

## *The incremental and cumulative effects of dynamic capability building on service innovation in collaborative service organizations*

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### **Abstract**

Increasingly, innovation in services is brought to market by a network of firms, or alliance networks, asset orchestration, knowledge sharing capabilities, resources and competencies, and operated in a coordinated manner. Recent literature has recognized the evolutionary nature of dynamic capabilities in that managers may adapt their alliance networks dynamically to sustain competitive advantage, as well as identified a continuing gap in the lack of empirical studies on feedbacks between network environments, dynamic capabilities, and innovation performance. In addition, other literature calls for more quantitative research on examining dynamic capabilities in a network environment to provide a better understanding of how firms should direct their resources and capabilities to successfully respond to competition. This study contributes towards closing both gaps by empirically examining the *cumulative and incremental* effects of fostering and deploying different dynamic capabilities on services innovation, and by quantifying their impact, thus providing managers with a better account of how services innovation comes about in a service value network. It does so using empirical data from 449 respondents from a telecommunications service provider in Australia and its partnering organizations, using structural equation modelling.

**Keywords:** service value network, service innovation, collaboration, dynamic capability building, structural equation modelling

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### **INTRODUCTION**

A paradigm shift is taking place in the way in which organizations create value. Dynamic capabilities (DCs) complement the premise of the resource-based view of the firm, and the literature has recognized the evolutionary nature of DCs in that managers may adapt their alliance networks dynamically to sustain competitive advantage (Teece, 2009). As such, managers are nowadays looking to develop collaborative relationships external to the organization for the value creation needed to survive in the current economic environment (Hammervoll, 2009). It is argued that service innovation is increasingly brought to market by a network of firms, selected for their unique assets, capabilities, resources, and competencies, and operated in a coordinated manner (Agarwal & Selen, 2009; Teece, 2009). By deploying technologies and by leveraging their resources, collaborating service organizations are able to bring their intramural innovation accomplishments to

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market (Enkel, Gassmann, & Chesbrough, 2009). The innovation challenge is to overcome the longstanding 'value-in-exchange thinking from a producer perspective' to 'value-in-use thinking from a customer perspective' (Vargo, Maglio, & Akaka, 2008). As such, partnering with stakeholders, be it customers or suppliers, is fundamental for delivering new kinds of services in complex service networks that deploy the services systems approach (Weissenberger-Eibl & Koch, 2007).

Within this context of bringing innovation to fruition through a network of firms, recent literature identified a continuing gap in the lack of empirical studies on feedbacks between network environments, DCs, and innovation performance (Zheng, Zhang, & Du, 2011). In addition, another review and research agenda calls for more *quantitative research* on examining DCs in a network environment to provide a better understanding of how firms should direct their resources and capabilities in search of sustained competitive advantage (Wang & Ahmed, 2007). This is also recognized by Teece (2009: xv), who states that different levels of 'fitness' (DCs) will drive growth, profitability, and survival, and who calls for a comprehensive set of tests of DCs to be conducted.

Our study will help close the first gap of lack of empirical study on feedbacks between network environments, DCs, and innovation performance by examining the cumulative and incremental effects of fostering and deploying different DCs to provide managers with a better account of how services innovation comes about in a service value network (SVN). It does so using empirical data from 449 respondents from a telecommunications service provider in Australia and its partnering organizations. In particular, our research will investigate the cumulative and incremental effects of DCs in the particular context of how collaboration (referred to as organizational relationship capital – ORC) impacts on service innovation (termed as elevated service offering – ESO), and whether this effect is direct, or mediated by other DCs of collaborative organizational learning (COL), and/or collaborative innovative capacity (CIC). In this paper, *cumulative effects* refer to the overall effect of deploying different DCs in explaining services innovation; while *incremental effects* refer to which DC makes what contribution to explaining services innovation in its own right.

Our study also addresses the second gap of a lack in *quantitative research* on examining DCs in a network environment by studying above mentioned effects quantitatively using a structural model.

The remainder of the paper is structured as follows: first, the theoretical background is presented, followed by justification of the research hypotheses. Next, a synopsis of the research design and research methodology, along with associated analyses and results, are presented. Subsequently, managerial implications, contributions, and main conclusions are discussed, followed by limitations of the study and suggestions for future research.

The theoretical background of this research study and resulting research hypotheses are discussed next.

## THEORETICAL BACKGROUND

### The rationale of collaborative service organizations

Service organizations are increasingly operating in collaborative networks to build and sustain competitive advantage (Powell, 1990; Achrol & Kotler, 1999; Das & Teng, 2000; Kogut, 2000). While teamwork and internal partnering are common ground in organizations, networking with external stakeholders requires expanding the understanding and knowledge base of relationships in order to build and establish different forms of collaboration. The capabilities to recognize the value of new knowledge, to assimilate it, and to apply it to commercial ends has been defined as *absorptive capacity* that influences the innovative performance of the firm (Cohen & Levinthal, 1990; Newey & Verreynne, 2011).

The network rationale suggests that partnering enables organizations to cope with uncertainties, complexity, and associated risks through appropriate skill building and resource allocation (Cravens & Shipp, 1993). Each partner contributes part or whole of a core competence that other partners of

the network lack, such as access to a market, technology, or particular skills; all of which comprise the fundamental premise for collaboration. Agarwal and Selen (2011: 1167) defined such a network of partners as a SVN:

*a network of value chains, which vibrates its essence from the combined core competencies of the stakeholders in the chain, mobilizes the creation and reinvention of value of its assets, requires strategic focus and revives roles and responsibilities amongst different stakeholders. Through the use of relationship, technology, knowledge and process realignment and management, a SVN connects to the customer via the channel of choice, heightens the transformation of the nature, content, context and scope of the service offerings, opens up new market opportunities, keeps the social infrastructure intact and secures competitive advantage.*

Next, we discuss in greater detail how managers in collaborative service organizations can orchestrate service innovation. The resource-based view addresses the fact that firms operate in dynamic environments, and that resources valued or immobile in the current environment may not be valued or substitutable in tomorrow's environment (Teece, Pisano, & Shuen, 1997). Firms that can identify environment or market trends early by means of communicating with different stakeholders, and that can configure or reconfigure quickly to align their resources with the needs and demands of the new market and competitive situations, will operate with a competitive advantage. In addition to the typical physical, human, and organizational resources possessed by individual firms, firms can form and reform alliances with stakeholders, and through adoption of managerial practices can gain access and manage valuable, immobile, and rare resources in order to retain competitive advantages in dynamic environments (Yu & Hao, 2011).

Lee, Ginn, and Naylor (2009) argue that strong ties and linkages with other partnering organizations mitigate uncertainty and promote the ability to adapt through increased communication, information sharing, and transparency. Interactions with partnering organizations in a network allow entities to acquire new knowledge; thus allowing organizations to advance their competencies and build higher-order capabilities (Ibarra, 1993; Gupta & Govindarajan, 2000; Agarwal & Selen, 2009). Chen, Lee, and Lay (2009) state that the driving forces of the dynamic learning mechanisms play a decisive role in the evolution of dynamic competitive capabilities, a finding that the resource-based view has failed to clearly identify. They also state that learning intent and embedded learning positively influence the drivers of dynamic learning mechanism and dynamic competitive capabilities development in high-level management of international strategic alliances. Extant literature has further indicated that when entities are loosely coupled, these partnering organizations are more motivated to share ideas, resources, and competencies (Uzzi, 1999; Tsai, 2001), and it is through inter-organizational knowledge pooling that innovative outcomes can be attained. Henceforth, managers can foster complementary knowledge through structured collaboration (Gemunden, Ritter, & Heydebreck, 1996; Rindfleisch & Moorman, 2001; Sparrowe, Liden, & Kraimer, 2001), and open and transparent communication and cooperation that can lead to significant reductions in total costs for all parties involved (Gavirneni, 2002), hence enhancing overall service innovativeness (Goes & Park, 1997). Furthermore, recent research shows the role of collaborative networks in fostering business model innovation (Arana & Castellano, 2010).

After grounding the rationale for collaborating service networks in the literature, we next expand on the role of DCs in service innovation.

### **DCs and their role in service innovation**

Eisenhardt and Martin define DCs as 'the organizational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve and die' (2000: 1107). Zahra and

George (2002) reviewed the literature on knowledge absorption and conceptualized absorptive capacity as a DC. DCs constitute a type of competitive advantage derived from organizational routines, which offer the greatest sustainable value (Prahalad & Hamel, 1990). Winter (2000, 2003) conceives high-level management routines as combinations of various small routines in an organizational system that exerts a key influence on organizational success, and states that DC development in high-level management not only assists a firm in facing external challenges, but also provides limitless competitive advantages. Because decision-making power is generally concentrated among high-level managers, DC development in high-level managers via distinctive capabilities and specific processes can enhance success for a firm (Dierickx & Cool, 1989).

DCs have been contrasted to operational (ordinary) capabilities. An operational capability enables a firm to perform an activity on an ongoing basis using more or less the same techniques on the same scale to support existing products and services for the same customer population. Such a capability is ordinary in the sense of maintaining the *status quo* (i.e., not out of the ordinary; Winter, 2003). In contrast, a DC is one that enables a firm to alter how it currently makes its living to constantly reconfigure, renew, and redeploy resources and capabilities to exploit opportunities (Teece, Pisano, & Shuen, 1997). Recent research by Helfat and Winter (2011) warn against a clear delineation between dynamic and operational capabilities based on numerous industry examples, and add further complexity to the issue of capabilities in industry by introducing dual-purpose and multiple-variant capabilities. They illustrate a multiple-variant capability in a network setting through an example of integrative capabilities, one which enables communication and coordination across organizational units and firms (Helfat & Campo-Rembado, 2010). Newey, Verreyne, and Griffiths (2012) found how well DCs co-specialize with downstream operating capabilities. These capabilities can serve an operational purpose, for example, by facilitating shared activities that produce economies of scope across stages of production or product lines. Other types of integrative capabilities can make change possible, such as through the coordination of design and manufacture in new product introduction (Iansiti & Clark, 1994). Thus, an integrative capability may be dynamic or operational, depending on the nature of the capability and its intended use (Helfat & Winter, 2011). As such, the notion of DCs in our research is not to be contrasted to operational capabilities as defined earlier in the literature, but rather to encapsulate the dynamic nature of the capability as initially defined by Teece, Pisano, and Shuen (1997). Such DCs are subsequently studied to capture an organization's ability to achieve new and innovative forms of competitive advantage, reinforced earlier by Teece (2009).

Within this context, entering into an alliance can be an extremely useful strategy for cooperative partners, and can enable a firm to rapidly compete. A number of studies (Lane & Lubatkin, 1998; Zollo & Singh, 1998; Gulati, 1999) confirm that DCs can be derived from alliances or acquisitions, and that alliances can contribute new and useful resources to an organization. Teece (2010) links DCs to business model innovation as 'Dynamic capabilities help govern evolutionary fitness, and help shape the business environment itself. Get the business model wrong, and there is almost no chance of business success – get it right, and customize it for a market segment and build in non-imitable dimensions, and it will contribute to the firm's competitive advantage' (Teece, 2010: 190–191). With this backdrop, tacit capabilities are becoming more strategically important and quantifying their impact even more relevant.

Within the services industry, on the basis of scholarly work by Makadok (2001), organizational capabilities for service innovation are defined as firm-specific resources that improve the productivity of the other resources of the organization for the realization of new service developments. Recently, several models analyzing service innovation capabilities have been introduced, indicating growing interest attributed to understanding service innovation capabilities and their management. Prominent theoretical publications among these models on service innovation capabilities are authored by den Hertog, van der Aa, and de Jong (2010), Sung, Cho, and Choi (2011), Hogan, Soutar, McColl-Kennedy, and Sweeney (2011), and Kindström, Kowalkowski, and Sandberg (2013). Further, Agarwal and Selen (2009) have

empirically shown that innovations are increasingly brought to market by networks of firms through a process of DC building. They define service innovation in a SVN as an ESO, or 'a new or enhanced service offering which can only eventuate as a result of a collaborative arrangement, one that could not otherwise be delivered on individual organizational merits' (Agarwal & Selen, 2009: 432). They empirically validate the theoretical concepts by Forfas (2006) and Voss and Zomerdijk (2007) and show ESO as a three-dimensional construct, encompassing *Strategic*, *Productivity*, and *Performance* dimensions (Agarwal & Selen, 2011).

Our research will address the *cumulative* and *incremental* effects of DCs on services innovation in a SVN, by extending a recent study of Agarwal and Selen (2009) on the use of DCs in SVNs for achieving service innovation. Understanding such cumulative and incremental effects of deploying particular DCs for achieving service innovation, and quantifying their effect, will provide valuable insights for practitioners to implement better decision-making mechanisms, and processes and practices. In addition, such understanding will focus attention to relevant skill development, human capital development, and workplace practices for fostering innovation when working in partnership in alliance collaborative networks. In particular, our research will investigate how collaboration (ORC) impacts on service innovation (ESO), and whether this effect is direct, or mediated by other DCs of COL and/or CIC.

Next, the research questions and resulting hypotheses are elaborated on for demonstrating the cumulative and incremental effects of deploying DCs of bi-directional learning and knowledge sharing, as well as developing CIC with its enabling skills, on service innovation in a service network.

## RESEARCH QUESTIONS AND HYPOTHESES

Relationship capital is an antecedent to knowledge management, implying knowledge assimilation and creation within the firm (Bonner, Kim, & Cavusgil, 2005). As such, relationship capital is seen as a critical firm resource (Chrisholm & Nielsen, 2009; Locket, Thompson, & Morgenstern, 2009; Pollard & Jemicz, 2010), which provides resources of value. In the context of a SVN, ORC is key to the creation of higher-order competencies when collaborating with customers and suppliers. This is a DC made up of close, personal interaction between the partners at multiple levels, characterized by mutual respect, trust, and high reciprocity between the partners at multiple levels, as well as an ability to establish long-term relationships (Agarwal & Selen, 2009).

According to Das and Teng (2000), firm resources provide a relevant basis for partnering organizations as partnerships are most likely to be formed when there is a crisis in resources, or when they are likely to share valuable resources they possess. As such, leveraging a required set of skills and/or resources/competencies that each partnering organization do not possess is advantageous to both parties (Cravens & Shipp, 1993), and through a rapid diffusion of new technologies mutual learning across both partners is enhanced (Lorange & Roos, 1991). Thus, resources, DCs, and knowledge are intertwined and closely interrelated, and provide organizations a capacity to continually reconfigure, and hence become a source of competitive advantage (Barney, Wright, & Ketchen, 2001). COL in our research is composed of the focal company's learning, or *COL-yours*, and comprises learned, or acquired new or important information/knowledge from the partner. This includes weakness, strength, gaps and discontinuities, learned or acquired new critical capability or skill from the partner; enhancing its existing capabilities/skills as a result of the partnership and through working with partners increasing contextual capability and overall knowledge. In a similar vein, the second dimension of COL, or *COL-partners*, comprises of items such as collaborative arrangements that helped the partner learn or acquire new critical capability or skill, acquire new or important information/knowledge including weakness, strength, gaps, and discontinuities, as well as has helped the partner enhance their existing capabilities/skills.

CIC is seen as a dynamic skill which is developed when collaborating with partners, and comprises of an ability that evolves over time within individuals or groups. In this context, Lawson and Samson (2001: 384) define innovation capability as ‘the ability to continuously transform knowledge and ideas into new products, processes and systems for the benefit of the firm and its stakeholders’, which facilitates transformation of knowledge and ideas into practical insights. This capability is both operational and strategic and requires ‘a higher-order integration capability to mould and manage multiple capabilities’ (Lawson & Samson, 2001: 384). Furthering this argument, Fuchs, Mifflin, Miller, and Whitney (2000) in the context of DCs claim innovation as a higher-order integration capability, which means that organizations need to constantly manage their knowledge and skill base in search of innovation. Further, CIC promotes lateral thinking, equips partnering organizations with an ability to cross-fertilize ideas, apply and diffuse knowledge, and allow the application of ideas within and across industry sectors (Ganesan, Malter, & Rindfleisch, 2005); thus broadening horizons. In this study, CIC is made up of a continuous and plentiful supply of good ideas from partners and customers, collaboratively coming up with novel and interesting ideas when solving problems, and lastly working in tandem to produce perceptual and cognitive sets of information as a result of lateral and fresh thinking.

From the above discussion, it is shown that ORC has a positive influence on organizational learning, and innovation in a supply chain context. As such, members of the SVN who possess relational competencies are expected to positively influence the innovation outcome (ESO), organizational learning within the network, and enable innovativeness of all partners, including customers. In other words, deliberate learning efforts will code, articulate, and assimilate collective knowledge, and in the case of a SVN these deliberate efforts translate into managerial skills and competencies through which the network may modify its strategic assets and operational processes, routines and tasks, in pursuit of greater effectiveness and improved efficiency. Thus, organizational learning of the concerted team members will in turn enhance the ability to come up with new ideas and innovations, and hence will act as a mediator between ORC and CIC.

Therefore it is hypothesized that:

Hypothesis 1a: ORC has a positive influence on ESO.

Hypothesis 1b: ORC has a positive influence on the COL of the SVN partners.

Hypothesis 1c: ORC has a positive influence on the CIC of the SVN partners.

Hypothesis 1d: COL of the partners mediates the relationship between ORC and the CIC of the SVN partners.

In our earlier discussion, it was stated that collaborative learning of our customers, suppliers, and other stakeholders is core to innovation in service networks. Such deliberate efforts translate into higher-order managerial skills and DCs, through which the SVN is likely to modify its strategic and operating capabilities in pursuit of greater effectiveness and improved efficiency. Thus, it is hypothesized that COL influences CIC, and eventually the innovation outcome or ESO. Similarly, it is also believed that CIC will in turn enhance the ability to come up with new ideas and innovations, and hence will act as a mediator between COL and delivery of innovation in services – our notion of ESO.

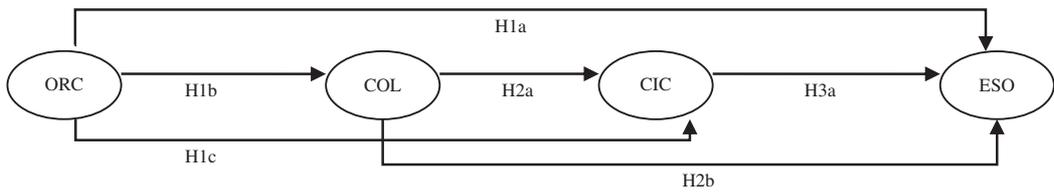
Therefore we hypothesize that:

Hypothesis 2a: COL has a positive influence on the CIC of the SVN.

Hypothesis 2b: COL will have a positive influence on the outcome of ESO.

Hypothesis 2c: CIC will mediate the relationship between COL and ESO of the SVN partners.

Organizations that possess innovation capability have the ability to integrate key capabilities and resources of their firms to successfully stimulate innovation (Fuchs et al., 2000). In the context of SVNs, CIC may broaden the perspectives and enable partnering organizations to foster, fertilize, and apply ideas within and across industry sectors, and also promote the ability to think laterally.



**Hypothesized Mediated links not shown in the above diagram:**

H1d: ORC → CIC via COL

H2c: COL → ESO via CIC

H3b: ORC → ESO via COL and CIC

ORC = Organizational Relationship Capital

COL = Collaborative Organizational Learning

CIC = Collaborative Innovative Capacity

ESO = Elevated Service Offering

**FIGURE 1. FULL RESEARCH MODEL (MODELS 1, 2, AND 3 COMBINED): ORC TO ESO MEDIATED VIA COL AND CIC**

Consequently, this innovative capability of partnering organizations may induce an ‘ordinary discovery’, generally referred to as incremental innovation, or an ‘extraordinary discovery’ referred to as radical innovation (Yu, 2001), resulting in successful outcomes in the form of an ESO.

Therefore it is hypothesized that:

Hypothesis 3a: CIC will have a positive influence on the outcome of ESO.

Hypothesis 3b: COL will mediate the relationship between ORC and ESO, of the SVN partners.

The key contribution of our research is the investigation of the *cumulative and incremental* effects of deploying DCs for achieving service innovation. In particular, how collaboration (ORC) impacts on service innovation (ESO), and whether this effect is direct, or mediated by DCs of COL and/or organizational innovative capacity in the service network. This results in three distinct research models, as follows:

In Model 1, collaboration (ORC) is assumed to directly affect service innovation (ESO), *without mediating effects from other DCs in the network*. In other words, how well does ORC explain ESO, without any cumulative effects of other DCs.

Model 2 tests whether collaborative service organizations create and deliver ESOs, *mediated through COL capability building*.

Model 3 finally investigates whether collaborative service organizations create and deliver ESOs, *fully mediated through COL and CIC capabilities*. This is the model in which cumulative and incremental effects of DCs of COL and CIC can be observed, and be investigated how much better services innovation (ESO) is explained as a result of such DC deployment.

The full research model, encompassing models 1–3, is illustrated in Figure 1.

As such, this research attempts to capture the cumulative and incremental effect of deploying DCs of *bi-directional* learning and knowledge sharing, as well as development of CIC with all its enabling skills as defined earlier, in order to more fully explain the innovation process and how service innovation comes about in a SVN. Next, the research design and methodology are elaborated on.

## RESEARCH DESIGN AND METHODOLOGY

### Sampling and data collection

Based on the theoretical grounding for our research framework, a survey instrument was designed and pilot tested on 79 employees belonging to a major Australian telecommunications service provider

TABLE 1. SAMPLE DEMOGRAPHICS

Characteristics	Data set 1 (n = 225)		Data set 2 (n = 224)	
	Count	Percentage	Count	Percentage
Employee organization				
Parent	101	44.88	110	49.10
Parent partner	55	24.44	42	18.75
Parent supplier	21	9.33	13	5.50
Parent customer	45	20.00	54	24.10
Intermediary	0	0.00	0	0.00
Other	3	1.33	6	2.60
Rank in organization				
Staff member	64	28.44	74	33.03
Supervisor/team leader	14	6.22	12	5.35
Manager	95	42.20	80	35.71
General manager, managing director	38	16.80	49	21.87
Group managing director, COO, CEO	4	1.77	3	1.33
Other	10	4.44	6	2.66

and its partnering organizations, followed by a main round online survey circulated to an additional 1,717 individuals across the chosen telecommunications service network. Embedded in the organizational philosophy of this telco lays the concept of partnering for value creation; and as such this telco, along with its partnering organizations, became a good sampling frame for a service network in action. The main round survey lasted for a period of 4 weeks, with a follow-up email sent to all participants after a period of 2 weeks. There were 380 valid and completed responses received, showing a response rate of 22.13%, out of which ~31, 22, and 47% of the responses were submitted by, respectively, the partnering organization, customer organizations, and the parent telecommunications organization. Data records with >25% missing data entries were deleted, as a result of which two data entries were deleted from the pilot stage data, and eight records deleted from the main round data set, leaving 77 and 372 data items, respectively. In total, <5% of the sample size was lost. Missing value analysis using expectation maximization treatment (Little & Rubin, 1987; Graham, Hofer, & Mackinnon, 1996) was used, resulting in a fully populated combined data set with 449 sample observations.

The sample demographics are listed in Table 1. The data were subsequently randomly split in equal proportion (data set 1 [DS1] and data set 2 [DS2]) to fulfil data requirements for subsequent exploratory factor analysis, confirmatory factor analysis, one-factor congeneric, and structural equation modelling (SEM) exploratory model and validation phases (Anderson & Gerbing, 1988; Gerbing & Hamilton, 1996).

### Construct development

Our research will address the *cumulative* and *incremental* effects of DCs on services innovation in a SVN, by extending a recent study of Agarwal and Selen (2009) on the use of DCs in SVNs for achieving service innovation. As such, the constructs of ORC, COL-yours and partners, CIC, and ESO were taken from Agarwal and Selen (2009). All measurement items of the above constructs are measured using a 5-point Likert scale with 1 = 'strongly disagree' and 5 = 'strongly agree'.

The measurement items were confirmed through one-factor congeneric modelling using confirmatory factor analysis for each construct, and the constructs used are summarized in Appendix A.

### Non-response and common-method bias

Non-response bias differentiates between answers given by non-respondents and respondents at a statistical level (Lambert & Harrington, 1990). In this study, we used the method as adopted by Paulraj (2002). Data were collected in two waves, with the first group comprising of 281 responses and the latter producing 99 responses. A set of 25 random variables were chosen for a *t*-test analysis, with the results indicating no significant statistical difference across the two groups (at 95% confidence interval) for the survey items tested, which means that non-response bias is not a major concern in our study.

According to Spector (1987) common-method variance is an artefact of measurement that biases results when relations are explored among constructs measured by the same method. We adopted the methods involving discriminant validity and convergent validity as a safeguard against common-method variance. Furthermore, the overarching empirical study validated the research model using a triangulation research methodology, initially with a qualitative case study method, which was underpinned by convergent interviewing; followed by quantitative research involving exploratory factor analysis, one-factor congeneric modelling with item parcelling for construct validation, followed by SEM model building and model validation, as detailed in Agarwal and Selen (2009).

### Reliability and validity

A rigorous process was used to develop and validate the survey instrument. Before data collection, content validity was supported by evidences from extant literature, executive interviews, organizational documents, and pilot tests. This was followed by a rigorous testing of reliability and validity of the constructs. Narasimhan and Jayaram's (1998) two-step method was deployed to test construct reliability, employing exploratory factor analysis to ensure unidimensionality of the scales, followed by Cronbach's  $\alpha$  (Cramer, 2003) for assessing construct reliability. Results showed the constructs used to be valid, reliable, and unidimensional. Cronbach's  $\alpha$  values for the constructs are shown in Table 2.

Next, discriminant validity and convergent validity were tested using confirmatory factor analysis (O'Leary-Kelly & Vokurka, 1998). In the model, each item is linked to its corresponding construct

TABLE 2. RELIABILITY ANALYSIS

Construct	Number of items	Cronbach's $\alpha$
Organizational relationship capital	5	0.870
Collaborative organizational learning		
a. Your organizational learning	4	0.813
b. Your partner organizational learning	3	0.897
Collaborative innovative capacity	3	0.715
Elevated service offering		
a. Strategic	5	0.828
b. Performance	4	0.876
c. Productivity	3	0.879

Note. Taken from Agarwal and Selen (2009: 449).

and the covariances among those constructs are freely estimated. A construct with either loadings of indicators of at least 0.5, a significant  $t$ -value ( $t > 2.0$ ), or both, is considered to be convergent valid (Fornell & Larcker, 1981). DS2 ( $n = 224$ ) is used to examine and validate the factor structure before its use in SEM. Our analysis showed all factor loadings to be  $>0.50$ , and all  $t$ -values to be  $>2.0$ , thereby demonstrating convergent validity. Finally, the inter-correlations between the item scales were computed and confirmed discriminant validity between all the latent variables for both data sets.

### Item parcelling

According to Kishton and Widaman (1994) item parcelling is a technique whereby parcels are constructed from summing or averaging a number of item responses from a construct that is assumed to be unidimensional. In these instances, these parcels can then be used as indicator variables of latent constructs for further SEM analysis provided they meet the Cronbach's  $\alpha$  reliability standard of values  $\geq 0.5$  (Pedazur & Schmelkin, 1991), and are unidimensional as indicated by scree plots (Cattell, 1966). After completing exploratory factor analysis, and one-factor congeneric model analysis checking for unidimensionality via scree plots, item parcelling was conducted. Item parcelling reduces the number of parameters estimated, resulting in more stable parameter estimates and proper solutions of model fit (Bandalos & Finney, 2001; Little, Cunningham, Shahar, & Widaman, 2002). Through the use of item parcelling the number of measured items was reduced. After item parcelling, ORC and CIC constructs were shown to be single-factor latent constructs, whereas COL and ESO represented higher-order constructs, each containing two to three parcelled indicator variables. The inter-correlations between the item parcelled scales were computed and also confirmed discriminant validity between all latent variables for both data sets.

## SEM MODEL ANALYSIS AND RESULTS

As stated earlier, a methodology of a split sample was used for, on the one hand, estimating the appropriate structural equation model ( $n = 225$ ), followed by a holdout sample for model validation ( $n = 224$ ). SEM estimates using AMOS 7.0 (Arbuckle, 2006) were generated, and the maximum likelihood estimation method was applied to DS1 and DS2. In SEM, there is no single test of significance that can absolutely identify a correct model based on the sample data (Holmes-Smith, Coote, & Cunningham, 2005; Shah & Goldstein, 2006). Many goodness-of-fit criteria have been established to assess acceptable model fit, and in this study the recommended fit indices as suggested by Kline (2005) were adopted.

### Research model 1: ORC as a driver of ESO, without mediation

In the first research model, ORC serves as the sole predictor variable of service innovation, operationalized as an ESO consisting of strategic, productivity, and performance dimensions. Figure 2 shows the standardized parameter estimates for Hypothesis 1a, for DS1 ( $n = 225$ ) in the initial and validated ( $n = 224$ ) study.

Above each of the rectangles the square of the variable's standardized loading is displayed; which indicates what percentage of the variance is explained. For example, the factor loading for the relationship between ORC and ESO is 0.46, with 55% of the variance explained for ESO\_Strategic, 53% for ESO\_Productivity, and 53% for ESO\_Performance (the three sub-constructs of ESO). Further, the model fit indices are all within their acceptable ranges ( $\chi^2 = 1.726$ ,  $n = 225$ ,  $df = 2$ ,  $CMIN/df = 0.863$ ,  $p = .422$ ,  $GFI = 0.996$ ,  $AGFI = 0.981$ ,  $TLI = 1.004$ ,  $CFI = 1.000$ ,  $RMR = 0.0167$ , and  $RMSEA = 0.000$ ). The standardized factor loading for the

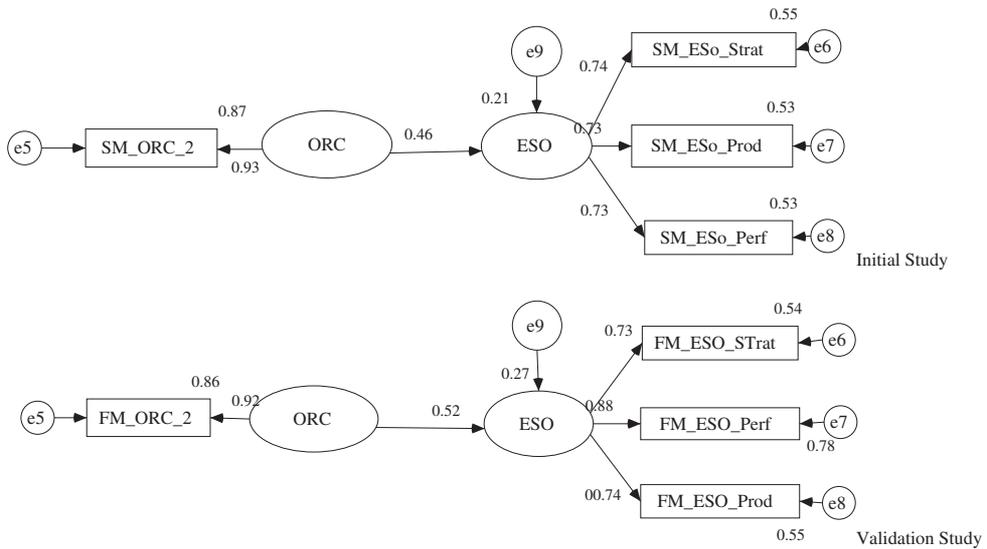


FIGURE 2. RESEARCH MODEL 1: INITIAL AND VALIDATION STUDY

ORC → ESO causal path is 0.46. This means that for a 1 standard deviation change in ORC, the ESO outcome is predicted to increase by 0.46. Further, the factor loading from ORC to ESO is statistically significant at the 0.05 level. Thus, the overall results reveal a significant relationship between the ORC and the ESO outcome, and hence Hypothesis 1a is supported. The next step was to conduct a validation study using DS2 ( $n = 224$ ), the results for which are summarized in Figure 2. Model fit indices are ( $\chi^2 = 8.608$ ,  $n = 224$ ,  $df = 2$ ,  $CMIN/df = 4.304$ ,  $p = .014$ ,  $GFI = 0.982$ ,  $AGFI = 0.912$ ,  $TLI = 0.936$ ,  $CFI = 0.979$ ,  $RMR = 0.0303$ , and  $RMSEA = 0.122$ ). The  $R^2$  value of 0.21 and 0.27, respectively, indicates that 21/27% of the variation in ESO outcome is explained by ORC for the initial and validated model analyses. Further, in the direct relationship mode between ORC and ESO, the factor loading is statistically significant at the 0.05 level for both studies. With the RMSEA slightly higher than the generally accepted value for satisfactory fit of 0.1 (Browne & Cudeck, 1989), and all the other fit statistics within range, the model fit statistics can be accepted. The results imply that collaboration with customers, suppliers, and other stakeholders is pivotal for the creation of value in the form of ESO outcomes – the premises for innovation in a service network.

Next, to start investigating the mutual, cumulative, and incremental effect of DC deployment, a more comprehensive research framework is tested, in which ORC is mediated by the DC of COL.

### Research model 2: ORC as a driver of ESO, mediated by COL

In this model, ORC serves as the predictor variable for ESO, with COL as the mediating variable. COL was earlier defined as a higher order-construct, made up of two sub-constructs: *COL-yours*, and *COL-partners*. There are benefits to each of the partners as each firm will develop enhanced set of skills and/or resources that it lacks in, and that both partner firms will stimulate rapid diffusion and deployment of new technologies and create ESOs as a result of mutual learning. The standardized parameter estimates, using the initial data set, for Hypotheses 1b and 2b are as shown in Figure 3.

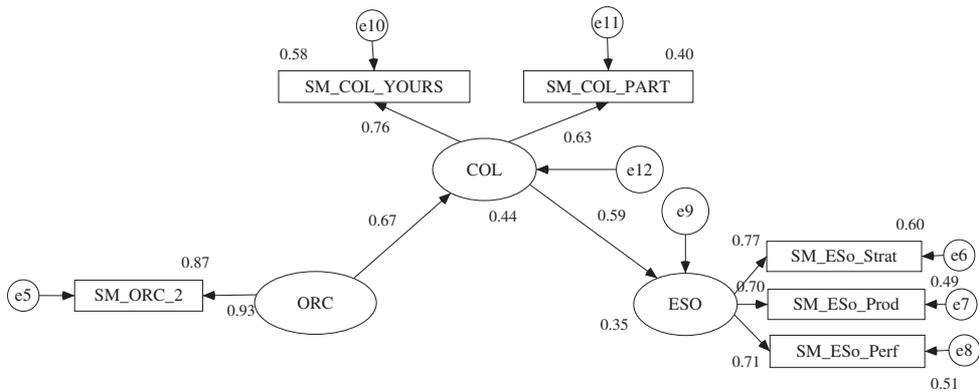


FIGURE 3. RESEARCH MODEL 2: INITIAL STUDY

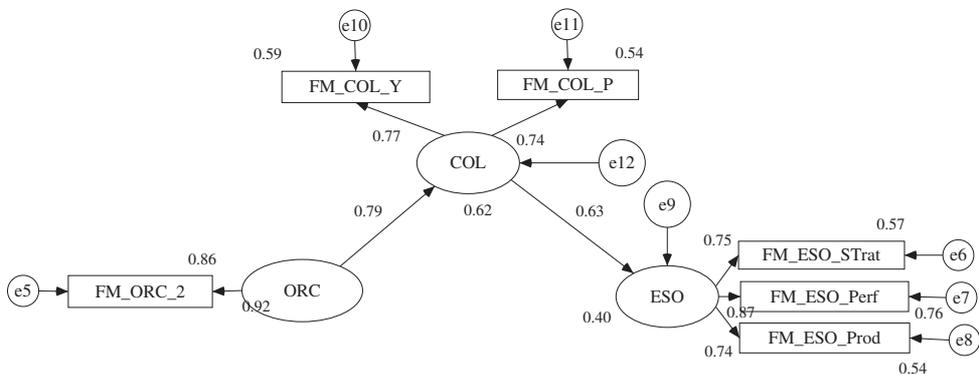


FIGURE 4. RESEARCH MODEL 2: VALIDATION STUDY

Results from the validation study using DS2 ( $n = 224$ ) yield standardized coefficients as displayed in Figure 4.

The fit indices for both the initial and validation studies are summarized in Table 3.

The standardized factor loading for the ORC  $\rightarrow$  COL and COL  $\rightarrow$  ESO causal path for the initial and validation study are 0.67 and 0.59, and 0.79 and 0.63, respectively. The  $R^2$  value of 0.35 and 0.40 indicates that 35/40% of the variation in ESO outcome is explained together by ORC and COL across the two studies. Further, the factor loading from ORC  $\rightarrow$  COL and COL  $\rightarrow$  ESO is statistically significant at the 0.05 level. Thus, the overall results reveal a significant relationship between ORC, COL, and the ESO outcome, and hence Hypotheses 1b and 2b are supported. This model demonstrates the incremental value-add in the explanatory power of ESO with the role played by COL as an additional capability of the organization.

Next, we test the most comprehensive framework in which ORC is mediated by both COL and CIC to investigate the cumulative and incremental effect of deploying all DCs considered in this study.

### Research model 3: ORC as a driver of ESO, mediated by COL and CIC

In the context of model 3, Figure 5 shows the standardized parameter estimates, using the estimation DS1 ( $n = 225$ ) for the best fit (initial) model. The factor loading for the relationship between ORC

TABLE 3. FIT INDICES SUMMARY FOR INITIAL AND VALIDATION STUDIES: RESEARCH MODEL 2

<i>Scale</i>	$\chi^2$	<i>df</i>	<i>Probability</i>	<i>CMIN/df</i>	<i>GFI</i>	<i>AGFI</i>	<i>TLI</i>	<i>CFI</i>	<i>RMSEA</i>	<i>RMR</i>	<i>CAIC</i>
Acceptable level for excellent fit			$p > .05$ , BSP => 0.05	Up to 3	>0.95	>0.95	>0.95	>0.95	<0.05	<0.05	
Acceptable level for reasonable fit			$p > .05$ , BSP $\geq$ 0.05	Up to 5	$\geq$ 0.90	$\geq$ 0.90	$\geq$ 0.90	$\geq$ 0.90	$\leq$ 0.10	$\leq$ 0.10	
Initial study	18.610	8	$p = .017$	2.326	0.973	0.929	0.944	0.970	0.077	0.0377	102.0.18
Validation study	23.789	8	$p = .002$	2.974	0.965	0.907	0.944	0.970	0.094	0.0449	107.141

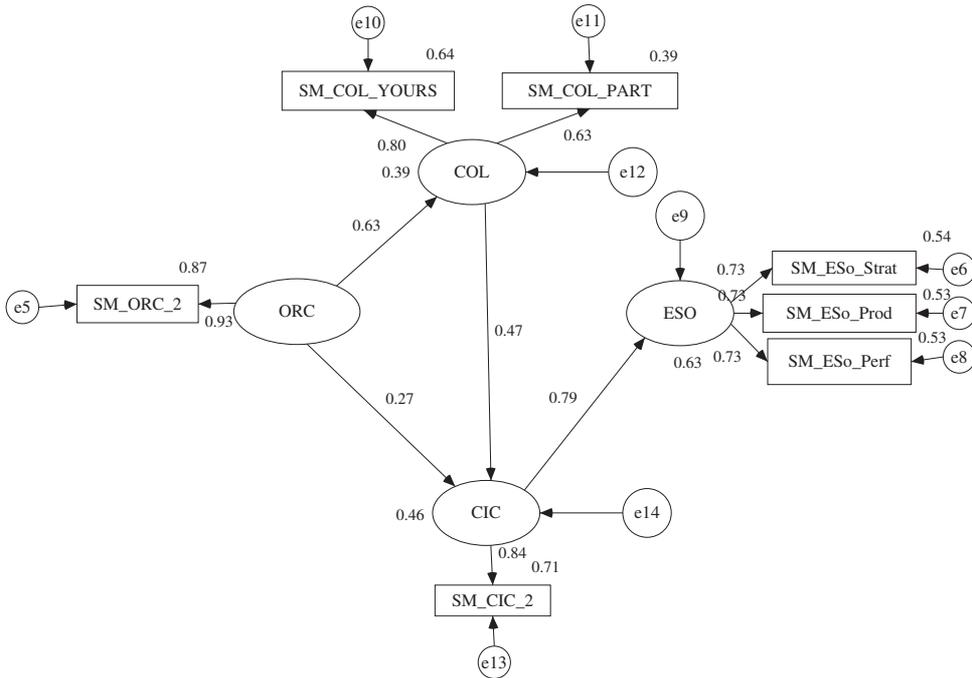


FIGURE 5. RESEARCH MODEL 3: INITIAL STUDY

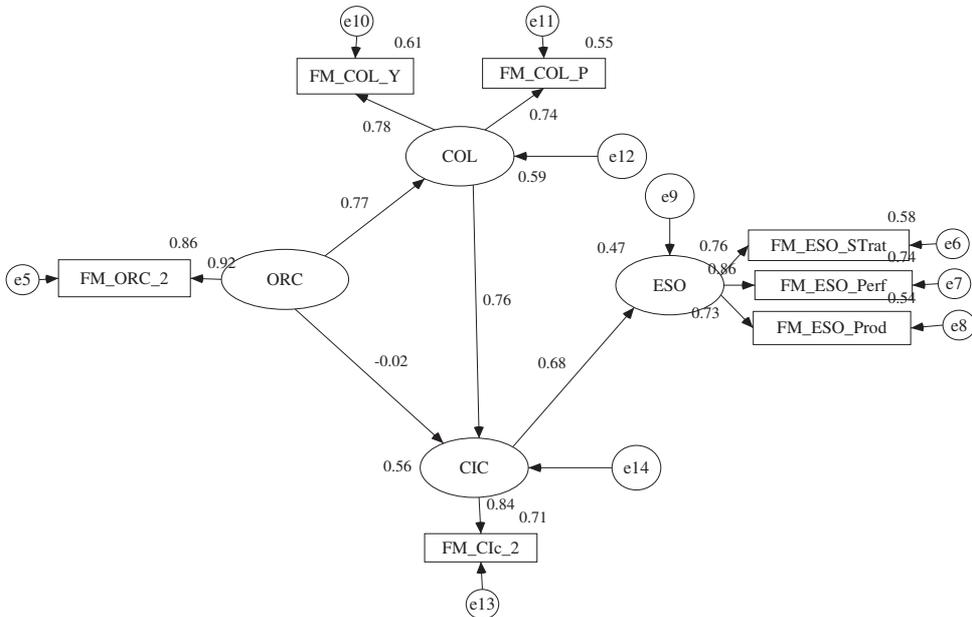


FIGURE 6. RESEARCH MODEL 3: VALIDATION STUDY

and COL is 0.63, with 64% of the variance explained for your learning and 39% of the variance explained for the partners' learning (the two sub-constructs of COL).

Results of the validation study using DS2 ( $n = 224$ ) are displayed in Figure 6. The fit indices for both the initial and validation studies are summarized in Table 4.

The factor loading for all the paths in the matching validation study were statistically significant at the 0.05 level, except for the causal path from ORC to CIC. This was in contradiction with the initial study findings. The Bollen-Stine  $p$ -value was applied to test the overall model fit, and corrected standard errors of the parameter estimates show statistically significant path coefficients (Nevitt & Hancock, 2001). Using the procedure by Cumming and Finch (2005), it concludes that Hypothesis 1c or the ORC to CIC path was not supported.

The mediation and cumulative effect of DCs of COL and CIC in explaining the incremental increase in  $R^2$  value of the dependent variable service innovation (ESO) is evident, as summarized in Table 5.

From our analysis of the three postulated research models, there is a pronounced cumulative and incremental effect of deploying additional DCs in the creation and delivery of ESO. Results of the postulated research hypotheses are summarized in Figure 7.

This research study demonstrates for organizations and managers alike, the ability to magnify and take advantage of cumulative effects of various strategic and operational DCs in delivering ESOs. The key outcome being that the concerted efforts of partners are core to innovation. In addition, managers need to understand the importance and value of co-creation, intertwined processes, and interdependencies resulting in cumulative knowledge assimilation and creation processes, in combination with the deployment of higher-order capabilities, and whether they captured innovative ideas for implementation at a later stage. Subsequently, the managerial focus needs to be centred on skill and human capital development, and values and practices underpinning workplace culture.

Next, theoretical and managerial implications from the study findings are discussed.

## THEORETICAL AND MANAGERIAL IMPLICATIONS

This research provides the magnifying and cumulative effect of different DCs, thus a method for quantification and measurement of DCs and their impact on firms' innovation outcomes. This research contributes to strategic management theory, innovation theory and DC theory by providing a framework/tool for assessing capabilities and their impact on firms competitive positioning through its DC building to enhance service innovation. In particular, this research shows that the relationship between ORC to ESO is fully mediated by the COL and CIC capabilities, congruent with several empirically supported studies that have demonstrated the key role of collaboration, learning, and innovative capacity in small firms and supply chains (de Jong, Bruins, Dolfma, & Meijaard, 2003; Douglas & Fredendall, 2004; Panayides & So, 2004; Perks, 2004; de Jong & Marsili, 2006).

Managerial implications of these research findings are profound. COL and CIC are important capabilities to be developed, fostered, and utilized. In our study, ORC leads to *learning and knowledge assimilation on both sides of the partnership (your learning and the partner's learning)*, and not just one partnering organization. This is consistent with the collective application of knowledge leading to significant improvements in services (Leiponen, 2005). Managerially, in the context of service networks, this means that *new knowledge is created through the conversion of tacit and explicit knowledge, and establishment of new connections with other partners*. Knowledge and learning is the currency for innovation, thus the effect of COL on CIC is significantly enhanced through socialization and collaboration, leading to creativity, enhancement of innovation, and competitive advantage.

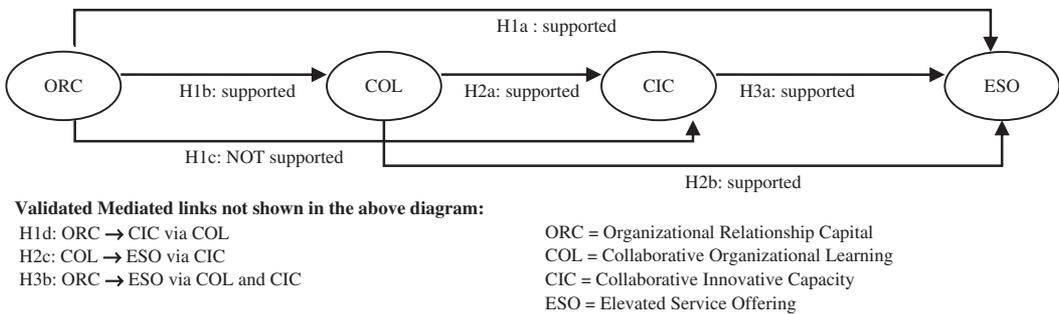
TABLE 4. FIT INDICES SUMMARY FOR INITIAL AND VALIDATION STUDIES: RESEARCH MODEL 3

Scale	$\chi^2$	df	Probability	CMIN/df	GFI	AGFI	TLI	CFI	RMSEA	RMR	CAIC
Acceptable level for excellent fit			$p > .05$ BSP = > 0.05	Up to 3	>0.95	>0.95	>0.95	>0.95	<0.05	<0.05	
Acceptable level for reasonable fit			$p \geq .05$ BSP $\geq$ 0.05	Up to 5	$\geq$ 0.90	$\geq$ 0.90	$\geq$ 0.90	$\geq$ 0.90	$\leq$ 0.10	$\leq$ 0.10	
Best fit initial study	19.473	12	$p = .078$	1.622	0.976	0.945	0.973	0.984	0.053	0.0313	122.131
Best fit validation study	29.150	12	$p = .004$ BSP = 0.104	2.429	0.965	0.918	0.951	0.972	0.080	0.0450	131.736
Matching fit validation study	41.233	12	$p < .001$ BSP = 0.010	3.427	0.951	0.885	0.917	0.953	0.105 <sup>a</sup>	0.0668	143.820

Note. <sup>a</sup>RMSEA slightly higher than the generally accepted value for satisfactory fit of 0.1 (Browne & Cudeck, 1989).

**TABLE 5. CUMULATIVE AND INCREMENTAL EFFECT OF DYNAMIC CAPABILITIES: INCREMENTAL INCREASE IN R<sup>2</sup> VALUE OF THE DEPENDENT VARIABLE ELEVATED SERVICE OFFERING**

Research model	R <sup>2</sup> value of ESO across initial and validation study	Additional higher-order dynamic capability(ies) included
Research framework 1	0.21/0.27	Organizational relationship capital
Research framework 2	0.35/0.40	Collaborative organizational learning
Research framework 3	0.63/0.47	Collaborative innovative capacity



**FIGURE 7. RESEARCH HYPOTHESES RESULTS**

Furthermore, our empirical evidence demonstrates the evolutionary process and the key role DCs of ORC, COL, and CIC collectively play in *improving service network effectiveness* through the cumulative and mutual effects of various distinct capabilities. Managerially, our empirical evidence shows this takes place *through strategic innovations, as well as operational efficiencies via productivity and performance improvements*, our notion of an ESO.

Importantly, the research findings open up pathways of how managers can better understand the use of organizational processes and capabilities involved to facilitate innovative outcomes within collaborating service organizations. While most recent studies deal with the structural aspects and nature of DCs, our research demonstrates the increasing per cent of variation in the service innovation outcome explained by the gradual deployment of learning and innovative capabilities. Through quantification of their impact, our research findings show managers that there are *distinct cumulative and incremental effects* on service innovation by fostering *collaboration, bi-directional learning, and knowledge sharing*, as well as the ability to continuously *transform and orchestrate knowledge and ideas into new products, processes, and systems*.

Henceforth, managers of service organizations need to *understand the underpinning benefits of true and effective collaboration*. Building trust internally with customers and suppliers, and engaging with them as well as collaborating with other external partners, are crucial to relationship capital building. Managers should focus on targeted skill and human capital development, and adopt practices that foster a workplace culture where orchestration of knowledge and learning is embedded in the organization's fabric. Irrespective, one could envision managerial scenarios where relationships with partners were either not established or managed effectively, with organizations held hostage by conflict management; or where not enough time or resources were invested in effective knowledge management, or existing ideas were not captured and/or potential ideas ignored. In such situations

innovation is expected to be hampered, and more interestingly, nurturing specific capabilities as discussed will yield incremental and cumulative benefits towards reaping tangible innovation benefits.

## CONCLUSIONS AND LIMITATIONS

This study illustrates that, as organizations increasingly collaborate, DCs have a profound impact on service innovation in a service network. In particular, this research highlights the cumulative and incremental effects of ORC, COL, and CIC to help create and deliver service innovation in a service network. The research has important managerial implications by demonstrating distinct cumulative and incremental effects on service innovation by fostering collaboration, bi-directional learning, and knowledge sharing, as well as the ability to continuously transform knowledge and ideas into new products, processes, and systems.

This study also has its limitation in that empirical data were collected from a single large telecommunications service provider organization, and its partnering organizations. Future research may seek to collect data from the entire telecommunications industry sector and their partnering organizations, across other service sectors, or even any other partnering organizations where collaboration is pivotal to their success, in order to generalize and validate findings within and across industries.

Building on our research findings, future research may investigate which component of the knowledge management process, that is, creation, storage, retrieval, transfer, or application, is most pertinent or influential in increasing innovative capacity or service innovation outcomes. Further, longitudinal studies should be conducted to research the dynamics over time of DCs on service innovation, as it takes time for people to attain, internalize, diffuse, adopt, and employ new knowledge to produce innovative solutions. Therefore, influences of knowledge management on individual and organizational creativity and innovation may be significantly distinguishable only after some time has elapsed. Other future research could examine the consequences of network changes, such as how different actors (be they individuals, groups, or organizations) envision and manage the evolving agential properties of SVNs to achieve desired ends. Further, DC as discussed may be further investigated in the context of different firm size or firm ownership structures – be it small and medium enterprises, non-government, government, domestically owned, or multinational; or even emerging economies versus developed economies. Added to these, it would also be interesting to research how partnering firms belonging to a SVN may benefit individually – flow-on effects of DCs affecting individual firm capability building. Furthermore, it may be worthwhile to investigate what relative proportion of innovative outcomes are attributed to which partners' capabilities, for example, the focal firm versus other partners in the service network. Another perspective worth considering could be how such service innovation process may pan out under different scenarios – for example, outsourcing, offshoring, and internationalization strategies. Finally, prior research has indicated that the culture of a host country may influence workplace cultures and relationships (Kickul, Lester, & Belgio, 2004), prompting further studies on the cross-cultural dimension of DCs in firms from different economies.

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## APPENDIX A

**TABLE A6. CONSTRUCT MEASUREMENT AND CONFIRMATORY FACTOR ANALYSIS RESULTS**

	Factor loading
<i>Dynamic Capabilities</i>	
Organizational relationship capital	
There is close, personal interaction between the partners at multiple levels	0.67
The collaboration is characterized by mutual respect between the partners at multiple levels	0.82
The collaboration is characterized by mutual trust between the partners at multiple levels	0.87
The collaboration is characterized by high reciprocity among partners	0.81
Once we establish collaborative arrangements we develop long-term relationships	0.50
Fit measures: $\chi^2 = 13.933$ , $n = 224$ , $df = 5$ , $CMIN/df = 2.386$ , $p = .016$ , $BSP = 0.121$ , $GFI = 0.976$ , $AGFI = 0.928$ , $TLI = 0.965$ , $CFI = 0.982$ , $RMR = 0.0326$ , and $RMSEA = 0.090$	
Note: ORC was a single factor construct in final configuration	
Collaborative organizational learning	
Collaborative organizational learning–yours	
Your organization has learned or acquired new or important information/knowledge from the partner including weakness, strength, gaps, and discontinuities	0.63
Your organization has learned or acquired new critical capability or skill from the partner	0.85
Your organization has enhanced its existing capabilities/skills as a result of the partnership	0.82
Working with partners increases our contextual capability and knowledge	0.58
Fit measures: $\chi^2 = 6.224$ , $n = 224$ , $df = 2$ , $CMIN/df = 3.112$ , $p = .045$ , $BSP = 0.101$ , $GFI = 0.986$ , $AGFI = 0.932$ , $TLI = 0.959$ , $CFI = 0.986$ , $RMR = 0.0296$ , and $RMSEA = 0.097$	
Collaborative organizational learning–partners	
The collaborative arrangement has helped the partner learn or acquire new critical capability or skill	0.82
The collaborative arrangement with the partners has helped the partner acquire new or important information/knowledge including weakness, strength, gaps, and discontinuities	0.89
The collaborative arrangement has helped the partner enhance their existing capabilities/skills	0.84
Fit measures: $\chi^2 = 2.009$ , $n = 224$ , $df = 2$ , $CMIN/df = 1.004$ , $p = .366$ , $GFI = 0.994$ , $AGFI = 0.982$ , $TLI = 1.000$ , $CFI = 1.000$ , $RMR = 0.0115$ , and $RMSEA = 0.004$	

TABLE A6 (Continued)

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Collaborative innovative capacity	
There is always a continuous and plentiful supply of good ideas from partners and customers	0.56
We collaboratively come up with novel and interesting ideas when solving problems	0.78
Working in collaboration breaks perceptual and cognitive sets of information promoting lateral and fresh thinking	0.72

Fit measures:  $\chi^2 = 0.217$ ,  $n = 224$ ,  $df = 1$ ,  $CMIN/df = 0.217$ ,  $p = .641$ ,  $GFI = 0.999$ ,  $AGFI = 0.996$ ,  $TLI = 1.017$ ,  $CFI = 1.000$ ,  $RMR = 0.0072$ , and  $RMSEA = 0.000$

**Service Innovation-Elevated Service Offering (ESO)**

The elevated service offering through partnership results in

Strategic ESO	
A new service offering	0.55
A new customer encounter interface	0.77
A new operating structure	0.79
A new service delivery process	0.74
An increase in the service attributes of an existing service offering	0.66

Fit measures:  $\chi^2 = 16.987$ ,  $n = 224$ ,  $df = 5$ ,  $CMIN/df = 3.394$ ,  $p = .005$ ,  $BSP = 0.121$ ,  $GFI = 0.970$ ,  $AGFI = 0.911$ ,  $TLI = 0.938$ ,  $CFI = 0.969$ ,  $RMR = 0.0366$ , and  $RMSEA = 0.104$

Operational ESO – performance	
An increase in the level of service customization	0.66
An improvement in level of customer satisfaction	0.84
An increase in level of customer retention	0.89
An increase in memorable service experience of customers	0.81

Fit measures:  $\chi^2 = 2.507$ ,  $n = 224$ ,  $df = 2$ ,  $CMIN/df = 1.253$ ,  $p = .285$ ,  $GFI = 0.994$ ,  $AGFI = 0.972$ ,  $TLI = 0.997$ ,  $CFI = 0.999$ ,  $RMR = 0.0133$ , and  $RMSEA = 0.034$

Operational ESO – productivity	
A reduction in service delivery lead times	0.83
An increase in on-time delivery of services	0.86
A reduction in customer waiting time	0.83

Fit measures:  $\chi^2 = 0.003$ ,  $n = 224$ ,  $df = 1$ ,  $CMIN/DF = 0.003$ ,  $p = .957$ ,  $GFI = 1.000$ ,  $AGFI = 1.000$ ,  $TLI = 1.009$ ,  $CFI = 1.000$ ,  $RMR = 0.0004$ , and  $RMSEA = 0.000$

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(Note: Scales comprising of final items only are reported here. Scales were initially developed using exploratory factor analysis, and confirmed using one-factor congeneric modelling using confirmatory factor analysis. Items dropped during exploratory factor analysis and confirmatory factor analysis are not reported here. Taken from Agarwal & Selen, 2009).