Service Modularity and New Service Advantage
A Resource-Based Approach

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ABSTRACT
Although modularity has been widely studied, the relationship between service modularity and new service advantage remains unclear. Drawing on resource-based view and dynamic capabilities theory, the results indicate that service modularity as the foundation for service modularity capabilities, which in turn are positively related to new service advantages.

Keywords: Service Modularity, New Service Advantage

INTRODUCTION
Service modularity refers to an attempt to develop new services by combining the flexibility of tailoring and the efficient production methods of standardizing (Pekkarinen & Ulkuniemi, 2008). A new service with high modularity means a group of elements that are highly inter-dependent, but only marginally dependent on the characteristics of other modules. When new services are modularized, they are composed of a number of less complex modules, which can be independently developed by service designers (Bask, Lipponen, Rajahonka, & Tinnilä, 2011). These facilitate management of new service development for service providers.

However, while modularity has been widely studied (Salvador, 2007), extant modularity literature offers conflicting views regarding the impact of service modularity. A stream of literature suggests that modularity could improve a firm's ability to innovate and consequently lead to positive business performance (Bask et al., 2011), while some literature argues that modularity may inhibit a firm's ability to generate innovations when common modules are repeatedly reused, leading to similar design (Robertson & Ulrich, 1998; Jacobs, Droge, Vickery, & Calantone, 2011). Accordingly, the relationship between service modularity and its performance remains unclear.

We address these critical gaps by proposing and empirically testing a framework based on the principles of the Resource-Based Review (RBV) and dynamic capabilities theory. Specifically, in our study, instead of examining the direct link between service modularity and new service advantage, we investigate the mediating role of service modularity capabilities on the service modularity-new service advantage relationship. In addition, because it is firms' strategic

decisions that determine firms' ability to capitalize on their service modularity, resulting in service modularity capabilities, differentiation and cost leadership strategies are considered, due to their effects on service operations (Sundbo, 1997).

THEOREY and HYPOTHESES DEVELOPMENT

The RBV addresses the origins of competitive advantage by arguing that performance differences among firms result from resources that can be used to create idiosyncratic, inimitable internal capabilities (Barney, 1991). A resource is an observable asset that can be valued and traded, while a capability is not observable and only as part of its entire unit (Makadok, 2001). Capabilities are a firm's accumulated knowledge and skills that enable the firm to utilize and enhance the value of resources. As such, service modularity capabilities are developed based on service modularity that is tacitly held and difficult for rivals to copy.

Following the literature of service modularity (Böttcher & Klingner, 2011; Ulkuniemi & Pekkarinen, 2011), service modularity consists of the following five key aspects: (1) *Reduction*: To simplify allocation of resources and massive service processes; (2) *Configuration*: To rearrange structured service processes and connect each service configurator; (3) *Transparency*: To easily understand or recognize service processes or interfaces in a clear way; (4) *Enhancement*: To develop delimited and less complex service processes or offerings further; (5) *Reuse*: The way to planning, implementation, and improvement of service processes, which can be used again in many different service offerings.

Previous studies have examined different types of firms' service capabilities, including service innovation capability (Cheng, 2011), service marketing capability (Morgan, Vorhies, & Mason, 2009), or learning and developing ability (Luo, 2002). According to their studies, developing rare, valuable, and inimitable capabilities is a challenging process. Given that, we follow their approaches and use *reduction, configuration, transparency, enhancement,* and *reuse* capabilities to represent five service modularity capabilities possessed by firms.

The extant literature has provided empirical evidence of the relationship between service modularity and new service advantage (e.g., Worren et al., 2002; Bask et al., 2011). However, service modularity is a precursor to service modularity capability building in that service modularity has only potential value. This is because unless a firm successfully develops capabilities, it cannot create a competitive advantage (Grant, 1996). Simply assessing the service modularity-performance relationship fails to capture the core concepts of the RBV. Accordingly, based on the RBV as our theoretical foundation, we examine the mediating effects of (1) service modularity capabilities on the service modularity-new service advantage relationship.

Similar to previous research (e.g., Atuahene-Gima, 2005; Agarwal & Selen, 2009), as a precursor to capability building, service modularity has only potential value in contributing to desirable performance. As such, to realistically evaluate the service modularity-performance relationship, it is vital to include the development of service modularity capabilities. Thus, it is not service modularity that affects performance, but rather using service modularity in developing service modularity capabilities to improve performance. Therefore,

H1: Service modularity capabilities mediate the effect of service modularity on new service advantage.

In examining the transformation of service modularity into service modularity capabilities, researchers have conceptualized firms' strategic decision as the key constructs (Barreto, 2010).

Therefore, we propose that the impact of service modularity on service modularity capabilities is moderated by two strategic decisions: differentiation strategy and cost leadership strategy.
A differentiation strategy is related to delivering different new services to the customers compared to the offerings of the competitors. As the differentiation strategy is based on adjusting the service provided (Koelling, Neyer, & Moeslein, 2010), we expect that when using a differentiation strategy, a firm likely develops greater service modularity capabilities. For example, service firms that pursue a differentiation strategy are able to differentiate their service offerings from those of their closest competitors by reducing, reusing, and configuring the service package to meet the demand or by enhancing the efficiency of their provision process. Therefore, high levels of differentiation strategy create the necessary environment for service modularity capabilities to be developed more effectively.

H2: Differentiation strategy strengthens the effect of service modularity on service modularity capabilities.

Service firms generally adopt cost-based strategies to enhance performance because they possess comparative advantages in low costs of service employees and/or service offerings (Aulakh et al., 2000; Koelling, Neyer, & Moeslein, 2010). Firms pursuing a cost leadership strategy require the ability to match competitors' service offerings at lower prices. Because compared with other types of service modularity capabilities, reduction and reuse capabilities are of utmost importance to them (Böttcher & Klingner, 2011; Ulkuniemi & Pekkarinen, 2011), firms will pay more attention to collecting and analyzing cost information and developing reduction and reuse capabilities. Accordingly, we expect that, for firms pursuing a cost leadership strategy, the effect of service modularity on reduction and reuse capabilities will be stronger, while service modularity's effects on configuration, transparency, and enhancement capabilities will be weaker. Thus,

H3: Cost leadership strategy strengthens the effect of service modularity on reduction and reuse capabilities, but weakens the effect of service modularity on configuration, transparency, and enhancement capabilities.

RESEARCH METHOD

Our measurement development is based on existing measures and field interviews. We conducted 19 in-depth interviews with eligible senior managers in their respective firm. Two pilot studies were then conducted to improve the questions. At this stage, some item wordings were slightly modified for clarity.
From a commercial list provided by the marketing research firm (China Credit Information Service, 2011) we developed a contact list of senior managers from 1,000 firms in the services industries. This procedure yielded 143 usable questionnaires. The sample consists of information services (18.8%), financial services (20.6%), tourism and travel services (19.3%), technical and scientific services (20.2%), retailing services (19.2%), and others (1.9%). The respondents who were senior managers had been with their firms on average for 14 years of experience in NSD, which suggests a high level of knowledge competency.
Using a t-test, there is no significant difference at the .05 alpha level between early and late respondents across firm age, number of employees, sales, and study variables, indicating no systematic differences between early and late respondents (Armstrong & Overton, 1977). We

then conducted a Harman one-factor test that assessed the potential problem of common method variance (Podsakoff & Organ, 1986). A factor analysis of all these constructs resulted in a solution with expected factors and the first factor accounted for only 23.24% of the variance. The test failed to provide evidence of common method variance.

ANALYSIS AND RESULTS

We then test the measurement models using CFA. Following previous research (Hult, Hurley, & Knight, 2004), we divide the variables into related groups and use the raw data as input to the maximum likelihood-based estimation procedure. Each item is set to load only on its respective latent construct, and the latent constructs are allowed to be correlated (Gerbing & Anderson, 1988). The factor loadings for each individual indicator on its respective constructs are statistically significant ($p < .001$), and there is no evidence of cross-loading, supporting the dimensionality and convergent validity of the constructs. The composite reliabilities of each construct range exceed the usual .70 benchmark (Bagozzi & Yi, 1988).

We further assessed discriminant validity by using the Fornell and Larcker (1981) procedure and an alternative procedure that Anderson and Gerbing (1988) recommend. For each construct the value of the square root of each average variance extracted is greater than the values of the inter-construct correlations. In addition, the unconstrained models outperform the constrained models in all cases. Because both approaches' criteria are satisfied, an inference error of multicollinearity is unlikely (Grewal, Cote, & Baumgartner, 2004), which supports discriminant validity.

We examined the mediating effect of service modularity capabilities and new service advantages by following the analysis strategy of Baron and Kenny (1986), implemented through a structural equation model reported in Tables 1.

Table 1: Structural model of service modularity, service modularity capabilities, and new service advantage

	Service Modularity-Service Modularity Capabilities-New Service Advantage					
	Reduction capability	Configuration capability	Transparency capability	Enhancement capability	Reuse capability	New service advantage
Service modularity	.52*** (4.22)	.53*** (4.24)	.51*** (4.21)	.56*** (4.32)	.55*** (4.30)	.02 (.26)
Reduction capability	-	-	-	-	-	.19* (2.34)
Configuration capability	-	-	-	-	-	.25*** (3.43)
Transparency capability	-	-	-	-	-	.27** (3.21)
Enhancement capability	-	-	-	-	-	.31*** (3.79)
Reuse capability	-	-	-	-	-	.38*** (4.89)

Model fit: χ^2 / d.f. = 2.04, RMSEA=0.04, CFI = 0.96, IFI = 0.95, NNFI = 0.95
Standardized coefficients are presented with *t*-value in parentheses
* $p < .05$; ** $p < .01$; *** $p < .001$ (N=143)

We estimated a structural model of the relationships among service modularity, service modularity capabilities, and new service advantage, and the model fits the data well. The results in the Model show that service modularity is significantly related to the five service modularity

capabilities. In addition, the effect of service modularity loses its significance when service modularity capabilities are included in the model. As expected, the link from service modularity to new service advantage is indirect through service modularity capabilities, thus suggesting that service modularity capabilities mediate the effects of service modularity on new service advantage. Therefore, H1 is supported.

Table 2: Results for service modularity interactions

Independent variables	Reduction capability		Configuration capability		Transparency capability		Enhancement capability		Reuse capability	
Service modularity (SM)	.25*** (5.13)	.26*** (5.22)	.22*** (4.83)	.20*** (4.10)	.32*** (6.89)	.29*** (6.28)	.24*** (5.66)	.25*** (5.73)	.23*** (5.26)	.26*** (5.57)
Differentiation strategy (DS)	.13* (2.13)	.10 (1.72)	.09 (1.69)	.16* (2.21)	.05 (.88)	.09 (1.45)	.12* (2.01)	.11* (1.99)	.08 (1.41)	.09 (1.54)
Cost leadership strategy (CLS)	.23*** (3.45)	.24*** (3.56)	.15* (2.18)	.14* (2.14)	.19** (2.43)	.20** (2.44)	.13* (1.98)	.13* (1.99)	.26*** (4.34)	.25*** (4.09)
Firm size	-.02 (-.57)	-.02 (-.48)	-.02 (-.36)	-.03 (-.54)	.04 (1.21)	.06 (1.23)	.04 (1.20)	.05 (1.12)	.01 (.30)	.02 (.32)
Firm age	.06 (1.34)	.05 (1.23)	.08* (2.01)	.09* (2.13)	.11* (2.43)	.09* (2.14)	.08 (1.78)	.08 (1.89)	.04 (.90)	.03 (.81)
Firm capital	.06 (1.65)	.05 (1.49)	.01 (.25)	.02 (.28)	.04 (.87)	.03 (.66)	.03 (.66)	.01 (.30)	.05 (.98)	.06 (1.01)
Interaction effects										
SM × DS	-	.09* (1.92)	-	.18** (2.34)	-	.06 (1.44)	-	.16** (2.21)	-	.05 (1.36)
SM × CLS	-	.17** (2.29)	-	-.11* (-2.12)	-	-.19** (-2.72)	-	-.15* (2.14)	-	.20** (2.76)
Adjusted R^2	.27	.28	.31	.34	.36	.37	.39	.41	.42	.45
***F*-value**		2.52*		3.27**		2.76*		3.85**		4.43**

Standardized coefficients are presented with *t*-value in parentheses
* $p < .05$; ** $p < .01$; *** $p < .001$ (N=143)

Hierarchical moderated regression is employed for testing hypotheses of moderating effects (Aiken & West, 1991). We tested the effects of service modularity on service modularity capabilities. The independent variables were service modularity, differentiation strategy, and cost leadership strategy. We mean-centered relevant variables before creating the interaction terms. H2 hypothesizes that differentiation strategy strengthens the effect of service modularity on service modularity capabilities. The results in Table 2 show that the interaction terms between differentiation strategy and service modularity are significant for reduction capability, configuration capability, and enhancement capability. Hence, we find partial support for the moderating effect of differentiation strategy on the service modularity-service modularity capabilities relationship. Therefore, H2 is partly supported. In addition, the interaction terms between cost leadership strategy and service modularity are positively related to reduction and reuse capabilities, but negatively related to configuration capability, transparency capability, and enhancement capability, therefore supporting H3.

DISCUSSION

Our framework represents an initial attempt at developing a comprehensive and theoretically informed basis for understanding the effects of service modularity on new service advantage. We

contribute to the extant literature in the following respects. First, since service modularity can be a way of reducing service complexity and simplifying service process design in order to provide service variety to effectively meet customers' needs, it should have a positive effect on new service advantage. However, simply assessing the direct link between service modularity and new service advantage omits core concepts of the RBV. By focusing on the mediating role of service modularity capabilities, our results suggest that all five service modularity capabilities (reduction, configuration, transparency, enhancement, and reuse) mediate the effects of service modularity on new service advantage. Therefore, it is crucial to include service modularity capabilities when examining the service modularity-new service advantage relationship.

Second, we further investigated the strategic decisions that affect how firms deploy service modularity in developing service modularity capabilities. Because service modularity can be seen as a design principle (Langlois, 2002) to simplify and rationalize service process design for managing complexity, how to employ service modularity principle represents an enormous challenge for managers. We found that differentiation strategy somewhat strengthens the effects of service modularity on reduction, configuration, and enhancement capabilities. Thus, it may be desirable to complement service modularity by differentiation strategy to augment its strategic value in developing service modularity capabilities. In addition, the results show that cost leadership strategy appears to weaken somewhat the effects of service modularity on configuration, transparency, and enhancement capabilities. Reduction and reuse capabilities seem to be of great importance to managers by providing customer value at lower costs. Consequently, while service modularity plays a critical role in new service performance, whether firms can realize service modularity's potential value on capability building may depend on what strategies they apply.

Our findings also confirm that no strategy is universally superior (Venkatraman, 1989). We draw managers' attention to the idea that the critical role of service modularity on service modularity capabilities may vary across the different levels of strategic decisions. Our research suggests that the differentiation strategy and cost leadership strategy may influence the effects of service modularity on service modularity capabilities. Thus, managers should be aware of the complex and contingent processes of capabilities development to fully comprehend the impact of service modularity on new service advantage through different types of service modularity capabilities.

Our study has a number of limitations, which also represent important directions for future research. First, although we have used new scales to measure service modularity capabilities, the measures used in our study may not have captured those capabilities sufficiently as the nature of these capabilities is complex. Future research should attempt to capture the domain of the constructs with much richer and more detailed items. Second, this study is primarily based on the subjective assessment of the key informant, so the evaluation of the firm's new service advantage is inclined toward subjective biases. Future research that collects a diversity of viewpoints can potentially overcome such biases. Third, although the sample for this study is drawn from a wide range of service sectors, the applicability of these findings to other industries should be considered with caution.

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