The feasibility of modularity in professional service design
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CHAPTER 1

General introduction

1.1 Motivation for this study

In an effort to respond to heterogeneous and complex customer demands, professional service organisations provide a wide variety of services. Customers today are very value-oriented and demand more transparency in service delivery (Frei, 2006; Lewis & Brown 2012). Parallel, professional service organizations face limited budgets and price pressure which force them to reduce costs (Lewis & Brown 2012; Evetts 2011). Cost reduction is associated with high levels of standardization, which seems to contradict the increasing customer demand for variety (Frei, 2006; Bohmer, 2005). As such, a central challenge that many professional service organizations face is how to answer the heterogeneous and complex customer demands, while at the same time keeping the costs of providing this variety as low as possible.

A field in which this challenge clearly emerges is healthcare. In the Netherlands, as in most Westernized countries, a political orientation towards more person-centred care is emerging (Taylor, Hawley & Ebrary, 2010). Person-centred care is associated with individualized treatment, patient education and empowerment, and shared decision-making (Mead & Bower 2000; Michie, Miles & Weinman, 2003; Auerbach, 2001; Kiesler & Auerbach, 2006; Rijckmans et al., 2007). In this thesis, person-centred care involves striking a better balance between the heterogeneous clients’ needs and their consumption of scarce healthcare supplies (Mead & Bower 2000; Michie, Miles & Weinman, 2003; Auerbach, 2001; Kiesler & Auerbach 2006; Rijckmans et al., 2007). At the same time, the aging society results in a growing number of older adults who will consume an increasing share of the available healthcare resources (Lafortune et al., 2009a), especially in late age and as they near mortality (Forma et al., 2009). As such, governments of Westernized countries face financial and capacity-related constraints. The developments identified leave healthcare organizations puzzling over the question of how to deliver person-centred care, while at the same time keep the internal operation costs low (Van Bilsen, 2008; De Blok et al., 2010b).

The emphasis in achieving a better balance between clients’ needs and their consumption of scarce resources has been on cost reduction by means of standardization and the adoption of ‘production line approaches’, such as lean practices and business process redesign (Bowen & Youngdahl, 1998; Noordegraaf, 2011). The application of these managerial concepts is associated with higher quality
and lower costs through enhanced efficiency (Bowen & Youngdahl, 1998). More specifically, in the context of healthcare, these managerial concepts involved, among others, the development of clinical pathways and integrated care programs. Similar to other professional service settings, the application of such managerial concepts was recognized as extremely valuable (Minkman et al., 2009; Olsson et al., 2009; Minkman, Ahaus & Huijsman, 2009), especially when cost reduction and increasing continuity of care did not come at the expense of employee satisfaction (Panella, Marchisio & Di Stanislao, 2003; Barbieri et al., 2009; Wulff et al., 2008; Eklund, Wilhelmson, 2009).

However, the application of these managerial concepts also resulted in criticism, as it was argued that these managerial concepts undermine professional autonomy (Evetts, 2009) and that the application of these managerial concepts results in ‘McDonaldization’ of professional services (Ritzer, 2011). More specifically, in the context of healthcare, many doctors still argue that clinical pathways result in ‘cookbook medicine’, i.e., following a standardized recipe in treating patients, without addressing individual clients’ needs (Panella, Marchisio & Di Stanislao, 2003). Another concern is that the managerial concepts are too inwardly focused and insufficient attention is paid to provide value for clients (Porter & Teisberg, 2006). Moreover, hospitals are not ‘cookie factories’ and the client’s individual needs and preferences should not be ignored when redesigning care (Lynn et al., 2007).

Thus, managerial concepts currently applied within the context of professional services, and more specifically healthcare, seem to focus too much on standardizing the service process and too little on providing customer value (as argued by Porter (2007) for the case of medical care). Nowadays, customers highly value person-centred service offerings. Yet, providing person-centred offerings through the ad-hoc provision of variety for each individual customer would be extremely costly and time consuming (Lynn et al., 2007).

Recently, attention has therefore been drawn to the managerial concept of modularity as a means to balance variety and costs in professional service offerings (Bohmer, 2005; De Blok et al., 2010a; 2010b; Chorpita, Daleiden & Weisz, 2005; Voss & Hsuan, 2009). Modularity refers to breaking a complex offering, such as healthcare, into simpler parts that function independently and which in turn can be recombined in many different ways (Schilling, 2000; Ulrich, 1995; Duray et al., 2000; Salvador, 2007). Variety is thus provided at lower costs by optimizing pre-specified modules and by standardizing the modules’ interfaces. By recombining these pre-specified parts, heterogeneous client needs can be addressed. In practice, the term module is highly popular in more routine service offerings, such as in insurance policies and in mobile
phone subscriptions. Within the context of professional services the term is less frequently used.

The feasibility of modularity (i.e., the degree to which it is possible to apply modularity according to modular design principles) in the design professional service offerings is complicated by two factors. First, what is actually involved in a module for (professional) services lacks conceptual clarity (Voss & Hsuan, 2009; Rajahonka, 2013). The term ‘module’ is used for many different constituents in the context of services (Voss & Hsuan, 2009; Rajahonka, 2013) and researchers seem to apply the concept in a way that fits their own interest (Rajahonka, 2013). As a result, what a module is in (professional) services remains vague and ambiguous (Voss & Hsuan, 2009). Without conceptual clarity, the question of whether modularity is feasible in the design of professional service offerings remains unanswered.

Second, particular professional service characteristics, such as high levels of input and throughput uncertainties (Lewis & Brown, 2012; Larsson & Bowen, 1989; Silvestro et al., 1992), seem to complicate the feasibility of modularity in professional service design. High levels of input uncertainty are caused by heterogeneous customer demands and customers’ disposition to participate (Larsson & Bowen, 1989). The more heterogeneous customer demands and the more customers tend to play an active role by providing labour or information inputs, the harder it is to pre-specify modules with standardized interfaces. Although it is widely accepted that modularity only provides value when there is heterogeneity in demands, this heterogeneity should not be taken to the extreme, as this will complicate the pre-specification of modules (Schilling, 2000). High levels of throughput uncertainty refer to high levels of process variability and low levels of process analysability (Perrow, 1970; Daft & Macintosh, 1981). The more unexpected events occur during service delivery and the less knowledge about cause-effect relationships exists (Thompson, 1967), the harder it is to identify relatively independent modules and to standardize their interfaces.

Also, the pivotal role of professionals in delivering professional services (Abbott, 1988) should not be neglected in determining the feasibility of modularity. Suppose that professional service modules can be developed, despite conceptual vagueness and certain levels of input and throughput uncertainties, how would professionals, who deliver these modules to customers, apply modularity within their services design? Professionals highly value their professional autonomy and in some professional services, this autonomy is highly institutionalized by means of professional codes (Von Nordenflycht, 2010). This gives rise to the question of whether professionals are willing to give up in part their (highly institutionalized) professional autonomy by applying modularity in their service design. At the same time, professionals also feel confronted with the challenge to balance costs and provide variety. Although, in theory
modularity offers an appropriate means to balance costs and variety in their services, it remains unclear how professional practitioners (would) apply the concept and in turn how the application (would) then reflect a balance between costs and variety.

To summarize, limited conceptual clarity exists on what actually is a service module and it remains unclear how the concept of modularity can be applied properly to the design of professional service offerings, such as in healthcare. It is particularly interesting to study modularity within the context of professional services, as it is unknown how the inherent professional service characteristics input and throughput uncertainties influence the feasibility of this concept. Moreover, to what extent professionals themselves will appreciate modularity as an appropriate response to the challenge they face in balancing costs and variety and incorporate modularity in their supplies is unknown. Also, how modularity can contribute to balancing costs and variety remains unclear in the literature. In this thesis, I will address these three research gaps: a.) the lack of conceptual clarity of what constitutes a module in professional service settings; b.) the feasibility of modularity in the design of professional service offerings, considering the contingencies in service characteristics and in the institutional context; and c.) how modularity in professional service design could contribute to providing variety and person-centred care at lower costs. Below, I will provide a theoretical framework which provides guidance in assessing the feasibility of modularity within professional service design. The two central concepts of this thesis; modularity including the underlying modular design principles and professional service offerings are explained and discussed below. Guided by this theoretical framework, I will formulate four research objectives at the end of this chapter.

1.2 Modular design principles

In this research, we build on the general modular system theory of Schilling (2000), who defines modularity as a general systems concept:

   It is a continuum describing the degree to which a system's components can be separated and recombined, and it refers to the tightness of coupling between components and the degree to which the rules of the system architecture enable or prohibit the mixing and matching of components(Schilling, 2000 p. 312).

Schilling (2000) refers to components in her definition of modularity. Components refer to the smallest identifiable parts that still fulfil a function but that cannot be offered individually (Ulrich, 1995). Building on systems theory, Rajahonka (2013, p. 47) recently provided a definition for the term module in service systems: “a module
can be defined as a relatively independent part of a system with a specific function and standardized interface”. In this thesis, we refer to modules as the central building blocks of a modular design and components as identifiable but not separately deliverable parts in modules. The definitions describe the three modular design principles that are central to this thesis and need further explanation in order to enhance conceptual clarity and to assess the feasibility of modularity in professional service design, i.e., specific function, relative independence, and standardized interface. These modular design principles are outlined below.

1.2.1 Specific function

The modular design principle ‘specific function’ refers to the idea that each module is expected to contribute to the overall service offering by fulfilling a specific function. Functions are commonly expressed in linguistic terms such as ‘providing’, ‘helping’ and ‘facilitating’ (Ulrich, 1995). According to Spring et al. (2014) a service module’s function objectifies a service offering in terms of writing. One of my personal favourite examples of explaining this modular design principle is by referring to the modules offered by a traveling organization called Riksja Travel (www.riksjatravel.nl). Riksja Travel offers their customers short itineraries which reflect a particular traveling experience. These experiences are objectified and described for instance as: 1.) visit the architectural highlights of Bangkok by bike; 2.) explore the jungle in Chiang Mai; and 3.) relax on the beaches of KohLanta. These objectifications show that a wide variety of experiences are possible, and that by selecting the functions that best fit a customer’s needs, a customized traveling itinerary can be delivered. The functions of the modules, described in terms of customer experiences, make the arrangement of a holiday tour manageable, and provide customers with an idea of the customer value they can expect. The notion of ‘specific’ in the modular design principle ‘specific function’ refers to the level of detail in which functions are specified. Functions can be specified in general (e.g., visit Thailand) or in more detail (e.g., visit the architectural highlights of Bangkok). These different levels of detail at which functions can be specified is in line with Simon’s (1969) idea of hierarchy, i.e., a complex system can be decomposed into sub-systems that, in turn have their own subsystems, and so on (Simon, 1962).

1.2.2 Relative independence

The modular design principle of relative independence refers to the idea that the components that make up the module are interdependent with one another, whereas the interdependencies between modules are minimized (Simon, 1962; Campagnolo & Camuffo, 2010; Baldwin & Clark, 2000). In analysing the dependency patterns, I draw on the classic work dependencies typology of Thompson (1967): pooled, sequential, and reciprocal. Pooled dependence is the loosest form of dependence in
which each sub-system fulfils completely independent functions but does draw on common resources (Thompson, 1967). Sequential dependence is when one subsystem’s output is the input for another sub-system. Reciprocal dependence is the most complex form, and is similar to sequential dependence, with the addition of being cyclical (Thompson, 1967). A modular design should reflect rather loose dependence between modules, i.e., preferably pooled and more complex interdependencies between the components that make up the module, i.e., sequential and reciprocal. The modular design principle ‘relative independence’ draws upon the idea of ‘nearly decomposable’ as discussed by Simon (1962) who theorizes that in nearly decomposable systems the interactions among the subsystems are weak, but not negligible (Simon, 1962). Thus, the short run behaviour of modules should be relatively independent. As a result, specific details can be kept within the module (Chorpita, Daleiden & Weisz, 2005) and the need for information exchange between modules is minimized. Modular services afford localized innovation and optimization within the modules without affecting the whole (Ethiraj & Levinthal, 2004). Drawing again upon the traveling example of Riksja Travel, changing the hotel service component or the excursion component within one module does not affect the design of the other modules.

1.2.3 Standardized interfaces

The third modular design principle ‘standardized interface’ is probably the least well understood within the context of (professional) services (Voss & Hsuan, 2009; Spring & Bonomi Santos, 2014). Within the service modularity literature, a discussion has emerged about the nature of service modules’ interfaces and whether these interfaces should focus on interdependencies between service modules, service providers or between customer and service provider (Spring & Bonomi Santos, 2014; Gittell et al., 2009). For example, De Blok et al. (2014) defined service module’s interface as follows: “the set of rules and guidelines governing the flexible arrangement, interconnection, and interdependence of service components and service providers” (De Blok et al., 2014 p. 30). Within this thesis, I distinguish between functional interfaces and organizational interfaces. Functional interfaces focus on linking modules, i.e., when having decomposed a service offering some of the functional components may need to be coupled to provide an integrated service to a customer. Standardization of functional interfaces refers to the degree in which mix and match rules allow modules to be combined with each other (Fixson, 2005). Organizational interfaces focus on coordinating work between providers and making interactions among various (groups of) service providers manageable (De Blok et al., 2014). Standardization of organizational interfaces involves applying forms of standardization as coordination mechanisms to coordinate tasks that are distributed over different practitioners and/or units.
The modular design principles, as described above, can be applied to different types of service systems. Within this thesis, I assess the feasibility of modularity for professional service offerings. Below, I conceptualize professional service offerings and elaborate on their characteristics.

1.3 Professional service offerings: Defining characteristics

Within this thesis, I focus on applying the modular design principles on professional service offerings. By focusing on professional service offerings, I apply a comprehensive conceptualization based on a customer value (Grönroos, 2000), which involves both the service outcome dimension and the service process dimension (Grönroos, 2000). I will elaborate on the concept of service offering below. Subsequently, I will discuss the professional service characteristics input and throughput uncertainties as these service characteristics might hamper the feasibility of modularity in professional services. The contextual factor of institutionalized professional context may also hamper the feasibility of modularity in professional service design and, therefore, I also explain what is meant by this institutional contextual factor.

1.3.1 Service offering

In this thesis, I draw upon the conceptualization of a service offering as proposed by Grönroos (2000). A service offering refers to the service outcome that fulfills the needs of the target market (“what” is delivered) and also to the service process and the interactions between the organization and its customers, that is, the service production (including delivery) process (or “how” the service is delivered) (Grönroos, 2000). The service outcome dimension describes the bundle of various services, both tangible and intangible, and consists of the core service (e.g., lodging services for a hotel), the facilitating services (and goods, e.g., reception services of making a reservation in a hotel), and the supporting services (and goods, e.g., room-service in a hotel) (Grönroos, 2000). As such, the outcome dimension reflects customer value. Customer value involves the trade-off between what customers receive, such as quality, benefits, and utilities, and what they sacrifice, such as price, opportunity cost, and maintenance and learning cost (Heskett & Schlesinger, 1994; Woodruff, 1997). Customers may consider value at different times, such as when making a purchase decision or when experiencing service performance during or after delivery (Woodruff, 1997). The service process dimension refers to the interactions between the service provider and customers and the activities that need to be performed in order to transform customer inputs into service outputs, namely service specification, production, and delivery. Figure 1.1 schematically displays this conceptualization of a service offering.
1.3.2 Characteristics of professional service offerings

In this thesis professional service offerings are often characterized by high levels of input and throughout uncertainty (Lewis & Brown, 2012; Larsson & Bowen, 1989; Silvestro et al., 1992). I will elaborate on these two service characteristics below.

First, Larsson and Bowen describe “customer induced input uncertainty is the incomplete information about what, where, when and how customer input is going to be processed” (1989). The level of input uncertainty is determined by two sources: heterogeneity of demands and customer’s disposition to participate (Larsson & Bowen, 1989). Heterogeneity of demands refers to the uniqueness of customers’ demands, and includes the uniqueness of the customer’s inputs that is to be serviced and the uniqueness of the desired outcomes (Larsson & Bowen, 1989). The presence of customers’ inputs is a necessary and sufficient condition to define a production process as a service process (Sampson, 2010). Customers can provide information, belongings or themselves as inputs of the service production process. This increases heterogeneity and unpredictability in demand which leverages customer-induced uncertainty (Chowdhury & Miles, 2006). Customer disposition to participate refers to the extent the customer tends to play an active role in supplying labour or information inputs during the service delivery process. The more the service provider and the customer (have to) work together to define, produce, and deliver the offerings (Kellog & Nie, 1995), the higher the level of customer induced input uncertainty.
Second, professional service processes are generally characterized by high levels of throughput and process uncertainties (Lewis & Brown, 2012; Von Nordenflycht, 2010). Throughput uncertainty refers to the inability to predict the service process accurately (Milliken, 1987). One dimension closely related to the degree by which a service process can be accurately predicted is the level of process variability, i.e., the number of exceptions that may occur during a service process (Frei, 2006). For example, in a healthcare setting two patients may have a similar demand, a hip replacement surgery for example, but yet the operating time and length of stay in the hospital may differ. Another dimension associated with throughput uncertainty is process analysability, meaning the degree to which it is possible to predefine a procedure that involves responding to and solving problems (Perrow, 1970). When processes have low levels of analysability, there is no objective calculation or procedure to propose a proper response, and “inference” (Abbott, 1988) is necessary. Inference involves the reflective process that professional staff engages in when the connection between diagnosis and treatment is obscure (Abbott, 1988; Lewis & Brown, 2012). According to Abbott (1988), inference or “professional judgment” is what actually makes a service offering a professional service.

Next to the professional service characteristics, the institutionalized professional context may also influence the feasibility of modularity in professional service design. This contextual factor is currently changing. Below, I will briefly elaborate on this contextual change. A more in-depth elaboration of this contextual change can be found in Chapter 4.

1.3.3 Contextual changes for professional services

Within the context of professional service offerings, institutionalized ideas and beliefs are currently changing. In sociology literature, this change is often labelled as the movement from “old professionalism” towards “new professionalism” or “organized professionalism” (Evetts, 2011; Taylor, Hawley & Ebrary, 2010; Noordegraaf, 2011). Old professionalism places a heavy emphasis on specialized training and upon having expertise in a particular area, which grants professionals the autonomy in deciding what is best for the client (Abbott, 1988; Evetts, 2003). Rather than emphasizing the possession of specialist scientific knowledge, new professionalism places considerably more value upon creating partnership with customers (Taylor, Hawley & Ebrary, 2010). Moreover, new professionalism advocates professionals themselves to develop their organisational capacities and become more ‘management-minded’ (Noordegraaf, 2011). As such, new professionalism emphasizes the collaboration in multidisciplinary teams and focuses more on performance indicators, such as transparency and efficiency (Evetts, 2011; Gleeson & Knights, 2006; Faulconbridge & Muzio, 2008). Modular service design can be considered as a way of organizing professional services
in such a way that is in line with the movement towards new professionalism. However, much old professionalism is still around (Taylor, Hawley &Ebrary, 2010). Designing a modular architecture seems to move away from old professionalism and towards more commercial thinking as it involves the identification of transparent choice options in terms of pre-specified, value-added modules and the efforts towards providing variety at lower costs by means of standardization. Therefore, it is interesting to analyse to what extent professionals themselves view modularity as a legitimate response to the challenges they are facing in balancing costs and variety. Legitimacy refers to the extent to which actions are socially accepted and approved by various stakeholders (Kostova, Roth, &Dacin, 2008) and are consistent with widely held norms, rules, and beliefs (Sonpar, Pazzaglia, &Kornijenko, 2009; Miles, 2012).

1.4 Research objectives

In summary, I have identified three research gaps: a.) the lack of conceptual clarity of what constitutes a module in professional service settings; b.) the feasibility of modularity in the design of professional service offerings considering the contingencies service characteristics and the institutional context; and c.) how modularity in professional service design could contribute to balancing variety/person-centred care and costs. These three research gaps will be addressed in four studies. Below, I will elaborate on how each study addresses one or multiple research gaps.

The concept of modularity remains vague and is ambiguously defined in the literature (Voss &Hsuan, 2009;Rajahonka, 2013). Different methods to determine service modules are emerging in the service modularity literature. Specifically, the multidimensional nature of service offerings, with both an outcome and a process dimension, fuels the debate concerning the decomposition of service offerings. For example, Pekkarinen and Ulkuniemi(2008) make a theoretical distinction between service product modules (service outcome dimension) and service process modules (service process dimension). In contrast, Chorpita et al. (2005) decompose the service offering into modules encompassing both the outcome and process dimensions. Another discussion concerns the decomposition level on which modules should be identified. On the one extreme, a service offering can be decomposed on a rather high decomposition level resulting in modules which are objectified by general functions, like for example, helping people to overcome a depression. On the other extreme, a service offering can be decomposed at a low decomposition level, resulting in modules objectified by detailed function specifications, like teaching a relaxation exercise.

The current literature on service modularity does not provide a systematic understanding of the different ways to modularize service offerings. Whilst the service
modularity literature offers diverse examples of modularity types, a systematic comparison and conceptualization is lacking. We will enrich service modularity theory and its practice by identifying and comparing the different ways to decompose a service offering into modules. In doing so, we contribute to creating more conceptual clarity of what actually a module is in professional services. Moreover, in comparing the different modular decompositions, we also explore whether these differences are related to service characteristics, i.e., the level of input and throughput uncertainties. By considering the impact of these service characteristics on a modular design, a first step in analysing the feasibility of modularity in the design of professional service offerings can be made. Also, we analyse whether and how the modularization aim emphasis on costs or variety relates to the decomposition. As such, we contribute to the third research gap. While the service modularity literature recognizes the relevance of modularization aim (Geum, Kwak& Park, 2011; Bask, Tinnilä&Rajahonka, 2010) and service characteristics (Bohmer, 2005; Gittell et al., 2009), the possible relations of these contextual factors to modular decompositions have never been systematically analysed. The first research objective is formulated as follows:

Research Objective 1: Enrich service modularity theory and practice by: a.) surveying the different options available to break down service offerings into modules; b.) identifying the design choices underlying them; and c.) developing contingency-based arguments for these design choices in decomposing service offerings.

The feasibility of modularity in the design of professional services, such as healthcare, is limitedly discussed and not critically reflected upon within the literature. Schilling’s (2000) general modular system theory states that the more heterogeneous demands, the less likely customers are willing to agree on one single configuration. In other words, an essential step in determining the feasibility of modularity in professional service design is to analyse the heterogeneity in demands. However, too much heterogeneity in demands may hamper the pre-specification of a set of service modules. Reconfiguration of pre-specified service modules implies that there should also be a certain degree of homogeneity of demands. Considering the two extremes of a one-of-a-kind service offering that answers the unique demands of a single customer and a standardized service that answers the relative homogeneous demands of a considerable number of customers, the potential for modularity lies somewhere in between (Pekkarinen&Ulku, 2008; Fogliatto& da Silveira, 2008). In addition to the degree of heterogeneity in demands, I will argue below that a person-centred characterization of that heterogeneity of demand is also important if it is customer value we are after.
In many professional service fields, the perspective on clients and their demands has changed. Previously, clients had a minor position in defining their needs and demands; instead, this was the task of the professional due to their specific body of knowledge. Today, however, a more person-centred view on clients has also been adopted in the professional service fields (Taylor, Hawley & Ebrary, 2010; Lynn et al., 2007). More specifically, in healthcare, this is referred to as the movement towards person-centred care. Person-centred care involves striking a better balance between the heterogeneous clients’ needs and their consumption of scarce healthcare supplies. Client needs could relate to various professional domains, the physical, social and psychological. Providing person-centred care through the ad-hoc customization of care for each individual would be extremely costly and time consuming (Lynn et al., 2007). Therefore, the necessity is to determine persons’ felt difficulties in fulfilling their basic biopsychosocial needs on a group basis (Plek & Wilson, 2001; Boult & Wieland, 2010), with each group being sufficiently homogeneous and having adequate volume in some of the important aspects that are to be managed (Lillrank, Groop & Malmström, 2010).

Therefore, an important condition for making a modular design in professional service feasible is the identification of target groups in which there are relative homogeneous demands within a larger population with relative heterogeneous demands. Although the healthcare population is almost as diverse as the population at large, there have only been very limited attempts to characterize the heterogeneity in demands based on experienced needs fulfilment (Calkins & Sviokla, 2007). The World Health Organization’s International Classification of Diseases is the best-known demand classification system but this organise diseases rather than people, and is based on objective clinical judgements, not on personally felt needs (Lillrank, Groop & Malmström, 2010; Sanderson & Mountney, 1997). In order to design person-centred care by means of modularity, it is necessary to re-examine the way in which heterogeneity in demands is characterized (Lynn et al., 2007). Therefore the second research objective of this thesis is formulated as follows:

**Research Objective 2: To develop a characterization of the heterogeneity in demands that forms the input for designing a person-centred modular supply within the context of healthcare.**

Although the perspective on clients and their demands are changing towards a more person-centred approach, still much old professionalism is around (Taylor, Hawley & Ebrary, 2010). This old professionalism is highly institutionalized in professional values and codes and indeed in the structuring of these services. Although, institutionalized professional codes play a significant role in legitimizing new practices (Greenwood, Suddaby & Hinings, 2002), limited attention is paid to the influence of the
institutional context on legitimizing modularity, and the resulting restructuring of these professional services. Moreover, in previous studies, professionals were limitedly involved in modular design processes (Chorpita, Daleiden & Weisz, 2005; Meyer, Jekowsky & Crane, 2007; Meyer & DeTore, 2001). Most studies on modularity within a professional service setting analysed whether modules can be recognized in existing service systems, and consequently it was the researchers who delineated service elements as modules (De Blok et al., 2010a, 2010b; Meyer, Jekowsky & Crane, 2007; Meyer & DeTore, 2001; Rahikka, Ulkuniemi & Pekkarinen, 2011). In the few studies that do pay attention to the modular design process within a professional service setting, limited attention is paid to design choices underlying the eventual design and the reasons why certain design choices were made (see e.g., Chorpita et al., 2005; Meyer & DeTore, 2001; Meyer, Jekowsky & Crane, 2007). At the same time, the resulting designs described in the literature do not deliberately meet the three modular design principles: specific function, relative independence, and standardized interface (see Chapter 2).

Thus, although it is known that institutionalized professional codes play a significant role in legitimating or rejecting new practices (Greenwood, Suddaby & Hinings, 2002), little is known about how these institutions influence the application of modularity. Moreover, modular design described in the context of professional services (see e.g., Chorpita et al., 2005; Meyer & DeTore, 2001; Meyer, Jekowsky & Crane, 2007) only partly, or at best implicitly, reflect the modular design principles. By analysing the influence of institutionalized professional codes on the (non)legitimation of the three modular design principles, insights about the feasibility of modularity in professional service designs are created. Moreover, providing insights into how professionals apply the three modular design principles to their services design helps to understand to what extent and how modularity in professional services may contribute to balancing costs and variety. Therefore, we performed an examination of a modular design process and the way in which professionals (non)legitimized modularity in the design of their service offering. Research objective 3 is formulated as follows:

Research Objective 3: a.) to provide insights into how professionals craft the concept of modularity in the design of their service offering and b.) uncover which arguments they use to legitimize or reject the modular design principles

Finally, although modularity is associated with balancing costs and variety, little understanding exists on how modularity in professional service settings could contribute to achieving this balance. Although agreement exists that the modular design principle of ‘standardized interface’ plays an essential role in providing variety at lower costs (Salvador, 2007; Sanchez & Mahoney, 2002), limited understanding exists as to what actually constitutes an interface and how such an interface could or
should be standardized within the context of professional services (Spring & Bonomi Santos, 2014). As professional services in their nature are associated with high levels of uncertainty and require person-centred variety, modularity can contribute to professional service design in offering this variety for lower costs. Modularity within professional service organizations might be used to restructure the supply in a way that reduces the need for managerial coordination, hence the cost of organizing. Within the literature, little emphasis is put on how professional service providers can restructure their supply in order to reduce the coordination costs. For example, while De Blok et al. (2010a; 201b) argue that the need identification and the selection of appropriate modules within the context of elderly care are time-consuming and thus costly activities, they do not show how modularity contributes to reducing costs in elderly care. It is particularly relevant to provide insights into how modularity can contribute to balancing costs and variety within the context of professional services considering the high levels of input and throughput uncertainties involved in these service offerings. Therefore, the fourth and final research objective is formulated as:

Research Objective 4: To identify how modularity in the design of professional service offerings can contribute to balancing variety and costs

1.5 Outline of this thesis

This thesis is structured as follows. In Chapter 2, we provide a systematic identification and comparison of the different options available to decompose a service offering into modules. We perform a systematic literature review and analyse papers that present empirical data about modular service designs. By comparing the object of decomposition, the decomposition level(s) and interdependencies between service parts, we will work towards an overview of options for decomposing a service offering into modules. This overview explicates the design choices involved in decomposing a professional service offering into modules. Also, we will develop contingency-based arguments for these design choices.

Chapter 3 of this thesis involves the identification of a more person-centred manner to characterize heterogeneity in needs in a healthcare context, by means of population segmentation. First, this study will provide a set of variables on which a more person-centred segmentation should be based. Furthermore, this study provides an empirical identification and description of robust, person-centred segments by means of a Finite Mixture Model. Also, the usefulness of segmenting a healthcare population in a more person-centred manner is discussed, including how such segmentation could contribute to the design of modular care.
Chapter 4 of this thesis involves a rich description of a modular design process by professionals themselves. This study shows how a multidisciplinary group of professionals gave substance to the three modular design principles within a healthcare context. In this chapter, we show whether or not and how professionals legitimize the concept of modularity in the design of their service offerings. Also, we show how the institutionalized professional values and ideas the professionals draw on influence the partly legitimation of modularizing their service offerings.

In Chapter 5 of this thesis, we identify three professional service architectures that can be used to combine modules into a coherent service offering professional service supply. Thus, whereas the focus in Chapter 2 is on decomposition of a service offering into modules, the focus in Chapter 5 is on combining modules into coherent service offerings. We describe a multiple case study in which the designs of multiple professional service offerings are compared. The three professional service architectures that emerge reflect different emphases in balancing variety and costs. These differences are discussed and critically reflected upon.

Chapter 6 consists of a general discussion of the main findings in the aforementioned studies and provides a guide for further research that should be undertaken to advance the knowledge on modular service design within professional service contexts.