment (LCA) and Recycling.
Three core or fundamental concepts of PLM are: 1) universal, secure, managed access and use of product definition information, 2) maintaining the integrity of that product definition and related information throughout the life of the product or plant, and 3) managing and maintaining business processes used to create, manage, disseminate, share and use the information. While information includes all media (electronic and hardcopy), PLM is primarily about managing the digital representation of that information (CIMdata 2011).

... PLM may facilitate the mass customization business approach ...

However, according to Hewett (2009, p. 82) "there are many parallels that can be drawn between some of the initial ERP implementations and the current PLM implementations: improperly set executive management expectations, high application implementation costs, frustrated end-users, armies of IT consultants, and evasive returns on investment." Moreover, current PLM products and suppliers are primarily geared to supporting manufacturing.

In the researcher's view PLM may be adapted and extended to facilitate ISM firms. This view is also supported in the literature. For example, Lusch, Vargo et al. (2010) observe that PLM may be adapted to a service environment. Golovatchev, Budde et al. (2010) argue that an effective PLM helps in coping with the challenge of complexity in the telecommunications industry. This is also endorsed by a report of the TeleManagement Forum on 'Holistic Product Lifecycle Management' (TMF 2007). A number of authors argue that PLM may facilitate the mass customization business approach (Ramani, Cunningham et al. 2004; Zha and Sriram 2004; Ming, Yan et al. 2005; Cross, Seidel et al. 2009). According to Georgalas and Achilleos (2009) the need to accelerate PLM adoption

is increasing further because communication service providers are changing their product development approach from the traditional telecoms-oriented approach to one of a more software-oriented nature.
The SLIM framework as developed in this thesis could provide a foundation for the application of PLM within ISM firms[69] because it supports componentization of product, process, and business models of ISM firms, and defines an innovation process to support decoupled and coherent lifecycle management on the entire business component fabric. This would require adaptations to existing software solutions in the area of PLM and PDM. According to Ramami, Cunningham et al. (2004) several existing PLM/PDM software solutions are not product-centric, but rather (product) data-centric (reflecting 'PDM', rather than 'PLM'). These systems offer improved product-related data management by multiple actors across distances, but do not add inherent value to the product itself. To support mass customization, the latter authors believe that a 'product-centric' model is needed for PLM/PDM tooling. To support ISM firms with the SLIM model, even such a product-centric model would not suffice. Rather, a model based on the three-layered Web of Business Components would be required to enable Continuous Innovation Management on a fabric of reusable business components. Furthermore, a SLIM-based PLM software solution with Continuous Innovation Management 'workflow' would be required to enable business component 'reuse suggestions' as outlined in Paragraph 5.3 (Figure 5.10). By applying SLIM-based concepts to PLM, this could transcend PLM from the traditional product development and product data management realm toward a customer value-centric approach in coherently managing a web of product, process and business model-related business components throughout their entire lifecycle.

Operationalizing SLIM-based PLM
The next section offers a brief explanation of how the SLIM model could be applied to extend PLM to ISM firms (Figure 6.6). The WBC framework-based Business Component Catalog (BCC) forms the central catalog of coherent business components. Business components (PBs, VPs and CPs) are created, modified, and phased-out by Innovation as part of the innovation process, operationally deployed by Operations, and coupled with various product and process-related inventories to push/publish and pull/collect product and process-related data.

[69] Such application of PLM concepts for ISM firms might be dubbed 'Service perspective Product Lifecycle Management' (SPLM).

The BCC resembles the role of a 'Product Catalog' with associated Product Data Management (PDM) in PLM. However, it models not only products, but allows for equivalent lifecycle management on business components on all three layers in the WBC framework: Product Bundles, Value Packages and Capability Platforms. This way, reuse of business components on the three layers can be promoted by the system. The CIM-based Innovation function manages the lifecycle of the business components by manipulating the data in the BCC. Innovation is supported by tooling that facilitates cooperation between the various innovation/lifecycle management roles. This matches the role of 'classic' PLM systems, but to accommodate service products in addition to 'good' products requires additional functions. For instance, aside from the traditional Computer Aided Design (CAD) visualization of tangible products, it would require visualization of the coherence of the web of business components. Grieves (2005, p. 73) observes that "if theory building should be disciplined imagination as Weick (1989) claims, then visual models provide the tools that enable this." And besides a Bill of Material (BoM) for the production of physical products, a 'Bill of Capabilities' for the production of service perspective products would be required. For operations the BCC forms the basis for manual and automated operations tasks ('orchestration'/'choreography'; Peltz 2003). For this purpose, the WBC-based BCC data must be enriched with 'orchestration' data that drives the workflow of (manual and/or automated) operations.

... a 'Bill of Capabilities' for the production of service perspective products would be required ...

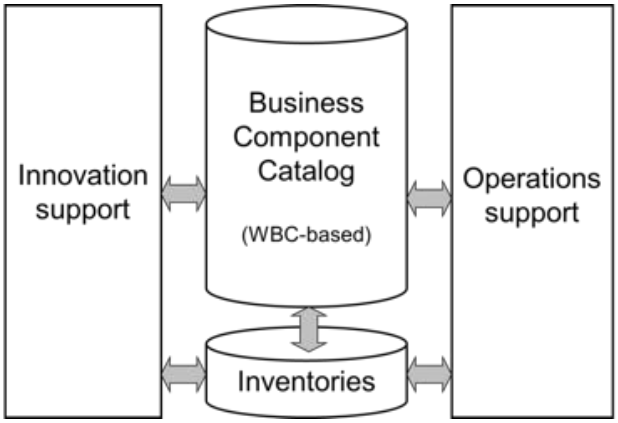

Figure 6.6 – Application of the SLIM model for PLM in ISM firms

At a tactical level the interfaces between the WBC-based business components of the BCC represent the normative performance against which the operational performance of operations is measured. By developing and maintaining a fabric of interface agreements with normative performance parameters between the business components as part of the (ICT supported) innovation process in a PLM-based environment, the development and

maintenance of multiple point-to-point paper-based 'Service Level Agreements' (SLAs) by operations is preempted. Hence, operations can concentrate on meeting the normative performance in the operational processes and suggest improvements and innovations based on their operational experience with customers and suppliers. In this paragraph it has been shown again that, by applying PLM-based concepts and tooling based on the SLIM model, operations is not only indirectly supported by the SLIM model as foundation for the innovation process, but is also directly supported by SLIM-based innovation management (refer to relationship R6 in CF3).

The application of SLIM-based PLM within Telco

Within Telco, the relationship between product lifecycle management and mass customization has not yet been acknowledged. On the other hand, requirements pointing in the direction of PLM have indirectly emerged from various user groups demanding an overview of the coherence of the existing product-process fabric. Especially during the last 3 to 4 years these requirements has been expressed by operations (e.g. for incident management, change management and service level management), finance (business continuity classification of Telco assets), architecture (the 'ist'status of the 'enterprise architecture'[70]), and strategy implementation (end-of-life planning of legacy platforms, cost modeling). Until now, these requirements have invariably resulted in one-off subject-specific inventories that can neither be interrelated nor maintained. Many catalogs, repositories and configuration management databases exist within the company, both at the level of products and technology. Many of these information bases are only spreadsheet or paper-based and sometimes multiple versions coexist, covering the same area. E.g. two different (internal) product catalogs could coexist covering the same product scope: one applied for service level management between organizational departments, another for defining ICT for customer order 'orchestration'. If interconnected at all, this is usually done on an ad-hoc basis at a fine-grained IT-level to respond to one specific business requirement. This impedes application for future requirements. With a SLIM-based PLM approach an up-to-date business-level repository would be available for all of the above applications at all times, providing one corporate-wide 'truth' on the 'business architecture' as a coherent foundation for both innovation and operations.

Many catalogs, repositories and configuration management databases exist within the company, both at the level of products and technology ...

[70] In Chapter 3, the term 'Enterprise Architecture Integration' was mentioned as one of the initiatives within the IT Reference Architecture case (Case 3-2). Discussions on 'Enterprise Architecture' and derivative notions like 'Enterprise Architecture Management' have deliberately been avoided in this study. Both in literature and business practice the meaning of these terms seem much debated. For the purpose of this study a discussion on this subject is not deemed necessary.

6.5 Summary

This chapter has further integrated the main concepts of this study into a 'Service perspective Lifecycle Innovation Management' (SLIM) model. The Telco case was wrapped-up with a discussion on the development of supportive concepts, as given in the various cases throughout this thesis. Furthermore, it was shown how the SLIM model can form a foundation for Product Lifecycle Management (PLM) concepts and ICT in support of ISM firms. The SLIM model can be applied to transform PLM from a product/data-centric approach into a customer-oriented business component-centric approach.
The next chapter (Chapter 7) forms the conclusive chapter of this thesis.

7. Conclusion

7.1 Discussion and conclusions

This study seeks to respond to the challenges in managing innovation for mass customization in ICT-intensive service perspective firms in a fast-changing environment. This concluding chapter will clarify to what extent the research question has been answered, and to what extent the resulting innovation management system has provided a coherent response to the various challenge areas. Contributions to research and management practice will be given, as well as limitations and suggestions for further research.

The research question was formulated as follows: *'What are the challenges in managing innovation for mass customization in ICT-intensive service perspective firms in a fast-changing environment?'* The study concentrates on gaps in the literature on the intersection of mass customization (Davis 1987; Pine, Davis et al. 1999), service perspective (Grönroos 2000; Vargo and Lusch 2004a), and innovation management and NSD (various authors) in the context of ICT-intensive firms in a fast-changing environment. The research question is positioned in the research model: Conceptual Framework 0 (CF0). ICT-intensive services have been positioned in the four quadrant service classification by Lovelock (1983). The research area was subdivided into four challenge areas (Figure 7.1) with associated research sub-questions (RSQs):

- 'Product/process decoupling' at the intersection of mass customization and service perspective: What do the terms 'product' and 'process' mean in a service perspective context, and how can their lifecycles be decoupled in the innovation process to apply mass customization principles (RSQ1)?
- 'Missing innovation objects' at the intersection of service perspective and innovation management: How can the end result of the innovation process be defined in terms of 'tangible' objects for the actors in the innovation process (RSQ2)?
- 'Innovation management for mass customization' at the intersection of mass customization and innovation management: What are the challenges in managing innovation for mass customization (RSQ3)?
- What is the overall coherence between mass customization, service perspective, and innovation management, given the main research question (RSQ4)? The resulting framework can be viewed as an innovation management system for ISM firms.

After a foundational overview of the challenge areas in Chapter 2, the first three research sub-questions were discussed in Chapter 3, 4 and 5 respectively. The fourth research sub-question will be discussed in this final chapter, based on findings obtained throughout the study.

Although each of the chapters concentrated on only one challenge area/research sub-question, various linkages have been made explicit to the other chapters to explain the coherence between the challenge areas. These linkages, made both via interpretations of the cases and the literature, allow for the development of the conceptual framework that could, in its final form, be viewed as an innovation management system for ISM firms. Hence, the models and concepts described in the cases have served a three-fold role: they have 1) been applied as an intervention mechanism to attain sustainable business results for Telco, 2) served to gain knowledge of the underlying processes and mechanisms, and 3) been conceptualized in mutual coherence resulting in an innovation management system for ISM firms. This paragraph will discuss the main conclusions concerning the four research sub-questions.

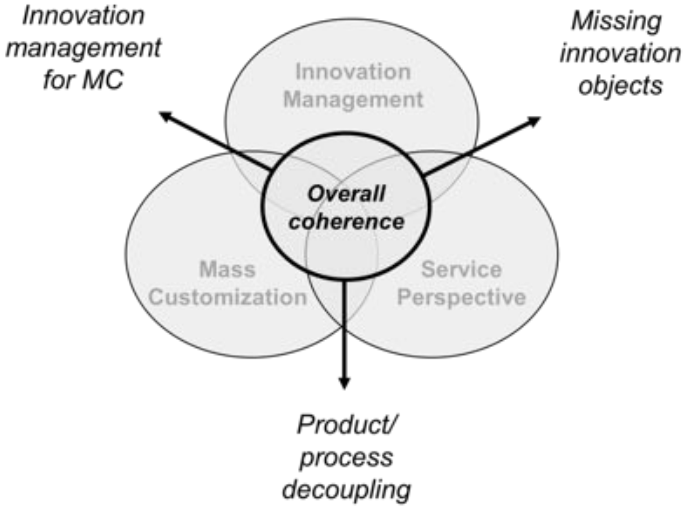

Figure 7.1 Four challenge areas in managing innovation for mass customization in ICT-intensive service perspective firms

RSQ1 – What do the terms 'product' and 'process' mean in a service perspective context, and how can their lifecycles be decoupled in the innovation process to apply mass customization principles?

The main conclusions relating to RSQ1 are:

C1.1. Technological layering approaches only provide limited support for the transition toward an ISM firm because processes, data and organization remain untouched, hence siloed.

C1.2. Product and process can be clearly defined and positioned in a service perspective context by applying a customer value perspective to the product, and a provider resource control perspective to the process.

C1.3. In ISM firms, an external focus not only applies to the product but equally to the process.

C1.4. Business model innovation can support decoupling of product and process innovation (Product-Process-Business model innovation framework; PPB; see Chapter 3).

RSQ1 relates to the requirement to decouple product and process in the system of mass customization (Pine, Davis et al. 1999, p. 255). The research gap identified is the fuzziness of the concepts of product and process (innovation) in the literature, especially in a service perspective context (Davenport 1993; Bitran and Pedrosa 1998; Hauknes 1998; Uchupalanan 2000; Djellal and Gallouj 2001; Gallouj 2002; Van der Aa and Elfring 2002; Tether 2005; Miles 2008). This fuzziness impedes clear a decoupling of product and process innovation in a service perspective environment.
Various perspectives on horizontalization or de-siloing in the telecom sector were discussed in Chapter 2. Both in the literature (e.g. Fransman 2002) and the Telco practice, these perspectives seem to be dominated by technological layering models, like the telecom-related applications-middleware-'pipes' model (refer to Paragraph 2.7). This study shows that, while these technological layering approaches have value of their own, they only provide limited support for the transition toward the horizontalized organization structure of an ISM firm as they leave processes (notably service management capability-related processes), data and organization basically untouched, i.e. siloed (C1.1). With a pure technology-oriented layering, decoupling only applies within (the core product-related service function capability part of the) process, not between product and process. Chapter 3, exploring the challenge area of 'product/process innovation decoupling', is probably the most conceptual part of this study. It sought to unequivocally position and define the concepts of product innovation and process innovation that they may be generally applied by service perspective firms. This may facilitate decoupling of product and process innovation to support the mass customization business approach in ISM firms. The discussion was based on Drucker's view (1985) on innovation, the product/process innovation taxonomy by Edquist, Hommen et al. (2001), and the literature on business modeling (notably Chesbrough and Rosenbloom 2002; Osterwalder and Pigneur 2002; Voss and Zomerdijk 2007). Product and process can be clearly defined and positioned in a service perspective context by applying a customer value perspective to the product, and a provider resource control perspective to the process (C1.2). Following the given definitions of product and process, and in line with the characteristic that ISM firms co-produce with their (service perspective) suppliers and customers, an external focus should not only be applied to the product but equally to the process (C1.3). This contrasts with the leading view in the literature that an external focus is primarily required on the product, while the process is primarily viewed from an efficiency-driven perspective (Abernathy and Utterback 1975). The current study shows that an external focus on the process can be induced by an external focus on the full product. This can be achieved by equally giving attention to the supportive, service

... an external focus on the process can be induced by an external focus on the full product ...

management capability-related, product characteristics as to the core, service function capability-related, product characteristics. The seamless integration of both categories determines the overall customer experience with the (service) product. 'Distribution' was operationalized for ISM firms. Although the term seems a remnant from the manufacturing era since it suggests a one-way delivery while service perspective firms co-produce with their customers, the concept of distribution may also be positioned in a service perspective context. It encompasses elements from both product and process as defined in this study. With the given definitions and positioning of product and process the concept of 'service' – which is one form of product – was clarified by differences in 'process': in case of a service, the provider controls resources (applied in a mutual process) that are used/experienced by the customer. This was clarified by means of the three service areas by Judd (1964): owned goods service, rented goods service, and non-goods service.
The concept of business model innovation is applied to form an integrative bridge between product and process innovation. It supports decoupling of product and process innovation by providing an integrative 'value bus' interface between the two (C1.4). The 1-Model as described in Case 3-1, the Business Model Framework by Osterwalder and Pigneur (2002), and the product/process/business model innovation framework by Voss and Zomerdijk (2007) were used to position product, process and business model innovation. The resulting Product-Process-Business model innovation framework (PPB) in the research model equals the first conceptual framework (CF1), and it lays the foundation for the further development of the conceptual framework in Chapter 4 to 6, and for this conclusive Chapter 7.
By responding to RSQ1, contributions have been made to research in the areas of mass customization (and related areas like modularization and platform thinking) and business modeling.

RSQ2 – How can the end result of the innovation process be defined in terms of 'tangible' objects for the actors in the innovation process?

The main conclusions relating to RSQ2 are:

C2.1. By applying coarse-grained business componentization to product, process and business model the end result of the innovation process can be defined in terms of a coherent set of 'tangible' objects for the actors in the innovation process (Web of Business Components; WBC; see Chapter 4).

C2.2. The notion of 'product platform' in the literature is more related to the process than to the product.

A number of authors have discussed the difficulties in dealing with service innovation as a result of the intangible character of services (Edvardsson and Olsson 1996; Edvardsson 1997; Bitran and Pedrosa 1998; Seegy, Gleich et al. 2008). Existing tangibilization concepts for ISM firms are predominantly geared to visualizing the detailed service process flow, like in the service blueprinting approach (Shostack 1984; Kingman-Brundage 1989; Bitner, Ostrom et al. 2008), or confined to finer-grained IT-level components or services;

Sanz, Becker et al. (2007) provide a discussion on the latter category and advocate a 'real' business-level business componentization approach. The current study seeks to proceed on such a business-level business componentization approach.

Chapter 4, exploring the second challenge area of 'the missing innovation objects', looked at ways to define and handle the outcomes of the innovation process for service perspective firms as 'tangible' components for the actors involved. This enables the application of manufacturing-based approaches like product and process modularity (Ulrich and Tung 1991; Baldwin and Clark 1997) and platform thinking (Meyer and Zack 1996; Meyer and Lehnerd 1997; Robertson and Ulrich 1998; Sawhney 1998; Jiao, Zhang et al. 2006) in a service perspective context. In the literature, however, concepts like 'business componentization' and 'service orientation' usually do not apply to the business level, but rather to the IT level (Sanz, Becker et al. 2007). In recent literature on business componentization the concept increasingly shifts from the IT level toward a 'real' business level. At such a business level the emphasis is on business functions in a network with customers and suppliers, not on IT level functions, components, services etc. This is, for example, the case in IBM's Component Business Model® (CBM) approach (Cherbakov, Galambos et al. 2005; Sako, McKenna et al. 2006). However, this modeling approach does not explicitly componentize the product and business model layers as defined in the PPB framework.

The concept of 'business component' was defined in this chapter based on a (IT-related) definition of 'component' by Kozaczynski (1999). Building on this definition of business component, the PPB framework of Chapter 3, and Telco empirical material on product structuring, capability platforms, and business and supply chain modeling, a three-layered componentization framework was developed to enable the creation of a coherent fabric of internal and external components: the Web of Business Components (WBC; C2.1). The WBC forms a coherent set of business components corresponding to each of the PPB areas: Capability Platforms (CPs), Value Packages (VPs), and Product Bundles (PBs). Each WBC layer represents a distinctive integration role: CPs integrate resources delivering a set of (normative) business services; VPs integrate value from CP business services to achieve optimal value creation and delivery for the customer and optimal value capturing for the ISM firm; PBs integrate (bundles of) propositions/products for (groups of) customers. The role of the VP layer as a 'value bus' resembles a business-level equivalent of the role of an 'enterprise bus' in an IT-related service oriented architecture (SOA) context. Just as the enterprise bus, the value bus prevents a multitude of unnecessary 'n:m' relations between the layers.

Each layer represents a distinctive integration role …

In the second conceptual framework (CF2), the PPB and WBC were mutually related to each other. Product, process and business modeling (as combined in the PPB framework) were discussed in Chapter 3, 4 and 6 to understand the relationship with business component modeling (conceptualized in the WBC framework). However, a detailed discussion of product, process and business modeling as distinct activities was deemed beyond the scope of this study. This also applies to the relationship with (automated)

operational processes, with notions like (web) service 'orchestration' and 'choreography' (Peltz 2003).
Finally, it has been made clear that, with the definitions of product and process as developed in this study, the concept of 'product platform' (Meyer and Lehnerd 1997) is more related to the process than to the product (C2.2). Usually the notion of product platform is applied to denote the use of shared common parts and assemblies in the production process of manufacturing companies. Such common parts and assemblies have relevancy for the cost and flexibility of the process, but need not influence the user experience of the product.
By responding to RSQ2, contributions have been made to the research in the areas of business componentization, business modeling and ICT.

RSQ3 – What are the challenges in managing innovation for mass customization?

The main conclusions relating to RSQ3 are:

C3.1. With an increasing role of ICT in the operational processes of ISM firms, the relative importance of the innovation process for the operational performance of the firm also increases.

C3.2. ISM firms with a modular, horizontalized business architecture require Continuous Innovation Management (CIM) on a Web of Business Components (see Chapter 5).

C3.3. The NSD process can be transformed into a continuous process by incorporating a business component maintenance sub-process as an integral part of the NSD process.

C3.4. In a CIM-based continuous NSD process, the innovation sub-processes are decoupled from the innovation lifecycle stages.

C3.5. Continuous Innovation Management on a Web of Business Components requires an 'empowered' line organization-based innovation management responsibility for each business component. The organizational positioning of this role is crucial for its success.

RSQ3 relates to the requirement to be able to manage the innovation process in ISM firms with a modular, horizontalized business architecture like the proposed Web of Business Components (WBC) framework. What changes are required to the NSD process, and what are the implications for innovation roles and organization? These questions have relevancy for both research and business practice.
Innovation is defined as "changing the value and satisfaction from resources obtained by the customer" (Drucker 1985, p. 33). The innovation process is positioned as the provider of the prerequisites for operations (Edvardsson and Olsson 1996) by implementing new/renewed products and processes within operations, while innovation management is a management process that manages the innovation process. Furthermore, the scope of the innovation process should encompass the full product (combination of core services, auxiliary services and manufactured goods as perceived by the customer), and the full

process (combination of service function and service management capabilities and manufacturing processes as controlled by the provider).

With an increasing role of ICT in the operational processes of ISM firms, the relative importance of the innovation process for the operational performance of the firm increases (C3.1): in a highly automated operations environment the innovation process not only provides the prerequisites for operations but the results of the innovation process directly translate into the operational processes themselves. This puts additional strain on the positioning and design of the innovation process in a modular, horizontalized environment.

Chapter 5, exploring the third challenge of 'innovation management for mass customization', built further on the combination of the PPB and WBC of the second conceptual framework. This chapter looked at ways the innovation process can be managed to cope with a horizontalized fabric of business components. Although much has been written on innovation management, the literature on this specific area is scarce. This is probably due to the fact that 'real business/less IT-related' notions of 'business component' are relatively new. Most existing NSD processes suggest a linear 'open-loop' innovation process consisting of a number of stages from concept development to introduction. For example Scheuing and Johnson (1989) propose a 'normative model of NSD' consisting of 15 stages. The current study has shown that an alternative, continuous approach is needed for innovation management in a horizontalized environment with modular business components based on the WBC framework. Both for innovation and operations, knowledge of the design and (normative) performance/output of operational business components should be continuously available to the various actors. This applies both at the level of individual business components, and at the level of the overall chain architecture. This approach is conceptualized in the Continuous Innovation Management (CIM) framework (C3.2).

Maintain… acts as the 'Check' at the level of business component performance in the Plan-Do-Check-Act cycle …

In this study, the non-linear two-stage NSD process model by De Jong, Bruins et al. (2003) was applied as a starting point for the discussion on innovation management for mass customization. To enable autonomous yet mutually coherent lifecycle management on each business component within the three layers, the innovation process was altered to accommodate this requirement. The resulting NSD process, divided into two sub-processes (Direct and Implement), was transformed into a continuous process by adding a (third) sub-process – the maintenance sub-process (Maintain) – as an integral part of the NSD process (C3.3). The Maintain sub-process acts as the 'Check' at the level of business component performance in the Plan-Do-Check-Act cycle (Deming 1986). This way, principles of continuous improvement and (software industry-originating) release management (Van der Hoek, Hall et al. 1997) have been combined at the level of business components to attain continuous innovation at the business level.

In contrast with open-loop NSD processes, in the CIM-based NSD process the innovation sub-processes are decoupled from the innovation lifecycle stages (C3.4): all three innovation sub-processes play a role during each lifecycle of a business component. Innovation management roles, including the organizational positioning of these roles, are crucial for the successful application of the CIM framework. The most important role is the tactical innovation management role that drives the Maintain and Direct sub-processes of the CIM framework on all three layers of the WBC. This line organization-based role should be fully empowered to take responsibility for the development and normative business performance of a business component (C3.5). At a strategic level it is especially important to implement portfolio management (roles) on each of the three business component layers to drive the continuous creation, changing, combination, and phasing out of business components in mutual coherence. Although some reference has been made to the literature on innovation (management) roles, an extensive discussion of the literature in this area (e.g. Allen 1970; Witte 1977; Galbraith 1982; Hauschildt and Chakrabarti 1989; Hauschildt and Schewe 2000; Hauschildt and Kirchmann 2001) was deemed beyond the scope of this research.
With the rise of the term 'delivery streets' or 'production streets' within Telco during the last 5 to 6 years it became even more clear to the researcher that a continuous innovation management process requires business components on all three layers of the PPB framework. Chronologically, this awareness of the need to fully (business) componentize product, process and business model (see the discussion on RSQ2) came *after* efforts to transform the innovation process into a continuous process. This is visualized in Figure 6.1 (Case 4-2 'Componentized Product Structure' versus Case 5-2 'Life Cycle Management on processes'). For the readability of this thesis, however, it was decided to discuss business componentization *before* continuous innovation management, in Chapters 4 and 5 respectively. This change could be regarded as a 'redirection' in terms of the Systematic Combining research approach (see Appendix B).
By responding to RSQ3, contributions have been made to the research in the areas of NSD and innovation management (organization and roles).

RSQ4 – What is the overall coherence between mass customization, service perspective, and innovation management, given the main research question?

The main conclusions relating to RSQ4 are:

C4.1. (Top)management of ISM firms should consistently communicate the intended mass customization strategy, including strict enforcement of the application ('governance') of the proposed mass customization-supporting business architecture.

C4.2. ISM firms, striving for a modular, horizontalized business architecture, require an integrated innovation management system geared to continuous innovation on a web of business components. The Service perspective Lifecycle Innovation Management (SLIM) model, combining the above PPB, WBC and CIM frameworks, is proposed as such an innovation management system.

C4.3. The transition toward an ISM firm requires a paradigm shift concerning positioning, design and organization of the innovation process.

RSQ4 was not explicitly examined as a specific research sub-question like the other three research sub-questions. Rather, some overall conclusions emerged during the course of this study. The following discussion summarizes a number of such overall conclusions.
As mass customization is a business strategy (e.g. Blecker and Abdelkafi 2006), encompassing the firms' entire value chain, such a strategic direction should be well-communicated by management. From the Telco case it became clear that the transition toward an ISM firm should start with a clear strategy that is consistently communicated by (top) management (C4.1). The term 'mass customization' was rarely used in Telco's strategy communication to label these developments. However, this business strategy clearly seemed to be the aim of the company, especially during the second half of the last decade during which customer focus increased dramatically as part of a strategy to become a full ICT service provider.
A number of Telco initiatives indeed started with clear guidance by (top) management with respect to the pursued goals and the way they should be accomplished. This applied especially to the two strategic long-term 'technology transition' programs described in Cases 3-2 and 3-3. Only after a number of years had passed, the communication intensity diminished somewhat. Although cost reduction was an important driver for these programs, there was also an emphasis on complexity reduction. A weaker point concerned the administrative capacity to enforce enduring change. Most formal governance models as described in the cases remained largely in the realm of corporate networking or IT architects. Furthermore, innovation was not viewed as the full implementer of the prerequisites for operations (Edvardsson and Olsson 1996) but rather as the implementer of networking and ICT. Finally, with the focus on short term (financial) goals, little effort was made to accommodate process flexibility to facilitate future changes. The current study has shown that ISM firms with a modular, horizontalized business architecture require an integrated innovation management system geared to continuous innovation on a web of business components. Chapter 6 discussed the further integration of the three frameworks (PPB, WBC and CIM) into an innovation management system (Koivuniemi 2008, p. 10) for ISM firms: the Service perspective Lifecycle Innovation Management (SLIM) model. This SLIM model forms the overarching contribution of this study (C4.2).

... customer orientation in a 'mass' context may be achieved via the combination of product and process innovation, supported by business model innovation ...

By applying the product, process and business model positioning of the PPB to perform Continuous Innovation Management on a Web of Business Components the concepts of customer orientation and product orientation need not be mutually exclusive, as in customer-versus-product-oriented strategies (Andreasen 1985). Rather, customer orientation in a 'mass' context may be achieved *via* the combination of product and process

innovation, especially if a leading role is given to business model innovation, as proposed in this study.

In Figure 6.3 the SLIM model is positioned in the final Conceptual Framework of this thesis: CF3. The PPB framework forms an architectural foundation for both the WBC and CIM frameworks (R2 and R1 in Figures 6.1/6.2). It was shown that the WBC and CIM frameworks are interdependent. Although WBC and CIM may also positively contribute to the PPB framework no evidence was found for this (reverse) relationship.

Apart from indirectly contributing to Operations as a foundation for innovation management in ISM firms, a SLIM-based innovation management system can also directly support the operational business components, e.g. to support SLA-management between the owners of operational business components. Hence, the SLIM model serves both as an innovation management system and a business architecture framework for ISM firms.

... a paradigm shift seems a prerequisite concerning positioning, design and organization of the innovation process ...

Aside from the numerous challenges per individual research area, and the highly significant role of corporate culture and leadership, there is an another challenge at the intersection of the challenge areas: the application of ICT, based on the concepts of this thesis, to support ISM firms. In a complex environment with multiple business components in each of the three PPB areas, the support of ICT seems indispensible to Direct, Implement and Maintain a Web of Business Components. Paragraph 6.4 has provided a brief introduction on the application of Product Lifecycle Management concepts and ICT for which the SLIM model may provide a foundation (PLM; Stark 2005; Georgalas and Achilleos 2009; Golovatchev, Budde et al. 2010; Lusch, Vargo et al. 2010; CIMdata 2011). This paragraph may be regarded as an operationalization of the concepts in this thesis by illustrating the role of innovation management-supportive ICT in a SLIM-based environment. By means of the SLIM model it was made clear that modifications to the PLM concept (and current PLM supplier products) are required to enable the application of PLM in ISM firms. According to Ramani, Cunningham et al. (2004), several existing PLM/PDM software solutions are not even product-centric but rather (product) data-centric; support for the full product-process-business model scope of the SLIM model would require even a further shift in the Product Lifecycle Management concept.

Hardjono and Bakker observe that an innovation can only be recognized afterwards by the fact that it has resulted in a paradigm shift (2006, p. 256). For ISM firms, a paradigm shift[71] seems a prerequisite concerning positioning, design and organization of the innovation process (C4.3), involving much more than horizontalizing the organizational chart. This

[71] 'Paradigm' is applied here in a generalized meaning of the term as defined by Capra: "A constellation of concepts, values, perceptions and practices shared by a community, which forms a particular vision of reality that is the basis of the way a community organizes itself. " Capra, F. (1996). The Web of Life: A new scientific understanding of living systems. London, Harper and Collins.

may be accomplished by consistently communicating a service perspective and mass customization strategy by top management and by positioning and organizing the innovation process along the lines of the SLIM model. According to Boynton, Victor et al. (1993) mass customization requires a hub-and-web-based control system with centralized network coordination and flexible processing units. They state that the mass customizer organizes and engineers both the processes and the connections between processes for low-cost flexibility. The SLIM model may enable a spider's web organization, "a light yet structured quality of its (network) connections", envisioned by Quinn and Paquette (1990, p. 72). The innovation management system based on the SLIM model may support such an organization at the level of the innovation process, providing well-designed (and well-implemented) prerequisites for operations, as well as directly empower front-line customer-interacting personnel by providing the required support. However, this is clearly not enough. Quinn and Paquette cite the respondents in their study: "… our technology is one key factor in execution. The other is the management system and culture that cause our people to react quickly and favorably to our offerings and customers' needs' " (Quinn and Paquette 1990, p. 75). This is probably the most important factor for any organizational strategy to succeed.

7.2 Limitations

A number of limitations can be identified regarding the research approach as well as the treatment of the various areas under study.

(1) A limitation concerning the research approach is that the study is based on a single-case study within one research context: Telco. Application of a single-case study inherently raises questions as to the generalizability of the research results. Seemingly generic context characteristics within Telco could prove to be rather specific. For example, the observed high level of technology orientation within Telco seems generic for most incumbent telecom (service) providers, but the actual consequences of this phenomenon could be rather Telco-specific. Yin warns against the risk that the case study may shift its orientation if too much attention is given to the individual subunits of the embedded cases (Yin 2003, p. 46). These effects are minimized by applying the Structured-Case approach in which the conceptual framework provides a continuous link to the research process and data. Apart from the evolving conceptual framework, a number of tables have been used to summarize related case evidence. According to Eisenhardt and Graebner (2007, p. 29) this is an effective way to present an 'unbroken narrative'. By applying the 'Critical Appraisal Guidelines for Single Case Study Research' of Atkins and Sampson (2002) as a checklist throughout the study the researcher has attempted to perform the case study in the best possible way. Probably the weakest point in the current research is the manner in which the data concerning the various sub-cases were collected (Atkins and Sampson 2002, p.107, table 3, item 15). Due to the researcher's combined practitioner/researcher role (Saunders, Lewis et al. 2003, p. 98-99) and the retrospective character of the study, it was difficult to

clearly separate own observations from those offered by interviewees. To overcome this issue, the entire manuscript was reviewed by three co-readers, of which two were involved in the programs as described in the sub-cases. One co-reader left Telco in 2005; the other left Telco in 2004, but remained involved in the sub-case programs until 2010 as an external consultant. These reviews resulted in a number of corrections in the research data of the sub-cases, as well as in the interpretation of this data.

The SLIM model has been developed from a broader generic perspective of ISM firms. Many of the concepts developed in this study have been tested within Telco, as discussed in the various cases. For generalizability, the validity of the SLIM model should be tested in other research settings.

(2) Telco has not explicitly communicated a mass customization strategy, neither within the company nor to external stakeholders. The current study has assumed that Telco sought a mass customization business strategy, delivering customized products and services at the lowest possible cost. This assumption is based on a combination of observations that suggest a mass customization ambition, as described in the case study.

(3) Although the concepts in this thesis have been developed from an 'extended enterprise' or innovation network viewpoint, the specific role of suppliers and customers with regard to managing innovation in ISM firms has received relatively little attention.

(4) A theoretical discussion on 'ontology' has not been given in this thesis, although the subject is highly applicable to this study, notably to the Chapters 3 and 4. An ontology is a framework that provides a shared and common understanding of a domain that can be communicated between people and heterogeneous and widespread application systems (Fensel 2001). An ontology may be defined as the specification of a representational vocabulary for a shared domain of discourse which may include definitions of classes, relations, functions and other objects (Gruber 1993). The NGOSS eTOM and SID model from the TMF, as discussed in Case 4-3, could be viewed as an ontology for the telecommunications industry (Duke, Davies et al. 2005). Likewise, the PPB and WBC frameworks that have been developed in Chapters 3 and 4 of this thesis could be viewed as an ontology for ISM firms. However, for the purpose of this study it was not deemed necessary to include a theoretical discussion on the subject of 'ontology'.

(5) The single case in this study roughly spans the last decade. This PhD research was conducted during the last five years of this period. This could imply a different research approach for the two periods. During the last five years a full practitioner-researcher role (Saunders, Lewis et al. 2003, p. 98-99) applied, although the researcher's involvement in the various case subjects varied; during the first five years only a practitioner role applied, again with varying involvement in the programs described in the sub-cases. Since the practitioner role did not substantially change during this decade, and most cases spanned both the first and second period, the difference in research approach is limited. Apart from additional explicit memoing during the last five years, there was no difference whatsoever in collecting and analyzing the data. Consequently, it is asserted that differences in the process and outcomes of this research are negligible.

(6) A possible source of bias may be the researcher's belief that structure, applied strictly yet moderately and pragmatically within a well-defined strategy, may induce another way

of working. Although several Telco-based empirical examples of this phenomenon have been given, this bias may be detectable in the reasoning and resulting conceptual framework of this thesis.

7.3 Further research opportunities

This study calls for further research in a number of directions. This paragraph offers some suggestions. To test the generalizability of the SLIM model, the model should be validated for application at other telecom providers and other ISM firms like financial service or e-business firms. This should include the extreme variants of full service firms and pure manufacturing firms.

One of the outcomes of this research is a strict definition of 'product' and 'process' (innovation) in a service perspective context, with 'business model' (innovation) as an integrating component. To be sustainable, these definitions must remain valid for any product/process combination in any context, including non-ISM firms. This implies that the proposed definitions and positioning should be further tested against existing literature (e.g. Abernathy and Utterback 1975; Simonetti, Archibugi et al. 1995; Gopalakrishnan, Bierly et al. 1999; Edquist, Hommen et al. 2001; Damanpour and Aravind 2006) and other empirical material.

Further research is required in the area of business components, notably the relationship between WBC and PPB-based product modeling, process modeling and business modeling. The specific role of customers, suppliers and other stakeholders needs further attention, specifically in an open innovation environment (Chesbrough 2003; Chesbrough 2011). Research is required on the measurement of innovation performance in a de-siloed, horizontalized, componentized environment, and on the relationship with financial management, e.g. measures to respond to the issue of 'the first passenger pays the bus' in case of additional initial investments to increase future reusability of business components. It would be interesting to study whether concepts and findings from the field of 'enterprise asset management' in the construction/utility industry (e.g. Sarkar 2003) could be translated toward the level of business components in ISM firms.

Another area of study pertains to the requirements for mass customization-supporting ICT for innovation management in an ISM context, including the relationship with other mass customization-related ICT, e.g. design tools/product configurators.

The relationship between mass customization and Product Lifecycle Management (PLM) concepts/ICT in a service perspective environment also requires further research. A specific subject in this context is the visualization of the WBC for the actors in the innovation and operational processes. Visualizing the 'service chain' coherence between business components in a web of business components based on service perspective PLM tooling offers an additional way of tangibilizing the outcome of the innovation process for the actors involved. This would offer an additional visualization tool besides the existing service process design visualization concepts based on service blueprinting or mapping

(Shostack 1984; Kingman-Brundage 1989; Bitner, Ostrom et al. 2008). A further research subject pertains to how such visualization could optimally support the innovation process. The relationship between SLIM model-based innovation management and operations needs further study, notably the relationship between the WBC and (automated) operational processes. This may include notions like 'orchestration' and 'choreography,and service develivery concepts like SDF/SDP.
Finally, more research is needed on innovation roles in a business componentized ISM context, e.g. the relationship between 'permanent' line organization-based innovation management roles that have been discussed in Chapter 5, and temporary project roles. Another area for further study could be the relationship between business component 'ownership' for innovation, versus responsibility/accountability for operational business components. In general, the 'human factor' needs further study: both at the level of professionals and the level of (top) management. In the end, the role of front-end operations personnel may determine the customer experience. However, given the growing importance of the innovation process to provide the prerequisites for operations, the human factor in innovation management could be equally decisive for the success of ISM firms. Hewitt (2009) describes the reluctance of product engineers with changes in the development process due to the implementation of PLM. With the scope extension of PLM toward the business model and process realm similar issues may apply to other innovation roles like product and process managers.

7.4 Managerial contributions and recommendations; final remarks

The aim of this research has been to develop theory that is not only of scientific interest, but also has relevancy for business. This paragraph provides managerial contributions and recommendations for ICT-intensive service perspective firms seeking a mass customization business approach.
The managerial motive for this research has been the quest for an innovation management system that could guide the transition from product oriented, silo-based organizations toward customer oriented, modular, horizontally organized ISM firms. An overarching managerial contribution of this research is the development of the Service perspective Lifecycle Innovation Management (SLIM) model, forming such an innovation management system. The SLIM model can also be viewed as a 'business architecture' framework for ISM firms as the scope of the model encompasses the entire business scope of ISM firms in their value networks. Versteeg and Bouwman (2006, p. 92) apply the concept of business architecture "to structure the responsibility over business activities prior to any further effort to structure individual aspects (processes, data, functions, organization, etc.)". In the SLIM model ICT-based concepts like service orientation, componentization, and release management have been extended to the business level of the (extended) enterprise. This should enable manufacturing-based concepts like platform thinking and modularity to be applied in ISM firms in a fast-changing environment. Business componentization is not

only applied to the area of business processes, but also on products and business models. Table 6.2 summarizes a number of enablers for such business componentization.
The SLIM model may form a foundation for Product Lifecycle Management in an ISM context, as described in Paragraph 6.4. However, although SLIM-based PLM may form an integrative ICT-supported basis for innovation management in ISM firms, the managerial contributions can also be described without reference to PLM. The results of the study can be applied to the following aspects relating to ISM firms:

- design and implementation of innovation management processes, roles, organization and tooling
- day-to-day innovation management in a modular, horizontally organized environment
- rationalization of existing product, process and business model portfolios
- transition from product/technology silos toward a modular, horizontalized organization structure
- portfolio management on both a tactical and strategic level, including the relationship between business component portfolios and project portfolios
- cost, revenue and business modeling
- business continuity management, risk management and compliance management
- outsourcing/out-tasking decisions and management of both internally and externally sourced tasks/goods/services
- (automated) operations, including SLA management, automated orchestration/ choreography and new (service) delivery concepts like the Service Delivery Platform (SDP)[72].

Managerial recommendations for ICT intensive service-perspective firms
In the course of this thesis various 'lessons learned' have emerged concerning the implementation of mass customization within Telco. These aspects have contributed to the development of the conceptual framework, ultimately resulting in the SLIM model. The next list summarizes the main do's and don'ts in the form of a set of recommendations for ICT-intensive service perspective firms pursuing a mass customization business approach based on modular business components:

1. Communicate a clear mass customization and service perspective strategy from top-level management, not only including productivity or cost elements, but explicitly stating the desired level of customization and related requirements of agility/flexibility concerning the development of products, processes and business models.
2. Think of the product as the 'value-in-use' customer experience, based on the full combination of a coherent set of customer-perceived core services, auxiliary services, and (manufactured) goods.

[72] A Service Delivery Platform (SDP) is an environment or framework that is a blend of components to create, deliver, 'provision', personalize, charge/bill and manage services independent of the network technology. Partridge, B. (2006). Next-Generation Service Delivery Platforms for Fixed and Full-Service Operators: Drivers, Inhibitors and Perceptions, Yankee Group

3. Think of the innovation process as the full implementer of the prerequisites for operations, not only as the implementer of a new proposition with associated technology or ICT. This includes innovation of the business model, operational processes, data structures and organization.
4. View 'the business' not only from a product proposition perspective, but equally from a process capability perspective. Provide balanced 'asset' ownership between the product and process layer, and apply the 'business model' concept and associated 'value bus' as a guiding and integrative layer.
5. Componentize and manage the firm as an extended enterprise, consisting of a coherent web of business components spanning the product, process, and business model areas.
6. Assign to each business component a single responsible, line organization-based, owner (person) and a single accountable owner (organizational unit) for continuous innovation, and a single accountable owner (organizational unit) for operations.
7. Organize portfolio management for comparable business components on each of the horizontal layers: not only on the Product Bundle layer, but also on the Capability Platform and Value Package layers. This should ensure the appropriate dynamics in forming, combining, splitting, and discarding business components in each layer.
8. Adapt the innovation process from a one-off projects perspective toward a continuously innovated business component lifecycle perspective, geared to knowledge preservation and reuse in a modular, horizontally layered environment. Link innovation projects to the associated business components: each project should explicitly contribute to one or more business component(s) (release).
9. Provide clear and long-term implementation governance for an ongoing firm-wide application of the above framework. Designing a business architecture in support of modular, horizontalized operations only forms the starting point.
10. Emphasize the operational advantages of the alternative innovation management approach. One such an advantage is a continuous up-to-date insight in the coherence of the entire 'service chain' for all actors involved. This e.g. enables coherent SLA-management between operational business component 'owners'. Although the innovation process provides the lever for effective ISM operations, sufficient emphasis should be given to the immediate and longer-term operational advantages, since this is probably more 'top of mind' for management and professionals than the innovation process or innovation management system.

Implications for Telco

How can the above recommendations impact the future development of Telco? From 2007 onwards Telco has explicitly presented itself as an ICT service company striving to be one of the best service providers in its geographical area. In Table 7-1 the prospective transition toward a full (ISM) service perspective firm is shown. In this table, the earlier Table 6-1 has been expanded with a third phase/column.

At Telco, the third, 'full (ISM) service perspective phase' (right column), has yet to get underway. Focus would need to shift from 'value-in-exchange' to 'value-in-use' (Vargo and Lusch 2004a) for any combination of goods-based and service-based products. In this

third phase, lifecycle focus would be on the post-launch (operational) phase of an entire product set-up in the market. This is the phase in which value for customers is created and delivered, and value for Telco is captured. Both innovation (management) and operations are focused on value creation, delivery and capture with customers and other partners in the value network. This includes all service function capabilities and service management capabilities in mutual coherence. Release management is focused on ongoing value creation, delivery and capture *after* the initial launch date. Moreover, release management is applied at the level of (versions of) business components. Next to release management, integrated portfolio management is applied to three layers of business components in mutual coherence. This could be accomplished by implementing Continuous Innovation Management on a Web of Business Components as proposed in the current study. Such a transition not only relies on governance structures and models, but requires another way of thinking and working, incorporating an unprecedented level of business and customer focus not only directly at the operational level but also in the innovation process.

Table 7-1 Telco's prospective transition toward a full ISM firm

	Initial service perspective	Emerging service perspective	Full (ISM) service perspective
Period	2000 - 2005	2005 - 2011(?)	2012(?) - … (?)
Lifecycle focus	Pre-launch period	Launch date	Post-launch phase
Innovation focus	Technology projects	Project deliverables	Value creation, delivery, capture
Operations focus	Technology	Core (TI-based) service + customer satisfaction	Value creation, delivery, capture
Release management focus	Technology release management	One-off release on coordinated initial launch date	Continuous innovation management on business components

Thus, for Telco, the transition to the third phase seems to have the character of a 'paradigm shift'[73]. This should start with a well-communicated strategy, not only at the pursued level of cost and productivity, but also at the pursued level of customization and the associated organizational agility. It would mean a repositioning and redesign of the innovation process as the full implementer and continuous 'maintainer' of the prerequisites for Operations, not only geared to the one-off 'roll-out' of product propositions, technical infrastructure and ICT. Furthermore, it would require professionals that are empowered to assume clear innovation responsibility in a Web of Business Components. This could be accomplished by re-vitalizing the Development Manager role (Case 5-3), and extending the scope of this role to the service management capability area. The application of PLM concepts and ICT based on a centralized WBC-based catalog would probably be indispensable to 'enforce' a company-wide practice. The implementation of the above measures within Telco would require an organizational change trajectory starting with a redesign of the innovation

[73] 'Paradigm' is used here in the same way as for footnote 71.

process, organization and roles based on a clear ISM strategy, and strong enduring leadership to achieve sustainable results.

Other generic managerial recommendations

The implementation of ISM-supporting ICT tooling, like service perspective Product Lifecycle Management (PLM)-based software as discussed in Paragraph 6.4, seems indispensible in a complex and fast-changing business environment. However, one should only start investing in such tooling once the ten recommendations described above have been sufficiently implemented.

Continuous Innovation Management should also be applied to the innovation management system itself. In a dynamic environment innovation management-related processes, roles, and tooling should continuously adapt to these changing circumstances. Furthermore, with an increasing importance of co-innovation with customers, suppliers and other stakeholders in an open innovation environment (Chesbrough 2003; Von Hippel 2005; Chesbrough 2011), innovation management capabilities may be increasingly exposed to external partners (via associated Value Packages and Product Bundles). In that case it would become appropriate to componentize (parts of) the innovation management system itself, and manage these components in the same manner as the operations-related business components.

Final remarks

This study has holistically explored the challenges in managing innovation for mass customization in ICT-intensive service perspective firms in a fast-changing environment. Via four challenge areas and associated research sub-questions the study has developed a Service perspective Lifecycle Innovation Management (SLIM) model that may serve as an innovation management system for such firms. It has been shown that it is insufficient to only concentrate on the operational processes of such firms. Giving at least as much attention to the positioning, design and organization of the innovation process can leverage the combination of customer focus, operational productivity, and innovational agility. The SLIM model has been developed by combining innovation management-related literature from diverse research areas with empirical material from a single-case study at the mid-size telecom operator ‘Telco’. Within the framework, the main contributions are the strict positioning and definition of ‘product’ and ‘process’ with business modeling as integrative concept supporting decoupling of product and process lifecycles; the notion of a web of business components spanning the product-process-business model scope of an extended enterprise; and a continuous innovation process for (modular) business components in a horizontalized business environment. The SLIM model lays a foundation for the application of PLM concepts and tooling, and it offers a starting point for various business applications and further study as suggested in this chapter. By heeding the above recommendations, and with the support of the discussions and findings in this thesis, the learning curve of companies pursuing the above strategy can be reduced significantly.

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Appendices

Appendix A – Abbreviations

BCC	Business Component Catalog
BMF	Business Model Framework
BSS	Business Support Systems
BU	Business Unit
CAD	Computer Aided Design
CAM	Computer Aided Manufacturing
CBM	Component Business Model® (IBM)
CBS	Composite Business Services
CD	Continuous Delivery (Telco specific)
CF	Conceptual Framework
CIM	Continuous Innovation Management framework
COPD	Customer Order Decoupling Point
CoPr	Commercial Product (Telco specific)
CP	Capability Platform
CRM	Customer Relationship Management
EAM	Enterprise Architecture Management
EAM	Enterprise Asset Management
eTOM	Enhanced Telecom Operations Map
ERP	Enterprise Resource Planning
ESB	Enterprise Service Bus
FAB	Fulfillment, Assurance, Billing
FO	Front-Office (Telco specific)
FuPr	Functional Product (Telco specific)
GPM	Generic Process Model (Telco specific)
ICT	Information & Communications Technology
IMS	IP Multimedia Subsystem
IP	Internet Protocol
ISM	ICT-intensive Service perspective Mass-customized
ISV	Independent Software Vendor
IT	Information Technology
ITU	International Telecommunication Union
LCM	Life Cycle Management
MSM	Mirrored Spaces Model
MSP	Managing Successful Programmes
NGOSS	New Generation Operations Software and Systems
NO	Network Operator
NP	Network Provider
NPD	New Product Development
NPS	Net-promoter Score
NSD	New Service Development
OFAB	Operational readiness, Fulfillment, Assurance, Billing
OECD	Organisation for Economic Co-operation and Development

OGC	Office of Government Commerce
OSI	Open Systems Interconnection
OSS	Operational/Operations Support System
OS&R	Operations Support & Readiness
PAC	Project Action Committee (Telco specific)
PB	Product Bundle
PDM	Product Data Management
PLM	Product Lifecycle Management
PPB	Product-Process-Business model innovation framework
PS	Product Structure (Telco specific)
RfI/RfP	Request for Information/Request for Proposal
RUP	Rational Unified Process (IBM RUP®)
R&D	Research & Development
SCA	Service Component Architecture
SCM	Supply Chain Management
SDF	Service Delivery Framework
SDP	Service Delivery Platform
SID	Shared Information/Data model
SIP	Strategy, Infrastructure, Product
SLA	Service Level Agreement
SLIM	Service Lifecycle Innovation Management
SNI	Service & Network Integration
SO	Service Operator
SOA	Service Oriented Architecture
SP	Service Provider
SPLM	Service perspective Product Lifecycle Management
SRM	Software Release Management
SRM	Standard Release Management process (Telco specific)
SRMO	Service & Resource Management and Operations
TAM	Telecom Applications Map
TePr	Technical Product (Telco specific)
TI	Telecom Infrastructure
TINA	Telecommunications Information Networking Architecture
TMF	TeleManagement Forum
TPM	Technical Product Manager (Telco specific)
UML	Unified Modeling Language
VOA	Value Oriented Architecture
VP	Value Package
WBC	Web of Business Components
W&O	Wholesale & Operations (Telco specific)

Appendix B – Research approach: Structured Case and Systematic Combining

Structured-Case

The Structured-Case method (Carroll and Swatman 1999; Carroll and Swatman 2000) is a methodological framework that was originally developed for Information Systems researchers (Figure B.1). It is aimed at performing qualitative theory-building research, to be done from an interpretative or positivistic paradigm. The method is designed for field research, which is 'research… which involves the direct observation of social phenomena in their natural settings' (Babbie 1992) and builds on existing methods for research such as case study of Yin (2003) and Eisenhardt (1989).

It strives to achieve convincing explanations that are strongly linked to both the research themes and the data collected in the field. According to Eisenhardt (1989) a strong theory building study has a good, although not necessarily perfect, fit with the data. The Structured-Case method can assist the researcher (and the reader) with three key issues:

- building theory using case studies
- demonstrating the process of knowledge and theory building, and
- assuring the rigor of the case study research (Carroll, Dawson et al. 1998, p. 65).

'Structured' in the Structured-Case method refers to the application of a formal process model comprising of three structural components: a conceptual framework, a pre-defined research cycle and a literature-based scrutiny of the research findings, to assist the researcher in theory building (Carroll and Swatman 2000, p. 236). The conceptual framework and a structured research cycle stem from the cyclical process of action research by Susman and Evered (1978) and Deming's process improvement model (1986).

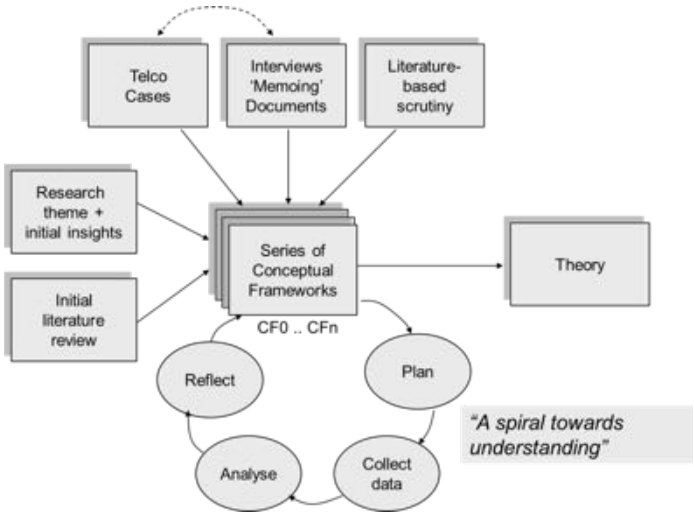


Figure B.1 Structured-Case method

The concepts in the Conceptual Framework are handled as 'codes': data with a certain conceptual or structural cohesion (Miles and Huberman 1994). These codes are the link between the data, data analysis and the research theme.
The literature-based scrutiny during each research cycle compares and contrasts the outcomes of the research process with a broad range of literature to support or challenge the theory built (Carroll and Swatman 2000, p. 236).
'Case' in the Structured-Case method refers to the unit of research or unit of analysis: a single case (person, organization, process or an information), 'a specific, unique, bounded system' (Stake 1995), that will be examined in its natural context.
From an initial Conceptual Framework 0 (CF0), that coincides with the research model, the theory develops through a number of cycles to the ultimate conceptual framework of this thesis: CF4. "Multiple iterations of these cycles enact a spiral toward understanding, as current knowledge and theory lay the foundations for yet another research cycle that will expand or revise our understanding. The resulting series of conceptual frameworks documents both the *process* through which the theory was built and its *links* to the data collected in the field" (Carroll and Swatman 2000, p. 239).

Systematic Combining
Systematic Combining (Dubois and Gadde 2002) is an approach to case research that is grounded in abductive logic (Peirce 1931; Fann 1970). "Abduction is an inference from a body of data to an explaining hypothesis. It is the only logical operation which introduces any new ideas; for induction does nothing but determine a value, and deduction merely evolves the necessary consequences of a pure hypothesis" (Fann 1970, p. 10). Systematic Combining can be described as a nonlinear, path-dependent process of combining efforts with the ultimate objective of matching theory with reality. In this process the theoretical framework, empirical fieldwork, and case analysis evolve simultaneously. During this process, the research issues and the analytical framework are successively reoriented when they are confronted with the empirical world. The approach is particularly useful for development of new theories (Dubois and Gadde 2002, p. 554).

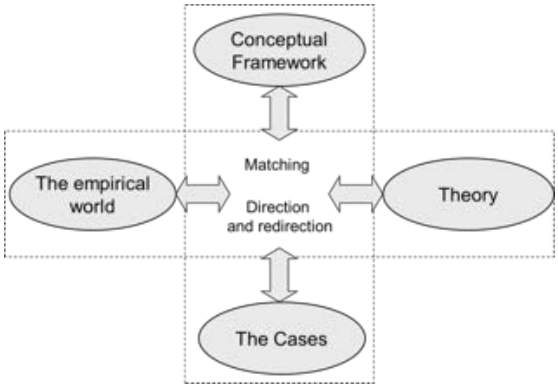


Figure B.2 Systematic Combining

The Systematic Combining approach builds on two concepts: matching and direction and redirection (Figure B.2). Matching is about going back and forth between framework, data sources, and analysis. Most data collecting activities are directed toward the search for specific data in line with the current framework. These activities need to be complemented by efforts aiming at discovery. This may result in redirection of the study. The analytical framework is of great importance in the systematic combining process. This framework is supportive of Weick's suggestion to 'invest in theory to keep some intellectual control over the burgeoning set of case descriptions' (Weick 1979, p. 38). Dubois and Gadde suggest to use a framework that is both tight and evolving (Dubois and Gadde 2002, p. 556). This fits well in the Structured-Case approach in which the Conceptual Framework evolves during the various research cycles (Carroll and Swatman 1999; Carroll and Swatman 2000).
One important consequence of Systematic Combining is that the case evolving during a study can be regarded as a 'tool', as well as a 'product'. The design of a case study, thus, becomes important to sharpen this 'tool' since this will be decisive of the final case, which is a 'product' that cannot be planned in advance. A selection must be made during the process because, when the case is finally turned into a 'product', there should be no confusing pieces left (Dubois and Gadde 2002, p.558).

Appendix C – Overview of semi-structured interviews

Function	Date	Contribution to case
IT Manager	3 Dec 2007, 14 Jan 2008, 4 Febr 2008	3-2, 3-3
Enterprise Architect	13 Jan 2008	3-2, Overall
IT Architect	28 Jan 2008	3-2, 4-4, 5-1, 5-2
Process Architect	28 Febr 2008, 3 April 2008	4-4, 5-2
Process Architect	17 and 26 March 2008	4-2, 4-3, 4-4, Overall
Quality Manager	18 March 2008	Overall
Network Architect	9 Oct 2008 and 25 Nov 2008	2-1 2-2, 3-1, Overall
Corporate IT Manager	2 Dec 2008	3-2, 4-4, Overall
Application Service Architect	29 April 2009	Overall
Innovation Manager	16 and 28 April 2009	Overall
Product Manager	20 April 2011	5-1, 5-2, 5-3, Overall
Legenda		
Case 2-1 – Portfolio Rationalization Business Market		
Case 2-2 – Modular Portfolio Business Market		
Case 3-1 – 1-Model		
Case 3-2 – IT Reference Architecture		
Case 3-3 – IP-based Networking & Services		
Case 4-1 – Technical Infrastructure Platform		
Case 4-2 – Product Structure		
Case 4-3 – TMF NGOSS eTOM framework		
Case 4-4 – Business Process and Supply Chain Modeling		
Case 5-1 – New Service Development process		
Case 5-2 – Release Management on Processes		
Case 5-3 – Development manager role		
Overall: contribution to multiple cases		

Appendix D – Mapping of innovation types in the literature on PPB product and process

Innovation types	Authors	PPB Product	PPB Process
Ad hoc	Gadrey and Gallouj (1998)	x	x
Administrative	Teece (1980), Damanpour (1987), Gopalakrishnan and Damanpour (1994)		x
Architectural	Henderson and Clark (1990)	x	x
Brand	Ahmed and Zairi (1999)	x	
Breakout	Coppendale (2004)	x	x
Business model	Hamel (2000), Osterwalder and Pigneur (2002), Chesbrough (2007)	x	x
Business process	Møller (2007)		x
Continuous	Tatikonda and Zeithaml (2001), Nonaka and Yoyama (2003)	x	x
Delivery	OECD (1997)		x
Discontinous	Veryzer (1998), Bessant (2005)	x	x
Disruptive	Christensen (1997), Markides (2006)	x	x
Distribution channel	Osterwalder and Pigneur (2002)		x
Enterprise model	Giesen, Berman et al. (2007)		x
Formalisation	Gallouj and Weinstein (1997), Gadrey and Gallouj (1998)		x
Good(s)	Tidd and Hull (2003)	x	
Incremental	Ettlie (1984), Henderson and Clark (1990), De Brentani (2001)	x	x
Infrastructure	Osterwalder and Pigneur (2002), Nightingale (2003)		x
IT	King, Gurbaxani et al. (1994)		x
Input	Schumpeter)1934)		x
Management	Currie (1999), Hamel (2006)		x
Management model	Birkenshaw and Goddard (2009)		x
Market	Schumpeter (1934), Johne (1999)	x	
Marketing	Peterson, Rudelius et al. (1972), Aitken, Ballantyne et al. (2006)	x	x
Modular	Henderson and Clark (1990)	x	x
Open	Chesbrough (2003), Von Hippel (2005), Chesbrough (2011)	x	x
Organisational	Djellal and Gallouj (2001)		x
Paradigm	Bessant and Davies (2007)	x	x
Position	Bessant and Davies (2007)	x	x
Process	Abernathy and Utterback (1975), Davenport (1993), Edquist (2001), Damanpour and Aravind (2006)		x
Product	Abernathy and Utterback (1975), Cooper 1984, Edquist (2001), Damanpour and Aravind (2006)	x	
Production	Ettlie and Rubenstein (1980), Jelinek (1987)		x
Radical	Ettlie (1984), Henderson and Clark (1990)	x	x
Recombination	Gallouj and Weinstein (1997)	x	x

Innovation types	Authors	PPB Product	PPB Process
Revenue model	Giesen, Berman et al. (2007)	x	x
Service concept	Edvardsson and Olsson (1996), Den Hertog (2000)	x	
Service delivery system	Den Hertog (2000)		x
Service offering	Van der Have, Toivonen et al. (2007)	x	
Service process	Edvardsson and Olsson (1996)		x
Service product	Van der Have, Toivonen et al. (2007)	x	
Service system	Edvardsson and Olsson (1996)		x
Service(s)	Martin and Horne (1993), Den Hertog (2000), Van der Aa and Elfring (2002), Tidd and Hull (2006)	x	x
Social	Drucker (1987)		x
Strategic	Markides (1997)	x	x
Strategy	Hamel (1998), Johnston and Bate (2003)	x	x
Systematic	Zhang, Tan et al. (2003)	x	x
Systemic	Dooley and O'Sullivan (2003), Jaspers (2009)	x	x
Technological	Utterback (1971), Teece (1986), Damanpour (1987), Christensen (1995), Dodgson, Gann et al. (2008)		x
Value	Kim and Mauborgne (1999; 2005)	x	x

Appendix E – Business componentization 'candidate concepts' in the literature

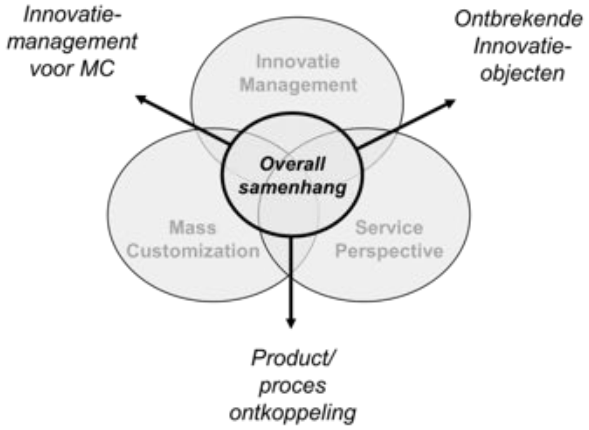
Concept	Description	Authors
Artefact	Each layer in the TMF's information model (SID, refer to Case 4-3) has its own artifacts, with each artifact having its own lifecycle.	TMF (2007)
Asset	Usually applied in the sense of a useful or desirable thing or quality, not applied in a business component sense as defined in this thesis. 'Asset' may denote a business component if used as a single item of ownership, e.g. to label a combination of resources in capital intensive industries, like real estate, infrastructure and utility providers (Brint, Bridgeman et al., 2009)	Brint, Bridgeman et al. (2009)
Bundle	Bundling is a form of versioning of products in which two or more distinct products are offered as a package at a single price.	Shapiro and Varian (1999)
Business capability	Business capabilities describe the ability of an organization, system or process to generate a defined output without having to define the applied technologies and resources. Business Capabilities are regarded as a 'black box'. Processes lying behind, resources and technologies are not transparent at first.	Fleischer (2007)
Business component	An enterprise can be described as a set of business components with business services as their interaction interfaces. The key characteristic of a business component is that a user of its services doesn't have to be aware of how the component works. Earlier notions of 'business component' were predominantly IT related.	Tian, Ding et al. (2006) Sanz, Becker et al. (2007)
Business module	Business modularity as a container for modularity in three dimensions: product, process and supply chain (or network) design. The term 'business module' is seldomly used in this context.	Wolters (2002)
Business service	As used in relation with the above business modularity related notion of business component. The user of a business service only knows about the service itself, along with whatever associated properties are elevant, for example: the price, agreed service levels, terms and conditions.	Sanz, Becker et al. (2007)
Capability	Usually not applied in a business component sense, e.g. 'internal and external organizational skills, resources, and functional competencies' (Teece and Pisano, 1994). Sometimes applied to denote a business component, e.g. 'a coherent block of business functionality, with its associated process and data, which is exposed via standard interfaces' (Glass, 2008).	Teece and Pisano (1994) Glass (2008)
Component	As applied in 'component-based development'. Concept from the software engineering area. A (business) component is the software implementation of an autonomous business concept or business process. It consists of all the software artifacts necessary to represent, implement and deploy a given business concept as an autonomous, reusable element of a larger distributed information system.	Herzum and Sims (2000)
Module	Modularity has its roots in the seminal work of Simon (1962), where he explored the architecture of complexity. A modular structure is a structure consisting of self-contained, functional units (modules) with standardized interfaces and interactions in accordance with a system definition (Miller and Elgård, 1998). Baldwin and Clark (2000) define a module as a unit whose structural elements are powerfully connected among themselves, and relatively weakly connected to elements in other units. Modules are usually described as distinctive types, e.g. product module, process module etc.	Simon (1962) Miller and Elgård (1998) Baldwin and Clark (2000)

Concept	Description	Authors
Organisation module	The loosely coupled organizational forms allow organizational components to be flexibly recombined into a variety of configurations, much as a modular product system enables multiple end-product configurations from a given set of components. The term 'organisation module' as a building block of a modular organisation is seldomly used.	Schilling and Steensma (2001)
Platform	'Platform thinking' concept: the process of identifying and exploiting the shared logic and structure in a firm's activities and offerings to achieve leveraged growth and variety. Can be applied on various levels, e.g. product, process, brand, industry.	Sawhney (1998)
Process	Usually not applied in a business component sense, refer to Chapter 3 of this thesis.	
Process component	Building blocks for reusable standardized service processes.	Cao (2006)
Process module	A process module is defined as a standardized, not further divisible, process step.	Hoogeweegen, Teunissen et al, (1999)
Process platform	Process platform refers to the specific arrangements of the development and production systems to produce the desired variety of products and services easily.	Halman, Hofer et al. (2003)
Product	Frequently denotes a component in a manufacturing context: the artifact of which ownership is transferred from a supplier to a customer. However, this is less clear in a service context, refer to Chapter 3 of this thesis.	
Product bundle	Refer to Bundle. With varying meanings of 'product'.	
Product line	The various meanings of this concept again reflect the the various meanings of the term 'product'. It may denote e.g. 1) the marketing related meaning of a collection of all products manufactured by a firm (Dean, 1950), 2) the software engineering related concept of Software Product Line (Clemens and Northrop, 2001, see below).	Dean (1950) Clemens and Northrop (2001)
Product module	A (product) module is an essential and self-contained functional unit relative to the product of which it is part. The (product)module has, relative to a system definition, standardized interfaces and interactions that allow composition of products by combination.	Miller and Elgård (1998)
Product platform	A collection of assets that are shared by a set of products.	Robertson and Ulrich (1998)
Production line	Or assembly line. Concept originating from the goods manufacturing area; a set of sequential production processes starting with the introduction of the assembly line by Henry Ford in 1914	Hemmer (1995)
Resource	Specific physical, human, and organizational assets that can be used to implement value-creating strategies (Teece, Pisano et al., 1997).	Teece, Pisano et al. (1997)
Service	Refer to this thesis. Some notions of service refer to a business component meaning. E.g. 'service' as used in Service Oriented Architecture (Steen, Strating et al., 2004), 'web services' (Yang, 2003, see below), and 'service' related to business componentisation (Cherbakov, Galambos et al., 2005).	Steen, Strating et al. (2004) Yang (2003) Cherbakov, Galambos et al, (2005)
Service bundle	Refer to Bundle. With varying meaning of 'service'. Sometimes used to denote the service part of a broader product bundle.	

Concept	Description	Authors
Service component	Predominantly used in IT-related notions like web service componentization (Yang, 2003), and Service Component Architecture (www.osoa.org).	Yang (2003) www.osoa.org
Service module	Related to the various meanings of 'service', a service module may e.g. refer to the 'service and maintenance process': Service modularity is the development of product modules with minimal dependencies upon other components in the product with regard to service and maintenance processes (Gershenson and Prasad, 1997). Recent definitions include the full 'service' scope: Service (process) modularity is defined as the usage of reusable process steps that can be combined ("mixed and matched") to accomplish flexibility and customization for different customers or situations in service implementation (Bask, Lipponen et al., 2010).	Gershenson and Prasad (1997) Bask, Lipponen et al. (2010)
Service platform	As with a physical product, the (service) platform comprises the major functional groups that must interact to deliver a complete solution to the customer.	Meyer and De Tore (1999)
Service system	The outcome of the service development process constitutes the prerequisites for the service by three concepts: the service concept, the service process and the service system (resource-structure). The service system consists of those resources that are required or available in order for the service process - and in a wider meaning the service concept to be realised. (Edvardsson, 1997). Service systems are value-creating networks composed of people, technology, and organizations (Maglio, Srinivasan et al., 2006)	Edvardsson (1997) Maglio, Srinivasan et al. (2006)
Software Product Line	A set of software-intensive systems sharing a common, managed set of features that satisfy the specific needs of a particular market segment or mission and that are developed from a common set of core assets in a prescribed way.	Clemens and Northrop (2001)
Value proposition	Defines how a product creates value for its target segments (Wind and Mahajan, 1997). It defines how items of value, such as products and services as well as complementary value-added services, are packaged and offered to fulfil customer needs (Kambil, Ginsberg et al., 1996).	Kambil, Ginsberg et al. (1996) Wind (1997)
Web service	Web services are self-contained, web-enabled applications capable not only of performing business activities on their own, but also possessing the ability to engage other web services in order to complete higher-order business transactions. Examples of such services include checking credit, ordering products, and procurement.	Yang (2003)
Work system	A work system is a system in which human participants and/or machines perform a business process using information, technology, and other resources to produce products and/or services for internal or external customers. Organizations typically contain multiple work systems and operate through them.	Alter 1999, Alter (2001)

Samenvatting

Mass customization is een bedrijfskundige aanpak waarbij massaproductie wordt gecombineerd met strategieën om individuele klantwensen in te vullen met 'customized' goederen en diensten. Dit wordt onder andere mogelijk gemaakt door modulaire producten en processen, waarbij de levenscyclus van producten en processen in onderlinge samenhang, maar wel van elkaar ontkoppeld, wordt bestuurd. Bij een pure goederenleverancier zijn modulariteit en ontkoppeling van product en proces relatief eenvoudig te realiseren omdat zowel product als proces grotendeels tastbaar zijn. Maar bij dienstverlening zijn zowel de proposities naar de klant als de productieprocessen grotendeels ontastbaar. Deze ontastbaarheid werkt belemmerend voor het innovatieproces omdat de te innoveren producten en processen niet door de actoren kunnen worden 'vastgepakt'. Daarbij wordt de rol en het belang van het innovatieproces ten opzichte van het operationele proces groter bij een toenemende rol voor ICT in de primaire bedrijfsprocessen: het innovatieproces is dan in toenemende mate randvoorwaardelijk voor een succesvolle inzet van klantgerichte en efficiënte operationele processen. Pure goederenleveranciers en pure dienstverleners worden zeldzaam: veel bedrijven nemen een gecombineerd 'service perspective' aan. Of ze nu hoofdzakelijke goederen of diensten leveren, service perspective bedrijven beschouwen de rol van dienstverlening in klantrelaties als strategisch voor hun succes. Voorbeelden van dergelijke bedrijven zijn bijvoorbeeld te vinden in de logistieke, financiële en ICT dienstverlening en verschillende vormen van e-business. Daarmee wordt bovengenoemde problematiek van modulariteit en ontkoppeling van product en proces voor veel bedrijven relevant.



Doel van dit bedrijfskundig onderzoek is uitbreiding van de theorie op het gebied van innovatie management op het snijvlak van mass customization, innovatiemanagement en 'service perspective'. De onderzoeksvraag luidt: '*Wat zijn de uitdagingen van het managen van mass customization in ICT-intensieve service perspective bedrijven?*' De volgende vier uitdagingen met bijbehorende onderzoeks-deelvragen zijn geïdentificeerd vanuit een

holistische benadering van het probleem: 1) ‘Product/proces ontkoppeling’ op het snijvlak van mass customization en service perspective: wat betekenen de termen ‘product’ en ‘proces’ in een service perspective context, en hoe kunnen hun levenscycli worden ontkoppeld in het innovatieproces om mass customization principes toe te passen? 2) ‘Ontbrekende innovatieobjecten’ op het snijvlak van service perspective en innovatie-management: hoe kan het resultaat van het innovatieproces worden gedefinieerd in termen van ‘tastbare’ objecten voor de actoren in het innovatieproces? 3) ‘Innovatiemanagement voor mass customization’ op het snijvlak van innovatiemanagement en mass customization: wat zijn de uitdagingen van het managen van het innovatieproces in relatie tot mass customization? 4) Wat is de overall samenhang tussen de gebieden innovatiemanagement, service perspective en mass customization gegeven de onderzoeksvraag? Het raamwerk dat voortkomt uit het beantwoorden van de onderzoeksvraag kan worden beschouwd als een innovatiemanagementsysteem voor ICT-intensieve service perspective mass-customized bedrijven in een snel veranderende omgeving.

Het onderzoek is gebaseerd op een enkelvoudige case study bij ‘Telco’, een middelgrote Europese ‘incumbent’ telecom operator. Hoewel het bedrijf zelden expliciet spreekt van ‘mass customization’ lijkt dat wel degelijk de strategie die het bedrijf nastreeft. Telco wil het laatste decennium transformeren naar een klantgerichte telecommunicatie en ICT dienstverlener, waarbij de klant kan kiezen uit een ruim en geïntegreerd aanbod van diensten en goederen. Tegelijkertijd dwingt de markt tot een substantieel lager prijs- en daarmee kostenniveau. Dit lagere kostenniveau wordt potentieel ook mogelijk gemaakt door (op het internet protocol gebaseerde) netwerktechnologie en ondersteunende ICT. Om deze visie te realiseren heeft Telco de laatste jaren een aantal initiatieven ontplooid. Naast een aantal organisatie-aanpassingen en operationele maatregelen gaat het hierbij om programma’s om bestaande product/technologie gebaseerde ‘silo’s’ met een veelheid aan netwerk- en ICT-systemen te vervangen door een samenstel van een veel kleiner aantal horizontaal gelaagde modulaire bouwstenen. De case study beschrijft twaalf programma’s en initiatieven uit het tijdvak 2001 tot 2010 vanuit het gezichtspunt van innovatiemanagement. Vier cases behandelen modularisering- en rationalisering-programma’s; acht cases behandelen hieraan gerelateerde architectuur en governance initiatieven. Er wordt gebruik gemaakt van een kwalitatieve onderzoeks aanpak gebaseerd op ‘structured case’ en ‘systematic combining’. In deze aanpak wordt gedurende het onderzoek een conceptueel raamwerk ontwikkeld, waarbij de case zowel het gereedschap als het ‘product’ vormt. Dit onderzoek heeft kenmerken van action research en longitudinaal onderzoek omdat de onderzoeker heeft bijgedragen aan een aantal van bovenstaande cases.

In de eerste twee hoofstukken wordt het fundament gelegd voor het beantwoorden van de onderzoeksvraag. Hoofdstuk 2 heeft speciale aandacht voor het aan mass customization gerelateerde concept van ‘horizontalisering’ in de telecommunicatiesector: de transitie van product/technology georiënteerde verticale silo’s naar horizontale structuren met als doel om beter passende goederen/diensten te kunnen bieden aan de klanten, de productiviteit te

verhogen en/of om te specialiseren op een specifieke component in de waardeketen. Zowel in de literatuur als in de praktijk lijkt de aandacht vooral uit te gaan naar technologische lagenmodellen. Hoewel toepassing van deze lagenmodellen op zichzelf nuttig kan zijn, bieden ze geen oplossing voor bovenstaand horizontaliserings probleem omdat ze bedrijfsprocessen, informatie en organisatie ongemoeid laten.

Hoofdstuk 3 behandelt de eerste uitdaging van product/proces ontkoppeling. Vooral in de service literatuur ontbreekt het aan een ondubbelzinnige definitie van 'product' en 'proces', met verschillende definities van het begrip 'service' zelf. De positionering van product en proces in dit onderzoek is gebaseerd op de concepten van 'customer value' en 'resource control'. Product is gedefinieerd vanuit de waarde voor de klant, terwijl proces is gedefinieerd vanuit het perspectief van besturing van 'resources' door de dienstverlener. Dit betekent echter niet dat klantoriëntatie slechts nodig is op het niveau van het product: omdat er bij dienstverlening sprake is van 'co-productie' tussen de leverancier en de klant is een externe focus evenzeer nodig op het proces.
Het concept van business model innovatie heeft een integrerende brugfunctie tussen product- en procesinnovatie, resulterend een 'Product-Proces-Business model innovatie' (PPB) raamwerk. Voortbordurend op het in 2001 door de onderzoeker ontworpen '1-Model', theorie over business model innovatie en bovenstaande positionering en definitie van product en proces is een expliciet onderscheid gemaakt tussen de concepten van product en proces in een service perspective omgeving. Dit maakt ontkoppeling van product en proces (innovatie) mogelijk voor de toepassing van mass customization in ICT-intensieve service perspective bedrijven.

Hoofdstuk 4 behandelt de tweede uitdaging van 'ontbrekende innovatieobjecten'. Dit hoofdstuk onderzoekt manieren om de uitkomst van het innovatieproces 'vastpakbaar' te maken in de vorm van 'business componentisering'. In recente literatuur wordt het, uit het ICT-werkveld afkomstige, concept van business componentisering benaderd vanuit een echt bedrijfskundig perspectief. Echter, deze benadering richt zich op de bedrijfsprocessen. Er is nog geen sprake van het componentiseren en integreren van product en business model zoals gepositioneerd in het PPB-raamwerk. Voortbouwend op een uit het ICT-werkveld afkomstige definitie van 'business component', bovenstaand PPB-raamwerk en Telco-gerelateerd materiaal over product structurering, capability platforms en business en supply chain modeling wordt een drielaags componentiseringsraamwerk voorgesteld om de vorming van een samenhangend stelsel van business componenten mogelijk te maken: het 'Web of Business Components' (WBC). Het WBC bestaat uit business componenten uit ieder van de drie PPB gebieden: Capability Platforms, Value Packages en Product Bundles. Het WBC is een datamodel in termen van ICT en iedere business component in het WBC omvat zowel het innovatie als operations domein. Value Packages vormen een brug ('value bus') tussen de resource/capability georiënteerde Capability Platforms en de marketing/sales georiënteerde Product Bundles in een samenhangende 'value-oriented (business) architectuur'. Op deze wijze kunnen de levenscycli van product en proces onafhankelijk van

elkaar, maar wel in samenhang, worden gemanaged. Er ontstaat een web van business componenten waaraan zowel interne als externe partijen kunnen bijdragen.

Hoofdstuk 5 behandelt de derde uitdaging van 'innovatiemanagement voor mass customization'. Dit hoofdstuk kijkt naar manieren om het innovatieproces te managen in een WBC-gebaseerd horizontaal samenstel van business componenten. Dit onderzoek neemt als startpunt een bestaand niet-lineair tweetraps New Service Development (NSD) procesmodel uit de literatuur. Om autonoom, maar wel samenhangend, innovatiemanagement op business componenten uit elk van de drie lagen mogelijk te maken zijn de bestaande 'Direct' en 'Implement' sub-processen uitgebreid met een derde sub-proces, 'Maintain', als integraal onderdeel van het NSD proces. Op deze manier worden principes van 'continuous improvement' en, uit de software industrie afkomstige, 'release management' praktijken gecombineerd op het niveau van business componenten voor continue innovatie op business niveau. In tegenstelling tot traditionele 'open-loop' NSD-processen zijn de innovatie sub-processen in dit NSD proces ontkoppeld van de innovatie levenscycli: alle innovatie sub-processen spelen een rol gedurende iedere levenscyclus fase van een business component. Het resulterende cyclische drietraps NSD-proces wordt herhaald op elk van de drie PPB-gebaseerde business component lagen van het WBC-raamwerk in een 'Continuous Innovation Management' (CIM) raamwerk. Hoewel iedere laag strikte innovatiemanagement verantwoordelijkheden omvat werken de drie lagen nauw samen op alle innovatie activiteiten. 'Empowerde' innovatiemanagement rollen zijn cruciaal voor de succesvolle toepassing van het CIM-raamwerk. De belangrijkste rol is de rol die release management op het niveau van business componenten bestuurt. In een aparte paragraaf wordt de organisatorische positionering van deze rol besproken. Op strategisch niveau is het vooral belangrijk om portfolio management (rollen) te implementeren die de voortdurende vorming, verandering, combinatie en uitfasering van business componenten in samenhang besturen.

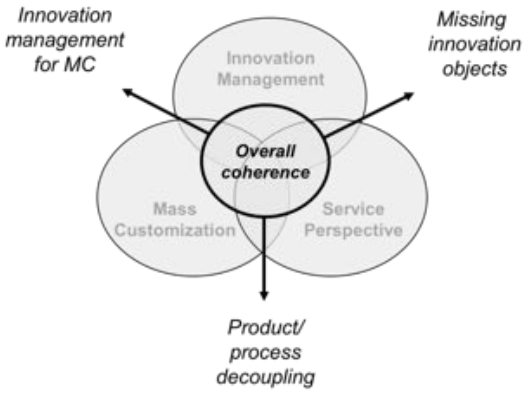
Het onderzoek laat zien dat voor het innoveren van mass-customized goederen/diensten een expliciet hierop gericht innovatiemanagement systeem noodzakelijk is. Hoofdstuk 6 integreert bovenstaande (PPB, WBC en CIM) raamwerken verder in het 'Service perspective Lifecycle Innovation Management' (SLIM) model, dat kan worden beschouwd als een dergelijk innovatiemanagement systeem. Het Product-Process-Business model innovatie raamwerk vormt binnen het SLIM-model de basis voor de andere twee raamwerken die op hun beurt wederzijds van elkaar afhankelijk zijn. Het SLIM model kan als fundament dienen voor het ontwerp van proces, rollen, organisatie en (ICT) gereedschap om een effectieve werkomgeving te creëren voor de actoren in het innovatieproces. Het model biedt handvatten voor het 'componentiseren' van product, proces en business model en maakt de inzet van Product Lifecycle Management (PLM) concepten binnen ICT-intensieve service perspective mass-customized bedrijven mogelijk. Een dergelijk innovatiemanagement system kan de transitie mogelijk maken van product/technology-georiënteerde 'silos' naar een productieve en klantgeoriënteerde dienstverlener. Het blijft relevant tijdens het operationele proces omdat het innovatieproces niet alleen de initiële inrichting verzorgt, maar gedurende de gehele

levenscyclus van producten, processen en business modellen een sturende rol blijft spelen. Het SLIM model vormt op deze wijze niet alleen een innovatiemanagement systeem, maar fungeert ook als een 'business architectuur raamwerk' voor ISM bedrijven. Door een voortdurend inzicht in de samenhang van het web van business componenten wordt de basis gelegd voor directe ondersteuning van de operationele dienstverlening en diverse strategische processen zoals strategisch portfolio management, business- en kostenmodellering, risicomanagement, architectuurontwikkeling en road mapping.

Hoofdstuk 7 geeft de belangrijkste conclusies en bijdragen aan de literatuur. De beperkingen van het onderzoek worden besproken, verdere onderzoeksgebieden worden genoemd en een aantal management aanbevelingen wordt gegeven. Uit het onderzoek blijkt dat een paradigmaverandering noodzakelijk is met betrekking tot positionering, ontwerp en organisatie van het innovatieproces, die veel meer omhelst dan het horizontaliseren van de organisatiestructuur. Dit kan worden bereikt door een consistente communicatie door het top-management van een service perspective en mass customization strategie en het organiseren van het innovatieproces langs de lijnen van het SLIM-model. Hoewel het SLIM-model nog niet is gevalideerd buiten Telco is het ontworpen om algemeen toepasbaar te zijn binnen ICT-intensieve service perspective mass-customized bedrijven in een snel veranderende omgeving.

Summary

Mass customization is a business approach in which mass production is combined with strategies to accommodate individual customer needs by offering and delivering customized goods and services. Mass customization is enabled in part by modular products and processes, through which the lifecycle of products and processes is managed in mutually coherent yet a decoupled way. In pure manufacturing decoupling of product and process is relatively easy to accomplish as both product and process are predominantly tangible. However, in the service area both the customer proposition and the production processes are largely intangible. This intangibility inhibits the innovation process since neither product nor process can be 'grasped' by the actors in the innovation process. Besides, the role and importance of the innovation process compared to the operational process is increasing given the growing role of ICT in the primary business processes: the innovation process increasingly preconditions the successful application of customer-oriented and efficient operational processes. Pure manufacturers or pure service providers are becoming rare: many companies take the approach of a combined 'service perspective'. Whether they provide predominantly goods or services, service perspective firms view the role of service components in customer relationships as strategically important to their overall success. Examples can be found in logistic, financial and ICT services, and diverse variants of e-business. Thus, the above issues concerning modularity and decoupling of product and process are becoming relevant for many firms.



The goal of this organization-oriented business study is to extend the theory in the area of innovation management to the intersection of mass customization, innovation management, and 'service perspective'. The research question is as follows: '*What are the challenges in managing innovation for mass customization in ICT-intensive service perspective firms?*' The following four challenges, with associated research sub-questions, have been identified through a holistic approach to the problem: 1) 'Product/process decoupling' on the intersection of mass customization and service perspective: What do the terms 'product' and

‘process’ mean in a service perspective context, and how can their lifecycles be decoupled in the innovation process to enable the application of mass customization principles? 2) ‘Missing innovation objects’ on the intersection of service perspective and innovation management: How can the end result of the innovation process be defined in terms of ‘tangible’ objects for the actors in the innovation process? 3) ‘Innovation management for mass customization’ on the intersection of mass customization and innovation management: What are the challenges in managing innovation for mass customization? 4) What is the overall coherence between the areas of mass customization, innovation management, and ‘service perspective’, given the main research question? The framework that emerges while responding to the research question could be viewed as an innovation management system for ICT-intensive service perspective mass-customized firms in a fast-changing environment.

The study is based on a single-case study at the business and wholesale/operations part of ‘Telco’, a mid-size European incumbent telecom operator. It seems that the company is pursuing a mass customization strategy, although the company has seldom explicitly mentioned this term. During the last decade Telco has sought to transform toward a customer-oriented telecommunications and ICT service provider, where the customer can choose from a broad and integrated portfolio of services and goods-based products. At the same time the market forces the company to attain a substantially lower price and associated cost level. This decreased cost level is potentially enabled by (internet protocol-based) networking technology and supporting ICT. To realize this vision, Telco has started a number of initiatives in recent years. Besides a number of organizational changes and operational measures a number of programs have started to replace existing product/technology-based silos with a multitude of networking and ICT systems by a much smaller number of horizontally layered modular building blocks. The case study describes twelve programs and initiatives during the time frame 2001 until 2010 from the perspective of innovation management. Four cases discuss modularization and rationalization programs; eight cases discuss related architecture and governance initiatives. A qualitative research approach has been applied based on ‘structured case’ and ‘systematic combining’. By means of this approach a conceptual framework has been developed during the study, in which the case can be regarded as both a tool and a ‘product’. The study has characteristics of action research and a longitudinal study while the researcher was an actor in a number of the above cases.

The first two chapters lay a foundation to respond to the research question. Chapter 2 specifically addresses the mass customization-related concept of ‘de-siloing’ or ‘horizontalization’ in the telecom business: the transition from product/technology oriented vertical ‘silos’ toward a horizontal structure aimed at providing better ‘fit’ goods/services to customers, increase productivity, and/or to specialize on one particular component in the value chain. Both in literature and business practice focus seems to be on technological layering approaches. While these approaches have value of their own they do not solve the

above horizontalization issue since they basically leave business processes, data and organization untouched.

Chapter 3 discusses the first challenge area of product/process decoupling. Especially in the service literature, the concepts of 'product' and 'process' lack unambiguous definitions, along with multiple views on the definition of 'service' itself. The positioning of product and process in the current study is based on the concepts of customer value and resource control. Product is defined from the perspective of the value for the customer, while process is defined from the perspective of the (service) provider controlled resources. This does not mean that customer orientation is only required on the product level: as provider and customer co-produce in service delivery, an external focus is equally required on the process. The concept of business model innovation forms an integrative bridge between product and process innovation, resulting in a 'Product-Process-Business model innovation' (PPB) framework. Building on the '1-Model' developed during the early 2000s by the researcher, theory of business model innovation, and the above positioning and definition of product and process, an explicit distinction is made between the concepts of product and process in a service perspective context. This enables the decoupling of product and process (innovation) to apply mass customization in ICT-intensive service perspective firms.

Chapter 4 discusses the second challenge area of 'missing innovation objects'. This chapter explores ways to tangibilize the outcome of the innovation process by means of 'business componentization'. In recent literature the concept of business componentization, which stems from the ICT field, is approached from a real 'business' perspective. However, these approaches are confined to the business processes and do not explicitly componentize and integrate the product and business model areas as positioned in the above PPB framework. Building on an ICT-related definition of business component, the earlier PPB framework, and Telco empirical material on product structuring, capability platforms, and business and supply chain modeling, a three-layered componentization framework is proposed to enable the creation of a coherent fabric of business components: the 'Web of Business Components' (WBC). The WBC consists of business components on each PPB-based area: Capability Platforms, Value Packages, and Product Bundles. The WBC forms a data model in ICT terms, and each business component in the WBC spans both the innovation domain and operations domain. Value Packages form a bridge ('value bus') between the resource/capability oriented Capability Platforms and marketing/sales oriented Product Bundles, together forming a 'value-oriented (business) architecture'. In this way, the lifecycles of product and process may be managed independently, yet coherently. Thus a web of business components emerges in which both internal and external parties can contribute.

Chapter 5 discusses the third challenge area of 'innovation management for mass customization'. The chapter looks at ways the innovation process can be managed to cope with a WBC-based horizontalized fabric of business components. In this study, an existing non-linear two-stage New Service Development (NSD) process model from the literature

was applied as a starting point. To enable autonomous yet mutually coherent innovation management on each business component within the three layers, the 'Direct' and 'Implement' sub-processes are extended with a third sub-process, 'Maintain', as an integral part of the NSD process. This way, principles of continuous improvement and (software industry-originating) release management practices are combined at the level of business components to attain continuous innovation at the business level. In contrast with traditional open-loop NSD processes, in this NSD process the innovation sub-processes are decoupled from the innovation lifecycle stages: all three NSD sub-processes play a role during each lifecycle of a business component. The resulting cyclical three-stage NSD process is replicated on each of the three PPB-based business component layers of the WBC framework into a 'Continuous Innovation Management' framework (CIM). Although each layer entails strict innovation management responsibilities per layer, the layers function in close co-operation on all innovation-related activities. Empowered innovation management roles are crucial for the successful application of the CIM framework. The most important role is the tactical innovation management role that drives release management on business components. A separate paragraph discusses the organizational positioning of these roles. At a strategic level it is especially important to implement portfolio management (roles) to manage the continuous creation, changing, combination, and phasing out of business components in mutual coherence.

The study shows that innovating mass-customized goods/services in ICT-intensive service perspective firms requires an innovation management system explicitly designed for that purpose. Chapter 6 further integrates the above (PPB, WBC and CIM) frameworks into the 'Service perspective Lifecycle Innovation Management' (SLIM) model, which can be regarded such an innovation management system. The Product-Process-Business model innovation framework forms the basis for the other two frameworks in the SLIM model, which in turn are mutually dependent on each other. The SLIM model may serve as a foundation for the design of processes, roles, organization, and (ICT) tooling to realize an effective environment for the actors in the innovation process. The model offers a foundation for componentizing product, process, and business model, and enables the application of Product Lifecycle Management (PLM) concepts in ICT-intensive service perspective mass-customized firms. Such an innovation management system can support the transition from product/technology-oriented silos toward a customer-oriented and cost-effective service provider. It remains relevant during the operational phase because the innovation process not only provides the initial prerequisites for operations, but also manages continuous innovation during the entire lifecycle of products, processes and business models. This way, the SLIM model not only forms an innovation management system, but also functions as a 'business architecture framework' for ISM firms. Providing continuous up-to-date insight in the coherence of the web of business components lays an immediate foundation for the operational processes and for various strategic processes like strategic portfolio management, business and cost modeling, risk management, architecture development and road mapping.

Finally, chapter 7 provides a discussion on the main conclusions and points out contributions to the literature. The limitations of the study are acknowledged, further research opportunities are provided, and a number of management recommendations are offered. Throughout the study it becomes clear that a paradigm shift is required concerning positioning, design and organization of the innovation process, involving much more than horizontalizing the organizational chart. This may be accomplished by consistently communicating a service perspective and mass customization strategy by top management and organizing the innovation process along the lines of the SLIM model. Although the SLIM model has not yet been validated outside Telco, it is designed to be generically applicable to ICT-intensive service perspective mass-customized firms in a fast-changing environment.

Resumé

Robert O. Reitsma (Haarlem, 1958) is a management professional and manager in the telecom/ICT services area. His leading career themes are innovation management and organizational change in a service environment. During the last decade, his main interest has been in leveraging the combination of customer experience and operations performance by enhancing the effectiveness of the innovation process and associated tooling.
He studied Electronics and Information Technology at the HTS Haarlem. After graduating in 1980 and the military service he worked for some five years as an editor for an educational publisher. In 1986 he started at PTT Telecom as an ICT trainee and subsequently worked as a system developer, project manager and sales consultant. From 1993 to 1999 he worked for Unisource, a pan-European telecom alliance. During that period he was responsible for innovation, technical consultancy and international product alignment in the area of messaging and information services. Furthermore, he led a program for the development, launch and operation of an access/transit service for internet service providers and was responsible for the implementation of a SAP/R3 system. Since 1999 he has been working for the wholesale and operations segment of KPN. Until 2007 he was responsible for a team of management consultants in the networking services unit. Areas of interest included strategy development, business planning and knowledge management. From 2007 on he has worked as a consultant and change manager in innovation management-related areas like portfolio management, technology intelligence, road mapping, rolling forecasting and product lifecycle management.