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THE ROLE OF BUSINESS INTELLIGENCE (BI) IN SERVICE INNOVATION: AN AMBIDEXTERITY PERSPECTIVE

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ABSTRACT

Advancement in information and communication technologies has been a key driver of the transition from a goods-based economy to a services-based economy where significant changes are occurring in the way that services are produced and consumed. There is tremendous opportunity to realize business value from service innovation by using the knowledge about services to develop and deliver new information services and business services. Organizations can seize this opportunity to use service innovation initiatives to set themselves apart from competitors. One of the means for organizations to achieve service innovation is to incorporate business intelligence (BI) both at the strategic and operational levels. A review of extant IS literature on service innovation and BI revealed that the strategic and operational role of BI in fostering service innovation from an organizational ambidexterity perspective is one that has not been explored. We address this gap in research by developing a theoretical model and hypotheses to examine the role of BI in service innovation. Our literature review revealed that firms use BI strategically and operationally for exploration and exploitation respectively to create opportunities for service innovations which have the potential to impact organizational performance.

Keywords

Service innovation, business intelligence, strategic BI, operational BI, BI capabilities, radical innovation, incremental innovation, organizational performance

INTRODUCTION

We are witnessing a dramatic transformation from a product-based economy toward a services economy (Rai and Sambamurthy, 2006). According to the Central Intelligence Agency (CIA), services now account for 76.9% of the U.S. gross domestic product (CIA, 2010). Spohrer and Riecken (2006) argue that the service sector has dominated economic activity in most advanced economies for the past 50 years and that the rapid reconfiguration of service value networks is driven by globalization, increasing automation, the growth of the Internet, and the dynamic componentization of business. Information technology (IT) has been the driver for this rapid increase in globalization and automation. IT has tremendous potential for digitization of services and services management (Rai and Sambamurthy 2006), and represents the leading edge of business innovation (Zahra and George, 2002). In the emerging electronic economy, enterprises that will survive will need to innovate and invent new ways of creating value (El Sawy, Malhotra, Gosain, and Young, 1999). Service innovation is "crucial to a firm's competitive advantage" (Paswan, D'Souza, and Zolfagharian, 2009, p. 513).

Gersung and Resengren (1973) define services as intangible, heterogeneous and perishable activities that require joint participation by the producer and consumer of the service. While this is the traditional definition of services, a new perspective of services is emerging where physical products are considered as services waiting to happen (Gustafsson and Johnson, 2004); all exchanges between the service provider and the service consumer are considered as service exchanges (Vargo and Lusch, 2004; Vargo and Lusch, 2008). The boundary between products and services is becoming more blurred than ever as evidenced by using services to add value to products (referred to as servitization) and by offering products as services, such as software-as-a-service (Barrett and Davidson, 2008). Organizations can use this enhanced understanding of the products-services relationship to look for opportunities for innovation and competitive advantage (Gustafsson and Johnson, 2003). In this paper, we use the term services to refer to IT-driven activities between the provider (supply) and the consumer (demand) of the services. While the service provider is the organization, the service consumer can be either internal or external to the organization. In the context of Business-to-Consumer (B2C) companies, the service consumers are external

to the organization. Organizations also use IT to serve the internal needs of the organization, where the service consumers are internal members of the organization. We define service innovation as the design and development of "an offering not previously available to the firm's customers that results from either an addition to the current mix of services or from changes made to the service-delivery process" (Menor and Roth, 2007, p. 826). This research paper uses the radical versus incremental service innovation typology. Radical service innovation is defined as the use of technological breakthroughs to fundamentally change the way services are developed and rendered to clients. Alternately, incremental service innovation is innovation that simply builds upon what is already there, requiring modifications to existing services, and are aimed at improving operational performance of the organization.

In this paper, we treat service innovation as endogenous to the organization. Organizations are constantly faced with the decision of whether to continue providing their existing services or to create new services in order to stay ahead of their competition. Fundamental to this organizational decision is the flow of business intelligence both within the organization, and between the organization and its customers. Business Intelligence (BI) is a collective term for data analysis tools (Anandarajan, Anandarajan, and Srinivasan, 2003). BI is a broad category of technologies, applications, and processes for gathering, storing, accessing, and analyzing data to help its users make better decisions (Wixom and Watson, 2010).

We use an organizational ambidexterity perspective to identify the role of BI in service innovation. Organizational ambidexterity describes the "ability of a firm to simultaneously explore and exploit" (O'Reilly and Tushman, 2007, p. 2). Exploration refers to seeking new possibilities and includes "things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation" (March 1991, p. 71). Exploitation refers to taking advantage of old certainties and includes "such things as refinement, choice, production, efficiency, selection, implementation, execution" (March, 1991, p. 71). We propose that organizations can become ambidextrous by using BI for both exploration and exploitation for creating opportunities for service innovation. We believe that BI for exploration leads to opportunities for radical service innovation and that BI for exploitation leads to opportunities for incremental service innovation. These service innovation opportunities have the potential to impact strategic and operational performances of the organization.

In this research paper our goal is to address the following research questions:

- ***What are the roles of strategic and operational Business Intelligence (BI) system capabilities and decision-making capabilities on the ability of an organization to provide innovative services?***
- ***In this context, how do BI for exploration and BI for exploitation mediate the relationship between BI capabilities and opportunities for service innovation?***

In response to these research questions, we integrate and build upon prior research to propose our constructs, relationships among those constructs, and research hypotheses.

Literature Review

Service Innovation

Paswan et al. (2009) use service-dominant logic (SDL) to develop a typology for service innovation. SDL argues that goods are delivery mechanisms for the exchange of services thereby questioning the traditional distinction between goods and services (Vargo and Lusch, 2004). Paswan et al. (2009) use an eight-cell service innovation matrix to present their service innovation typology and discuss the research and managerial implications of the typology. Although it serves as a guide to researchers to advance theory in service innovation and SDL, the Paswan et al. (2009) typology has not been empirically validated. More specifically, Paswan et al. (2009) state that one of their dimensions, perceived environmental uncertainty "may encourage service firms to engage in radical service innovation activities" (p. 521). Also, Paswan et al. (2009) state that they did not "actively explore the notion of organizational absorptive capacity" (p. 533) and add this as a limitation of their study. We address this research gap in our study by using an absorptive capacity and an organizational ambidexterity perspective by including the BI for exploration and the BI for exploitation constructs in our research model in Figure 1.

Druehl and Porteus (2010) study the incentives that drive an online firm to make various types of innovations in a competitive environment. They develop a simplified framework using one online and one offline retailer to study whether online firms should seek innovations that appeal to all customers or to specific segments such as high-end customers and whether an online firm's innovation has the potential to lower its profits. Results of the study indicate that the online firm's incentives for innovation depend on the competitive environment and on the nature of the innovations that are considered. Druehl and Porteus (2010) assume innovations are exogenous, or that they are a result of external influences. They add that the other view of innovations is that they are organizational decisions. This is the view that we take in our paper, hence, we assume that innovations are endogenous. While Druehl and Porteus (2010) use the high-end/low-end typology for classifying

innovations, we use the radical/incremental typology for service innovations as indicated by the BI-driven radical service innovation and the BI-driven incremental service innovation constructs in our research model in Figure 1.

Bardhan et al. (2010) evaluate research in services science by presenting a robust stakeholder analysis framework that emphasizes the multiple roles of different stakeholders (producer, intermediary, consumers etc.). They argue that services science is multidisciplinary (involves many disciplines such as IS, computer science, economics, finance, marketing, and operations and supply chain management), and that the study of service science is a fundamental content area for IS research. The Bardhan et al. (2010) study involves conceptual framework development, whereas our study involves empirical analysis. While addressing the limitations of their study, Bardhan et al. (2010) indicate that their study does not address organizational issues such as the effects of service orientation and technology on knowledge management. We address this gap in research by adopting an absorptive capacity and an ambidexterity perspective in our study. Bardhan et al. (2010) add that their study has not given producer stakeholder issues much scrutiny, whereas much of the focus of our study is on producers of service innovation, i.e., the organizations themselves. More specifically, we are interested in studying the potential impact of BI-driven service innovation on organizational strategic and operational performance. Therefore this becomes the dependent construct in our research model presented in Figure 1.

Business Intelligence

In this paper, we conceptualize service innovation as an organizational decision and critical to this decision-making is the flow of business intelligence both within the organization, and between the organization and its customers. Therefore, in addition to doing a literature review on service innovation, we conducted a focused literature review of recent research on BI. Wixom et al. (2008) conducted a case study at Continental Airlines to describe how business intelligence at Continental has evolved over time. While Wixom et al. applied a data warehouse maturity model perspective for their study, we use an ambidexterity lens in our research paper. Watson (2009) discussed the past, present, and future of BI and highlighted the latest trends including scalability, pervasive BI, operational BI, and the BI-based organization. We contribute to research on operational BI, one of the trends discussed by Watson, by including it as a critical part of our research model. Wixom and Watson (2010) stated that BI for organizational decision-making is among many areas that are ripe for exploration by academics. This area is specifically address by our research. For a more in-depth understanding of BI, please refer to Watson (2009) and Wixom and Watson (2010).

Theory and Hypotheses Development

Absorptive Capacity and Organizational Ambidexterity

We apply an absorptive capacity and organizational ambidexterity lens in this paper to address our research questions. Absorptive capacity is the ability to successfully recognize, assimilate and replicate new knowledge gained from external sources (Cohen and Levinthal, 1990). It refers to "the set of organizational routines and processes, by which organizations acquire, assimilate, transform, and exploit knowledge to produce dynamic organizational capabilities" (Malhotra, Gosain, and El Sawy, 2005, p. 145). Absorptive capacity is a dynamic capability pertaining to the creation and utilization of knowledge that impacts an organization's business performance (Lane, Salk, and Lyles, 2001), organizational knowledge transfer (Gupta and Govindarajan, 2000), and organizational learning (Lane et al., 2001). The absorptive capacity view suggests that knowledge creating absorptive capacity is an IT-driven capability (Zahra and George, 2002). Lack of absorptive capacity is a major barrier to internal knowledge transfer within organizations (Szulanksi, 1996). BI can provide organizations with an IT-enabled capability that can facilitate the knowledge creation and application processes necessary to realize the benefits of internal and external knowledge transfer.

Cohen and Levinthal (1990) propose that absorptive capacity contributes to innovation by tending to develop cumulatively and building on prior related knowledge. Malhotra et al. (2005) state that absorptive capacity developed through rich information exchange between an organization and its partners often leads to significant innovations. Jansen et al. (2005) found that realized absorptive capacity, which focuses on transformation and exploitation of knowledge, promotes innovation. Absorptive capacity enables knowledge recombination and integration within an organization and frequently underlies the organization's innovation (Grant, 1996; Kogut and Zander 1992). Rothaermel and Alexandre (2009) found that a firm's level of absorptive capacity is "statistically significant when predicting firm innovativeness" (p. 772).

March (1991) defined organizational ambidexterity as the management of tradeoffs between exploitation and exploration. Exploration refers to seeking new possibilities and includes "things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation" (March, 1991, p. 71). Exploitation refers to taking advantage of old certainties and includes "such things as refinement, choice, production, efficiency, selection, implementation, execution" (March, 1991, p. 71). Tushman and O'Reilly (1996) defined ambidexterity in terms of innovation as the "ability to simultaneously pursue both incremental and discontinuous innovation and change" (p. 24). Exploratory innovations are

designed to meet the needs of *emerging* customers or markets (Benner and Tushman, 2003; Danneels, 2002) while exploitative innovations meet the needs of *existing* customers or markets (Benner and Tushman, 2003). Rothaermel and Alexandre (2009) found that higher levels of absorptive capacity allow firms to more fully capture the benefits resulting from ambidexterity. They state that firms enhance their innovative performance "when they focus internally on exploitation through the sourcing of known technologies and externally on exploration through the sourcing of new technologies" (p. 772). We begin with a preliminary model that represents how organizations use BI ambidextrously for exploration and exploitation leading to opportunities for service innovation, shown in Figure 1.

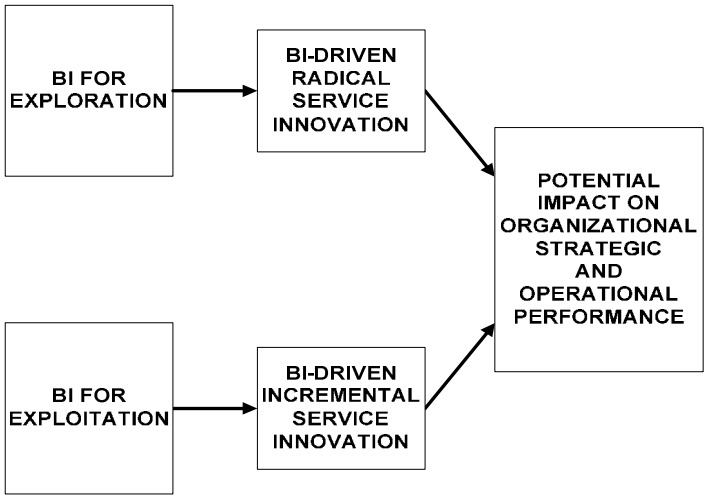

Figure 1. Initial Research Model for Ambidexterity Perspective of BI in Service Innovation

BI for Exploration and Exploitation

Organizational use of BI for exploration is exemplified by firm behavior towards business decisions characterized as search, discovery, and experimentation. The focus of BI for exploration is on pursuing new knowledge and developing new products and services for emerging customers or markets. Organizational use of BI for exploitation implies firm behavior towards business decisions characterized by refinement, implementation, and execution. The exploitation (March, 1991) and exploitative innovation (Jansen et al., 2006) literature form the basis for BI for exploitation construct. The focus of exploitative innovation is to "build on existing knowledge and extend existing products and services for existing customers" (Benner and Tushman 2003, p. 243).

BI systems can be classified into strategic BI systems and operational BI systems. Strategic BI systems allow organizations to gather and manage timely and accurate internal and external information to help them gain strategic advantage over their competitors by allowing them to better plan for actions to secure their position in the marketplace (Cochran, 1991). Operational BI is the application of Strategic BI to operational systems and processes, when it can make a business impact (Schrader, 2010). The goal of operational BI is to make more timely business decisions by reacting faster to business needs and by anticipating business problems in advance, before they become major issues (White, 2006).

Strategic BI Capabilities

Strategic BI systems allow organizations to gather and manage timely and accurate internal and external information to help them gain strategic advantage over their competitors by allowing them to better plan for actions to secure their position in the marketplace (Cochran, 1991). This exploration capability, provided by strategic BI, allow for the achievement of great insights into the business (Schrader, 2010). Strategic BI capabilities include Executive Decision-Making Capabilities and BI Analytical, Predictive, and Reporting Capabilities. Executive Decision-Making Capabilities refer to top management usage of BI to identify key high level opportunities that can leverage the current business to differentiate the organization from their competitors (Schrader, 2010). BI Analytical, Predictive, and Reporting Capabilities refer to the abilities of the BI system to provide strategic intelligence to the organization's executives (Schrader, 2010).

Operational BI Capabilities

The goal of operational BI is to make more timely business decisions by reacting faster to business needs and by anticipating business problems in advance before they become major issues (White, 2006). Operational BI capabilities include BI Integration, Performance Management, and Reporting Capabilities and Business User Decision-Making Capabilities. Based on the operational intelligence literature (Schrader, 2010; White, 2006), BI Integration, Performance Management, and Reporting Capabilities refer to the abilities of the BI tool to provide operational intelligence to the organization's executives. Business User Decision-Making Capabilities refers to business users' usage of BI to identify small every day opportunities that, taken together, influence profitability and reputation (Schrader, 2010). The operational decisions (Schrader, 2010) and operational capabilities (Cepeda and Vera, 2007) literature form the basis for Business User Decision-Making Capabilities.

Relationship between Strategic BI Capabilities and Operational BI Capabilities

Schrader (2010) argues that in order to make better and faster organizational decisions, which is typically the case with service innovation, strategic BI and operational BI must be aligned and accelerated. He adds that operational BI is the application of strategic BI to operational systems and processes, when it can make a business impact. Therefore, we propose the following hypothesis:

H1: Strategic BI capabilities lead to operational BI capabilities

Relationship between Strategic BI Capabilities and BI for Exploration

Rai and Sambamurthy (2006) propose that BI capabilities can be leveraged to understand the needs of customers, to identify micro-segments, to coproduce services, and to innovate. BI capabilities can lead to opportunities for innovation through BI for exploration. Jansen et al. (2006) show that executive decision-making is closely related to exploratory innovation. Examples of strategic decisions include which products and services drive profitability, which issues are driving the most cost, and which relationships are more valuable (Schrader, 2010). Hence, we propose the following hypothesis:

H2: Strategic BI executive decision-making capabilities lead to BI for exploration

BI is a broad category of technologies, applications, and processes for gathering, storing, accessing, and analyzing data to help its users make better decisions (Wixom and Watson, 2010). Fundamental to the executives' decision-making capabilities is the flow of strategic business intelligence, both within the organization and between the organization and its customers. We believe that the BI system's analytical and predictive capabilities enable executives to make better and faster decisions regarding service innovation. Therefore, we propose the following:

H3: Strategic BI system analytical and predictive capabilities lead to BI for exploration

Relationship between Operational BI capabilities and BI for Exploitation

BI capabilities can also lead to opportunities for innovation through BI for exploitation. BI for exploitation is characterized by increasing the efficiencies of existing operational processes. It requires decision-making capabilities from the BI business users who deal with day-to-day operations of the organizations. Examples of operational decisions include whether to give a client a special price, how to handle a customer's complaint, and whether to offer a seat upgrade to a passenger (Schrader, 2010). Thus, we propose the following hypothesis:

H4: Operational BI business user decision-making capabilities lead to BI for exploitation

Operational BI requires linking the BI systems with operational systems of the organization. Fundamental to the business users' decision-making capabilities is the flow of operational business intelligence, both within the organization and between the organization and its customers. BI systems' integration and performance management capabilities can enable business users to make better and faster decisions regarding service innovation. Hence, we propose the following:

H5: Operational BI system integration and performance management capabilities lead to BI for exploitation

BI-Driven Radical Service Innovation

BI-driven radical service innovation is defined as the organization's opportunity for using BI to create major strategic innovations leading to the expansion of current markets, thus making obsolete the old ways of doing things. BI-driven radical service innovation is based on literature from radical innovation (Koberg, Detienne, and Heppard, 2003).

Relationship between BI for Exploration and BI-Driven Radical Service Innovation

Rai and Sambamurthy (2006) state that the ability to generate and apply business intelligence is a service management capability and add that mining of event-stream data, and real-time execution of business rules present opportunities for

service innovation using business intelligence. Benner and Tushman (2003) add that radical innovations, "or those for emergent customers and markets, are exploratory" (p. 243). Therefore, we have reason to believe that BI for exploration is related to BI-driven radical service innovation.

H6: BI for exploration leads to BI-driven radical service innovation

BI-Driven Incremental Service Innovation

BI-driven incremental service innovation is defined as the organization's opportunities for using BI to create service innovations that simply build on what is already there, thus requiring modifications to existing functions and practices. The incremental innovation (Koberg et al., 2003) literature provides the basis for BI-driven incremental service innovation.

Relationship between BI for Exploitation and BI-Driven Incremental Service Innovation

Benner and Tushman (2003) state that "incremental technological innovations and innovations designed to meet the needs of existing customers are exploitative and build upon existing organizational knowledge" (p. 243). Therefore, we have reason to believe that BI for exploitation is related to BI-driven incremental service innovation.

H7: BI for exploitation leads to BI-driven incremental service innovation

Potential Impact on Organizational Performance

Potential impact on organizational performance is the potential impact of BI-enabled service innovation on organizational market growth, market dominance, business value, customer referrals, and operational efficiencies. This construct is based on literature from long term and competitive performance (King and Malhotra, 2000), strategic impact (Grover, Cheon, and Teng, 1996; Lee and Kim, 1999), and organizational performance.

Relationship between Radical Service Innovation and Organizational Performance

Jansen et al. (2006) find that in dynamic environments, organizational units that are pursuing exploratory (radical) innovations increase their financial performance. Therefore, we propose the following hypothesis

H8: BI-driven radical service innovation has the potential to impact organizational performance

Relationship between Incremental Service Innovation and Organizational Performance

Jansen et al. (2006) find that in competitive environments, organizational units that are pursuing exploitative (incremental) innovations increase their financial performance. Hence, we propose the following:

H9: BI-driven incremental service innovation has the potential to impact organizational performance

The proposed conceptual model, shown in Figure 2, is representative of how organizations can potentially use BI capabilities ambidextrously for exploration and exploitation, leading to opportunities for radical and incremental service innovation.

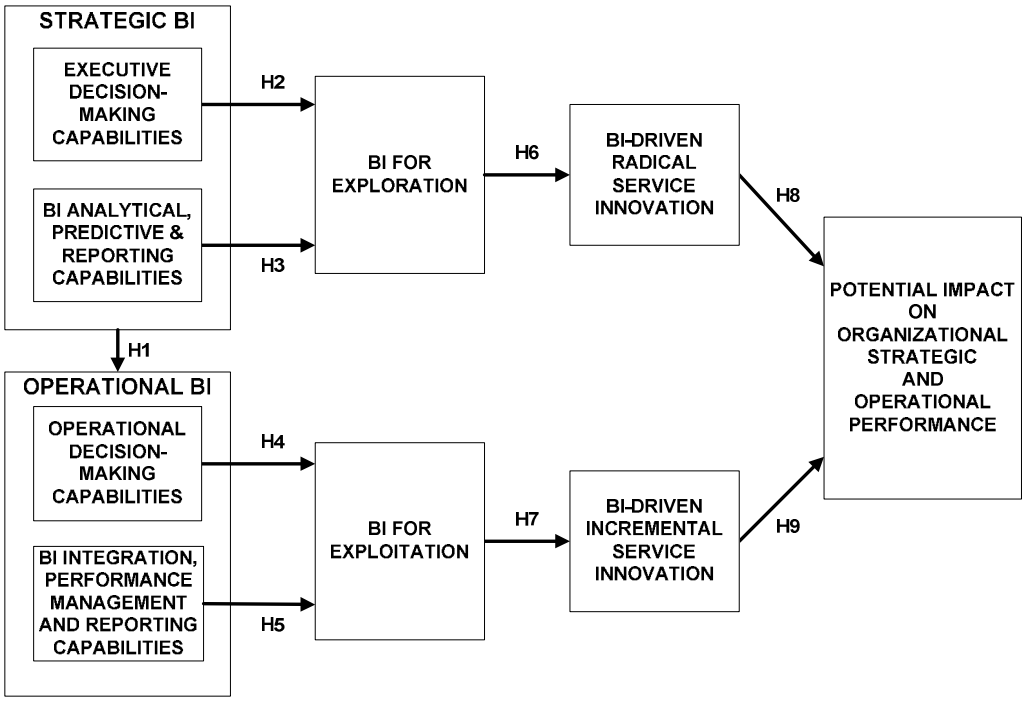

Figure 2. Proposed Research Model for Ambidexterity Perspective of the Role of BI in Service Innovation

CONCLUSION

This research creates supplementary areas for future research to provide additional knowledge on BI capabilities and its role in service innovativeness. Due to the minimal research on the operational and strategic capabilities of BI, we chose to focus on this dichotomous view of BI in order to better understand how organizations use it for innovative service offerings. We also chose to examine service innovation through its degree of novelty, rather than as a singular improvement within the organization.

This study has important implications for both research and practice. Prior to this study, there was an unclear linkage between BI and the quantifiable benefits that it provided to an organization (Jourdan, Rainer, Marshall 2008). However, this research adds incremental knowledge on how BI is used for exploration and exploitation to identify innovation opportunities which lead to improvements in the organization's overall performance. Our results show that BI enables organizations to explore ways in which they can make significant changes to their business approach leading to a more service focused approach. The results also highlight how BI enables organizations to continue maximizing operational efficiencies to realize the benefits of marginal improvements to their business offerings. These results inform practitioners of the strategic capabilities of BI and its organizational use in exploration of radical service opportunities. Strategic BI allows organizations to create and implement new and innovative service strategies that are essential to achieving a competitive advantage in the marketplace. This research also highlights the operational capabilities of BI and its organizational use in exploitation of incremental, or current, service opportunities. Organizations can gain from the additional knowledge that BI operational capabilities provide by improving on current service offerings to customers. Organizations that utilize BI's various capabilities can potentially realize a significant improvement in the organization's performance.

Future research can utilize other theoretical approaches to explain how organizations use BI to better identify opportunities for innovation within their market and in their business offerings. Researchers could approach service innovation from a broader view to capture the issues that prevent organizations from considering service innovation as optimal in their market conditions. By focusing on the lack of innovation, additional knowledge can be gained as to the necessary conditions for innovation to flourish.

This study is part of an on-going research initiative. On the basis of our literature review, we designed a survey based on measures from existing literature to collect data on BI skills, capabilities, leadership, service innovation, and performance. We are currently involved in collecting data from organizations to empirically test our model and verify our findings.

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