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Modularity in Care and Service Provision: An Exploratory Case Study

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Abstract

In most Western countries, public service providers are operating in a mass-customization like environment in which they have to align customization and efficiency goals. While the advantages modularity can offer to private mass-customization environments are well-known, its characteristics and implications have hardly been researched in public services. By means of exploratory case research, packages of care and related services of four providers in the Dutch elderly care sector were investigated against product and service modularity features as identified in literature. Among others, results show that, strikingly, the aim of modularity, i.e. customization of content elements, is perceived as less far-reaching as personalization of delivery-related elements. The output of our study are propositions for new theory that capture the characteristics and essentials of modularity in public service provision to elderly, to be tested and refined in subsequent research.

Keywords: modularity, elderly care, service operations, case study research
1. Introduction

During the past decades, governments all over the developed world have been engaged in reforming their healthcare systems to cope with the challenges that are thrown up by their ageing populations (Gooijer 2007). On the one hand, systems are created in which patients and clients are given a central position (e.g. Herzlinger 2004, Rijckmans 2005), encouraging suppliers of healthcare services to become more responsive towards the highly diverse needs and desires of their clients (e.g. Bosselaar 2005). On the other hand, these providers are asked to drive down their costs of operation (Post and Kagan 1998, Breedveld et al. 2006). As such, care providers are struggling with the problem of how to provide healthcare with both a client and efficiency focus.

In the profit sector, an increasing demand for variety at reasonable cost led to the development of mass customization (Pine 1993, Kotha 1995). The core of mass customization is that a wide range of products is offered that meets the specific needs of individual customers at a cost near that of mass production (e.g. Duray et al. 2000, Da Silveira et al. 2001). One of the responses that facilitate in meeting consumers’ demands for customized goods and enable mass customization is modular production, since it allows components to be combined into a wide range of end products (e.g. Pine 1993, Jiao et al. 2004, Mikkola 2007).

Also in services, flexible production in a modular service system has been proposed as a good way to increase the efficiency of developing services to cope with heterogeneous demands (e.g. Meyer and DeTore 2001, Pekkarinen and Uulkuniemi 2008). Conceptually, the application of modularity in a care setting might have high potential to align the dual focus on customization and efficiency (De Blok et al. 2009). However, the concept of healthcare modularity is a novel one and, to date, its features and implications have hardly been researched. We want to develop new theory regarding this concept and its impact in the healthcare sector. More specifically, we aim to explore its applicability in the context of care
and related service provision to independently living elderly in the Netherlands. We will start from theory on product and service modularity and, by means of exploratory field research, we aim to address the following research question: *To what extent are product modularity principles applicable to the field of elderly care, where packages of care and related services are provided to independently living elderly clients?*

To answer our research question we first introduce our research field, being the Dutch sector for elderly care. We then provide an overview of literature on product and service modularity and subsequently use explorative case studies to detect the specifics and particularities of modularity in elderly care. The output of our study are propositions for new theory that capture the features and essentials of modularity in elderly care, to be tested and refined in subsequent research.

### 2. Setting the scene

For a number of reasons, healthcare services are radically different from ordinary services. (Lanseng and Andreassen 2007). The production of this type of service involves extensive customer contact (Verma 2000, Jaakkola and Halinen 2006). As the service is mainly targeted at the receiver’s body or mind, healthcare services are prime examples of customers working together with the provider in co-creating value (Vargo and Lusch 2004, Lanseng and Andreassen 2007). Besides, specification and delivery are highly influenced by the specialist knowledge, skills and experience of the care professional (Jaakkola and Halinen 2006). The provider of health services knows much more than the receiver, who has to trust the provider with his or her life. Any incident of service failure puts the confidence of clients (and their family members) at risk (Berry and Leighton 2004) and inability to meet demand has more serious consequences that it does in other services (Jack and Powers 2004). Furthermore, demand for many types of health services is negative. Although in need of them, people are
not likely to look forward to medical injections or wound care (Kotler 1973) and, in general, demanding healthcare services goes together with considerable stress (Berry et al. 2004).

A brief categorization of the healthcare sector is given in figure 1. In this study, we specifically focus on the field of home care as opposed to cure or institutional care.

![Figure 1 - Healthcare sector and research focus (rectangles in bold)](image)

Needs and requirements of independently living elderly care rather different from the needs of patients in a hospital or another institutional setting such as a psychiatric clinic or nursing home. Since they want to live independently as long as possible, even when they need care and support (Schols 2004), the issues surrounding care provision are extensive, involving many aspects of life such as health, social services, housing, transportation, and support services (Leichsenring et al. 2005, Van Bilsen 2008). Besides, the provision of care and related services to old people will be mostly long-term, since full recovery from most functional impairments is often impossible. Over time, needs might alter as a result of changing health conditions that, generally speaking, will deteriorate (Van Bilsen 2008). The degree to which independently living elderly are able to take care of themselves and their household decreases over time and the amount and intensity of homecare to be provided by an organization, subsequently, increases.
Home care refers to care provided at home by professional home-nursing organizations and home-help services. Home help includes services like housekeeping assistance, moral support and psychosocial support. Home nursing includes services such as hygienic and other personal care (e.g. helping with showering), technical nursing activities (such as wound care) and psychosocial activities. Welfare services (such as counseling activities, meals-on-wheels and alarm systems) are complementary services intended to support elderly people to live at home independently. Furthermore, domestic services (such as handrails, grab bars, easy-access bathrooms and kitchens, zero-step entrance) can modify the physical features of houses and make it easier and safer to carry out daily activities like bathing, cooking and climbing stairs (Van Bilsen 2008).

In most Western countries, systems are created that encourage suppliers of care and services to independently living elderly to become more responsive towards the needs and desires of their clients (e.g. Bosselaar 2005) and to treat their demands as an entity to be approached in a well-tuned manner (Billings and Leichsenring 2005). We define this trend, that appears in many forms (e.g. McLaughlin and Kaluzny 2000, Herzlinger 2004, Rijckmans 2005), as one towards demand-based care. Traditionally, organizations and even organizational departments providing care and services to elderly work autonomously and separate from each other (Meijboom et al. 2004). Ideally speaking, however, demand-based care provision would imply that organizations providing services in housing, welfare and care should take conjointly the needs and demands of an individual elderly client as a guideline and provide each client with a package of care and services that is optimally tuned to his or her needs and requirements. Besides the trend towards demand-based care, organizations in elderly care also have to deal with increasing cost pressures. Governmental policies can be characterized by efforts to introduce more business risks (e.g. Post and Kagan 1998, Breedveld et al. 2006), thereby initiating the need for cost containment.
In the Dutch political system, several financing streams have been set up to fairly distribute the restricted amount of care and services that is available and thereby influence care and service provision to elderly. The AWBZ (Exceptional Medical Expenses Act) is a law by which every Dutch citizen is ensured of care when suffering from chronic illness, handicaps, or old age complaints and, as such, regulates and finances elderly care. The act, which was introduced decades ago, has recently been modernized and now distinguishes among several care functions, which citizens can acquire access to by applying for an indication at the, so called, Central Indication Organ. This is an independent body that assesses a citizens needs with respect to the seven functions. Besides, the Social Support Act, introduced in 2007, regulates access to social services. To get access to some of its functions, such as home help, citizens also need an indication. Once possessing an indication under either act, a client can choose the provider he or she wants to receive care and services from and this provider, in turn, can be sure that the services provided will be reimbursed by the government. As a consequence of the indication system, the moment of package purchase and the moment of money reimbursement are separated. Furthermore, a part of care and services that are provided, which are mostly luxury and supportive services, have to be financed by the elderly person himself.

3. Research method

To answer our research question, being ‘to what extent are product modularity principles applicable to the field of elderly care, where packages of care and related services are provided to independently living elderly clients?’, we carried out a literature study and empirical research. The literature study resulted in the identification of product modularity features. Furthermore, some service modularity features could be identified from the sparse theory on modularity in the service field. Together, the features of product modularity and
service modularity form our theoretical basis against which we will investigate care and service parts as they are provided to elderly clients.

For our empirical research, the case study was chosen as the research method. Yin (1993) recommends this method as the most appropriate when, among others, contextual conditions are believed to be highly pertinent to the phenomenon of study. Modular production principles have proven their value in several industries such as automotives. We believe that modularization is as applicable in care and service provision to independently living elderly. However, the context of care and related services highly differs from an industrial context, so a conversion of the concept will probably be necessary. Furthermore, case research is particularly appropriate for research area’s where research and theory are at their early, formative, stages (Bensabat et al. 1987). As such, it is an appropriate method to develop first insights on a new phenomenon of study for which no specific hypotheses can be proposed yet.

We conducted our case study research following the principles of Yin (1993, 2003), Eisenhardt (1989) and Voss et al. (2002). Because we are interested in investigating the modularity features of care and service packages, we took the offerings in care and related services as our unit of analysis. Care and service offerings, however, are highly intangible. To get more grip on the peculiarities of care and related service parts, we particularly focused on the care and service parts in the process of assessing, assembling and adapting care and service packages. Here, the characteristics, organization and combinability of various parts of care and services an individual client requires become most visible.

Purposive sampling was used for case selection to ensure unity and comparability on some case characteristics while warranting maximum variation on others. Voss et al. (2002) stress the importance of control variables in case study research. In order to be able to make meaningful comparisons we only selected case companies that have elderly people as the major part of their client base. Having the same target population implies that these
organizations all have to deal with similar issues when organizing and combining various parts of care and services. Besides, all case organizations provide their clients access to the three service domains that are of major importance to elderly, being housing, welfare and care. As such, package construction in all cases includes the challenge of combining dissimilar types of service parts. Finally, all organizations are certified with the care-related ISO9000 (HKZ certificate) meaning that their products and processes are registered and implemented in an established manner. Although care comes to existence in interaction between two people, and thereby might differ each and every time it is provided, the certification will minimize variation among different employees working in the same organization. As such, it diminishes individual deviations within one case but facilitates comparison among the case organizations.

Although all case organizations selected currently provide care and services to independently living elderly, variation can be found in their historical background, which is either in home care or institutional care. Home care organizations historically are used to working in many locations, in fact they have as many working places as they have clients since they deliver care in the homes of their clients. Traditionally, these organizations have a service range focusing mainly on the care aspect of their client’s needs. On average, home care organizations provide only one or a few care or service components to their clients who are living scattered around the organization’s working area. Institutional care providers supply a range of care and service parts encompassing all domains of living, including welfare and housing. As such, institutional organizations are used to deliver packages of care and service components to their clients. However, delivery only takes place at one single location, being the premises that their clients live in collectively. Since we aim to get insight in the provision of packages of care and services to independently living elderly, knowledge and experience of both types of organizations is essential for our research.
Furthermore, all organizations make sure that services in housing, welfare and care can be easily reached by their elderly clients. However, the way in which the organizations make the various service domains accessible varies from having all domains in-house to different types of cooperation with other providers. Different types of strategies might imply that the organization, assessment and assembly of the various service types differs among the cases. As such, this variation might influence the way in which packages come to existence. Table I displays the particularities of each case.

Table I – Sample of case organizations

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<thead>
<tr>
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<th>Case T</th>
<th>Case R</th>
<th>Case K</th>
<th>Case V</th>
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<tbody>
<tr>
<td>History in</td>
<td>Home care</td>
<td>Institutional care</td>
<td>Home care and institutional care</td>
<td>Home care and institutional care</td>
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<td>Strategy to</td>
<td>Initiatives for</td>
<td>All services in-house</td>
<td>Cooperalational agreement among organizations in both types of care, welfare and housing</td>
<td>Recent merger among three organizations in institutional care and home care</td>
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<tr>
<td>make all</td>
<td>cooperation</td>
<td>recent expansion to home care</td>
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<td>domains</td>
<td>with organizations in welfare and housing</td>
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4.2 Data collection and analysis

To guide data collection and analysis in the field of operations management, Voss et al (2002) state that one should have a prior view of the general categories to be studied. To acquire a thorough overview and understanding of the process of package assessment, assembly and adaptation, data gathering was guided by a data collection protocol (Yin 1989). With reference to Eisenhardt (1989), the protocol comprised a topic list on the basis of our literature study with all research variables to address concerning the specification, construction and adaptation of care and service packages and the respective indicative questions. Topics concerned service architecture, modules, components, interfaces, and specifics of the elderly care environment. Multiple sources of evidence were used for data
collection to facilitate a process of triangulation (Eisenhardt 1989). Semi-structured interviews were conducted; in the analysis we can for each case include the perspectives of the regional director, team leader home nursing, team leader home help, front desk employees, start-up nurses, key nurses and representatives from complementary services, call centers and marketing respectively. To ensure unity in style and form of interviewing, all interviews were conducted by the same researcher. All interviews were transcribed, and after transcription the interview texts were put up for a member check to raise validity. Besides, documents like handbooks, process descriptions and product books were analyzed and each case study involved three observation visits to observe and experience working processes.

The qualitative data analysis software Atlas.ti 5 (Atlas.ti 2004) was used for on-screen coding and exploration of patterns and relationships in our data. For data reduction, the three-step coding scheme of Strauss and Corbin (1998) was used. The first step, open coding, is an analytic process in which concepts are identified by grouping individual observations, sentences, ideas and events into categories (Voss et al. 2002). When coding constructs based on case research, it is often prudent to limit the number of categories (Voss et al. 2002). Therefore, we derived a codes list upfront, identifying the most important concepts related to theory on the basis of our topic list. As such, coding was applied in a deductive way. With this codes list, each interview was coded independently by two researchers who then discussed and compared their codes to reach consensus on each of them. During this process, however, it appeared that the richness and nuances of the data collected could not sufficiently be captured. We therefore decided to open the codes list for additional codes that appeared through the data. Inductive codes, thus, were added. In the second step of the coding process, axial coding (Strauss and Corbin 1998, p. 123), we bundled text fragments with similar codes and systematically analyzed their contents to reveal the core concepts related to the process of package assessment, assembly and adaptation. As such, we were able to create a codes tree as
depicted in table II, giving insight in the different (sub)categories related to the realization of care and service packages. The final step is selective coding (Strauss and Corbin 1998, p. 143), where we related codes categories to one another. As such, we developed insights in the mutual relations among the categories both within and across the cases.

<table>
<thead>
<tr>
<th>Theoretical background</th>
<th>Deductive codes</th>
<th>Inductive codes added</th>
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<tbody>
<tr>
<td>Modularity</td>
<td>Architecture</td>
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<td>Interfaces</td>
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<td>• Flow of information</td>
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<td>Package</td>
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<td>• Specific package</td>
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<tr>
<td>Service / Care</td>
<td>Interaction</td>
<td>• Customize</td>
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<td>client-professional</td>
<td>• Personalize</td>
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<td></td>
<td>Client choice</td>
<td>• Functionality related</td>
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<td></td>
<td></td>
<td>• Delivery related</td>
</tr>
</tbody>
</table>

The process of assessing, assembling and adapting packages: a general description

In all cases, dissimilar care and service parts are typically offered to an elderly client to support him to continue to live independently. One organization or a group of partner organizations generally provide several types of care and services, such as home care, home help, supporting services and housing services. However, these service types operate fairly unconnected with respect to organizational departments providing the services, that each have their own entrance, finance stream and assessment phase. Only in case R independently
working departments are connected through a centralized assessment process, in which a coherent package of dissimilar services is aimed at.

In order to meet the demands of a given client, certain tasks will have to be performed. In all cases, an assessment of the required care and services takes place. In general, professionals determine together with an individual elderly client what should, can and will be delivered with respect to a particular type of service. The assessment process starts when a client expresses his needs for care and related service provision by means of a phone call to the organization. During this call, an assessment professional checks whether the client possesses an indication and broadly specifies the client’s needs and requirements. Subsequently, when the indication is assigned, a house visit takes place. During the house visit, an assessment professional specifies the client’s needs in depth by questioning the client on his personal situation and observing the client’s living environment. As such, the required care and service parts are determined. Arrangements are made with the client concerning the content, duration and moment of delivery. These are drawn up in the personal care plan of the client. After the house visit, package delivery can start. Assessment of the care and service package continues on the job, where during care and service delivery, components are tuned in further detail. As such, package specification takes place in close interaction between the care professional and elderly client. All case companies seem to be very much prepared to the fact that over time, needs of independently living elderly, are transient and subject to change. Packages are evaluated on a regular basis and package adaptations can be put into practice at the moment the client requires this.

4. Literature review: theoretical features of modularity

4.1 Product modularity

In one of the first contributions in literature on modular production, Starr (1965) formulates
the basic idea behind modularity as "… design, develop, and produce […] parts which can be combined in the maximum number of ways". This basic idea persisted over the years in the field of operations management, where modularity means that a final product can be assembled from smaller subsystems that can be managed independently yet function together as a whole (e.g. Sanchez and Mahoney 1996, Baldwin and Clark 1997, Mikkola and Grassmann 2003).

Key to successful product modularization is product architecture: the scheme by which the functional elements of a product are assigned to independent components (Ulrich 1995). A perfectly modular product architecture includes a one-to-one mapping of functional elements to physical components of the product (Fixson 2005). Components, thus, perform a well-defined function and as such represent a distinct portion of a product that is autonomously functioning (e.g. Fine 1998, Duray et al. 2000, Wolters 2002). These distinct components, then, need to be arranged into a product that consumers will treat as an entity. Linkages among components are formed by interfaces, which are descriptions of how components fit together, connect and / or communicate (Baldwin and Clark 1997). In modular goods, interfaces often take the form of standardized physical connections that attach one component to another and aim to resolve potential conflicts between two interacting parts of a design (Baldwin and Clark 2000). Sanchez (1999, 2000) distinguishes between different types of standardized product interfaces, e.g. attachment, transfer, and spatial interfaces. Interface standardization creates a high degree of independence, or loose coupling, among components (Sanchez and Mahoney 1996). This means that components in a product can be substituted without requiring changes in other components to be made (Sanchez 1999).

Together, distinctive, independent components and standardized interfaces allow either the producer or the consumer to mix-and-match the components and come up with many variations of the end product (e.g. Salvador et al. 2002, Voordijk et al. 2006). In addition, the
use of modular production principles enhances product variety at no significant increase in cost (Starr 1965). Standardization at component level allows for cheap component production (Baldwin and Clark 1997). Furthermore, the components can be shared across multiple products that appeal to different clients or client groups. As such, economies of scale can be gained (Ulrich 1995).

In sum, two important dimensions in the study of modularity are components and interfaces. Interfaces are standardized. Components are distinctive, independently functioning, and bring into practice only one, or very few, functionalities.

4.2 Modularity in services

Although Menor et al (2002) promoted further study of the development and application of modularity in services over half a decade ago, research on service modularity is scarce. Among notable exceptions are Meyer and DeTore (1999, 2001), Sundbo (1994), Pekkarinen and Uulkuniemi (2008) and Voss and Hsuan (2008). These authors have suggested modularization for optimizing, among others, financial services and business services in order to arrive at customized service provision at reasonable cost.

With modular services, we mean that services or service packages are created out of distinct components that can be combined in many ways for a client at the moment of purchase (Sundbo 1994). As such, customization, i.e. modification of the good or service offering by choosing from a set of available services (e.g. Gwinner et al. 2005) takes place. Following Pekkarinen & Uulkuniemi (2008) a final, modular service package will be combined from one or several service components, each corresponding one-to-one with a certain service functionality. A service module is understood as a conceptual grouping of one or several service components offering one functionality. Thus, service components are considered as the smallest units into which services are divided. Voss and Hsuan (2008), with reference to
the ESD Architecture Committee, define service interfaces as linkages that govern the arrangement, interconnections and interdependencies of components within a package.

Owing to the process character of many services the line between product and process is not clearly definable (Van der Aa and Elfring 2002). They are two complementing and intertwined dimensions in final service provision (Pekkarinen and Ulkuniemi 2008). As such, in a modular service architecture, the functional elements of the service can be put into practice by product components, process components or both. Another characteristic of services is the central role of people. Services come to existence in close interaction between producers and customers in the service delivery process (e.g. Edvardsson et al. 2005, Sampson and Froehle 2006). Besides, in many services, employees play an important part in service personalization and customization (Gwinner et al. 2005). Therefore, both service components and service interfaces will not only have technical aspects, but human aspects as well. To arrive at a coherent whole, interfaces will have to govern the flow of people undergoing service provision and the flow of information concerning service provision (Voss and Hsuan 2008).

Although healthcare services, in general, are different from ordinary services, insights from service modularity provide an important starting point for exploring long-term care modularity. Both in cure (Bohmer 2005, Meyer et al. 2007) and care (De Blok et al. 2009) awareness is stimulated to the opportunities modularity provides for efficient provision of customized healthcare services. However, the introduction of modularity in care has been mainly conceptual and its features and implications have not been empirically investigated.

5. Results and discussion
On the backdrop of our literature study, we conducted our empirical study to investigate to what extent modularity features do also apply to the provision of care and service packages to
independently living elderly. We used the definitions on component, module and interface as given in section 4.2. Besides, we define a package as a bundle of care and related services in which components are combined such that they are optimally tuned to the needs and requirements of an individual elderly client. In the next sections, we aim to provide insight in the particularities and characteristics of two important dimensions of modularity, components and interfaces, in long-term care. Furthermore, we reflect upon service characteristics that influence the application of modularity, as highlighted in literature on service modularity. From here, several propositions are developed that form a first stepping stone in the development of theory on long-term care modularity.

5.1 Ingredients for package composition: components and architecture

In order to assess client’s needs and wants and assemble a package, professionals mainly start from the indication that is provided by the Central Indication Organ: “The indication that a client receives states the care parts that this person is entitled to and this is what we are going to provide. The actions and activities that are stated in the indication”. Each service category provided by the case organizations, such as home care, home help, housing and support services, brings about a number of functionalities that are represented by care and service modules. On the basis of the indication, clients and professionals together determine the most optimal components from care and service modules relevant to the client. For example, one manager indicated: “The indication for the functionality home help indicates that the client is entitled to support in heavy household work. That means there are various parts to be selected such as vacuum cleaning, window washing outside, window washing inside, washing curtains, cleaning the bathroom floor, dusting atop or under large furniture, etc. But providing heavy household work is the starting point”. Depending on his situation, a client
receives only one, a selection of, or all of the components from this module, thereby bringing about variations in intensity and quantity.

In general, professionals do realize that a client also might require services outside of the indication, however, there is no outline of what a package as a whole is supposed to perform for a client. This results in very dissimilar approaches to package construction, where, depending on the professional and the organization, for one client the package is extended beyond the indication while for another client it is not. This observation is different from literature on modularity where the desired end product is taken as a starting point for product design (e.g. Ulrich 1995, Jiao et al. 2006). In product modularity, an architecture is set up that clearly distinguishes between different functionalities the product has to perform. These functionalities are brought into practice by (variations of) components. However, although the architecture specifies the mapping between components and functionalities, it also makes sure that the end product still represents a coherent whole, i.e. a unity of distinct components that all do one’s bit for the end result to appear. The modularization as observed in long-term care practice came to existence mainly because of the financing system: because of financial regulations and the reimbursement system, the total range of supply was decomposed into distinct categories and product parts. Whereas the underlying basis of any package should be facilitating in working towards the final package composition for any client, the basis underlying care and service packages is more regulating.

Despite this, all component-related features of modularity still seem to be present in the set-up and provision of packages to independently living elderly. The manager’s statement as depicted above shows a clear mapping from functionality to components. A module is related to the functionality and filled with components that bring about variations on this functionality. While the mapping from functionalities to components is closely related to the
financing structure it provides clear lines between a care functionality and the components that put this functionality into practice.

Besides, components in care and related services, overall, have clear boundaries. These boundaries result from the financing structure and sector-wide protocols, both being external to the case organizations. Furthermore, boundaries result from organizational decisions concerning the total range of supply and task division among nurses and other professionals: “we [home care nurses] are not allowed to cut toenails, that is a task of the pedicure”, and “I (manager home help) tell my employees: do not touch the client. So home help is strictly separated from services in home care provision and from services that are more severe, in nursing”. These boundaries result in each component being distinct in that it brings into practice its own functionality. Furthermore, interviewees indicate that components, when bringing about their functionality, work independently from each other: “There is absolutely no overlap in services”, “they do not get in each other’s way”, and “tuning is hardly needed”.

PROPOSITION 1: components in care and related services are distinct, independently functioning and clearly related to a functionality and as such can be combined into a package.

PROPOSITION 2: an architecture that is focused on the end product for the client does not seem to be a prerequisite to assemble modular packages in long-term care however the absence of the architecture does bring about a lack of receptiveness in needs assessment and package assembly.

5.2 Managing dependencies: interfaces

Components are combined into a package for one client at the moment of purchase, being mainly in the assessment phase. After assembly, then, delivery of the package starts. As already indicated, package delivery to independently living elderly is not a one-time experience and over time package contents are subject to change (Van Bilsen 2008).
Furthermore, each package component might have its own delivery frequency. Some components, such as medicines, might be provided every three hours, whereas others are delivered each day (e.g., meals-on-wheels), every week (e.g., home help) or every fortnight (e.g., elderly advisor), depending on the needs and requirements of a particular client. To make sure that all components together form a coherent whole still and the client continuously flows smoothly from one component to the next, dependencies and interferences among components have to be prevented or managed by means of interfaces. From case data, three reasons for the management of dependencies could be discerned, resulting in the use of different types of interfaces.

Firstly, components are managed when planning their execution. The case data reveal certain measures that are taken to make sure the client will flow efficiently and effectively through all components in his package. Since the components share the object of service provision, i.e. the client, tuning in time, order, frequency and location will make sure that the flow of the client is not disrupted. Here, the interfaces used are general rules that take care of the arrangement of components within a package and primarily prescribe a sequence to be taken into account when delivering components to one client. “Clients that have to go to day care, have to be taken care of early in the morning, since they have to be washed, dressed and fed before the bus comes to pick them up”. Remarkably, since it is not documented sector-wide, all cases work according to the following sequence:

1. components offered to a group of people (day care) and fixed care appointments, e.g. in a hospital;
2. care components provided to an individual client, such as washing or home help;
3. care-related and supportive services, such as a hair dresser-at-home, clothing service-at-home or pedicure-at-home.
Putting into practice these rules, however, will not be possible without the transfer of information with respect to the contents of a client’s package from professionals in the assessment process to the planning departments. On the basis of this information, planners know what rules to take into account and, as such, make sure that the components are scheduled in the right order. For this information transfer, no fixed rules have been prescribed. Professionals just seem to know what information they have to provide to whom.

Secondly, components are managed due to dependencies regarding their medical contents. The interview data show that some components, when provided in a certain combination, start to interfere when not provided in the right manner: “When a client receives both a shower and wound care, we have to make sure that the shower is planned first, otherwise the wound cream will be rinsed off.”, and: “when a client suffers from diabetes and needs an injection of insulin in the morning, this has to happen right before the client will be given breakfast otherwise we can take him to the hospital”. When content-related dependencies are not managed with respect to order, frequency or timing, the outcome of service provision for the client will be negatively influenced and the potential interferences might have a huge impact on the health status of a client. Therefore, several interfaces prevent loss of functioning and ensure a safe flow of the client from one component to the next. Because of the severe possible consequences, components are executed according to protocols that prescribe fixed ways of working in how to deal with a certain (combination of) component(s). Besides, planning departments make sure that components are planned, and thus executed, in the right sequence following the protocols. On the basis of information provided by professionals who have assembled the package, planners are able to comply with these protocols.

Thirdly, components are managed with respect to changes over time. Professionals providing care and service components to independently living elderly are very much trained to signal changes in a client’s situation. To make sure that a client will always receive the
optimal package, all information with respect to changes in a client’s situation is transferred to a key nurse being responsible for this client. On the basis of the information provided, the key nurse will consider if changes are required in the contents of a package, how this package should be adapted and how the execution of these components can be efficiently and safely integrated into the original package content. In this respect, communication and consultation among professionals involved happens instantly. They, just know what to do because of their nursing education or yearlong experience without making use of protocols.

In professional care provision, each client and his situation are considered as unique. From the professional, this requires that she thinks and acts dependent on the context (Vulto and Morée 1996). Because of high variability in client demand and the almost infinite number of possible changes, interfaces with respect to information transfer and subsequent actions taken do not strictly prescribe what has to happen when changes occur. Rules only indicate that something has to happen, which leaves room for the professional to adapt the information exchanged and actions taken to each unique situation. Interfaces, thus, mainly take the form of guidelines instead of fixed rules.

In sum, interfaces govern the arrangement of components and manage dependencies concerning the flow of clients and the flow of information, thereby confirming existing literature on service modularity (Voss and Hsuan 2008). Different types of interfaces can be discerned in care and service provision to independently living elderly, each having their own focus. With respect to planning and content-related interferences, the flow of people plays the first fiddle, with respect to management of packages over time, the flow of information does. More specifically, we propose the following types of interfaces:

PROPOSITION 3.a: Interfaces can be rules governing the arrangement of components with respect to planning so the client can flow smoothly from component to component.
PROPOSITION 3.b: Interfaces can be rules governing the arrangement of components with respect to their contents so the client can flow safely from component to component.

PROPOSITION 3.c: Interfaces can be guidelines regarding the flow of information with respect to smooth and/or safe component delivery.

PROPOSITION 3.d: Interfaces can be guidelines regarding the flow of information with respect to component adaptation.

5.2.1 Mediating factor with respect to interface use

The case data showed that decoupling of components in terms of production, i.e. produced and delivered by various professionals, requires different forms of tuning to make the package function as a coherent whole. Planning rules are used and information exchange takes place among nurses and professionals involved in order to determine how and when to provide individual components. So the focus is on the flow of the client as well as on the flow of information. However, when components are produced by a single professional, the need for information exchange is eliminated and the effort in planning is diminished since a professional can manage all components by herself.

Case data, thus, suggest that tight coupling of care and service components in production reduces the need for coordination and eliminates interfaces in information exchange. While being in contrast to the state of art literature in modularity (e.g. Sanchez 2000), this finding is in line with literature on the degree of coupling of services, i.e. the degree to which a service is broken up in several activities that are allocated to different employees (Zomerdijk and De Vries 2007). When an organization aims to provide personal and customized services that are high in responsiveness and flexibility, activities should be performed by a single professional since this reduces handovers of client information (Metters and Vargas 2000, Zomerdijk 2005). In the transfer of information among professionals, information might get lost or noise
might be created. Furthermore, handovers cost time (Zomerdijk 2005). In elderly care provision, changes in a client’s situation might require acute action with respect to the components provided. Furthermore, incomplete or unreliable information might negatively affect actions taken and, thereby, also the health outcome of the client.

PROPOSITION 4: The use of interfaces with respect to the flow of information can be diminished when components in care and related services are coupled in production, i.e. provided by a single professional.

5.3 The central role of people

One manager clearly phrased the central role of and close interaction between people in care and service provision: “the teamwork between the nurse and the client makes that the support can be realized”. The importance of this close interaction revealed two observations that influence the extent to which product modularity literature can be applied.

Firstly, functionalities coincide due to close interaction. Case data show that components bring into practice one technical functionality, being a principal problem solving benefit the client seeks (Lovelock and Wirtz 2007: p.70): “When we are there to put on supportive socks, that is what we do. Nothing less, but also nothing more, we are not going to clean one’s false teeth or make some tea’. However, related to the close interaction between professional and client, also several social functionalities can be observed at the same time. A typical statement was: “While you are putting on these supportive socks, you want to be nice to that client, because you might be the only one that this elderly person will see for the rest of the day. So you make sure these socks are put on in the right way and at the same time, you ask how this client is doing.” The presence of people in care provision makes the inclusion of human aspects, such as diminishing loneliness, signaling changes, being there, and giving company, inevitable. In general, the delivery of care and related services is characterized by an
interwovenness of aspects related to the ‘hand, head and heart’. Although officially professionals only deliver, for example, personal care or home care, giving attention to the client, listening to his stories and talking about everyday life are an indispensible part of the profession (Vulto and Morée 1996). Because of this, clients experience feelings of warmth, trust and confidence. Care and related service provision is thereby comparable to experience-centric services as described in Voss et al (2008). In care provision, however, the experience is not in pleasure-seeking in the sense that people like it, but in ‘displeasure-preventing’ since it is the client’s body, mind or possessions that has to be serviced. Still, a high degree of sociopsychological aspects that are inseparable from the technical core of the service being provided are at stake. Although purely modular components only bring into practice one functionality, the social and technical functionalities coinciding in care provision will not necessarily defeat a modular way of working, since they do not interfere. The technical functionalities are mainly brought about by the components included in the package whereas social functionalities come to existence during component execution.

PROPOSITION 5: Due to the nature of care and related service provision and the fact that these services always come to existence in close interaction between professional and client, component delivery always includes the provision of a few functionalities and not one.

Secondly, the close interaction between client and professional influences the tuning of packages. “A fit-to-size package only comes to existence when we, together with the client, assess what particular question a client has about a certain functionality and what components, thus, will suit this person best”. Tuning, on the one hand, takes place by combining the distinct and loosely coupled components that the total range of supply consists of: “because of the combination of the standardized components, we come to a more or less fit-to-size package for each client”. Variation, thus, is achieved by mixing and matching
components into a package. Also over time, the package can be easily adapted by adding or omitting components: “When a client receives wound care, but the wound has healed, the nursing care for this component will be closed. At the same time, we of course continue the provision of components related to personal care, such as supportive socks, washing or meal service”. In line with modularity theory, packages are customized by combining and adapting components on the basis of each client’s specific situation.

Although service product and service process are closely related in services, they play different roles in the provision of care and service packages. Besides tuning by means of package customization, a lot of ‘tuning effort’ is devoted to the alteration of various aspects within the boundaries of each component. The changes and adaptations that are put through, however, do not alter the content-related functionality of a component but merely relate to the execution of a component. At the start of the care provision process, a care or related service component is provided to each client in about the same manner. During the first times of service provision, however, component delivery is evaluated on the job and various aspects, such as time, frequency, way of execution, devices or materials used and personal behavior, can be adapted to fulfill a client’s needs. As nurses indicated: “Within the bandwidth of the indication, we can vary in for example time and quantity”, and “During delivery, you try to take a client’s customs and habits into account as much as possible”. This finding is in line with service personalization: ‘the person interacting with the customer adapts the delivery of the service to respond to the customer’s expressed or implied needs’ (Voss and Hsuan 2008). Both process adaptive behaviors and service-offering adaptive behaviors occur at the time of customer contact (Gwinner et al. 2005). Personalization of execution-related aspects provides elderly clients and professionals with the feeling that the package is tuned to the client’s needs. As one manager put it: “care is just care, in whatever combination it is offered, however, distinctions can be made in the details of a package such as the experience,
treatment and the way clients are directed”. However, when striving for the provision of packages in a demand-based and modular manner, adapting aspects related to the process of execution is far from actually modifying the contents of a package.

PROPOSITION 6: By means of mixing-and-matching, customized packages make sure that a client receives all technical functionalities required, however personalized execution of components is used to provide clients with a feeling of fine-tuning.

6. Conclusions

Our paper aims to answer the following research question: To what extent are product modularity principles applicable to the field of elderly care, where packages of care and related services are provided to independently living elderly clients? In general, basic modularity features also apply to care and related service parts. As such, we propose that:

1. components in care and related services are distinct, independently functioning and clearly related to a functionality and as such can be combined into a package.

However, to capture the specifics of care and related service provision, original modularity features need to be either adapted, refined or extended in order to shape modularity in a health service setting. Our case-based research led to the following propositions concerning architecture, interfaces, high interaction between client and professional, and the role of product and process in the light of long-term care modularity:

2. an architecture that is focused on the end product for the client does not seem to be a prerequisite to assemble modular packages in long-term care however the absence of the architecture does bring about a lack of receptiveness in needs assessment and package assembly.

3.a Interfaces can be rules governing the arrangement of components with respect to planning so the client can flow smoothly from component to component.
3.b Interfaces can be rules governing the arrangement of components with respect to their contents so the client can flow safely from component to component.

3.c Interfaces can be guidelines regarding the flow of information with respect to smooth and/or safe component delivery.

3.d Interfaces can be guidelines regarding the flow of information with respect to component adaptation.

4. The use of interfaces with respect to the flow of information can be diminished when components in care and related services are coupled in production, i.e. provided by a single professional.

5. Due to the nature of care and related service provision and the fact that these services always come to existence in close interaction between professional and client, component delivery always includes the provision of a few functionalities and not one.

6. By means of mixing-and-matching, customized packages make sure that a client receives all technical functionalities required, however personalized execution of components is used to provide clients with a feeling of fine-tuning.

Implications for practice

From earlier research it follows that conceptually speaking, modularity has an added value for long-term care provision, however, it is important to support this concept empirically. Results of our explorative case study research indicate that modularity features are indeed applicable, either in their original or in an adapted formulation. Although our research did not investigate the advantages of modularity in long-term care, its applicability implies that this concept can help providers to align the sector’s focus on both client and efficiency. The propositions provide a first step in guiding providers of long-term care to rearrange their total supply according to technical functionalities, while leaving room for the human aspects that are
attached to the execution of components. As such, providers can work in a modular manner while still taking into account the peculiarities of care provision. By having clarified different types of interfaces that guide the arrangement of components, coherent package provision by either several departments within one organization or with a group of partner organizations will be facilitated. In order to reduce coordination efforts, providers of elderly care could consider coupling of components. However, when coupling components in execution, providers should be aware of the fact that not all professionals will be allowed or competent to execute all service parts. Education and experience play a large role in this.

A prerequisite for the application of modularity in elderly care, seems the development of an architecture that clearly states all functionalities a client would require in order to live independently as long as possible. Currently, the indication puts a strict stamp on the delivery of, primarily, care services. Content, intensity and quantity of components to be delivered are largely pre-determined by the indication. Therefore, tuning of these components largely focuses on aspects related to delivery and other service types are often overlooked. Working from an architecture encompassing the desired end product might stimulate care and service providers to start from a broad client perspective and actually customize both product and process.

Besides its applicability in long-term care, we believe that the insights and propositions will also be applicable to other fields of healthcare. In the field of mental healthcare, research shows that the complexity of client results in highly diverse needs and preferences with respect to package composition, however clients adjust their demands to the existing services (Rijckmans 2005: p.92). A modular setup of supply would enable providers and clients to disconnect the articulated demand from the existing supply and make way for new services to be developed. Furthermore, in cure, hospital patients often are treated in a specific, predefined, care trajectory. In this light Bohmer (2005) advocated a more patient-oriented
approach by blending standard and custom processes in the treatment of a single patient. On the basis of the propositions, his conceptual insights could be further advanced.

Limitations and future research

The case method used in this research has both strengths and weaknesses. The relatively small number of cases limits the generalizability of our findings. We used the cases to provide a richer understanding of new phenomena and to explore related propositions (Voss et al. 2008). The propositions stated hold for all cases investigated, even though these cases differed from each other on various aspects. As such, we made our propositions have solid ground. Future research, however, should focus on a broader generalization of the propositions, to other elderly care providers and to other types of healthcare provision, either by means of qualitative or quantitative research.

Furthermore, case research was complicated because providers of care and services do not address their way of working as being modular so that a common language first had to be developed. At the same time, explorative interviews with managers in advance of the case studies showed many similarities with a modular way of working. Moreover, the care and service providers involved do operate in a mass customization-like environment, being an environment that is very much suited for modularization of supply. For further development of modularity in long-term care, future research should focus on organizations that work in a modular fashion vis-à-vis those that do not. As such, insights can be gained in the trade offs both types of organizations have to deal with and the advantages modularity can and cannot offer in long-term care.

In this research, we specifically focused on the specification and execution of care and service packages for an individual client. Besides interfaces that are concerned with the safe and efficient flow of a client from component to component within his package we came
across planning rules that take care of the overall planning of the organization, prescribing how professionals should flow from one package to another. Although being out of the scope of our research, these rules can still influence the provision of a package to an individual client. Future research should take a broader perspective on modularity, thereby also taking into account modularity in processes and supply chains. Furthermore, conditions for and issues related to modularity in the provision of services, such as knowledge structures, should be explored.

Our case based research yielded several propositions that form a first stepping stone in the development of theory on long-term care modularity. It is our hope that future research in both healthcare and the broader field of services will build on this foundation to shed greater light on the alignment of client and efficiency orientation.

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**8. References**


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