The role of innovativeness and supply chain agility in the Australian service industry: a dynamic capability perspective

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Abstract

Purpose – This paper aims to investigate the conditional indirect effect of innovativeness on performance via supply chain agility (SCA) in the service industry at higher and lower collaborative relationships.

Design/methodology/approach – The hypothesised model is operationalised with survey data from 245 Australian service firms collected via LinkedIn and analysed using structural equation modelling and fuzzy set qualitative comparative analysis (fsQCA).

Findings – The analysis found that SCA significantly mediates the relationship between innovativeness and performance. Further, the conditional indirect effect of innovativeness on performance via SCA was significant when the collaborative relationship was high. Results also revealed that a configuration of both innovativeness and agility better predicts performance.

Originality/value – This study is an early attempt to investigate SCA in service industries by scrutinizing SCA from an innovative point of view. While previous studies have demonstrated the role of innovativeness in enhancing a firm's performance, this study explores this link further by investigating the conditional indirect effect of innovativeness on performance via SCA at different levels of collaborative relationships.

Keywords Supply chain agility, Innovativeness, Performance, Service industry, Collaborative relationship, Conditional indirect effect

Paper type Research paper

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1. Introduction

Over a number of years, considerable attention has been paid to the concept of supply chain agility (SCA) as a linchpin for long-term profitability and competitiveness (Gligor *et al.*, 2013) and has become one of the significant features of supply chain management (SCM) (Dubey *et al.*, 2018). Associated with the speedy sense and response capabilities (Calatayud *et al.*, 2019), SCA has become essential as a response to the ever-growing global market requirements for enterprise competitiveness (Braunscheidel and Suresh, 2009). Research on SCA becomes more crucial than ever, especially in quickly responding to COVID-19 and business uncertainties. SCA is an essential capability to minimize the disruption caused by COVID-19 and help balance the volatility in supply and demand through its sense and response capabilities. This is more prominent in the service sector which has witnessed the most substantial pandemic impact (OECD, 2020) [1]. In essence, to manage the quickly changing business environment due to highly unpredictable disruptive events such as COVID-19, firms and their SC members need to adopt innovative solutions and a rapid response mechanism to preserve performance and gain competitive advantage. Extant literature defined such capabilities as the dynamic capability (DC) of firms and their SCs (Ali *et al.*, 2022; Chowdhury and Quaddus, 2017).

Firms' competitive environment has changed over the last decades due to globalisation therefore it is vital for organisations to look for strategies that provide them with sustainable competitive advantages (Ruvio *et al.*, 2014; Salunke *et al.*, 2019). Among such factors is the ability to innovate. This is widely recognized as the most critical factor in helping the company to stay ahead of its competitors with more chance to survive in the fast-changing environment and the business uncertainty (Calantone *et al.*, 2002; Yamin *et al.*, 1997). The history of business is littered with the graveyards of businesses that were destroyed due to the lack of innovation and the failure to adapt to their changing environment (Chandy and Tellis, 2000). Golgeci and Ponomarov (2013) envisaged innovativeness as a key DC that could be leveraged to succeed in the ever-changing dynamic business environment. Modern organisations have attempted to stimulate innovativeness internally by inspiring employees, teams and executives to exploit behaviours, products/services and practices stemming from the absorptive capacity concept (Vega-Jurado *et al.*, 2008).

Since the source of innovativeness overflows a firm's borders to include suppliers, customers, competitors and consultants (Chang *et al.*, 2012), an interplay between SCA and innovativeness can be established. Basing our argument on the DCV, we theorize and test the criticality of innovativeness for SCA using widely accepted dimensions of innovativeness. The core rationale for proposing firm innovativeness as a driver of SCA lies in its capacity for enabling firms to renew and reconfigure their internal routines and external offerings, thereby preserving the value of their resource base in times of increasing environmental dynamism (Eisenhardt and Martin, 2000) and this is exactly where SCA's main theme resides. By exploring innovativeness as an enabler of SCA, not only will this research address Flint *et al.*'s (2014) call on how to achieve agility through innovativeness but will also expand the SCA's enablers body of literature. We present the idea of SCA representing a DC able to positively influence the performance.

Given that innovativeness as a DC enhances the performance of organizations, the mechanism of SCA in enhancing innovativeness-led performance in service supply chain is lacking. This study sheds new light on the indirect impact of innovativeness on performance based on surveys of Australian service firms. To ensure that service firms achieve better gains, they are not only required to promote innovativeness but also to develop agility with their SC members (Al Humdan *et al.*, 2020). Managers embrace agile SCs due to their efficacy in capitalising profits (Wu *et al.*, 2017). While existing studies have separately investigated the influence of innovativeness (Ryu and Lee, 2018; Salunke *et al.*, 2019; Weerawardena *et al.*, 2019) and SCA (Blome *et al.*, 2013; Braunscheidel and

Suresh, 2009; Calatayud *et al.*, 2019; Gligor and Holcomb, 2012) on firm's performance, this study aims to empirically test the indirect effect of innovativeness on performance via SCA. This potential association has remained hidden thus far. Notably, existing studies investigate the net independent effect of SCA and innovativeness on firm's performance. Interestingly, innovativeness and SCA can have a combined effect on performance. Assessing the net independent effect while the causal interactions are configurational can be misleading, which may lead to incorrect decision-making (Olya and Akhshik, 2019). Therefore, examining the combined effect of innovativeness and SCA on performance is salient.

In this study, we further investigate the boundary conditions that influence the impact of innovativeness on performance via SCA. In particular, we argue that a collaborative relationship may influence this relationship. Our core argument is that collaborative relationship creates a socialization environment for firms to maximize greater benefits from innovativeness. The exchange relationship between and within firms in its formal and informal settings (Chen *et al.*, 2013), leads to relational capital and thereby is crucial to competitive success (Cousins *et al.*, 2006). Since SCA aligns the network and its operations to face the market turbulence (Ismail and Sharifi, 2006), an information-enriched supply chain is achieved (Mason-Jones and Towill, 1999), leading to informational alignment and reduction in uncertainty (Tan *et al.*, 2010). We also argue that such collaboration may have a detrimental effect on the link between innovativeness and performance. Empirical studies which investigate the effect of a collaborative relationship on the link between innovativeness, SCA and performance are notably absent. We are addressing this gap by investigating the conditional indirect effects of innovativeness on performance via SCA at different levels of collaborative relationship.

While SCA has gained momentum in operations management and SCM literature, very little intellectual attention has been paid in a broader service context despite its importance (Boon-itt *et al.*, 2017). Transferring insights gained from the manufacturing sector to the service context might not be particularly appropriate due to the inherent differences in services (Wang *et al.*, 2015). The simultaneity characteristic of most services makes its competitive advantage duplicable which necessitates constant innovative offerings (Weerawardena *et al.*, 2019). Therefore, it seems to some extent surprising that such an essential sector has been short of empirical investigation in the SCA literature. By studying SCA within the service sector, this study responds to various recent calls by authors who recommended conducting SCA research in the service settings (e.g. Dubey *et al.*, 2018; Kim and Chai, 2017; Shi *et al.*, 2016, 2017) that will enrich practitioners with new insights.

The study's contribution is fourfold. First, our research contributes to the empirical aspect of the DCV by validating a multidisciplinary state-of-the-art conceptual model. Second, the study investigates the mediation effect of SCA in the relationship between innovativeness and performance. This has not been empirically tested in the prior literature. Third, this study examines the conditional indirect effect of innovativeness on performance via SCA at different levels of collaborative relationship. Finally, our study is pioneering in focussing the complex dynamism of innovativeness, agility and collaborative relationships and their combined effect on the performance in the service sector. As almost all our understanding of SCA has been derived from studies of manufacturing (Patel and Sambasivan, 2022), the growth of services raises questions about the adequacy of our understanding of SCA in service dominated economies, particularly as SCA is regarded as fundamental to the competitiveness of advanced economies. This study has several managerial implications that are explained in the discussion section. The remaining sections present the literature review and hypotheses development, followed by methodology and the results. The article concludes with discussion of the results and their implications.

2. Literature review

2.1 Dynamic capability view (DCV)

As part of enhancing the understanding of how firms are able to use their resources to develop competitive advantage in fast-changing environments, Teece *et al.* (1997) introduced the concept of dynamic capability view (DCV) as complementary to a resource-based view (RBV). The DCV logic is that an organisation operating in a dynamic environment and facing uncertainties in the SC needs to develop capabilities to manage these uncertainties (Teece, 2007).

DCs incorporate elements of sensing and seizing opportunities (Teece, 2000), learning new information and improving effectiveness (Zollo and Winter, 2002) and reconfiguration of resources and processes (Zahra *et al.*, 2006). We follow the model of Teece (2007) and distinguish DCs as having three categories that are relevant for sustaining competitive advantage: the capacity to sense and shape opportunities and threats; the capacity to seize those opportunities; and the capacity to maintain competitiveness through enhancing and reconfiguring intangible and tangible resources. According to the DCV, innovativeness is expected to be indirectly related to performance outcomes by enabling firms to reconfigure their operational processes or capabilities which, in turn, generate value (Zahra *et al.*, 2006), However, the DCV has been criticised for its lack of "empirical grounding" (Eisenhardt and Martin, 2000). In this respect, our research contributes significantly by developing and empirically testing a conceptual model that spans many disciplines (i.e. supply chain, innovation and strategy). We argue that a firm's SCs need to develop DCs to mitigate vulnerabilities in an uncertain environment, which necessitates agile capabilities to survive in the long run employing its sense and response capabilities. The DCV is relevant to the service sector because of the complicated characteristics embedded in services (Den Hertog *et al.*, 2010).

2.2 Innovativeness

Innovativeness is perceived in contemporary literature as a desirable aspect of firms because it energises and augments the probability of survival and continued success (Crossan and Apaydin, 2010). Innovativeness is a multifaceted construct encompassing the adoption of an idea or behaviour, whether pertaining to a device, system, process, policy, program, product or service that is new to the adopting organisation. Innovativeness indicates a proactive willingness to abandon old habits and try never-tested ideas (Golgeci and Ponomarov, 2013).

In the last few decades, there has been an unprecedented growth of service industries in advanced economies. In parallel, there has been a great deal of services management and innovativeness studies that attempted to articulate the emergence of innovativeness in services and explain the difficulty in analysing innovativeness in service industries (e.g. Drejer, 2004; Gallouj and Djellal, 2011). These scholars agree that the "fuzzy" and "curious" nature of service output makes it difficult to measure or assess its innovativeness. They further illustrate that lack of protection possibilities due to its intangible character of service, and existing innovativeness theories that are developed around technological innovation in manufacturing activities, might act as a barrier to investigating innovativeness in the service setting. However, these scholars acknowledge the importance of innovativeness in the service sector. They argue that even where innovation does occur radically in service sector, it does not follow a technological imperative, but rather technology is a vehicle to enhance the process.

This study is guided by Damanpour's (1991, p. 556) definition of innovativeness: "the generation, development and implementation of new ideas or behaviours. Innovativeness can be a new product or service, a new process, a new structure or administrative system, or a new plan or program on organisational members." This view of innovativeness reflects the

development in services, products and systems through interactions between a focal firm and SC member. According to this definition, innovativeness reflects the development in services, products and systems through interactions between the focal firm and its SC member. Three types of innovativeness identified in this study are service, process and administrative innovativeness. Service innovativeness is the firm's new service offering beyond its usual services; process innovativeness is adopting new initiatives into a firm's operations system that could result in an improved SC; while administrative innovativeness refers to changes in organisational structure including the authority, structuring of tasks, recruiting of personnel and allocating of resources and rewards (Damanpour *et al.*, 2009).

At this point, it is critical to recognize the distinction between innovativeness as a process which is the focus of this research and innovation as an output which is the volume of the firm's innovations as measured by patent counts or overall originality and novelty. In this research, innovativeness at the firm level in the context of SCM is postulated. In particular, this manuscript views innovativeness as an ability and process-oriented not as an output (Gopalakrishnan and Damanpour, 1997; Helkkula *et al.*, 2018).

2.3 Supply chain agility

Being attentive and responsive to customers is a crucial requirement for any industry. Further, the shift in competition from the firm level to the SC (e.g. Christopher and Towill, 2001) has triggered the need to find a smart SC that emphasises speedy delivery and accelerated response times. Over a number of years, considerable attention has been paid to the concept of SCA as a linchpin for the long-term profitability and competitiveness of companies (e.g. Gligor *et al.*, 2013; Ismail and Sharifi, 2006) and has become one of the significant features of SCM (Dubey *et al.*, 2018). Associated with the sense and response capabilities (Calatayud *et al.*, 2019; Li *et al.*, 2008, 2009), SCA has become a *sine qua non* as a response to the ever-increasing global market requirements for firm competitiveness (Braunscheidel and Suresh, 2009; Calatayud *et al.*, 2019). Lusch (2011) conceptualized SCs as service ecosystems of *sensing* and *responding* networks where the core of SCA lies. Additionally, the author stressed the importance of speed of learning and implementation that coincides with the essence of SCA.

There has also been research on several facets within service SCA. Yet, discussion of SCA within the service context has been poorly researched. It is thus hoped that this study will add value to the current literature of SCA. In high velocity markets and uncertainty context such as the service sector, agility, through its swift sense and response capabilities, is ever needed.

2.4 Collaborative relationship

A collaborative relationship seeks advantages through resources spilling over firms' boundaries that entail developing and sustaining relational capabilities driven by long-term relationships built on mutual trust and information sharing (Dyer and Singh, 1998). As a result, its competitive advantage may be based on interfirm relations, or more precisely, on resources that are deeply embedded in interfirm cooperation (McEvily and Zaheer, 1999). Nesheim (2001) argued that the critical resources of a firm may be developed and strengthened through external transactions. Consequently, the need for additional resources drives companies to seek alliances with other organisations (Eisenhardt and Schoonhoven, 1996). In other words, the rationale for alliances is the value-creation potential of firm resources that are pooled (Das and Teng, 1998). For example, it has become a practice for firms to obtain needed resources by sharing them through an interfirm arrangement with their current owner, allowing both firms to perform activities that neither could perform alone (Hamel, 1991). Firms that combine resources in unique ways may be able to outperform firms that are unable to do so (Dyer and Singh, 1998).

Therefore, firms increasingly engage and invest in developing and maintaining collaborative interfirm relationships with upstream and downstream members (Braunscheidel and Suresh, 2009). Stank *et al.* (2001) argued that external collaboration increases internal collaboration which improves the firm's service performance. In the service settings, Bhappu and Schultze (2006) envisage relational performance as those firms who proactively seek to understand customers' needs and maintain relations with customers proactively and reactively when providing the exact service requested. Relations will be strengthened between all members of the supply chain including customers. Flint *et al.* (2014) confirmed the importance of network actors acting quickly being resource integrators. Resource integration is central to structuring service ecosystems (Vargo and Akaka, 2012).

2.5 Services and the supply chain

In the modern world, most employment and wealth in developed countries is derived from services (Wang *et al.*, 2015). According to the Australian Bureau of Statistics (ABS, 2018), the service sector in Australia constitutes an important segment of the total business community and represents 70% of Australia's GDP and employs four out of every five Australians, confirming its significance in research. Because of its importance, there is a necessity for extending the sectoral coverage of SCA research to include the service sector.

The service offerings and delivery involve processes enhanced by support amenities, facilitating information and implicit services (Roth and Menor, 2003). In service supply chains, human labour forms a significant component of the value delivery process (Zhou *et al.*, 2009). Also, the variation and uncertainties of outputs are higher because of the human involvement (Ellram *et al.*, 2004; Bitner *et al.*, 1997). In addition, services themselves cannot be inventoried as the focus of efficiency in service supply chains is on management of capacity, flexibility of resources, information flows, service performance and cash flow management among others (Boon-itt *et al.*, 2017; Ellram *et al.*, 2004). The service sector is unique with its own set of defining factors, characteristics and measurements (Brandon-Jones *et al.*, 2016). Companies in this sector are, therefore, attempting to find ways to improve their efficiency, flexibility, responsiveness and relationship with other members in the chain and in turn increase their competitiveness by changing their operation strategy, methods and technologies that include the implementation of SCM approaches.

3. Conceptual model and hypotheses

3.1 Innovativeness and performance

It has been widely acknowledged that innovativeness is a key source for achieving a competitive edge for all firms (Yu *et al.*, 2019) because it is strongly linked to creating market value (Gunday *et al.*, 2011), responding to uncertainty (Lee, 2002) and surviving turbulent markets (Marshall, 1997). Authors have generally agreed that such impact of innovativeness on performance is also prominent in the service sector (Helkkula *et al.*, 2018; Ryu and Lee, 2018; Salunke *et al.*, 2019; Weerawardena *et al.*, 2019), where customers often participate in the innovation process (O'Cass and Wetzels, 2018).

As turbulent environments shrink the product life cycle, innovativeness provides an effective capability to respond to such dynamic markets (Teece *et al.*, 1997). Innovation represents changes of the way things are done (Piening and Salge, 2015). This change process is prominent in the service sector due to the ease of imitation because services are co-created and co-designed with customers and other partners (Ryu and Lee, 2018; Weerawardena *et al.*, 2019). In order to gain and sustain competitive benefits and improve performance, firms need to develop an environment of continuous change and innovation (Yamin *et al.*, 1997).

Panayides and Lun (2009) suggested that openness to novel ideas that endorse administrative efficiency and adoption of fresh technologies in the SC could lead to improvements in performance. Innovativeness that encompasses change or adoption of new processes, business models and services creates strong interactions between a firm and its business partners and quickly enhances knowledge sharing (Gunday *et al.*, 2011; Yu *et al.*, 2019). Innovativeness represents the ability to reconfigure organisational processes mainly through continual technological innovation, improved operation and distribution processes, improved access to resources and implementation of cost-reduction operations (Piening and Salge, 2015). The result will be a higher value for the customer in terms of cheaper, faster, or more flexible products and services. Therefore, we hypothesise that

H1. Innovativeness positively influences performance in the service industry.

3.2 Mediating role of SCA

Innovativeness plays an important role in augmenting performance and the link between innovativeness and firm performance is well established (Calantone *et al.*, 2002; Damanpour *et al.*, 2009). However, innovativeness may not necessarily create outcomes *per se*.

We argue that merely being open to new services and processes will not boost revenues or achieve operational excellence. The firm must take action; its attitude towards innovativeness must result in sensing and responding measures designed to enhance performance. As SCA is always associated with speed (Dubey *et al.*, 2018) to represent the accelerated pace of market changes, and since innovativeness is a rapid adaptive process, we consider SCA as being a critical proximate outcome of innovativeness. That is, through SCA, innovative firms take shape by swiftly signaling customers' demands, allowing them to extend customers' value and alter their competitive posture. The real potential value of developing innovative services, processes and business models, therefore, manifest in the agility of the firm's SC. Innovativeness has a positive effect on firm performance measures, but this effect is mediated by SCA. We thus hypothesise:

H2. SCA mediates the relationship between innovativeness and performance in the service industry.

3.3 Conditional and moderating effect of collaborative relationship

Information integration among SC partners not only enables the performance of SCA in developing relational and operational aspects, but also possesses the ability to improve the firm's profitability (Wu *et al.*, 2017). While we argue that SCA is acting as an effective mechanism to reap better benefits of innovativeness, we extend this line of argument considering the boundary conditions that affect this link. As service firms are currently facing highly turbulent environments, with strong doses of dynamism, complexity and uncertainty (Salunke *et al.*, 2019), we argue that collaborative relationships may strengthen the indirect impact of innovativeness on performance.

Because innovativeness represents a close relationship between business partners with a high level of shared knowledge (Roy *et al.*, 2004), such relationship between these members can generate tension due to their diverse visions and approaches (Macchion *et al.*, 2020) and can increase complexity. Prior studies have suggested co-created services require the active involvement of both the supplier and the customer (Grönroos, 2011). For instance, Theoharakis *et al.* (2009) demonstrated that partnering capabilities improved organizational innovativeness, improving customer performance and, subsequently, the firm's financial performance.

These relational initiations can be represented by operational collaboration and the willingness to share information and trust (Stank *et al.*, 2001). This relational factor is

a driving force in satisfaction and performance for all SC members (Cao and Zhang, 2011) that will engender trust, commitment and satisfaction at the firm level because such investment in relationships and trust will enhance visibility and accelerate responses and might lead to superior relational benefits (Wieland and Wallenburg, 2013). Yang (2014) advocated that such relational outcomes may increase trust, satisfaction and cooperation and decrease any opportunistic behaviour and conflict. Collaboration helps firms tailor service offerings to the specific requirements of customers of choice by identifying their long-term requirements, expectations and preferences.

In short, collaborative relationship decreases the efforts required to liaise partners' innovativeness and performance, this eventually increases the indirect effect of innovativeness and performance. Based on these arguments, we hypothesise that

H3. In the service industry, the conditional indirect effect of innovativeness on performance through agility is high at higher level of collaborative relationship and collaborative relationship moderates the mediation effect (indirect effect) of SCA between innovativeness and performance.

Relying on the hypothesised relationships, a conceptual model has been developed which is presented in Figure 1.

4. Research methods

The population of interest for this research is the Australian services sector. The sample frame of this study is service organisations across multiple industries in all Australian territories. It is represented through 2,150 firms. The unit of analysis is identified as *the focal firm in a service-based supply chain*. The questionnaire was directed at the firm's senior and operational executives (C-level managers). This ensures the responses provided were from people who possess extensive knowledge of firm innovativeness and SCA and experience with strategic aspects of firm performance. Respondents were recruited from distribution, finance, insurance, communication, property and business, education, research and health and community services, amongst others. Ninety-two percent of participants have more than ten years' work experience, with 63.6% of respondents having more than 20 years' work experience. This is a fair indication of utilizing qualified participants in the current study as this indicates that the respondents will have sufficient knowledge to answer the survey questions meaningfully. Eighty-one percent of companies have been established for more than five years, and, roughly 50% of companies have been set up for more than twenty years.

An online self-administered survey was used to collect data. Social media networks (SMNs) were employed as a source of data. SMNs can serve as a means to find relevant

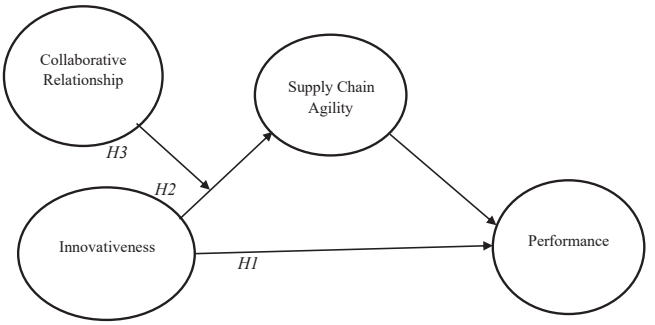

Figure 1.
Conceptual framework

informants and convince them to commit to answering the questionnaire (Mirabeau *et al.*, 2013). While pinpointing the problems associated with business surveys in findings and collecting substantial quantities of empirical data from hard-to-reach population, Gregori and Baltar (2013) made it clear that recruiting from SMNs is legitimate and valid, especially as most professionals are familiar with such technology. This study utilized LinkedIn which is principally relevant to this study because it is the most prominent social networking in the business area (Utz, 2016). Using LinkedIn features, the author started building first degree connections with the respondents requested using inclusion/exclusion criteria in line with the research objectives. Terms such as CEO, GM, MD, CEO, SC manager were entered, and the search was also limited to those industries belonging to the service sector. In order to increase the response rate, a customised message that included a link to the survey was sent to respondents in all Australian areas and different firm sizes which increased the representativeness. Creating this link was through subscription to a web-based survey host application (SurveyMonkey), Based on a sample size of 2,150 firms, 459 valid responses were collected, 245 of which were useable cases, yielding an overall response rate of 11.4%, which is accepted within operations management research (Flynn *et al.*, 1990).

This study adopted a variety of multi-item scales. All the scales were obtained from the literature review and developed to fit the research purpose and context. Six items of SCA were selected that make up the sense S and response R capabilities and have been directly adopted from Li *et al.* (2009). The dimensions of firm innovativeness (service innovation (SI), process innovation (PI), administrative innovation (AI)) were selected based on the seminal work of OECD (2005) and Gunday *et al.* (2011) Nine items were selected to measure operational performance covering flexibility, quality and dependability and were adapted from various studies (Flynn *et al.*, 2010; Prajogo *et al.*, 2012). Financial performance was measured using a three-item scale derived from Calantone *et al.* (2002). All items were measured using a 5-point Likert Scale. A panel of experts from the service sector and academia reviewed the survey questionnaire, after which a pilot and trial run of the questionnaire was carried out.

Proactive attempts were undertaken to minimise common method bias in this study, including assuring informants' anonymity, constructing effective and simple questions and optimising survey layout. Also, the wordings of the survey items were refined to improve their clarity by using expert judgement and *q*-sort techniques, resulting in tentative item reliability and item validity (Churchill, 1979). Statistically, two different statistical analyses were also performed in this regard: Harman's single-factor test (Podsakoff *et al.*, 2003) and full collinearity assessment (Kock, 2015). Both tests' results indicated that CMB is unlikely to influence the interpretation of the results of the study.

A sequential approach that simultaneously utilizes a traditional regression-based quantitative approach (e.g. PLS-SEM) to examine the net effect of innovativeness, SCA and collaborative relationship on performance and a configurational analysis using fsQCA to assess the combined effect (Vis, 2012) were used in this research. The sequential approach allows the examination of the relationships between the exogenous and endogenous variables and facilitates the development of a comprehensive assessment of how a combination of various causal variables can produce a particular outcome (Roy *et al.*, 2018). To complement the results of our regression-based study and to analyse combined and interactive effects of various antecedents on the outcomes, we adopted configurational analysis using fsQCA as configurational analysis has been found to be prudent to allow the managers to simulate various combinations of causal conditions for the outcome (Fiss, 2011). The results of the fsQCA are assessed based on the solution consistency and the solution coverage (Ragin, 2018). A configuration can be of higher consistency but with lower coverage or vice versa. Therefore, a suitable configuration is the combination of both high consistency ($\geq$0.80) and high coverage ($\geq$0.50) (Ragin, 2018).

5. Data analysis

Partial least squares (PLS) were employed for testing the measurement properties. Because the sample size of the present study was 245 and the study included a complex predictive model, PLS was deemed to be more appropriate than other statistical methods for this study (Hair *et al.*, 2011). We used the Hayes PROCESS to test the hypotheses of the research model. As this research includes hypotheses relating to indirect effect and conditional indirect effect SPSS PROCESS is highly suitable (Chowdhury *et al.*, 2022). Latent variable scores of different constructs, derived from PLS-SEM, were used in the SPSS PROCESS enabled regression models. We used nonparametric bootstrapping (Efron and Tibshirani, 1994) to obtain the standard errors of these estimates. We evaluated the models by analysing the *t*-value of each path coefficient, the bootstrap results of conditional effect at 95% confidence intervals (Hayes, 2013) and the explanatory power of the models.

5.1 Measurement model assessment

We evaluated the measurement model using psychometric properties such as factor loadings and corresponding *t*-values, average variance extracted (AVE), composite reliabilities and construct correlations. All item loadings corresponding to the constructs are greater than 0.7 and significant at $p < 0.01$ except for COL2, OP1, AInv5, PInv4, SCA1 (see Table 1). Following Hair *et al.*'s recommendations (2011), we dropped these four low-loaded items (loading < 0.7) from the measurement model. The AVE and CRs of all constructs exceeded the minimum thresholds of 0.5 and 0.7, respectively (Hair *et al.*, 2011; Henseler *et al.*, 2009).

The construct correlations in Table 2, show that the square root of AVE is higher than the off-diagonal components presented both across the row and down the column (Fornell and Larcker, 1981). In addition, the heterotrait-monotrait ratio (HTMT), which is shown in Table 3, is lower than 0.85 (Henseler *et al.*, 2015). Both of these approaches support the discriminant validity of our measurement model.

5.2 Hypothesis testing

As noted previously, we used SPSS PROCESS (Hayes, 2013) enabled regression analysis to test the hypotheses. In relation to H1, we found a positive and significant relationship between innovativeness and performance (see Table 4 Model 1). Further, the interaction effect of collaborative relationships COL and innovativeness on performance was also positive and significant (see Table 4 Model 3). Therefore, the individual effect of innovativeness as well as the combined effect of innovativeness and COL positively influences performance in the service industry.

In relation to H2, the mediating role of SCA in the relationship between innovativeness and performance, we found that the indirect effect between innovativeness and performance via SCA was positive and significant ($\beta = 0.1579$, LLCI = 0.0772, ULCI = 0.2463) (see Table 4 Model 4). Therefore, SCA significantly mediates the relationship between service innovativeness and performance. From Model 3 we found that the effect of the collaborative relationship on SCA is positive and significant and the interaction effect of innovativeness and collaboration (INN × COL) on SCA was positive and significant ($\beta = 0.3978$, $t = 12.6406$). Therefore, a collaborative relationship positively moderates the link between innovativeness and SCA.

Referring to H3, we found that the conditional indirect effect of innovativeness on performance via SCA deteriorated when collaborative relationships were low (the indirect effect = 0.1544 at LLCI = 0.0737 and ULCI = 0.2488). However, the conditional indirect effect was significant when the collaborative relationship was high (the indirect effect was = 0.1005 at LLCL = 0.0465, ULCL = 0.164 (see Model 5 in Table 4)).

Dimensions	Sub-dimensions	Variables	L	CR	AVE
Performance	Operational performance	OP1- Offering consistent services	0.494	0.893	0.520
		OP2-Uncovering discrepancies easily	0.711		
		OP3- Maintaining effective quality systems	0.760		
		OP4- The firm's effective systems/ methods	0.738		
		OP5- Supplier's ability/Speed	0.718		
		OP6- Adherence to deadlines	0.713		
		OP7- Offering a large degree of service variety	0.786		
		OP8- Changing operation volume quickly	0.718		
		OP9- Adjusting to market change quickly	0.786		
	Financial performance	FP1- Return on asset (ROA)	0.882	0.918	0.788
		FP2- Overall profitability	0.880		
		FP3- Return on investment (ROI)	0.901		
Supply chain agility		SCA1s- Detecting strategic opportunities/challenges	0.624	0.904	0.612
		SCA2- Detecting changes in supply/ demand	0.783		
		SCA3- detecting changes in supply chain's daily execution	0.708		
		SCA4-Responding to strategic opportunities/challenges in a flexible manner	0.834		
		SCA5-Responding to changes in supply/ demand in a flexible manner	0.839		
		SCA6- Responding to changes in daily supply chain execution in a flexible manner	0.798		
Firm innovativeness	Service innovation	SInv1- Replacing obsolete services	0.824	0.877	0.704
		SInv2- Increasing the range of services	0.841		
		SInv3- Reducing the time required to develop a new product	0.851		
	Process innovation	PInv1-Managing a portfolio of interrelated technologies	0.783	0.843	0.579
		PInv2- Mastering the basic and key technologies	0.864		
		PInv3-Possesssing knowledge on the best processes and systems	0.804		
		PInv4-Developing programs to reduce operational costs	0.556		
	Administrative innovation	AInv1-Exploiting best practices	0.747	0.813	0.528
		AInv2- Implementing practices for employees' development	0.740		
		AInv3- Adopting decentralization	0.789		
		AInv4-Using inter-functional working groups	0.799		
		AInv5- Utilizing flexible job responsibilities	0.631		

(*continued*)

Table 1. Psychometric properties

Dimensions	Sub-dimensions	Variables	L	CR	AVE
Collaborative relationship		COL1- Use of informal information sharing with suppliers and customers is crucial	0.704	0.896	0.564
		COL2- Lack of trust among supply chain members prevents it from achieving the full potential of supply chain management	0.330		
		COL3- Processes and/or procedures are slightly customized to deal effectively with key supply chain members	0.887		

Table 1.

Note(s): Significant *$p < 0.05$; **$p < 0.01$; ***$p < 0.005$ L-Loadings

	AInv	COL	FP	INN	OP	PER	PInv	SCA	SInv
AInv	0.726								
COL	−0.343	0.800							
FP	0.234	−0.234	0.888						
INN	0.764	−0.457	0.342	0.631					
OP	0.515	−0.375	0.432	0.656	0.721				
PER	0.505	−0.382	0.686	0.650	0.950	0.648			
PInv	0.527	−0.378	0.336	0.882	0.556	0.566	0.835		
SCA	0.434	−0.502	0.322	0.582	0.568	0.565	0.492	0.782	
SInv	0.419	−0.389	0.281	0.838	0.542	0.531	0.684	0.516	0.839
AVE	0.528	0.641	0.788	0.398	0.520	0.420	0.697	0.612	0.704
Cronbach's	0.704	0.460	0.866	0.858	0.867	0.872	0.781	0.872	0.790
CR	0.817	0.778	0.918	0.885	0.896	0.895	0.873	0.904	0.877
rho_A	0.714	0.527	0.868	0.874	0.870	0.879	0.784	0.877	0.791

Table 2.
Measurement model assessment

AInv	AInv	COL	FP	INN	OP	PER	PInv	SCA	SInv
COL	0.573								
FP	0.285	0.352							
INN	1.024	0.719	0.385						
OP	0.641	0.581	0.495	0.759					
PER	0.630	0.580	0.781	0.749	1.088				
PInv	0.687	0.604	0.405	1.036	0.676	0.685			
SCA	0.528	0.757	0.368	0.659	0.652	0.641	0.592		
SInv	0.546	0.642	0.337	0.826	0.655	0.635	0.839	0.619	

Table 3.
Heterotrait-monotrait ratio (HTMT)

5.3 fsQCA based analysis

After testing the net effect of the constructs using regression based statistic, we tested the combined effect of the constructs on firm performance using fsQCA. For fsQCA analysis, we ran multiple models. At first, we ran a model based on the outcome variable overall performance. However, to analyse which causal conditions are suitable for predicting specific areas of firm performance (e.g. operational performance or financial performance) we ran two other models. To conduct fsQCA, first, we conducted calibration of crisp values of the data to

Table 4. Result of hypothesis testing

	Model 1 DV = P	Model 2 DV = P	Model 3 DV = SCA	Model 4 DV = P	Model 5 DV = P
Innovativeness	β = 0.652 t = 13.420		β = 0.6356 t = 11.7696	β = 0.4890 t = 8.7144 Direct effect = 0.4890 LLCI = 0.3784 ULCI = 0.5995 Indirect effect = 0.1579 LLCI = 0.0772 ULCI = 0.2463	Direct effect = 0.4890 LLCI = 0.3784; ULCI = 0.5995 At low collaborative relationship-Conditional indirect effect = 0.1544 LLCI = 0.0737; ULCI = 0.2488 At medium collaborative relationship -Conditional indirect effect = 0.1275 LLCI = 0.0630; ULCI = 0.2014 At high collaborative relationship -Conditional indirect effect = 0.1005 LLCI = 0.0465; ULCI = 0.1641
Supply chain agility (SCA)		β = 0.279 t = 4.927		β = 0.2190 t = 4.9265	β = 0.2190 t = 4.9265
Collaborative relationship			β = 0.3161 t = 11.3330		
Innovativeness × collaborative relationship			β = 0.3978 t = 12.6406		

obtain fuzzy values transforming latent variable scores of the constructs into fuzzy set scores ranging from full membership to full non-membership. For this study, the 90th percentile of latent variable scores was considered as the full membership, the 10th percentile as full non-membership and 50th as the cross-over point (Acquah *et al.*, 2021).

Next, we conducted a necessary condition analysis to check which causal conditions are necessary to predict firm performance. From necessary condition analysis we found that the consistency of the causal conditions ranged from 0.699904 to 0.768261 which infers that no causal condition met the minimum threshold (>0.9). Following the necessary condition analysis, we produced truth tables to conduct a sufficient condition analysis by deriving possible combinations of antecedent conditions of the outcome performance. To simplify the truth table, the consistency cut-off was set as 80% and above, and frequency was set to 2 because of a large sample size (Ragin, 2018). Three truth tables were developed based on the outcome variables capturing overall performance, operational performance and financial performance. We also conducted the negation test of each model.

Model 1a (p = f (SI*PI*AI*S*R)) in Table 5 shows six configurations corresponding to the outcome performance. Of those, four configurations met the threshold of consistency (>0.80) and coverage (>0.50). Sensing and service innovation were found to be common causal conditions in three out of four plausible configurations while configuration 3 shows only innovativeness can predict overall performance. Among all configurations the most suitable combination was found to be S*R*SI*PI*AI with high consistency (0.939 > 0.80) and high coverage (0.526 > 0.50). This configuration infers that the combination of all capabilities under agility and innovativeness (S, R, SI, PI and AI) best predicts overall performance. Parallel to model 1a we also tested which conditions are responsible for deteriorating firm performance by running model 1 b (~p = f (SI*PI*AI*S*R)). In this case, three configurations met the consistency (>0.8) and coverage (>0.5) threshold. However, the most plausible configuration responsible for inhibiting performance is ~S*~R*~SI*~PI which infers that lack of sensing, responding, service innovation and process innovation can substantially affect firm performance.

Model 2a (OP = f (SI*PI*AI*S*R)) three configurations emerged that had a high consistency (>0.8) and coverage (>0.5). The 1st configuration shows innovativeness can predict firm performance while the 2nd configuration implies that service and product innovation with sensing capability lead to higher operational performance. Similarly, the 3rd configuration infers that administrative innovation with agility (both sensing and responding) lead to firm performance. Based on the outcome variable ~ OP our results, presented in Table 5 revealed two solutions that have high consistency and coverage. These solutions imply that compromising any of the conditions either S or R or SI or PI or AI would harm SCS.

Finally, Model 3a (FP = f (SI*PI*AI*S*R)) shows two configurations that can significantly enhance financial performance with high consistency and coverage. Among the configurations the agility components (both S and R) and administrative innovativeness are common causal conditions to enhance financial performance. On the other hand, Model 3 b shows that lack of agility (both S and R), process innovation and administrative innovation may substantially cause deterioration in financial performance.

6. Discussion

Despite an increasing number of empirical investigations on SCA enablers and consequences, the vast majority of scholarly SCA research is either operationally or technically oriented with an unbalanced view of firm performance. The gaps are most acute when exploring previous studies. These are mainly conducted in the manufacturing setting, leaving the service sector virtually unexplored. Establishing SCA as a DC, our work attempts to extend

Table 5.
Models showing configurations

	RC	UC	C		Rc	UC	C
Configuration				*Configuration*			
Model 1a: p = f (SI*PI*AI*S*R)				Model 1 b: ~p = f (SI*PI*AI*S*R)			
S*SI*PI	0.510262	0.0229475	0.89044	~R*~PI*~SI	0.583389	0.0158998	0.860529
S*R*AI	0.522867	0.0259373	0.896136	~R*~SI *~PI	0.635402	0.0878724	0.8309
SI*PI*AI	0.538704	0.0130899	0.883983	~S*~R*~SI*~PI	0.53662	0.0180143	0.899617
S*~R*SI*~AI	0.246122	0.0123625	0.819258	S*~R*SI*~AI	0.260656	0.0129398	0.828941
S*~SI*~PI*AI	0.313914	0.0079186	0.826948				
S*R*SI*PI*AI	0.526067	0.0414227	0.939092				
solution coverage: 0.735779				solution coverage: 0.710757			
solution consistency: 0.839782				solution consistency: 0.809322			
Configuration				*Configuration*			
*Model 2a: OP = f (SI*PI*AI*S*R)*				*Model 2b: ~OP = f (SI*PI*AI*S*R)*			
SI*PI*AI	0.547142	0.029214	0.906391	~R*~PI*~AI	0.595763	0.0332308	0.870009
SI*PI*S	0.516728	0.0264927	0.910321	~S*~R*~SI*~AI	0.540577	0.0183668	0.897207
AI*S*R	0.525932	0.0260125	0.909985	S*~R*SI*~AI	0.271741	0.0148642	0.855568
SI*~AI*S*~R	0.241316	0.00840402	0.81092				
solution coverage: 0.759564				solution coverage: 0.637195			
solution consistency: 0.807385				solution consistency: 0.858342			
Configuration				*Configuration*			
*Model 3a: FP = f (SI*PI*AI*S*R)*				*Model 3b: ~FP = f (SI*PI*AI*S*R)*			
S*SI*PI	0.45724	0.0391157	0.796108	~S*~R*~PI*~AI	0.569541	0.469541	0.819922
S*~R*SI*~AI	0.246518	0.016278	0.81872				
S*R*SI*AI	0.510431	0.0162781	0.82608				
S*R*PI*AI	0.406543	0.027049	0.81626				
R*SI*PI*AI	0.5012455	0.0329609	0.821717				
solution coverage: 0.564464				solution coverage: 0.569541			
solution consistency: 0.764003				solution consistency: 0.789922			

the effect of firm innovativeness, forming a concrete basis for service SCs and enhancing the literature on SCA. To our best knowledge, there is little literature in which a framework of SCA has investigated its link to innovativeness as input and scrutinized its broad performance implications in the service sector.

6.1 Theoretical contributions

While our empirical tests validate the existing literature that innovativeness positively influences performance in the service sector (Helkkula *et al.*, 2018; Ryu and Lee, 2018; Salunke *et al.*, 2019; Weerawardena *et al.*, 2019), our findings extend this relationship and show that SCA mediates the relationship between innovativeness and performance. Our study establishes that the sense and response capability of the firm's SC speed up the process of innovativeness to reflect on the accelerated pace of changes in the service sector. We reveal that innovativeness is a necessary precursor to being agile within the SC. As SCA require firms to quickly detect and respond to market changes, it is necessary to nurture innovativeness to ensure change is correct and timely. A lack of innovativeness may encourage SC partners to implement changes that are not in parallel with the required market needs.

Further, we found that SCA mediates the link between innovativeness and performance at higher values of collaborative relationships. In other words, when collaborative relationships increase, the indirect effect of innovativeness on performance through SCA also increases. Firms working in a disruptive business environment such as the service sector often manage a cooperative and collaborative relationship with SC partners to quickly respond and quickly recover from crises (Jüttner and Maklan, 2011). Thus, this study extends the existing body of knowledge of innovation in the sense that in turbulent SCs, innovativeness may not yield the expected outcome (i.e. operational and financial performance in this study). Our findings reveal that as innovativeness constitutes a close relationship between partners, with a high level of shared knowledge that may generate tension and complexity at a velocity level, collaborative relationship is necessary to ensure the smooth exchange of this critical information and knowledge.

Relating to firms' overall performance, our configurational analysis shows instead of independent effect a combination of agility components and the components of innovativeness can better explain firms' performance. Thus, our study extends the existing body of knowledge by unveiling the different causal combination of both innovativeness and SCA components in explaining firm performance. This finding complements the results of our symmetrical analysis (i.e. regression-based analysis) which shows the net effect of agility and innovativeness on firm performance in contrast to combined effect. Our configurational analysis also shows that sensing and service innovation are highly important for enhancing firms' overall performance; this is reflected in most of the configurations. Further, it is evident that response capability, service and process innovation are critical for firms as compromising those factors may substantially deteriorate firms' overall performance. Therefore, our findings show that the configurations for inhibiting performance are to some extent consistent with the configuration of enhancing performance but they are not exactly the mirror opposite.

To dig deeper, we also analysed the causal conditions responsible for different areas of firm performance such as operational and financial performance. Our results show that causal conditions predicting the individual areas of performance are different. However, there are some commonalities such as the configuration SI*PI*AI, which has been found to be sufficient in predicting operational and financial performance. It has also appeared that sensing and responding are dominant capabilities in most of the optimal configurations leading to different domains of firm performance.

The results presented suggest that the demarcation between services and manufacturing loses most of its meaning, which pinpoints the need to develop a unified theoretical framework to analyse agility in both the service and manufacturing industries. The suggestion to work towards an integrated approach also applies to innovation policies which, so far, have been directed mainly towards the manufacturing industry. This implies that manufacturers are realizing the importance of servitization and applying similar policies and methods. The servitization of manufacturing (Vandermerwe and Rada, 1988) is a natural development of heightening competition in product-centric firms that felt pressure to add value through the provision of services. Traditional manufacturing firms are discovering that their revenues are dominated by their service offerings rather than to their manufactured products (Cook *et al.*, 2006). Servitization has accounted for the blurring of boundaries between the product and service business (Kroh *et al.*, 2018) that might have led to adopting similar agility concepts in the service sector. In the context of servitization, firms require to have "quick-response" attitude in answering clients' requirement, such as financing service bundled with the car sales in order to release customers' financial concerns in a quick manner. Offering servitization requires the firm to create agile supply chain ecosystem in response to the fast changes of market demand, in collaboration with the key stakeholders in supply chains.

6.2 Managerial contributions

Executives need to know how agility in SC is enabled. Examining the role of firm innovativeness is extremely useful in their quest to manage the ever-changing dynamics and interactions in the SC. By identifying the various dimensions of a firm's innovativeness, this study will help managers gain a better understanding of factors that contribute to increasing agility in the SC, especially in the uncertainty context.

Our study will also assist SC managers in understanding the conditions in which innovativeness can positively enhance performance. Under environmental uncertainties, firms wanting to improve their performance must enhance their SCA coupled with their innovativeness and collaborative relationship. The results from the present study will also assist the SC managers in shaping the structure of collaborative relationships in parallel with improving SCA and innovativeness to ensure performance. Our study thus offers managers new insights into how they should develop effective agile mechanisms to extract performance benefits of innovativeness among SC members. More specifically, focal firm SC managers should focus in maintaining relationships between customers and suppliers to improve operational excellence and financial benefits.

Our study also alerts managers to a realisation of the importance of agility. It is a key factor in determining the success of the business and maintaining a firm's competitive advantages in an uncertain environment, such as that of COVID-19. Adopting an agile philosophy within the SC amid crises provides managers with the ability to restructure sources and operational systems to adapt to customer needs while nurturing a growth mindset. Agility helps a firm reduce operational risk and improve its financial performance because it views changes not as expected and manageable, but as a chance to disrupt. This is evident from many companies being transitioned to an entirely virtual workplace in response to the pandemic. Amongst their latest releases, Mckinsey and Company (2019) stated that adopting agility in service operations not only led to 20-point increases in customer satisfaction but also to a more than 30% rise in efficiency.

Finally, the findings from our configurational analysis provides an eye-opening strategic insight for the decision makers that they should focus on both innovativeness and agile approaches to enhance firm performance otherwise a standalone application of each approach may result in sub-optimal result. Our study also informs the service managers that

they should not compromise with certain critical capabilities because absence of those capabilities, such as responding capability, may lead to substantial deterioration in firm performance. From the findings of our configurational analysis, managers may find an idiosyncratic recipe to improve the low performing dimension of firm performance.

6.3 Limitations and future research avenues

While our research has provided some intriguing insight, limitations exist, which also reflect possible avenues for future studies. First, this study used cross-sectional data rather than longitudinal data which may make cause-effect inferences on constructs examined problematic, even though some control variables were utilized in this study to approximate the rigorous test for causality. Replication of this study should be undertaken to observe the changing relationships between the variables and to better examine their dynamism. Second, it is ideal to employ a multiple-informant design to obtain a more accurate evaluation of variables that represent inter-firm processes and relationships.

7. Conclusion

This paper aims to investigate the conditional indirect effect of innovativeness on performance via SCA at higher and lower collaborative relationships using data collected from 245 service firms in Australia based on the DCV. Our study has four theoretical contributions.

Firstly, our research contributes to the empirical aspect of the DCV by validating a multidisciplinary state-of-the-art conceptual model from SC, innovation and strategy literature streams, so enriching not only the DCV literature but also enhancing the body of knowledge in the SCA literature in particular and the SCM in general. The DCV suggests an accumulation of resources and capabilities to combat challenges at the firm level. However, the impact of environmental challenges is no longer confined within the boundaries of an organisation; instead, it is spread across the entire supply chain, especially amid the recent COVID-19 pandemic. In this article, we posit that firms' SCs need both sense and response modes of DCs to develop agility to absorb disruptive events along their SCs. We thus extend the scope of the DCV from organisational boundaries to the entire SC. This is regrettable considering that looking at DC might be a promising alternative for gauging a firm's ability to innovate in services and achieve superior performance. It is against these backdrops that this paper provides new insights into the hitherto neglected links between innovativeness, SCA and firm performance by providing further evidence that SCA constitutes higher order DC that enables service firms to quickly alter models and reconfigure resources to match the requirements of a changing environment, resulting in superior performance. We thus capture the essence of DC in services and provide insights into how firms can achieve competitive advantage in a SC context and an uncertainty environment.

Secondly, this study contributes to the growing literature of SCM and innovation by extending the relationship between innovativeness and performance by testing and validating the mediating effects of SCA, a relationship that has not been tested in prior innovation literature. Thirdly, by testing the conditional indirect effect of innovativeness on performance via SCA at different levels of collaborative relationship, this study extends our understanding of the relationship between innovativeness and performance from a collaboration perspective. Existing literature on innovation has not investigated the boundary conditions of the relationship between innovativeness and performance. An attempt has been made to bridge the gap between operations management and innovation literature, providing unique empirical contribution. Therefore, our study's focus on the conditional indirect effects of innovativeness on performance via SCA at different levels of collaborative relationship is novel in SC literature.

Fourthly, the simultaneity feature of services where both the service provider and the customer (and sometimes other business partners) produce and design the service at the same time makes barriers to entry relatively low due to ease of imitation (Brandon-Jones *et al.*, 2016) making competition in services fiercer than other industries and thus agility is of paramount importance. Agility in services is an essential business competence in acquiring market information and responding to turbulences promptly (Overby *et al.*, 2006). From the financial sector that needs to deal with several high-impact regulations urgently, the intense competition in commodity services where prices are under pressure or the highly customised services that need to be put in markets in ever-shorter time in telecommunications, SCA can be seen as always necessary. This study provides timely insights into SCA in the Australian competitive service environment and contributes to the knowledge needed for the future to compete in the service economy.

Finally, our study makes an important methodological contribution by the application of fsQCA to empirically test the causal conditions in explaining firm performance concerning innovativeness and SCA in the context of service industry.

Note

1. OCED is an intergovernmental economic organisation with widely accepted international economic guidelines concerning developed economies.

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