Università
Ca'Foscari
Venezia

**Department
of Management**

Working Paper Series

A. Cabigiosu, D. Campagnolo, A. Furlan, and G. Costa

Balancing customization and standardization in knowledge intensive business services: The use of modular service architectures

Working Paper n. 11/2012
September 2012

ISSN: 2239-2734

BALANCING CUSTOMIZATION AND STANDARDIZATION IN KNOWLEDGE INTENSIVE BUSINESS SERVICES: THE USE OF MODULAR SERVICE ARCHITECTURES

(September 2012)

Anna Cabigiosu[1]
Università Ca' Foscari Venezia
Department of Management
Fondamenta San Giobbe, 873 Cannaregio
30121 Venezia, Italy
Tel +39 041 2346963 – Fax +39 041 2348701
anna.cabigiosu@unive.it

Diego Campagnolo
Università degli Studi di Padova
Department of Economics and Management
Via del Santo, 33
35123, Padova, Italy
Tel: +39 0498274247
email: diego.campagnolo@unipd.it

Andrea Furlan
Università degli Studi di Padova
Department of Economics and Management
Via del Santo, 33
35123, Padova, Italy
Tel: +39 0498274235
email: andrea.fulan@unipd.it

Giovanni Costa
Università degli Studi di Padova
Department of Economics and Management
Via del Santo, 33
35123, Padova, Italy
Tel: +39 0498274035
email: giovanni.costa@unipd.it

Abstract

While the mainstream literature on knowledge-intensive business services (KIBS) has long emphasized their customized nature and their role in exploring new knowledge to satisfy each client's needs, recent research has argued that competition is inducing KIBS firms to standardize their offer. In this paper, we concentrate on a particular type of KIBS firms, third-

[1] Corresponding author

party logistic service providers (TPLs), and analyze how two TPLs face the customization-standardization trade-off by using service architectures. We find that TPLs do not trade off customization for standardization, instead they manage to pursue both simultaneously relying on modular services, which constitutive elements are standard procedures. Service modularity enables the TPL to exploit its existing knowledge base while only some knowledgeable clients prompt TPLs to explore new procedures. Overall, our results suggest that service customization and knowledge exploration can be separated. TPLs should manage their customer relationships using a portfolio approach, balancing supply relationships in which they replicate existing services with partnership-based relationships with competent customers in which they develop new procedures. Managing the temporal separation between exploration and exploitation consequently becomes a core competence.

Keywords: Services, Innovation, Performance, Standard services, Modular services
JEL classification: O32; O33

Acknowledgments: we thank the Cassa di Risparmio di Padova e Rovigo (CARIPARO) that funded this research.

INTRODUCTION

KIBS firms are enterprises whose primary value-added activities consist of the accumulation, creation, or dissemination of knowledge for the purpose of developing a customized service (Bettencourt et al., 2002). Examples of KIBS firms are technical engineering services, management consultancy, software and information processing services, research and development, marketing and media services, third and fourth party logistics service providers (Miles, 2005).

KIBS are complex and customized services developed to specifically meet each client's needs. The production of services is often the result of a joint effort of the service provider and the client (Den Hertog, 2000): clients possess much of the knowledge and competence (e.g. client's business/industry features, desired service attributes/goals, client's available technologies and routines) that a KIBS firm needs to effectively design and deliver

the service (Sundbo, 2002; Bettencourt et al., 2002). Thus, clients collaborate to the service development and production via an intense knowledge-sharing with the KIBS firm.

The main challenge for KIBS is to balance between the ability of adapting to individual customers' needs and, at the same time, the ability of serving several customers. This clearly points to a trade-off in the KIBS business: on the one hand, the ability of adapting to individual customers' needs calls for service customization, while on the other the ability of serving several customers requires greater problem-solving capabilities and service standardization to obtain economies of scale and scope. As Corrocher, Cusumano and Morrison (p. 176, 2009) pointed out that "exists a tension between the pressure to reduce the production costs of services, which leads firms to look for increasing standardization, and the need to meet specific user requirements, which, on the contrary, force firms to seek a high degree of customization in their products".

The KIBS literature has focused mainly on providing quantitative descriptions of these services and has not yet disentangled how KIBS solve this trade-off (Muller and Doloreux, 2009). The concept of service architecture may come in useful to tackle this issue, drawing particularly on the idea of modular architecture because it enables customization and standardization to be achieved at one and the same time. Using a modular service architecture, a service can be designed as the combination of a number of standard modules, which can be "mixed and matched", thereby reducing the project's complexity (Cabigiosu and Camuffo 2011; Campagnolo and Camuffo 2010; Sanchez and Mahoney 1996). Combinable standard modules allow for efficient service customization: suppliers design their services like a "black box", replicating their own best practices with little or no need to share knowledge with clients. Even the KIBS literature, which traditionally emphasize the customized nature of KIBS, has recently made the point that KIBS might adopt modular approaches (Meyer and DeTore 2001; Miozzo and Grimshaw 2005).

The present study aims to explore how KIBS solve the trade-off between service customization and standardization by analyzing the service architecture of third-party logistic providers (TPLs). TPLs are now considered KIBS firms since, over time, they have increased the number and variety of their services as well as their knowledge and technology content (Hertz and Alfredson, 2003).

Our study confirms that TPLs succeed in being efficient while responding at the same time to a variety of different clients' requests relying on modular service architectures. We also find, from the knowledge sharing point of view, that TPLs manage their customer relationships using a portfolio approach. They balance supply relationships in which they replicate existing service modules (exploitation) with partnership-based relationships in which they develop new service modules with competent customers (exploration).

The study proceeds as follows. The next section highlights the role of service architecture and client-provider knowledge sharing in the modularity and KIBS literature. The third section outlines the research method, including the research setting, the study design and some background data on the firms considered. The fourth section contains the within- and cross-case analysis and advances a set of testable propositions. Our findings are discussed in the fifth section, while the final section contains our conclusions and identifies future research topics.

THEORETICAL SECTION: STANDARDIZATION *VERSUS* CUSTOMIZATION IN KIBS

In this section, we investigate the trade-off between customization and standardization, drawing on the theory of modularity applied to knowledge-intensive business services.

Modularity refers to the way in which a system can be divided into different parts or modules. The literature builds on Simon's (1962) intuition that complex systems like

products, services and organizations are adaptable if they are modular (i.e. hierarchical and nearly-decomposable). Modularization processes enable the complexity of the service design problem to be reduced and may also mean that the service development can be shared between specialized groups across the organization (Colfer and Baldwin, 2010). The managerial literature has made ample use of the concept of modularity in the product domain, while scholars have only recently started applying it to services (Campagnolo and Camuffo, 2010; Voss and Hsuan, 2009). According to this emerging literature, modular service architectures consist of standard modules containing standard sub-modules that can be freely mixed and matched with one another, i.e. they are combinable (Meyer and DeTore 2001). Langlois and Robertson (1992) make the point that a modular system can be seen as a service that customers can separate into sub-groups, which they can arrange into various combinations to suit their personal preferences. Modularity offers flexible solutions that enable customers to co-create their unique value through multiple service usage patterns (de Blok et al. 2010).

Voss and Hsuan (2009) define service architecture as the way in which service system functions are separated into service components to provide the overall services delivered by the system. In a modular service architecture, service components are linked via standardized interfaces. Pekkarinen and Ulkuniemi (2008) suggest a three-dimensional concept of modularity in service production, which includes modularity in services, processes and organization. *Modularity in services* refers to the opportunity (visible to a customer) to combine different service modules to meet a client's particular needs. *Modularity in processes* refers to standardized, indivisible process steps that can be combined to produce the service as a whole. Finally, *modularity in organization* refers to the way in which the firm uses its own and other firms' resources through internal or external organizational units. Using the platform concept paves the way to an architecture that combines the three dimensions of

modularity. Indeed, a platform consists of independent subsystems and interfaces between them, and each subsystem includes process modules and a modular organizational composition (Pekkarinen and Ulkuniemi 2008). For example in logistic services, order management (OM), supply chain management (SCM), and vendor-inventory management (VMI) are modular services that can be combined with additional services. Examples of modularity in processes include the management of information flows and the physical movement of goods, both of which can be divided into several sub-processes, such as ordering and booking processes. Finally, contract manufacturing, alternative work arrangements and alliances are examples of modularity in organization (Schilling and Steensma, 2001). Modularity in vertical inter-organizational relationships generally refers to the concept of loosely coupled organizations, which are characterized by a low level of integration. Product modularity literature has long analyzed the relationship between modularity in organizations and modularity in design (Sanchez and Mahoney, 1996). In this field, some scholars suggest that product and organizational architectures mirror each other (i.e. the mirroring hypothesis) and that modular architectures are developed by loosely-coupled organizations (Cabigiosu and Camuffo, 2011; Lau et al. 2010), while others maintain that the mirroring hypothesis holds only under specific conditions, such as product architecture stability and a low level of product technological change (Furlan, Cabigiosu, and Camuffo, 2010), and that modularity in design never eliminates the need of high-powered integration tools (Zirpoli and Becker, 2011). In the service domain, and particularly in the KIBS domain, only few scholars have debated the mirroring hypothesis and the empirical evidence about it is still mixed (Pekkarinen and Ulkuniemi, 2008; Miozzo and Grimshaw, 2005).

In line with Pekkarinen and Ulkuniemi (2008), Bask et al. (2010) analyze the service production process when they look at how modularity principles can be applied to services.

They define service process modularity as "the usage of reusable process steps that can be combined ("mixed and matched") to accomplish flexibility and customization for different customers or situations in service implementation" (Bask et al. 2010, p. 368). It is worth noting that this definition of service modularity stresses the concept of standard service modules without clearly stating how the service modules can be standardized.

Despite the potential benefits of modularity, the knowledge-intensive nature of KIBS might interfere with their modularization. As Bettencourt et al. (2002) argue, KIBS are customized services because "clients themselves possess much of the knowledge and competence that a KIBS firm needs to successfully deliver its service solution" (p. 101). The relationship between a service provider and a client demands intensive knowledge and information sharing about the client's business and needs, especially when the nature of their relationship is complex. Interactions with client firms thus enhance KIBS firms' knowledge bases and ensure the required level of service customization (Mueller and Zenker 2001).

Nowadays, the empirical evidence on the extent of knowledge sharing in the service provider-client relationship and of the subsequent customization of KIBS is not straightforward. Tether, Hipp and Miles (2001) show that business service firms can offer a mix of services from standardized to fully customized services. Mueller and Zenker (2001) go further claiming that customized and modular KIBS may co-exist because KIBS firms can process and codify previously-acquired knowledge and sell it in 'modules' to other clients.

There are therefore still research questions to be answered regarding whether and how:

(a) KIBS firms leverage on service modularity to solve the trade-off between service customization and standardization (Voss and Hsuan 2009; Menor et al. 2002). Moreover, while the literature suggests that modular services combine standard services (Voss and Hsuan, 2009), a clear understanding of the constitutive elements of a standard service still lacks;

(b) KIBS firms usually leverage on clients' knowledge in developing their services. The reliance on clients' knowledge in developing a service limits the KIBS firm's usage of standard services that are the building blocks of modular services.

METHOD

Research setting

Third-party logistic providers (TPLs) are external providers that manage, control, and deliver logistic activities on behalf of a shipper (Hertz and Alfredsson 2003; Huo et al. 2008). The scholars' recent interest in TPLs stems from the rising tendency to outsource logistics in a variety of industrial sectors, which has been generating an ever-growing demand for advanced logistic services (Selviaridis and Spring 2007). TPLs are typically companies with the capabilities to offer sophisticated logistic solutions. To be classified as a TPL, a firm has to handle both transport and warehousing, but TPLs often provide a bundle of further services too, such as packaging, quality control, order handling, forecasting and inventory management, delivery planning and management, tracking and tracing (Stefansson 2006; Halldórsson and Skjøtt-Larsen 2004).

TPLs consequently differ from standard logistic service providers (LSPs) in that they offer a wider range of knowledge-intensive services, and they combine and adapt their resources to sell customized solutions (Hertz and Alfredsson 2003). In line with the definition of KIBS, a TPL relies on a project-based organization and adapts its knowledge and expertise to meet each client's needs (Bettencourt et al. 2002). As Hertz and Alfredsson (2003) maintain, TPLs face the trade-off between service customization and standardization.

Research design

To address our research question, we study two TPLs located in the north east of Italy using the case study methodology. In line with Yin's (2009) recommendations about case

study suitability, we believe this approach is appropriate for two main reasons. First, our research question is a *how* question about the trade-off between service standardization and service customization. Second, the argument standardization *vs* customization in TPLs is contemporary as TPLs are evolving toward KIBS firms by enlarging the service range and increasing the knowledge intensive nature of the service content.

Adopting the case study method, we applied the replication approach to multiple-case studies using both a within-case and a cross-case analysis (Eisenhardt 1989; Yin 2009). For data collection purposes, we developed a research protocol based on two main analytical domains deriving from our literature review, i.e. the service architecture and the extent of knowledge sharing between TPLs and their clients.

Our study started at the end of 2008. We first selected a sample of logistic service providers from the AIDA (a database of all the Italian limited companies). We narrowed our search down to the Veneto, a region that has one of the highest concentrations of business service firms (Union Camere Report 2008) in Italy. Then we surfed the Internet to distinguish TPLs from standard logistic service providers. This preliminary analysis gave us a short list of a dozen TPLs, from which we selected two independent, multi-customer firms (Cablog and Solaris), which work mainly for the same industrial sector, i.e. the food industry. We chose multi-customer firms because we aimed to analyze how TPLs design their service architectures to satisfy a number of equally important clients. Both firms performed above the industry's average (an overview of the two firms is given in the next section).

We conducted four rounds of interviews for each firm, interviewing the CEO and several key informants most knowledgeable about important client relationships. The interviews lasted about three hours each and were conducted by a team of three investigators. As Eisenhardt maintained (1989), the presence of multiple investigators adds to the reliability

of the results and increases the likelihood of surprising findings. Each interview was recorded and transcribed for subsequent within and cross-case analysis.

We conducted our interviews following a research protocol we developed following the results of the literature review section. The research protocol contains also an initial section on firm's background and data. We first collected detailed information on the firms' core business and services, sector characteristics, competitors, customers and suppliers. We then moved on to analyzing their service projects and how they are developed and implemented. We also investigated the TPL's knowledge management and innovation strategies, focusing particularly on the involvement of customers in the development of new services (see Appendix A for the list of questions contained in our research protocol).

To triangulate our data, the information from interviews was pooled with details obtained from other sources, such as websites, archival sources, internal documents, and site visits.

Based on the method proposed by Eisenhardt (Eisenhardt 1989; Ozcan and Eisenhardt 2009) and Yin (2009), we used the replication approach to multiple-case studies analysis in order to increase the external validity of our results and make them generalizable. We first conducted two separate case studies, and wrote individual case reports, then we compared them by drawing cross-case similarities and differences. Where data from the two cases were consistent, we tried to generalize a proposition; where they were not, we looked for a possible explanation. We went through frequent iterations between theory (i.e. the emerging propositions) and data before developing our final propositions.

Firms' background details

Cablog

Cablog was founded in 1983 as a transporter. In 1990, Cablog started focusing on warehousing, and in 1995 it entered the more profitable segment of distribution management.

Cablog operates in Italy and specializes in the packaged and canned foods and beverage sectors that, overall, account for 97% of its revenues[2]. Cablog has a market share of about 10%, with total revenues of 72 million Euro in 2009. Cablog's revenues are higher than the Italian average for the transport and logistics sector, which was 31.67 million Euro in 2007 (Confetra 2009). Cablog's main competitors are Ceva (403.74 million Euro), Number One (294. 61 million Euro), Fiege Borruso (52.38 million Euro) and Norbert Dentressangle (19.38 million Euro). Cablog's most important customers are manufacturers such as Nestlé-Purina, Bauli, Pepsi Cola, Melegatti, Colussi, and InBev, which account for 30% of the firm's total revenues.

Cablog relies on worker cooperatives for most material handling and warehousing activities. Other important suppliers are transporters and suppliers of transportation equipment, such as forklift trucks. Cablog's main distribution channel is to the large-scale distribution sector (i.e. supermarket and hypermarket chains). Overall, Cablog runs 5 central warehouses (located mainly in the north of Italy) and 14 transit points. The firm owns only a fraction of these physical assets.

The company employs 323 people. About fifty employees are in charge of non-operational functions such as administration, project planning, customer care, and distribution. The firm's services include warehousing, transportation and distribution and the firm directly designs, coordinates and supplies its distribution activities, while warehousing and transportation are designed and coordinated by Cablog but physically handled by third parties. Cablog integrates a network of companies, including several transport contractors for

[2] The remaining 3% of the firm's revenues come from the automotive industry.

point-to-point transportation services and two worker cooperatives that provide the labor employed at the warehouses.

Solaris Italia Group

Solaris Italia Group (Solaris) is a consortium founded in 1990 in Vicenza. Today, Solaris includes 9 firms that offer logistic, janitorial, and security services. The firm coordinates transportation and distribution services, operating mainly in northern Italy, and employs 533 people. Like Cablog, Solaris has revenues (39 million Euro in 2009) that are higher than the Italian average. Solaris's core business is logistics, which represents about 80% of its overall business, while janitorial and security services complete its range of services. Warehousing and advanced logistics, such as layout design and optimization, packaging, quality control, order administration and item traceability, are Solaris's main sources of revenue.

Solaris operates in several sectors, the most important being the packaged, canned food and beverage sectors (54% of sales), followed by manufacturing sector (24%). The firm also manages shop stores (11% of sales) and has customers in the public administration (9%), and healthcare (2%) sectors. Solaris operates at both its customers' and its own warehouses (it owns 5 warehouses).

Solaris's main clients account for 64% of its revenues and include Despar (food retail), Rana (food), Bauli (food), San Benedetto (beverages), Vetri Speciali (glass containers) and Mondadori (publishing house). Solaris's competitors, including Ceva, are mainly located in Lombardy.

As in the case of Cablog, Solaris integrates the services of a network of firms comprising consorters, transporters, logistics equipment suppliers, and information and communication technology (ICT) providers.

CASE ANALYSIS

Table 1 shows the main findings emerging from our case analysis. The information is categorized in the light of the two main domains of our research protocol, i.e. the nature of the firms' service architecture and the extent of knowledge sharing between the TPL and the client.

Insert Table 1 about here

TPL service projects: combining standard and customized modular services

Cablog

Cablog offers three bundles of services: transport, warehousing, and distribution. While transport and warehousing concern the physical aspect of logistics (i.e. storing goods or moving them from one place to another), distribution is about planning the flow of goods. In other words, distribution is an information-based activity that coordinates and optimizes the physical flow.

Transportation, warehousing, and distribution can be seen as bundles of services comprising a number of sub-services. Clients can choose the most appropriate combination of services and/or sub-services to suit their needs. For instance, Nestlé Purina buys all three services, Pepsi Cola requires transport and warehousing, Unilever only needs distribution. Transportation and warehousing each account for 30% of Cablog's revenues, while the remaining 40% derives from distribution services.

Distribution is also the most profitable service. It enables Cablog to plan warehousing and transportation efficiently and thus reduce overall logistics costs. By serving different clients, the firm is able to optimize its routes and saturate its fleet of trucks. Clients that do not

outsource distribution are not part of the network used by Cablog to optimize logistics. The distribution service is based mainly on standard procedures. Cablog has 9 planners who receive orders and manage distribution on a daily basis once the order-receiving phase has been completed (at 3.30 pm). Cablog uses an Internet-based software compatible with all types of system (SAP or others) that connects the client's ordering process to Cablog. Cablog uses a virtual private network to exchange data with clients, and a proprietary trans-codification system to read them. All transactions with clients are based on this system. Once Cablog has received the orders, its information system estimates the most appropriate distribution solution. Then the planners personally validate each cargo, taking into consideration a set of standard constraints associated with the specific characteristics of the goods (e.g. volumes, weights, number of items). When distribution is outsourced, for the client it becomes like a black box. Cablog's CEO said that "*distribution is a completely internal activity, the client is not interested in how we plan it, but only in the outcome. Planning is a black box, the client wants a competitive price and a high-quality, reliable service*".

Transportation and warehousing include specific sub-services. Each client selects the sub-services it needs and Cablog combines them into a service project. The majority of these services are standard. On the whole, transportation is a standard service that can be defined as "*the client's request to send some goods from one point to another*". Some additional standard services, such as insurance, can be added to the basic transportation service. Delivery performance is measured using industry-standard key performance indicators (KPIs), e.g. error-free deliveries, on-time deliveries. Only a few transport services (such as those covering short or mountain routes) are non-standard and consequently require dedicated resources.

As for warehousing, Cablog generally uses its own warehouses to consolidate different clients' products, which makes it easy to saturate the fleet of trucks and thus optimize the

distribution costs. Cablog's warehouses also serve clients that have no depots of their own or that temporarily need extra space. When Cablog manages its clients' warehouses, it uses dedicated transforming resources, e.g. dedicated workers, logistics equipment and trucks. Specific warehousing-related sub-services include customizing packaging. For instance, clients ask for specific packages on particular occasions, such as two bottles packed together as a limited series during the Christmas period. When it comes to transportation, the majority of clients monitor Cablog's warehousing operations by means of a set of KPIs, which may include the quality of the storage facilities and pest prevention practices, for instance. While KPIs are much the same at industry level (all clients in the food industry monitor the same categories of indicators), the value attributed to each parameter may differ across clients.

When Cablog uses its own transforming resources (warehouses, trucks, logistics equipment) to serve several clients, the service is standardized, whereas it is customized to some extent when Cablog uses its clients' infrastructures because the firm cannot replicate the same patterns of warehousing, transportation and distribution services for other clients. For example, Cablog has a client located in the north-eastern Italian Alps that produces detergents and Cablog directly manages this customer's warehouse, which is far away, outside Cablog's network of other warehouses. Cablog consequently uses dedicated trucks to cover the routes linking this client's warehouse to its own distribution centers and cannot include the client's products in the network it uses to optimize logistics. Bauli is an Italian leader making products for festive occasions and the croissant industry, and is another Cablog client that requires a dedicated transportation service. Bauli owns three plants that are located close to one another and are routinely swapping goods; Cablog manages Bauli's warehouses and uses two dedicated trucks that continuously move these goods from one plant to another.

Once Cablog's service project has defined the infrastructure, the next step is to integrate Cablog's services in the client's operations. This typically involves exchanging

information via telephone calls, e-mails, reports, and ICT. While clients transfer their orders to Cablog's distribution system via a standard ICT interface, which is defined *ex-ante* and common to all clients, the information exchanges about warehouse management (e.g. items available), transportation (e.g. trucks location), and KPIs are customized. Typically, each client want to use its own document formats and communication procedures, which have to be established in advance and then strictly respected by Cablog. Information flows are therefore something that always has to be customized, at least to some extent.

Solaris

Solaris's services are warehousing, transportation, janitorial services and security, and its clients can combine these services as they think fit. Logistics represents the firm's core business. Warehousing includes managing inbound logistics (physical and quantitative control on incoming items and the storage process) and outbound logistics (receiving orders, preparation, internal handling and loading trucks). Complementary services, such as packaging, complete the range of services offered.

The bundle of services required by a given customer is specified in a service project. Defining a project is a complex task, which starts with a technical analysis of the client's plant layout and available infrastructures (i.e. number and type of lift trucks, equipment, doors, ICT system, and employees). Solaris designs the most appropriate logistics solution based on standard procedures, which dictate which organizational and economic analyses are needed. These analyses enable the firm to set productivity targets (e.g. handling costs and lead times) related to the physical infrastructure that the firm has to manage, such as the warehouse layout, the type of shelving, and the categories of items to be stored. Solaris carefully analyses the features of the physical infrastructure and defines the corresponding variable costs for each item category, on which to base the service rate.

The warehouse layout is the main driver of customization. Solaris usually manages the clients' warehouses directly, using its own five warehouses to deal with demand peaks or to serve particular clients that do not have their own warehouses. For each service project, Solaris designs a new layout with a view to efficiently and effectively integrating the outsourced logistics with the customers' operations. Solaris physically identifies areas where its employees operate and separates these from the areas where the client operates.

Typically, it is the client who defines the delivery schedule, in which case the service project establishes the formats, tools and timing needed for clients to share information on orders with Solaris. A software developed by one of Solaris's ICT service providers usually connects the client's information flow on production planning to the Solaris information flow regarding inbound and/or outbound logistics.

Solaris operates in a number of industrial sectors, each of which demands specific solutions. As the Solaris CEO explained, "*the construction sector is different from the large-scale distribution industry, which in turn differs from manufacturing*"; for example, "*in the food sector, warehousing often has to cope with seasonality issues, while in the mechanical industry there is often the problem of just-in-time deliveries*". For each industry, however, logistics is relatively standardized in terms of equipment, layout, handling and storage practices and skills. Solaris has an office that codifies the knowledge it needs into job descriptions, one for each industry, which are used by employees as a guide for their jobs. These job descriptions explain, for example, how to handle and package items and how to arrange and sort pallets.

Janitorial services are usually based on standard procedures that only occasionally need to be adapted (e.g. fresh food). Security services are always based on standard procedures, which include how to manage goods reception and in-house controls designed to identify any anomalies such as thefts.

Cross-case analysis

In both cases, the TPLs' service projects list the combinable services (or modules) and sub-services (or sub-modules) that the client can choose from. These modular services are standard in Cablog while in Solaris they are standardized for each industrial sector. In both cases, the service modules are standard inasmuch as they rely on standard procedures and they can be variously combined to enable the TPLs services to be customized.

Service projects also identify the transforming resources to use in delivering the service, when TPLs may use transforming resources that are shared by several clients or dedicated to a given client. In the latter case, the service is customized at least to some extent because of the dedicated resources involved, but even in this case the use of standard procedures for service production and delivery enables service modules and sub-modules to be combined (mix-and-match). Service projects also define the interfaces needed to integrate the TPLs' services in their clients' operations. Both Cablog and Solaris are connected to their clients by means of information interfaces that may be standard or customized.

Proposition 1. TPLs deliver modular services. Modular services use standard procedures. The use of standard procedures enables service modules and sub-modules to be combined (mixed and matched) to meet different customers' needs.

Proposition 2. Modular services rely on transforming resources that may be shared by several clients or dedicated to a given client. The use of dedicated transforming resources is a form of service customization.

Exploration through TPL-client relations: knowledge sharing during service development

Cablog

Cablog develops knowledge-sharing routines with a limited number of selected clients (i.e. Nestlé Purina, Bauli, Pepsi Cola, Melegatti and InBev) that have their own particular competences, practices or methods. These clients transfer and share their best practices, procedures and service designs when they ask Cablog to deliver new services for which the TPL does not yet have the necessary expertise. Especially when these services are complex, the TPL has to build up a sizable body of new knowledge from scratch, and to do so it needs to draw on the customer's knowledge to develop the necessary capabilities.

To develop new services, Cablog relies on a team of 10 engineers with a consolidated experience in logistics. During the development phase, these engineers interact with the customer's employees and acquire the knowledge, procedures and practices the latter have already developed. After developing such a new service, Cablog tends to include it in its standard offer and offer it to other customers with similar requirements.

For example, as Cablog's CEO explains, "*Nestlé Purina had a central role for Cablog's know-how because it anticipated requirements that subsequently became standard for the industry. This happened in 2000 when it asked for an advanced traceability system that was new for us and for the industry as a whole. Our engineers started working with the Nestlé Purina engineers, who had already started implementing the project. In practical terms, they sent us the software specifications and other procedures they had developed. Then we worked together to complete the software and implement the traceability system. In 2005, the same service became mandatory for the industry. Our previous collaboration with Nestlé Purina was fundamental in enabling us to develop the know-how ahead of our competitors. Similarly, we worked with Nestlé Purina to develop accurate pest prevention practices in line*

with the client's requirements and we jointly invested in a voice-controlled picking technology. All these services, originally developed with Nestlé, are now part of the range of services Cablog can offer to the rest of its customers".

Cablog's CEO also said that, "*with the largest clients we can undertake joint service development projects because they invest, sometimes heavily, in logistics. With the rest of our clients, who account for 70% of our business, it is rather difficult to do the same because they are less competent and invest little in non-core activities*".

Solaris

Solaris begins a new supply relationship by gathering information on a client's requirements and then develops the service with a team of 10, sometimes supported by external consultants and university professors. It is worth noting that Solaris's clients are never involved in their service project's development.

Solaris acquires new knowledge from clients when it starts supply relationships in previously unknown industrial sectors, i.e. when Solaris needs to acquire the client's sector-specific knowledge. Solaris's CEO said that, "*when supply relationships are new it is easier to acquire a client's specific product knowledge by directly observing how it operates and working side-by-side*".

To give an example, this happened when Solaris won the contract to manage the warehouse for Deroma, a world leader in the plant pots sector. This industry deals in highly fragile products, an issue that was new for Solaris, which lacked a knowledge of the specific requirements of such products and the related handling and storing procedures. In other words, Solaris had few opportunities to use its own expertise and best practices. The project required close cooperation with the client and the transfer of knowledge from the client to Solaris. The latter's project design team members went to see for themselves how Deroma

was used to managing its warehouse, focusing on its handling and storage methods at the time. Once Solaris had learned Deroma's warehouse management practices, it combined them with its own and codified new procedures, which enabled Solaris not only to manage Deroma's warehouse, but also to extend these new practices to clients in similar sectors product-wise. The same approach was used when Solaris signed an agreement to manage the Prodotti Stella (or Stella) company's warehouse. This company produces ice-cream cones, which have to be handled with care. Solaris started by watching how Stella managed its warehouse and then codified Stella's handling and storage techniques; then it was able to identify the most appropriate practices to meet the requirements of this particular sector.

Cross-case analysis

Although both TPLs share information intensively with their clients (concerning orders, production levels and customers' requirements) and have collaborative relationships with them, knowledge sharing in the service development phase is rather limited. In fact, our empirical evidence indicates that interaction between the client and the TPL during the service development phase is minimal. Most of the time, clients want to outsource the logistic function (which is usually not seen as strategically important) and are therefore interested in getting rid of the associated activities while keeping a strict control on the service provider's performance (Forslund 2007).

In our case studies, the TPL tends to define the service project like a black box, without involving the client. The client participates in service development only when the TPL is not fully competent, i.e. when it has not yet developed standard procedures for a particular service required by the client, or when the latter operates in an industrial sector new to the TPL[3]. More specifically, these situations promote an exploratory phase on which the

[3] One might wonder why a client should establish a relationship with a TPL that is not fully competent in the former's area of interest. When seeking an answer to this query, we were told by both TPLs that reputation is

TPL would not embark on its own. In the case of Cablog, for example, knowledge is transferred by involving competent clients in the service development process. During the intensive interaction characterizing this process, clients transfer their key best practices and the associated body of explicit know-how. Clients also transfer their knowledge to Solaris when they ask for new services but, unlike Cablog, Solaris does not involve clients in its project development. Solaris acquires the necessary context-specific knowledge by studying and observing the client's operations. In short, Cablog emphasizes explicit knowledge transfers, while Solaris emphasizes the transfer of tacit knowledge, though both foster innovation and knowledge exploration strategies. In both cases, moreover, we can see that TPLs manage to exploit their newly-acquired knowledge to serve clients with similar requirements or operating in similar sectors.

Proposition 3. Client-TPL interactions for information sharing purposes are more frequent than interactions for knowledge sharing since TPLs define the service project like a black box with limited or no involvement of the client.

Proposition 4. Knowledge transfer between the client and the TPL occurs usually one way: the client transfers to the TPL more than what the TPL transfers to the client.

Proposition 5. Exploration refers to the development of new procedures for TPL services. Exploitation refers to the repetition of the same procedures to provide TPL services. Knowledge exploration precedes knowledge exploitation.

---

important in their line of business and it is costly for a company to switch to another TPL. If a TPL is recognized as being reliable and providing good-quality, efficient services, it is likely to attract clients asking for new services or clients from "new" industries. For example, if a customer decides to go a step further in the outsourcing of its logistics, it tends to rely on its current TPL and is prepared to share its knowledge with the TPL if the latter is willing to expand on its current offer of services. The customer will only replace the TPL if the latter is unwilling to do so or unable to provide a service of acceptable quality within a reasonable period of time. The TPL's competitive advantage also stems from its in-depth knowledge of the supply base and of the institutional characteristics of the geographical area in which it operates.

DISCUSSION

TPLs typically face the trade-off between service customization and standardization. In this paper, we use the case study approach to explore how TPLs manage this trade-off by building on service modularity and KIBS theories.

First, we analyze how TPLs conceive their service architectures, exploring in particular whether TPLs use modular service architectures obtained by mixing and matching a set of standard services and sub-services. Modular architectures enable services to be customized to suit a client's needs and, at the same time, to achieve economies of scale and specialization (Sanchez and Mahoney 1996). Our cross-case analysis confirms that TPLs generally design service projects using modular service architectures. Specifically, we found that the use of *standard procedures* is the constitutive element of modular services (Pekkarinen and Ukulmeni, 2009; Bask et al. 2010).

Procedures dictate the way in which a service is to be delivered and how the transforming resources, the materials handled, and the data processed are to be combined to produce and deliver the service. While the procedures are standards, the transforming resources, the materials handled, and the data processed can be customer-specific.

A modular service therefore makes use of a set of procedures that can be combined with other procedures at various levels (i.e. service bundles, separate services, sub-services or single activities). All in all, TPLs' services are described by the procedures and transforming resources involved (e.g. warehouses, trucks, forklifts, etc.). The procedures may be standard (when the TPL delivers an existing service, repeating the same procedures) or new (when the TPL develops new services or extends existing services to new industrial sectors), while the transforming resources may be shared by several clients or dedicated, for a given client.

We also found that TPLs manage complex client interfaces because the TPLs' services and their clients' operations need to be integrated via a number of (mainly informative)

interfaces. Most of these interfaces are designed *ex-ante* and can be either standard or customer-specific, but such interfaces (e.g. codification software and standardized order forms) can only manage a part of the interdependence between TPLs and their clients, while the parties need to rely on mutual adjustments to manage the rest. Such mutual adaptations take the form of meetings, e-mails, phone calls, and so forth. The TPLs' modular service architectures consequently diverge from the modular services described by Voss and Hsuan (2009), and this consideration is in line with the claim made by Pekkarinen and Ulkuniemi (2008) that TPLs are platform services with client-specific interfaces. On the other hand, while these authors suggest that service modularity and inter-organizational modularity go hand in hand, we found that, even when TPLs provide a modular service, the corresponding relationships are long-lasting and rely on intensive information sharing (Camuffo et al. 2007; Cabigiosu and Camuffo 2011). In the two cases, TPL-client relationships are associated with switching costs relating to the use of customized interfaces and costly coordination mechanisms. Miozzo and Grimshaw (2005) obtained similar results when they studied ICT firms in Germany and the UK.

Overall, our cases suggest that the combination of standard procedures is a sufficient condition to have modular services. Standard services are not necessary the constitutive elements of modular services in that a service is fully standard when it includes both standard procedures and standard provider-client interfaces. Modularity can be obtained mixing either standard procedures or standard services, but the usage of standard procedures suffices. Our cases suggest that when modularity is achieved relying only on standard procedures, modularity in service and modularity in organization are not related. Indeed, the mirroring hypothesis may be eventually supported when modularity is achieved combining fully standard services. In this case, standard services with standard interfaces would constitute a

coordination mechanisms other than high-powered integration tools, and modularity in service and modularity in organizations may go hand-in-hand.

Building on KIBS theory on client-supplier interactions (Bettencourt et al., 2002), we subsequently went on to look into whether, and to what extent, TPLs share knowledge and interact with clients during the service development stage. We found that a TPL's knowledge exploration activity is undertaken whenever a client requires a service that is new to the TPL. Our cases suggest that TPLs rarely conduct exploratory processes, and then only when they interact with clients possessing valuable expertise in logistics. Exploration is normally associated with a transfer of knowledge from the client to the TPL, and the knowledge that is transferred may be explicit (when new services are to be developed) or tacit (when existing services are to be extended to new industrial sectors). Our findings contrast with the prevalent literature on KIBS, which tends to emphasize the role of strong interactions and knowledge sharing between KIBS firms and their clients for the purposes of service development (Bettencourt et al. 2002). In point of fact, our cases indicate that such an interaction is limited and that any knowledge transfer is one-way - from the client to the TPL. In addition, most clients do not usually consider logistics a core competence and they are not likely to want to invest efforts in co-development once they have outsourced their logistics (Mortensen and Lemoine, 2008). When a TPL has developed the procedures that codify the knowledge needed to provide a new service, it exploits this knowledge by adopting the same procedures in relationships with other clients. In other words, TPLs strive to balance their exploration and exploitation (Levinthal and March 1993; March 1991) by following up an exploratory phase with the exploitation of their newly-gained knowledge. Codifying procedures promotes service design efficiency, while competent clients promote procedure innovation. This approach is known in the organizational literature on ambidexterity as temporal separation (Lavie et al. 2010). Our evidence shows that TPLs manage temporal separation by taking an

integrated approach, where the same development team generates new procedures, i.e. exploration, and combines existing procedures, i.e. exploitation (Raisch et al., 2009).

Different types of service and relationship stem from different combinations of these three domains (Table 2), i.e. existing *vs* new procedures, dedicated *vs* shared transforming resources, and different contents of TPL-client interactions (information sharing *vs* knowledge transfer plus information sharing). We named the combination of dedicated transforming resources with existing (knowledge exploitation) or new (knowledge exploration) procedures as *customized modular services*, and the combination of shared transforming resources with existing procedures (knowledge exploitation) as *standard modular services*. Our analysis did not confirm the existence of services based on shared transforming resources using new procedures, probably because developing new procedures demands dedicated transforming resources (though this issue warrants further investigation). As concerns TPL-client interactions, in all types of service we found evidence of intensive information sharing. TPLs and their clients routinely integrate their activities by exchanging information by means of telephone calls, e-mails, reports, and ICT. TPL-client interactions include knowledge transfers as well, but only when clients ask the TPL to provide new services.

Insert Table 2 about here

CONCLUSIONS

This study suggests that TPLs do not trade off customization for standardization, instead they manage to pursue both simultaneously. In fact, the TPLs' service projects analyzed contain service modules based on different combinations of the same set of standard

procedures. TPLs thus succeed in being efficient while responding at the same time to a variety of different clients' requests.

The development of new services, through the exploration and codification of new procedures appears a fundamental dynamic capability in that it enables the TPL to adapt to an ever-changing environment. The exploratory phase is usually triggered by large customers requesting new services and it takes place through a transfer of knowledge from the client to the TPL. From the managerial view point, TPLs would therefore manage their customer relationships using a portfolio approach, balancing traditional supply relationships (in which they replicate existing services) with valuable partnership-based relationships with competent customers (in which they develop new services and procedures). Managing the temporal separation between exploration and exploitation consequently becomes a core competence, requiring an agile organization expert in managing transitions between contradictory activities.

While in this study we focus on TPLs, the literature suggests that today a number of service firms may face the challenge of balancing between the ability to adapt to individual client's needs and the ability of serving several clients (Sundbo, 2002). As Corrocher et al. (2009, p. 176) pointed out that "exists a tension between the pressure to reduce the production costs of services, which leads firms to look for increasing standardization, and the need to meet specific user requirements, which, on the contrary, force firms to seek a high degree of customization in their products". The opportunity to solve the trade-off between service customization and standardization is associated with the configuration of the service. Thus, we believe that our findings may be extended to other KIBS typologies and particularly to those KIBS that, as Doroshenko (2011) suggests, compete in an industry in which the demand is manly characterized by the necessity to access, for the first time, to a new service. This

demand is price sensitive and without the competences to evaluate incremental differences/improvements among KIBS.

This study has limitations that can provide clues for future research. First, we analyzed two cases, thus the generalizability of our findings is limited. Future studies could investigate other KIBS sectors, a larger number of firms and compare well- and poorly-performing firms. Our propositions offer pointers to future research and could undergo quantitative validation. Future research could also focus on how TPLs manage the temporal separation between exploration and exploitation by developing efficient procedures to transfer from one mode to the other. Finally, future studies may focus on modular services obtained combining fully standard services, i.e. characterized by both standard procedures and provider-client interfaces, and on the consequent implications on the mirroring hypothesis.

REFERENCES

Baldwin, C.Y. and Clark, K.B. (1997), "Managing in an age of modularity", *Harvard Business Review*, Vol. 75, No. 5, pp. 84–94.

Baldwin, C.Y. and Clark, K.B. (2000), *Design rules – Vol. 1: The power of modularity*, Cambridge, MA: MIT Press.

Bask, A., Lipponen, M., Rajahonka, M., Markku, T. (2010). "The concept of modularity: diffusion from manufacturing to service production", *Journal of Manufacturing Technology Management*, Vol. 21, No. 3, pp. 355-375.

Bettencourt, L.A., Ostrom, A., Brown, S.W., Roundtree, R. (2002), "Client co-production in knowledge intensive business services", *California Management Review*, 44 (4), 100-128.

Cabigiosu, A. and Camuffo A. (2011), "Beyond the mirroring hypothesis: product modularity and supply relations in the air-conditioning industry", *Organization Science*. Forthcoming.

Campagnolo, D. and Camuffo A. (2010), "The concept of modularity in management studies: a literature review". *International Journal of Management Reviews,* Vol. 12, No. 3, pp. 259-283.

Camuffo, A., Furlan, A., Rettore, E. (2007), "Risk sharing in supplier relations: an agency model for the Italian air conditioning industry", *Strategic Management Journal*, Vol. 28, No. 12, pp. 1257-1266.

Colfer, L., Baldwin, C. 2010. The mirroring hypothesis: theory, evidence and exceptions. Harvard Business School Working Papers, No 10-058.

Confetra, (2009). "Analisi strutturale delle imprese nel settore dei servizi logistici e di trasporto". Report available on-line at: http://www.confetra.it/it/centrostudi/doc_pdf/QUADERNO%20N.1-2009.pdf (accessed 1 March 2011).

Corrocher, N., Cusumano, L., Morrison, M. (2009). "Modes of innovation in knowledge-intensive business services evidence from Lombardy", *Journal of Evolutionary Economics*, Vol. 19, pp. 173–196.

de Blok, C., Luijkx, K., Meijboom, B. and Schols, J. (2010). "Modular care and service packages for independently living elderly", *International Journal of Operations & Production Management*, Vol. 30, No. 1, pp. 75-97.

Doroshenko, M.E., 2011. How Knowledge-Intensive Business Services Upgrade their Customers: Evidence from Russia, National Research University, Moscow, working-paper.

Forslund, H. (2007), "The impact of performance management on customers' expected logistics performance", *International Journal of Operations & Production Management*, Vol. 27 No. 8, 2007 pp. 901-918.

Halldórsson Á., Skjøtt-Larsen T. (2004), "Developing logistics competencies through third party logistics relationships", *International Journal of Operations & Production Management*, Vol. 24, No. (2), pp. 192-206.

Hertz, S, and Alfredsson, M. (2003), "Strategic development of third party logistics providers", *Industrial Marketing Management*, Vol. 32, No. 2, pp. 139–149.

Huo B., Selen W., Yan Yeung, J.H., Zhao X. (2008), "Understanding drivers of performance in the 3PL industry in Hong Kong", *International Journal of Operations & Production Management*, Vol. 28, No. (8), pp. 772-800.

Eisenhardt, K. M. (1989), "Building theories from case study research", *The Academy of Management Review*, Vol. 14, No. (4), pp. 532-550.

Langlois, R.N. and Robertson P.L., (1992), "Networks and innovation in a modular system: lessons from the microcomputer and stereo component industries", *Research Policy*, Vol. 21, pp. 297-313.

Lavie, D., Stettner U., Tushman, M.L. (2010), "Exploration and exploitation within and across organizations", *The Academy of Management Annals*, Vol. 4, No. 1, pp. 109-155

Levinthal, D. and March J. (1993), "The myopia of learning", *Strategic Management Journal,* Vol. 14, No. 95, pp. 95-112.

Lau, A.K.W., Yam, R.C.M., Tang, E.P.Y., Sun, H.Y. (2010). "Factors influencing the relationship between product modularity and supply chain integration". *International Journal of Operations & Production Management*, Vol. 30 No. 9, pp. 951-977.

March, J. (1991), "Exploration and exploitation in organizational learning", *Organization Science*, Vol. 2, No. 1, pp. 71–87.

Meyer, M.H. and DeTore, A. (2001), “Perspective: creating a platform-based approach for developing new services”, *The Journal of Product Innovation Management*, Vol. 18, No. 3, pp. 188–204.

Menor, L.J., Tatikonda, M.V., Sampson, S.E. (2002), “New service development: areas for exploitation and exploration”, *Journal of Operations Management*, Vol. 20, No. 2, pp. 135–157.

Miles, Ian, (2005), "Knowledge intensive business services: prospects and policies", *Foresight*, Vol. 7, No. 6, pp. 39-63.

Miles, I, Kastrinos N., Flanagan, K. (1995), “Knowledge-intensive business services. their roles as users, carriers and sources of innovation”. Report available on-line at: http://research.mbs.ac.uk/INNOVATION/Portals/0/docs/KIBSEIMS1995shortreport.pdf

Miozzo, M. and Grimshaw, D. (2005), “Modularity and innovation in knowledge-intensive business services: IT outsourcing in Germany and the UK”, *Research Policy*, Vol. 34, pp. 1419–1439.

Mortensen O., Lemoine O.W., (2008), “Integration between manufacturers and third party logistics providers?” *International Journal of Operations & Production Management,* Vol. 28 No. 4, pp. 331-359.

Muller, E. and Zenker, A. (2001), “Business services as actors of knowledge transformation: the role of KIBS in regional and national innovation systems”, *Research Policy*, Vol. 30, pp. 1501–1516.

Muller, E. and Doloreux, D. (2009), “What we should know about knowledge-intensive-business-services”, *Technology in Society*, Vol. 31, No. 1, pp. 64-72.

Ozcan, P. and Eisenhardt, K. (2009), “Origin of alliance portfolios: entrepreneurs, network strategies, and firm performance”, *Academy of Management Journal*, Vol. 52, No. 2, pp. 246-279.

Pekkarinen, S. and Ulkuniemi, P. (2008), "Modularity in developing business services by platform approach", *The International Journal of Logistics Management*, Vol. 19, No. 1, pp. 84-103.

Raisch, S., Birkinshaw, J., Probst, G., Tushman, M.L. (2009), "Organizational ambidexterity: balancing exploitation and exploration for sustained performance", *Organization Science*, Vol. 20, No. 4, pp. 685-695.

Sanchez, R. and Mahoney, J. (1996), "Modularity, flexibility, and knowledge management in product and organization design", *Strategic Management Journal*, Vol. 17, pp. 63-76.

Schilling, M.A., Steensma, K.H. (2001), "The use of modular organizational forms: an industry-level analysis", *Academy of Management Journal*, Vol. 44, No. 6, pp. 1149-1168.

Selviaridis, K. and Spring, M. (2007), "Third party logistics: a literature review and research agenda", *International Journal of Logistics Management,* Vol. 18, No. 1, pp. 125-150.

Simon, H.A., (1962), "The Architecture of Complexity". *Proceedings of the American Philosophical Society*, Vol. 106, pp. 467-482.

Stefansson, G. (2006), "Collaborative logistics management and the role of third-party service providers", *International Journal of Physical Distribution & Logistics Management*, Vol. 36, No. 2, pp. 76-92.

Sundbo, J. (2002). "The service economy: standardisation or customisation?" *The Service Industries Journal*, Vol. 22, No. 4, pp. 93-116.

Tether, B. and Hipp, C. (2002), "Knowledge intensive, technical and other services: patterns of competitiveness and innovation compared", *Technology Analysis & Strategic Management*, Vol. 14, No. 2, pp. 163-82.

Tether, B., Hipp, C., Miles, I. (2001), "Standardization and particularization in services: evidence from Germany", *Research Policy*, Vol. 30, pp. 1115-1138.

Union Camere del Veneto, 2008. Veneto Reports available at http://www.unioncameredelveneto.it/pubblicazioni/testo_08.htm

Voss, C.A. and Hsuan, J. (2009), "Service architecture and modularity", *Decision Sciences*, Vol. 40, No. 3, pp. 541-569.

Yin, R.K. (2009), *Case study research: Design and methods*. Fourth Edition. London: Sage.

APPENDIX A: RESEARCH PROTOCOL

Case study research questions

Section A. Firm's business, data and organization.

1. Which services do you deliver?
2. Which are the transforming resources needed to deliver each service? Which transforming resources do you own?
3. Where is your headquarter?
4. How many employees do you have and in which departments do they work?
5. What is your revenue? What is your market share?
6. How would you describe your strategy?
7. Who are your clients? What is the share on your business of the first four clients and who are them?
8. Who are your competitors?
9. Who are your suppliers?
10. What is the content of a typical delivery contract?
11. Do you have long-lasting collaborative relationships with clients? What is the mean length of the relationships with your standard and main clients?
12. Does the contract include key performance indicators? Are they standard at the industry level? Are their tolerance levels standard for the industry?

Section B. Service configuration

1. Are your services combinable among each other? Provide some examples.
2. List the main procedures that characterize each service. Are these procedures customized to some extent or are they standard?
3. In delivering the services, when and why do you rely on shared or dedicated transforming resources (i.e. trucks, warehouses, etc.)?
4. How do you integrate your activities into the client's business processes?
5. Do you rely on standard or customized integration tools (i.e. modules, software, ICT interfaces) to exchange data with clients? Provide some examples.

Section C. TPL-client knowledge sharing

1. When do you develop a new service?
2. Who, inside your firm, is in charge of the service development activities? Do you have a development team?
3. Which are the mailstones of a standard development activity?
4. Is the client usually involved in the service development? Why?
5. During the service development, do you share information, knowledge or both with clients?
6. Can you classify your relationships with clients on the basis of your information and knowledge sharing with them?
7. Provide some examples of services that you co-developed with clients via knowledge sharing practices. What characteristics do these clients have in common?
8. How does the client transfer its knowledge to your organization?
9. Do you replicate the service co-developed with the client? How do you do it? Provide some examples.

TABLE 1
Main findings of the case analysis

	Cablog	*Solaris*
Service architecture	- Cablog offers three bundles of services: transportation, warehousing, and distribution. These services can be seen as bundles of services comprising a number of sub-services. Clients can choose the most appropriate combinations of services and/or sub-services. - Cablog delivers modular services consisting of combinable standard procedures. To deliver its services, Cablog relies either on dedicated transforming resources shared by several clients or on client-dedicated transforming resources, such as warehouses and trucks. - Cablog services are integrated in its clients' operations. Clients send their orders to Cablog via a standard ICT interface. Cablog also shares data and information with clients concerning warehousing and transportation using customized forms. Cablog is in contact with clients on a day-to-day basis via e-mails and telephone calls to manage the remaining interdependences.	- Solaris provides warehousing, transportation, janitorial and security services. Logistics are its core business. These services are bundles of separate services comprising a number of sub-services. - Solaris delivers modular services using procedures that are standardized for each industrial sector ("*the construction sector differs from the large-scale distribution sector, which in turn is different from manufacturing*"). Solaris's services make use of either transforming resources shared among several clients or client-dedicated resources. For example, warehousing is often a customized modular service that relies on standard procedures and client-dedicated transforming resources (mainly warehouses). - Solaris's services are integrated in its clients' operations. Solaris shares data with clients about warehouse management mainly via customized ICT interfaces. Solaris also uses plant layouts to improve its coordination with its clients' activities.
Knowledge sharing with clients	- Cablog collects details on its clients' needs but does not usually involve them in the service development phase. - Cablog shares knowledge with clients and co-develops new services with them only when it does not have the expertise needed to meet their requirements. As the Cablog's CEO explained, "*We can undertake joint service development projects with the largest clients because they have invested, sometimes heavily, in logistics*". In these cases, clients explicitly transfer their specific knowledge to Cablog. - Cablog uses its clients' knowledge to create new service modules that are subsequently offered to other clients too.	- Solaris does not involve clients in its service development. - When Solaris acquires a client that operates in a sector that is new to the TPL, Solaris needs to acquire industry-specific warehouse management practices. In these cases, Solaris observes how clients manage their warehouses and thus gains its industry-specific expertise through a tacit knowledge transfer. "*When supply relationships are new it is easier to acquire a client's specific product knowledge by directly observing how it operates and working side-by-side*." - A Solaris office codifies such newly-acquired knowledge in the form of standard industry job descriptions.

TABLE 2
TPL service types

<table>
<tr><td colspan="2">Procedures</td><td></td><td></td></tr>
<tr><td>Existing</td><td>New</td><td></td><td></td></tr>
<tr><td>• Customized modular services
• Knowledge exploitation</td><td>• TPLs introduce new procedures that are codified and combined with pre-existing standard procedures.
• Customized modular services
• Knowledge exploration</td><td>Dedicated</td><td rowspan="2">Transforming resources</td></tr>
<tr><td>• Standard modular services
• Knowledge exploitation</td><td>Question mark</td><td>Shared</td></tr>
<tr><td>Information sharing</td><td>Knowledge transfer and information sharing</td><td colspan="2"></td></tr>
<tr><td colspan="2">TPL-client interactions</td><td colspan="2"></td></tr>
</table>