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Antecedents of system purchasing in B2B services

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ABSTRACT

This article aims to analyze the relation between business-to-business (B2B) service integration and purchasing strategies and to provide new knowledge on the antecedents of complex purchasing systems. We present the results of an empirical study in the infrastructure management sector (i.e., electricity and telecom networks), in which integrating B2B services is a current concern among network operators. In this article, we compare the influence of operational services and strategic services on the B2B relationships between service providers and customers.

1. Introduction

This article aims to analyze the relation between business-to-business (B2B) service integration and purchasing strategies and to provide new knowledge on the antecedents of complex purchasing systems. We present the results of an empirical study in the infrastructure management sector (i.e., electricity and telecom networks), in which integrating business services is a current concern among network operators. In this article, we compare the influence of operational services and strategic services on the B2B relationships between service providers and customers. The objective is to contribute to the theories of purchasing strategy of complex solutions, which include bundled products and services (Wise and Baumgartner, 1999). We approach the topic via operational and strategic services, which are defined by the time of customer involvement, stage of modularity, and degree of customisation (de Blok et al., 2010). This study creates a linkage between the need for integrated bundles, co-creation of value, system purchasing strategy, and expected quality of services (Aarikka-Stenroos and Jaakkola, 2012; Ancarani and Capaldo, 2005; Epp and Price, 2011; Tuli et al., 2007; Vargo et al., 2008). With integrated service concepts recently emerging in the industry, we selected infrastructure management services as the focus of the article. The need to adopt such services among the operators of energy networks, particularly in distribution systems, arises from the fact that infrastructure-related functionality and quality requirements significantly increase the importance of effectively managing the interdependence among service activities in the future.

The main driving forces are modern societies' increasing dependence on reliable energy distribution and policy goals aimed at adopting microgeneration as a part of smart energy grids. Trends drive the demand flexibility of energy distribution, the ability to connect small-scale production to the distribution network, and the advanced metering services provided to customers; these increase the complexity of networks and challenge incumbent organizations to further develop their practices (Apajalahti et al., 2015; Hall and Roelich, 2016). The emergence of local micro grid business models will challenge the current centralized monopoly business. In the new business, specialized local energy actors link geographically proximate distributed energy resources, distributed generation, and local consumption or storage, which provide neighborhood-level demand response (Hall and Roelich, 2016; Ruester et al., 2014). The open questions in the energy distribution sector are not limited only to technological infrastructure, which enables the operation of new processes in the customer interface. The energy industry will be in the ferment stage until a consensus is reached on the division of tasks of distribution network operators and on the ownership and management of new resources, including metering equipment or data handling (Ruester et al., 2014). The issues in the business concepts in the renewing industry are related to the proper design and maintenance challenges of distributed generation and smart metering, as well as to the design of demand control services (Colak et al., 2016). New business concepts and technology will change relationships within value networks and thus drive the development of cooperative businesses through partnerships among firms (Apajalahti et al., 2015; Niesten and Alkemade, 2016; Stone and Ozimek, 2010). Joint development activities also increase diversification of the purchasing strategies among distribution network operators because the service requirements differ, and a single standard for

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purchasing no longer exists. Therefore, service providers must be aware of the most appropriate customer relation modes to use in order to provide the best value for customers and enhance competitiveness. This is related to the objective of the study to assess the purchasing behavior of network operators with regard to the two types of services.

The theory of service integration is based on creating value in industrial services and customer–supplier relationships in supply chains. In the industrial context, services are processes that integrate internal and external capabilities to co-create value in collaboration with another party (Aarikka-Stenroos and Jaakkola, 2012; Ulaga and Chacour, 2001). The concept of system purchasing designates the type of buying behavior in which the purchased services are treated as interconnected product–service systems that solve some strategic problem in ways that add value rather than entail costs (Epp and Price, 2011; Caldwell, Roehrich and Davies, 2009). System purchasing seeks new value by procuring such service solutions, in which the provider is integrating multiple service elements as an integrated solution that fits the customer's problem domain. The system approach in purchase management increases the importance of the relational view in service provision and highlights the service provider's capability to fit their service models to the customer's problem domains (Aarikka-Stenroos and Jaakkola, 2012; Tuli et al., 2007). Despite the wide range of literature on service business models, empirical studies that focus on the factors that lead to system purchasing in B2B services are lacking. To address this recognized gap, our research question is, "How does service integration influence the relationship between the actors and the goals of supply management? ".

For our sample, we selected the customer base of a service provider for IT networks and energy infrastructure. The study was carried out with a web-based questionnaire sent to the service provider's customers. The sample size was N=864, and we received responses from 18% of the target firms. The effective sample of customers consisted of 143 valid responses. The research model was analyzed using partial least squares (PLS) path modelling with nonparametric bootstrapping to compensate for non-normality and a low sample size (Henseler et al., 2009). We applied SmartPLS 2.0 software for the data analysis.

The article is structured as follows. The literature review is divided into two sections. First, we focus on service integration and its influence on collaboration between the service provider and the customers. In the second part of the literature review, we search for rationales for system purchasing and customer value expectations of integrated solutions. The empirical research is presented in a separate section where the case description, sample, method and results are described in detail. In the final section of the article, we provide a discussion and a conclusion regarding the research hypotheses.

2. Literature review

2.1. Integration and collaboration

According to Hayes (2002), operations management has become systems of complementary products provided through networks by different organizations. It follows that systems integration has become an important aspect of research in the analysis of complex service and product systems. In integrated solutions, suppliers provide customers with product and service elements that are closely interrelated (Wise and Baumgartner, 1999). A service in the industrial context is a process of doing something for and in collaboration with another party by integrating internal and external capabilities to co-create value (Aarikka-Stenroos and Jaakkola, 2012; Ulaga and Chacour, 2001; Touboulic and Walker, 2015). The value-creation process is often facilitated by integrating multiple service elements as a solution to the customer's problem. In this type of process, the strategic integration and collaboration in the supply chain are often more important for the value creation than just concentrating on savings in purchases (Ellram and Tate, 2015; Pohl and Förstl, 2011). The customer also has a major role in creating value in service offerings (see, e.g., Bettencourt, Ostrom, Brown and Roundtree, 2002; Grönroos and Ravald, 2011; Normann and Ramirez, 1993), specifically in defining the required services from the potentially huge variety within the provider's portfolio. The customer also contributes to creating value during the delivery process by offering information, rights and tangible products to the service provider (Fliess and Kleinaltenkamp, 2004).

Service providers aiming to succeed in the integrated-solution business must understand the customer's business goals and processes (Brady et al., 2005). Needs related to service purchasing in business markets are strategic make-or-buy decisions (Davies et al., 2007). Service integration or bundling in purchasing and supply refers to the need to group some contracts together and place that group of services with one supplier or a few (Ancarani and Capaldo, 2005; Gobbi and Hsuan, 2015). In the literature, there are two generic models for providing integrated solutions (Davies et al., 2007; Kapletia and Probert, 2010; Persson and Ahlstrom, 2006; Windahl and Lakemond, 2006, 2010; van der Valk and Axelsson, 2015), the strategic service model and the operational service model. Service models differ from one another by point of customer involvement, modularity type, and degree of customization. Customers are involved in the design of the tailored strategic services, in which the applied components have an original design, and most of the operational services are standardized and repeatable (de Blok et al., 2010). In many cases, bundling contracts tends to collect together groups of operational services separately from those of strategic services. Collaborative supplier relationships are preferred for this type of high-level complexity and high ongoing value services (Ancarani and Capaldo, 2005; Ellram and Tate, 2015).

The strategic service model gives the provider extensive responsibility for the customer's operations and an important role in creating long-term value for the end customer (Helander and Möller, 2007; Kapletia and Probert, 2010). The provider integrates the solution into the customer's processes, and the relationship resembles a strategic partnership (Windahl and Lakemond, 2010). The integration focuses on the solution and the customer's business targets, and the solution is tailored to the customer's problems (Helander and Möller, 2007). Despite the high customization degree of the offering, the service functions may be quite standard. Strategic services include collaborative planning of the business strategy, portfolio design-related activities, and development of the business processes of the customer firm. An example of a strategic service is interface development between customer databases and the service provider's systems. Based on the literature, we formulated the following hypothesis:

H1. The customers' need for integration of strategic services influences the tendency to create a collaborative relationship with suppliers.

The operational service model is derived from the relational view, meaning that the provider defines and operates the solution for the customer (Helander and Möller, 2007; Tuli et al., 2007; Windahl and Lakemond, 2010). The idea is to create technical platforms and joint value-creation processes through cooperation with no involvement in the customer's day-to-day routines (Cova and Salle, 2008; Helander and Möller, 2007). The integration is mainly on the solution level and focuses on optimizing performance via the customized functions and parts of the solution

(Persson and Ahlstrom, 2006; Pynnönen et al., 2011). In the bundling of services, an organization collects together groups of operational and strategic services and places that group of services with one supplier or a few (Ancarani and Capaldo, 2005). Operational services can be regarded as quite high-complexity and low-collaboration services where an arm's-length supplier relationship is preferred (Ellram and Tate, 2015; Cova and Salle, 2008; Helander and Möller, 2007). The aim of operational services is to maintain the operating condition of the service solution and minimize fault-repair costs. To maximize the contrast between strategic services and operational services, in this study, we focus on fault situation management services because they require quick reaction and do not involve strategic elements. An example of an operational service in the network infrastructure context is arranging back-up connections and an online reserve power. The following hypothesis was formulated:

H2. The customers' need for integration of operational services has no influence on the tendency to create a collaborative relationship with suppliers.

2.2. Collaboration and its link to purchasing

Research on relationship characteristics stems ultimately from the need to explore the impact of customer–supplier relationships on performance. As Fynes et al. (2008) pointed out, the deeper the partnership, the better the supply chain performance. Customer–supplier relationships are formulated in supply chains to satisfy customer needs effectively. This requires an appropriate fit between the customer's buying priorities and the supplier's capabilities (Sanchez-Rodrıguez, 2009). Autry and Golicic (2010) found a clear connection between the buyer–supplier relationship and firm performance. They argued that such relationships are dynamic and that their strength increases and decreases cyclically over time. Furthermore, strong relationships result in higher levels of performance in supplier relationships. For example, Cox (2001) defined power as follows: "The structure of power means analyzing and describing who gets what, where, how and when. It is also about structures of dominance and dependence in business relationships." The implication of power in relationships is that value can be co-created and collaboration be formed in a relationship only of high mutual interdependence or buyer dominance (Bensaou, 1999). As shown in the research, many views on value contribute to the research on business relationships (Allee, 2003; Anderson and Narus, 1998; Normann and Ramirez, 1993). A broad definition of value is needed that incorporates the tangible and intangible elements of value delivery in a systems approach to creating value.

Customer value creation is a complex phenomenon that has a strong link to supplier relationship characteristics. When the collaboration brings value to the purchaser, buying systems is more lucrative than buying separate goods and items. This phenomenon is defined in the service science literature as a service system, which is a configuration of resources (including people, information and technology) connected to other systems by a value proposition. Vargo et al. (2008) proposed that this exchange between service systems is strongly linked with the co-creation of value within complex configurations of resources. Co-creation of value can be defined as joint collaborative activities by parties involved in a system (Grönroos, 2012) and is a key activity in supply chain integration (Hawkins et al., 2015). Moreover, value co-creation with suppliers positively influences a firm's customization and service capability, meaning that creating value together with suppliers may highlight new sources of competitive advantage (Zhang and Chen, 2008). Companies, however, have different strategies for purchasing services, and therefore, the service provider should understand what, when and how to integrate (Hallikas et al., 2014).

Every supply chain relationship seeks value-creation opportunities (Möller and Törrönen, 2003), which may be based on either reciprocal or one-directional exchange. Reciprocal describes a bilateral relationship in which both parties create value. From the supplier perspective, value-creation opportunities arise in several tangible and intangible dimensions. Walter et al. (2001) and Walter et al. (2003) found that cost, quality, volume and safeguarding were the basic functions of value creation in manufacturing supply-chain relationships, potentially complemented by advanced market, scout, innovation and social support functions. Ulaga (2003) conducted a study on value drivers in manufacturer–supplier relationships; the value dimensions fell into the following eight categories: product quality, service support, delivery performance, supplier know-how, time-to-market, personal interaction, price and process costs. Ulaga (2003) showed how the weighting of these categories can be used for benchmarking suppliers' relationship-value-delivery capabilities.

Breaking it down further, according to the supplier relationship management literature, the components of deeper collaboration in the supplier relationship are related to relationship commitment, trust and loyalty (Morgan and Hunt, 1994). These components contribute to the willingness to outsource larger entities to suppliers and increase the tendency toward system purchasing. The concept of system purchasing designates buying behavior where the purchased services are treated as interconnected product–service systems that solve some strategic problem in ways that add value rather than cause costs (Epp and Price, 2011; Caldwell et al., 2009). Applied to purchasing and supply management, it means that the services and products related to a certain problem domain can be purchased from one supplier, system suppliers are preferred, and service integration benefits in the supply chain are emphasized (Davies et al., 2007; Helander and Möller, 2007; Ivens, 2005; Nordin and Kowalkowski, 2010). Thus, it can be concluded that:

H3. Customers' tendency to collaborate with suppliers has an influence on the system purchasing of services.

2.3. System purchasing and expected reliability

Ross and Jayaraman (2009) provided useful insights for examining and selecting suppliers that are willing to offer bundles of new and refurbished products. Meeting these requirements involves internal collaborative efforts from the purchasing side. In some industrial sectors, companies extend their product or service offerings and provide customers with full service contracts. Full service is defined as "comprehensive bundles of products and/or services that fully satisfy the needs and wants of a customer related to a specific event or problem" (Stremersch and Frambach, 2001).

As defined by Epp and Price (2011), the benefit of integration can be defined as a process of bringing together potentially diverse products and services in ways that create value. This means that system purchasing is often associated with situations where physical products and services are purchased together. Buyers prefer to purchase entities as a whole system. Sarin et al. (2003) stated that bundling strategies are used because they bring benefits for sellers and buyers. This, however, forms the background for win-win situations and buyer–supplier collaboration that may create the basis for innovations.

Many studies on the benefits and circumstances of bundle purchasing have been conducted in business-to-consumer environments. In many cases, bundle-based pricing and promotions are used to extract substantial savings from purchased items for

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customers (Garfinkel et al., 2006). In the industrial context, the total costs or life-cycle costs are the main driver in the value analysis of the attractiveness of the offer, rather than the purchasing price. Recent studies showed that systemic features may play a significant role in firms' purchasing preferences (Hallikas et al., 2014). Expected monetary savings, increased convenience and reduced compatibility risk are performance drivers for purchasing bundles (e.g., Harris and Blair, 2012; Sarin et al., 2003). This implies that the customer is likely to choose an offer that provides better systemic functionalities in terms of products and services that work smoothly together, are easy to implement and use and are effective from the total cost perspective.

Customer value in this sense refers to what the customer wants, given certain limitations such as time and financial resources, and it is therefore a significant determinant of customer satisfaction, which in turn influences the willingness to continue using the service (McDougall and Levesque, 2000). In line with Flint et al. (1997), we consider value in this study as either perceived or desired. We concentrate on the customer's expected value, which is the value customers expect from certain services (Flint et al., 1977). Expected value as a concept originates in the notion of assumed rational economic behavior, which is related to customer-perceived costs and sacrifices (McDougall and Levesque, 2000). The customer's expected value relies on three assumptions: the rationality of decisions, the subjectivity of value assessment and the dynamics between attributes during the evaluation-use-repurchase process. In this sense, the expected value is an outcome expectation with regard to the use of the service (Shankar et al., 2003). The value outcome in complex business service supply chains often comes down to the reliability of the service and service provider (see, e.g., Åhlström and Nordin, 2006; Hofenk et al., 2011; Hawkins et al., 2015). The SERVQUAL framework (Parasuraman et al., 1988) is commonly applied to measure the expected value (Ulaga and Chacour, 2001; Yee et al., 2010; Calabrese, 2012). According to Ancarani and Capaldo (2005), in bundling a whole range of purchased services together, the supplier becomes totally responsible for the delivery, monitoring, control and attainment of performance objectives that relate to operational benefit. Service systems interact through mutual service exchange relationships, improving the adaptability and survivability of all service systems engaged in exchange (Vargo et al., 2008). Thus, we propose the following:

H4. Customers' tendency toward a system purchasing influences the expected reliability of the service.

2.4. Research model and key concepts

Fig. 1 illustrates the research model, including the hypotheses, and presents the key concepts essential for the empirical study. The influences defined by the hypotheses are the main effects.

The theoretical concepts presented in the research model were operationalized into the survey instruments. The measurement

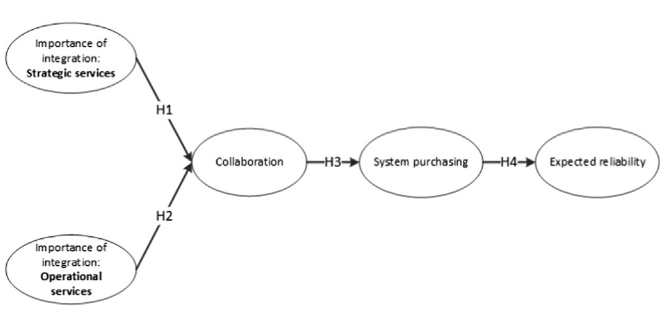

Fig. 1. Research model.

included multi-item scales that were mainly gathered from the literature and modified to fit the content of the research. The scales were kept as short as possible in order to make the questionnaire quick to fill out and to prevent frustration. Our data consisted of ordinal variables; we treated them as continuous, which is common practice when there are many categories. Here, a seven-point Likert scale $(1-7)$ varied from complete disagreement to complete agreement.

The importance of integration (StrDESIGN and OperMAN) (strategic services and operational services) describes the respondent's expectations of the importance of integrating particular services as a part of some system. The measurement scale included four service functions that represented some groups of service activities. In this study, the importance of integrating strategic activities was assessed with design- and business-process–related activities (Str1, Str2, Str3, and Str4). The importance of the integration of operational services was assessed with fault management processes (Oper1, Oper2, Oper3, and Oper4). These measurement scales are based on mapping workshops, in which the functions from the product and service portfolio of the infrastructure service provider are defined and operationalized. The process is described later in the section Case description.

When considering a service provider's offering to your company, how important is it that a function is integrated into a total service package?

Str1: Automation
Str2: Network designing
Str3: Helping in network development strategies
Str4: Aligning processes with customer
Oper1: Fault location (on-site)
Oper2: Fault repair
Oper3: Fault separation
Oper4: Fault situation management

Collaboration (COLLAB) can comprise the co-development (Brax and Jonsson, 2009) and coproduction of the solution (Thomke and von Hippel, 2002). Furthermore, collaboration can occur in parallel and in diverse order through a dialogical, hermeneutical process that includes the participation of the customer in the formulation of the value proposition (Aarikka-Stenroos and Jaakkola, 2012). The variables related to cooperative service and service process design, as well as forecasting and production planning (Collab2, Collab3, and Collab4) were taken from Morgan and Hunt (1994).

Collab1: The service offering is continuously developed in collaboration with our personnel.

Collab2: We cooperate extensively with the service provider with respect to service design.

Collab3: We cooperate extensively with the service provider with respect to service process design.

Collab4: We cooperate extensively with the service provider with respect to forecasting and production planning.

System purchasing (SYSTPURCH) evaluates the preferences in firms' purchasing strategies. The three-item measure (Syst1, Syst2, and Syst3) reflects a more service-dominant buying behavior when the purchased system comprises goods and services. In general, integration can be defined as the process of bringing together potentially diverse products and services in ways that create value (Epp and Price, 2011). When this definition is applied to purchasing and supply management, the services and products related to a certain problem domain can be purchased from one supplier, and system suppliers are preferred (Davies et al., 2007).

Syst1: We appreciate that a whole service package can be purchased from one service provider.

Syst2: Our aim is purchasing whole service systems rather than separate service elements.

Syst3: We concentrate on life-cycle costs instead of purchasing price when evaluating the alternative service provider.

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Expected reliability (RELIABILITY) is based on one factor of the SERVQUAL instrument and measures management priorities in order to process quality. We chose this instrument because it is commonly used to measure customer service value (Ulaga and Chacour, 2001). In this study, we applied the modified reliability scale, which included three measurement items (Rel1, Rel2 and Rel3).

Rel1: Service provider provides its services correctly at the first time.

Rel2: Service provider delivers its services at the time it promises to do so.

Rel3: Service provider's customer documents are always accurate.

3. Empirical research

3.1. Case description

The energy sector has traditionally been characterized by vertical integration and public ownership of utilities, which is believed to secure the basic infrastructure of a society. In practice, all failures in the networks immediately affect the electricity supply of numerous customers. In the Nordic countries, energy distribution network operators (DNOs) are natural monopolies that are publicly owned. At present, national sector-specific regulators supervise the monopolies to improve their operations. DNOs are rebuilding overhead networks with underground cabling to prevent supply interruptions caused by adverse weather. The need to develop purchasing among DNOs arises from the increased quality expectations, which will require effective management of the interdependence among service activities in the future.

We applied the relational service framework proposed by Tuli et al. (2007) so as to capture all parts of the customer–service process and used the Product Service System (PSS) methodology (Ulrich, 1995) to map the functions from the product and service portfolio of the infrastructure service provider. Two executives from the infrastructure service provider validated the service attributes and the service model categorization. The analysis of the services included recognition of tasks and features related to the service concept. These attributes define the features of the offerings that are expected to resolve particular issues raised by customers and thus to provide value. The analyzed offering includes two kinds of services representing strategic services and operational service activities.

Strategic services include levels of business strategy, network design-related activities, and the development of the business processes of the firm. The services related to business strategy formulation focus on investment planning and are expected to respond to signals from outside the industry. Network design is about finding technically and economically optimal network configurations in specific areas. The design of infrastructure networks focuses on a cost-benefit analysis aimed at minimizing the cost of investments, operations, maintenance, and interruptions while ensuring that technical and safety requirements are met. Process improvement services focus on performance improvement in feedback and in customer contributions to service provision that enhance material and data flows between service providers and customers. The increasing integration of processes produces more profound customer relationships. Examples of strategic services are network-present-state studies, planning and developing networks, implementation plans for network-development strategies, interface development between customer and service provider databases, and interaction definition between customers and service providers, to name a few.

Operational services represent activities that support the non-interrupted operation of infrastructure networks. The purpose is to safeguard the operating condition of the network and minimize fault repair costs. These operational services are related to general maintenance services. In this study, we have addressed fault situation management only and not preventive maintenance services. Fault situation management services require quick reactions, do not involve strategic elements, and therefore create a contrast to strategic services. In practice, many fault management failures are attributed to missing or false information among actors in value networks, and this situation changes the management of complex technical platforms (Mikkonen, 2011). Examples of operational services are receiving alerts, locating the site, forming repair plans, arranging fault separation, arranging back-up connections and online reserve power, locating faults on site by visual means or with the use of special equipment, bringing out damaged network parts, and repairing indicated faults at the site.

3.2. Sample and method

For our sample, we selected the customers of an infrastructure service provider whose purchases are related mainly to the IT network and the energy infrastructure. The respondents were all in managerial positions and were chosen on the basis of their experience in managing the current relationship with the service provider. The survey was conducted with the use of a web-based questionnaire sent to the customers via the CRM system. Two weeks after the original posting, we sent a reminder to the same respondent list. The sample size was $N=864$, and the response rate was over 18%. The effective sample from the customers of the case company consisted of 143 valid responses. All responses in the sample were anonymous, and the data were handled only by the researchers. The social desirability of the survey tended to be biased to positive responses; the persons who had positive experiences with the service provider or were interested in developing services answered the questions.

The analysis of the research model was based on a path modelling approach that set particular limitations upon the applied methods. We analyzed the research model using partial least squares ("PLS") path modelling with nonparametric bootstrapping to compensate non-normality and a rather low sample size (Chin et al., 2003; Henseler et al., 2014; Henseler et al., 2009). Conventional structural equation modelling approaches ("SEM") have strict standards for the data in terms of sample size and normality of distribution. The non-normal distributed data can be analyzed with SEM with least square methods, but then the sample size requirements are significantly higher for reaching reliable results (Flora and Curran, 2004; Olsson et al., 2000). In summary, we saw that PLS was the right approach for path modelling in this case due to the sample features and level of complexity of the research model. The PLS method also enabled more straightforward data handling, simple modelling and the avoidance of data manipulations (Little et al., 2002). We applied SmartPLS 2.0 software for the data analysis. The bootstrap sample size was $n=143$, which equaled the original sample. The resampling of the data was repeated 5000 times in the analysis, which is adequate for the estimation of parameters in this model (Henseler et al., 2009; Kline, 2011).

To avoid loss of the data, the missing values were replaced by the series mean substitution method, because if missing data depicts an adequate pattern, the method is straightforward to implement (i.e., it does not require a certain imputation model), and biases occur regardless of the applied imputation method (Karanja et al., 2013). The data screening revealed that approximately 3–10% of the data was missing at random (MAR) in the scale items, which provides a basis for the substitution of missing data by the series mean (Olinsky et al., 2003; Saunders et al., 2006). Before testing the main effects in the research model, the measurement model

Table 1.
Reliability and validity of the tested model.

	Loading	t-Value	p-Value	Mean	SD	AVE	CR
StrDESIGN				**4.46**	**1.169**	**.587**	**.850**
Str1	.803	11.22	***	4.29	1.421		
Str2	.805	8.33	***	4.65	1.715		
Str3	.706	5.77	***	3.98	1.484		
Str4	.745	8.65	***	4.94	1.393		
OperMAN				**5.67**	**1.192**	**.815**	**.946**
Oper1	.942	81.95	***	5.67	1.286		
Oper2	.920	52.17	***	5.89	1.344		
Oper3	.862	19.89	***	5.52	1.363		
Oper4	.884	27.74	***	5.60	1.284		
COLLAB				**4.61**	**1.199**	**.750**	**.923**
Collab1	.778	12.90	***	5.16	1.312		
Collab2	.920	23.30	***	4.54	1.349		
Collab3	.932	25.87	***	4.53	1.386		
Collab4	.827	18.16	***	4.21	1.503		
SYSTPURCH				**5.60**	**.908**	**.612**	**.823**
Syst1	.788	8.08	***	5.91	1.045		
Syst2	.839	11.94	***	5.59	1.180		
Syst3	.715	6.45	***	5.29	1.275		
RELIABILITY				**6.12**	**.845**	**.816**	**.930**
Rel1	.923	45.79	***	6.08	.909		
Rel2	.916	36.15	***	6.22	.921		
Rel3	.863	16.93	***	6.08	.976		

n not significant.
* Statistically significant at $p < .05$.
** Statistically significant at $p < .01$.
*** Statistically significant at $p < .001$.

Table 3.
Main effects that confirm hypotheses.

	R	t	p
Main effects of the research model			
OperMAN → COLLAB	.033	.414	n
StrDESIGN → COLLAB	.325	3.378	**
COLLAB → SYSTEMIC PURCH	.267	2.492	*
SYSTEMIC PURCH → RELIABILITY	.186	2.152	*
	R^2		
COLLAB	.114		
SYSTEMIC PURCH	.179		
RELIABILITY	.133		

n not significant.
*** Statistically significant at $p < .001$.
** Statistically significant at $p < .01$.
* Statistically significant at $p < .05$.

was validated using confirmatory factor analysis with regard to (1) measurement reliability, (2) validity of the factor structure and (3) the discriminant validity of the measurement model (Gefen and Straub, 2005; Henseler et al., 2009).

3.3. Validity of the measurement model

The measurement reliability was assessed using *construct reliability* ("CR") and the variance captured by latent construct by *average variance extracted* ("AVE"). The reliability coefficients are based on factor loadings and error variances (see, e.g., Diamantopoulos and Siguaw, 2000; Fornell and Larcker, 1981). The CR coefficient should exceed .50 to indicate acceptability if the model validity otherwise is good (Kline, 2011; Little et al., 1999). The measurement reliabilities are reported in Table 3. The CRs of the latent constructs were good, varying from .823 to very high at .946. All of the latent variables produced good reliability for further analyses. The factor structure of the measurement model was analyzed by the significance and weight of factor loadings, reliability and validity and for cross-loadings between latent factors. All loadings in the outer model (measurement model) were significant and acceptable, varying from .715 to .942. The convergent validity of all latent factors by AVE was acceptable, higher than .50 for all measured concepts, indicating that more variance was explained than unexplained in the variables associated with the measurement model. In turn, if the AVE is less than .50, the variance due to measurement error is larger than the variance captured by the construct (Fornell and Larcker, 1981). We assessed the discriminant validity of the measurement model (1) by cross-loadings of the measurement items and (2) by the square root of AVE (i.e., Fornel-Larcker criterion) (Gefen and Straub, 2005; Henseler et al., 2009). All measurement items were highly loaded to the defined latent factors, and the cross-loadings were not higher than .41. The square roots of AVE (Table 2) were much higher than the correlations between any latent factors, manifesting good discriminant validity of the measurement model. Table 1.

4. Results

We analyzed the main effects in the model, which were defined by hypotheses one to four. We found that the importance of integrating strategic services increases collaboration between service providers and their customers, but a similar influence was not found regarding the operative service activities (Table 3). The analysis also shows that cooperation in business development positively influences customers' tendency toward system purchasing. Finally, the system purchasing seems to moderately increase the expected reliability of the service. The r-squared for the latent variables in the path model varies from .11 to .18. The explanatory power of the model is adequate due to a relatively low sample, and the analyzed concepts are also definitely influenced by factors outside of the presented research model (Abelson, 1985; Prentice and Miller, 1992).

5. Discussion and conclusions

In this article, we aimed to analyze the relation between B2B service integration and purchasing strategies to provide new knowledge on complex systems purchasing theories. This chapter summarizes the findings of the study and provides a discussion of both managerial and theoretical contributions. In this article, we set four hypotheses to develop the research model by theoretical

Table 2.
Square root of AVE and correlations between latent factors.

	Sq. root of AVE	COLLAB	OperMAN	RELIABILITY	StrDESIGN	SYSTPURCH
COLLAB	.866	1				
OperMAN	.903	.159	1			
RELIABILITY	.903	.197	.269	1		
StrDESIGN	.766	.336	.384	.132	1	
SYSTPURCH	.782	.341	.265	.289	.303	1

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Table 4.
Summary of the findings.

Hypothesis	Conclusion	Findings
Hypothesis 1: The customers' need for integration of strategic services influences the tendency to create a collaborative relationship with suppliers.	*Supported*	• Integrating strategic services increases collaboration between service providers and their customers. • Integrating complex planning processes requires in-depth and long-term development of service offerings.
Hypothesis 2: The customers' need for integration of operational services has no influence on the tendency to create a collaborative relationship with suppliers.	*Supported*	• Integrating operational services has no effect on collaboration. • Integrating process solutions to optimize performance does not deepen the B2B relationship.
Hypothesis 3: Customers' tendency to collaborate with suppliers has an influence on the system purchasing of services.	*Supported*	• Cooperation in business development positively influences customers' orientation toward system purchasing. • System purchasing is related to long-term development and co-learning.
Hypothesis 4: Customers' tendency toward a system purchasing influences the expected reliability of the service.	*Supported*	• A system purchasing increases the expected reliability of the service. • System purchasing tends to increase the quality of the processes related to complex service systems.

assumptions, and these hypotheses were later operationalized to the web-based survey and tested by the PLS-SEM model. The effective sample consisted of 143 valid responses from the management of an infrastructure network service provider, which was contacted via the CRM system. Table 4 summarizes the findings, which showed several features of the antecedents of system purchasing.

The article broadened the understanding of purchasing strategies with regard to integrated solutions, in which suppliers provide bundled product and service elements that are closely interrelated (Wise and Baumgartner, 1999). The core concept of the study was the system approach in purchase management, which focuses on the relational view in service supply management and the service provider's capability to operate at the customer's problem domains (Aarikka-Stenroos and Jaakkola, 2012; Tuli et al., 2007). System purchasing was connected to the two different types of services bundles, operational and strategic services, which differ from each other by point of customer involvement, modularity type, and degree of customizations (de Blok et al., 2010). We found several features of infrastructure network operators' supply decision, and these features contribute to current theories. If the service system includes elements for strategic integration, it will positively influence the need to collaborate with a supplier. This result is in line with the findings of Windahl and Lakemond (2010). The empirical link between collaboration and system purchasing is in line with the conceptual framework of the co-creation of value under complex configurations of resources (Vargo et al., 2008). Correspondingly, an increased operational integration focus does not influence system purchasing. In this study, the integration is mainly on the solution level and focuses on optimizing performance via the customized functions and parts of the solution (Persson and Ahlstrom, 2006), with no involvement in the customer's day-to-day routines (Cova and Salle, 2008). Most importantly, however, system purchasing had a positive influence on purchasing performance in the current study. The benefits of integrating diverse products and services in novel ways seem to relate with the process in which system purchasing is linked to collaboration between the customer and service provider in case of strategic services (Epp and Price, 2011). In this process, the product bundling drives the performance objectives but requires the inclusion of both collaboration and the system view of purchasing in the management model (Ancarani and Capaldo, 2005).

The findings provide interesting managerial implications that support service providers in defining appropriate customer relation, so they can provide the best value to customers. The emergence of smart infrastructure service and the related technology drives the development of a complex business model, which changes relations between the actors involved (Niesten and Alkemade, 2016; Stone and Ozimek, 2010). Here, integrating strategic services increases collaboration between service providers and their customers, but integrating process solution services may not affect B2B relations. This finding can be explained by the different objectives of the actions involved. Integrating strategic services is tied to the business model design and investment planning of the network operator, which requires complex process integration and mutual connection between partners. In turn, the goal of integrating operational services is to optimize the performance and responsiveness of technically specific domains, but this optimization does not seem to influence the B2B relationship. The evolution of purchasing strategies among distribution network operators is also expected in the future because a single standard for contracting no longer exists (Apajalahti et al., 2015). We found that a long-term offering of co-development positively influences customers' tendency toward system purchasing, which we expect to be related to the learning process that reveals the latent benefits of integrated solutions. These latent benefits may be associated with the expected monetary savings, increased convenience, and reduced compatibility risk (e.g., Harris and Blair, 2012; Sarin et al., 2003). The latent benefits may also explain why collaboration does not directly influence the expected reliability of complex solutions. System purchasing also increased the expected reliability of the complex service solution. However, service integration did not self-evidently lead a firm to choose system purchasing; instead, it was linked through collaboration, which was probably related to co-learning during the development of the offering.

This study investigated the circumstances of system purchasing in an industrial service business. Nevertheless, many areas remain where this type of thinking could be further studied. One suggestion is to investigate the value of system purchasing at the product or service category level. That would provide interesting findings for implementing and improving purchasing strategies. Future research could address the role of digitalization and information management in the service integration.

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