

Review of Innovation Management Frameworks and Assessment Tools

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Abstract—Research studies are highly fragmented when an Innovation Management Framework is being discussed. With the aim to identify an Innovation Management Framework/Assessment Tool suitable for Small & Medium Enterprises (SMEs) in the service industry, this researcher critically reviewed existing innovation management frameworks and assessment models/tools and discovered a number of literature gaps. It is established that the existing literature lacks generally agreed innovation management dimensions, commonly accepted knowledge creation through empirical studies on innovation management in SMEs, effective innovation management performance measurements, suitable innovation management framework in SMEs, and studies on innovation management in the service industry, in particular in retail SMEs. As such, there is a dire need to develop an appropriate firm-level innovation management framework suitable for SMEs in the service industry for future research projects and further studies. In addition, this researcher also discussed the significance of establishing such an innovation management framework.

Keywords—Innovation management, innovation management framework, innovation management assessment tools, SMEs, service industry.

I. INTRODUCTION

MOST of the published knowledge on harnessing innovation is based on empirical information and data derived from large companies [1], [2]. However, there is a shortage of data relating to SME's and how they should approach innovation management at firm level [3].

There is scant attention paid to the reality that SMEs need to continually innovate as a firm-level strategic objective, since “innovations in and of themselves are not necessarily the key to long-term business success [4]. In other words, long term SME's survival hinges largely on the strategic-level company's innovativeness that produces dynamic capabilities, rather than on the actual innovation product(s) per se [5], [6]. In addition, the true innovative firms will be able to recognize and encourage innovation and creativity across the entire organization, where everyone plays a part in and commits to the innovation process rather than a particular innovation project team or a department [7].

Some scholars observed that current evidence demonstrates that the most successful innovation companies approach it in a systematic and holistic manner, developing their innovation strategy/ies integrated with their business goals, and aligning the organizational culture and systems with such strategy/ies [8].

Hence, the success of innovation management can only be made sustainable, if all dimensions of innovation management are addressed and managed properly. In so doing, the company

could possibly secure its long-term growth. As such, only a holistic view of firm-level innovation management can help sustain innovation and achieve growth of a company [9], [10].

In order to drive a company's competitiveness progressing in a systematic manner, an innovation management framework or model needs to be capable of tying the various aspects of the innovation domains: products or services, people, business processes, business strategies and the organization itself. Such innovation management frameworks must enable proper measurements of performance and firm-level capabilities for resource optimization, adjustment of the focus of activities, and ensuring that the competitive objectives are achieved [11]. However, it is observed that some of the chief challenges in managing firm-level innovation are owing to inconsistent understanding (and models) of innovation and the lack of adequate measurement-based management methodologies and tools [12].

II. INNOVATION MANAGEMENT IN SMEs IN RETAIL INDUSTRY IN SINGAPORE CONTEXT

The retail industry plays an important part in contributing to Singapore's economy, as retailing not only plays a critical role in making Singapore a liveable city for local Singaporeans, but also an attractive shopping destination to visit for international tourists.

According to Spring Singapore, the retail industry generates over S\$42.6 billion (Singapore Dollars) receipt in 2013 [13]. Indeed, the retail industry not only contributes markedly in dollar value to the Singapore economy, but also employs the most Singaporeans and possesses the highest number of establishments in Singapore [13]. Based upon Workforce Development Agency, Singapore (WDA) report, the retail industry employs, in total, more than 147,000 workers in approximately 21,500 establishments/companies, which represents 4% of Singapore's total workforce in 2013 [14]. In fact, the retail industry does have its own set of challenges, the volatile global economic situation and slowing economic growth in Singapore have rendered reduced spending and purchasing of cheaper goods from both local consumers and international tourists. Such changing consumer behavior has given rise to web-based e-commerce and smart phone-based m-commerce and hence, drastically reduced brick-and-mortar retailers' revenues. With a tightened labor market and high rental costs continuing to put pressure on retailers, many are forced to undergo store consolidations or close their operations as part of cost-cutting measures [13]. Hence, how to innovate becomes most relevant and critical in today's Singapore retail

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industry. With technology and globalization changing the way consumers shop and given Singapore's small domestic market, local retailers must keep up with the changes, innovate, and venture into new markets to achieve sustainable growth and business success. This becomes rather important [13]. Indeed, the Singapore government is trying to push all industry sectors, including retail, for innovation and productivity improvement.

Among a total of 21,500 local retail companies, 98.3% of these retailers are considered Small and Medium Enterprises (SMEs), as they either register annual sales turnover not more than \$100 million, or possess less than 200 full-time employees. In fact, only 37 retail companies managed to achieve revenue/sales turnover of more than \$100 million in 2013 [14]. SMEs are very important to the Singapore economy, as they not only employ seven out of every 10 workers, but also contribute more than 50% of the national Gross Domestic Product (GDP) [13]. SMEs importance to a nation's economy was reaffirmed by MasterCard Worldwide Survey findings in 2007. It was reported that, in most economies, SMEs provide the majority of

job opportunities and become the chief source of income for a significant number of citizens in that particular country. Furthermore, SMEs also support other major corporations by acting as suppliers and subcontractors of large businesses.

As such, carrying out research study in innovation management target at retail SME in Singapore is critical to the country's economy. Such importance is reflected by the dollar value created by the retail sector and number of establishments and employees in the sector as mentioned earlier on.

Whether a suitable Innovation Management Framework or Assessment Model can be found is an imminent question this researcher intends to address. In order to achieve that, this researcher reviewed existing innovation management frameworks and/or assessment models in an attempt to identify a suitable innovation management framework at the firm level covering all important dimensions of innovation management practices applicable to SMEs in service industry, in this case, the retail industry in Singapore.

TABLE I
COMPARISON OF INNOVATION MANAGEMENT FRAMEWORKS AND ASSESSMENT TOOLS

	Davila et al. [15]	Goffin & Mitchell [16]	Muller et al. [17]	Regnell et al. [18]	Collins & Smith [19]	Doblin [20]	Tidd et al. [21]	Morris [22]	Kearny [23]
Leadership			V						
Input/Output/ Outcome	V							V	
Innovation Process	V	V	V	V	V	V	V	V	V
Innovation Strategy/ Business Model		V			V	V	V	V	V
Organization & Culture					V	V	V		V
Organizational Learning & KM				V		V	V	V	V
Idea Management & IP		V		V		V		V	V
HR Management		V				V			V
Resources for Innovation			V		V	V			
Customer Innovation						V			
Products/Services		V				V		V	V
Open Innovation & Innovation Network				V		V	V		
Innovation Portfolio & Project Management	V			V				V	V
Technology Management			V						V

In an attempt to search for an appropriate framework applicable to service industry innovation, this researcher reviewed a range of innovation management frameworks and assessment tools/models, including, Balanced Scorecard Linear Model [15], Idea Funnel Model/Pentathlon Framework [16], Structural Perspective Model [17], MINT Framework [18], Business Growth Model [19], 10 Types of Innovation Model [20], Innovation Diamond Framework [21], Nine-stage Innovation Process [22], and Kearney's House of Innovation Model [23] (refer to Table 1), and discovered that there are a number of existing research gaps and none of the aforementioned innovation management frameworks will be suitable to use for research in SMEs in the eservice industry.

III. DISCUSSION ON RESEARCH GAPS IN THE LITERATURE

A. Lack of Generally Agreed Innovation Management Dimensions and Understanding of Their Relationships for Firm-Level Study

Having reviewed the literature on innovation management theoretical frameworks, it is noteworthy that no universally acceptable theory exists on the concept and model [24]. In fact, it is observed that the innovation management literature has been highly fragmented and researchers studied this field through the lens of many different disciplines, more often than not, studying and focusing on different dimensions of innovation management [25].

However, as discussed earlier on, innovation management covers all aspects fostering the innovation capabilities of a company, all of these components or dimensions have to be

managed to ensure the company's long-term growth. Therefore, it is imperative that research studies shall take a holistic view of innovation management in order to achieve sustainable innovation and growth of a company [9], [10].

Referring to Table 1, based upon the review of the literature, this research has noticed that various innovation management frameworks have a different focus in perspective and different number of firm-level innovation management dimensions. While useful, the various models are limited from a measurement perspective and have a various number of innovation management indicators or dimensions [26]. As such, there is a dire need to review and identify all relevant dimensions of innovation management in order to address innovation management holistically at the firm level [27].

Frequently, innovation management literature discussed these factors/dimensions which affect organizations' ability to innovate in a way that these factors are being studied individually in isolation and mutually exclusively. However, the relationships between these factors and the impact these relationships have on innovation are largely ignored. That means, the cumulative effect of the factors/dimensions and their relationships are not fully understood [28]. Furthermore, the relationship between these factors/dimensions will be influenced by the organizational context such as organizational size, age, and external environment, which are contingency factors. Therefore, further research is needed to understand how these contingency factors impact the relationships of the innovation capabilities or dimensions. As such, there is a need to choose or create a framework to integrate all these dimensions/factors and understand their relationships in a holistic manner.

B. Lack of Commonly Accepted Knowledge Creation Through Empirical Studies on Innovation Management in SMEs

In most economies, SMEs not only provide the bulk of job opportunities, but also become the chief source of income for a large number of local citizens. SMEs also supports large companies or multi-national corporations by acting as suppliers and subcontractors of large businesses [29]. Indeed, today, many policy-makers start to recognize the true innovative potential of SMEs and their important role in the economy [30]. In the same vein, SMEs are key pillars of Singapore economy, contributing more than 50% of the national Gross Domestic Product (GDP) and employing 70% of local workforce, according to Standards, Productivity and Innovation Board, Singapore [13]. Thus, it is in the national interest of Singapore to see these SMEs succeed in both local and international arenas.

Notwithstanding the critical role SMEs having played in contributing to an economy, some researchers noticed that there is a shortage of data relating to SME's innovation endeavor and how SMEs should approach innovation management at the firm level [3]. Furthermore, even among the studies exploring the SME innovation link, the results are controversial [31]. Hörte et al. highlighted that innovation research in small companies is immature, heterogeneous, and lacking in cumulative knowledge creation [32]. Basically, small firms do not typically

have large Research and Development (R&D) units, specific development strategies, or well-established technological capabilities, previous empirical studies have limited value in the current context and future studies [33]. Thus, to study innovation management in SMEs will be of great value for knowledge creation and future research.

C. Lack of Effective Innovation Management Performance Measurements

As the business environment has become more competitive, managing innovation function has become more critical for survival. To manage innovation effectively, it has to be measured [34]. Moullin suggests an actionable definition of performance measurement, "performance measurement is evaluating how well organizations are managed and the value they delivered for customers and other stakeholders" [35]. From the performance measurement perspective, there are two issues to be addressed. The first one is about "how well the organizations are managed"; in the case of innovation management, it is about assessment of innovation management in a systematic manner. Secondly, it is about value creation and company performance. As reflected in the definition, it is holistic value creation for customers and stakeholders alike, which is beyond company financial performance per se.

Based upon the literature review, many researches focus on measurements and analysis of innovation activities on 'innovation proxies', e.g., intellectual property or patents filed, research and development (R&D) expenditure, in order to draw conclusions about the effectiveness of countries or industries to innovate [36]–[38].

However, such proxy measurements offer little assistance to those individual organizations who wish to improve their innovation capability and examine "how well innovation is managed at the organizational level" [39]. In addition, some researches have pointed out the limitations in using such proxies. For example, Bienayme highlights researchers who have "confused R&D and innovation". In his view, analysis based on R&D investment is useful for little more than to "account for an expenditure of money, while innovation results in a tangible product or an efficient service satisfactory to a customer" [40].

Some research studies try to determine innovation performance of firms by deploying indicators or proxies of innovation as a means, rather than assessing innovation capability and innovation management per se [41], [42]. Such studies may be of help to organizations in providing a quantifiable comparison in the areas of certain inputs (for example, R&D investment) or outputs of innovation (number of patents filed and the like), and hence could be relatable, to certain extent, to the effectiveness of their innovation capability and innovation management practices. However, they will not provide companies with a clear understanding of what organizational innovation capabilities and resources contribute to convert these inputs into outputs and how these companies could embark on making improvements [43].

From this perspective, the "innovation proxy indicators", including input and/or output of innovation activities, could

help firms identify the areas of strength and weakness of innovation performance, which also will be related to or reflected on the effectiveness of innovation management practices. However, with the aim to improve organization performance in a sustainable manner, the needs for fostering a holistic understanding and appreciation of “how well an organization is managed from innovation management perspective” and “sustainable value creation through innovation for customers and stakeholders alike” will be warranted for further study.

D. Lack of Suitable Innovation Management Framework and Assessment Model for SMEs

Considering that innovation is a multi-disciplinary topic, including areas such as organizational strategy, knowledge management, project management, and so forth, there is no single agreed model for innovation management at firm level [44]. On the other hand, the need for a holistic and systematic view on innovation management, addressing all dimensions of a company-wide innovation system, is not well understood and fully embraced among SMEs [45].

There is a shortage of empirical studies providing details as to how company can achieve firm-level innovation [46]. Bullinger et al. summarized that the need for a holistic and systematic view on innovation management, addressing all dimensions of a corporate-wide innovation system, has not been well understood and appreciated among SMEs. As such, there is an imminent need to identify suitable innovation management framework and assessment model for SMEs [45].

A review of literature reveals that there are various limitations and potential problems in using existing innovation management framework and assessment models (refer to Table 2). Balanced Scorecard Linear Model focuses on the innovation process alone rather than firm-level innovation capabilities and it is not suitable/applicable for dynamic and open innovation [47]. Similarly, the Nine-stage Innovation Process emphasizes on innovation process per se without considering other key firm-level determinants of innovation capability [11]. The Pentathlon Framework is developed based upon manufacturing companies and thus not suitable for the service industry and it is unable to cover all key innovation capabilities, e.g., organizational learning & knowledge management, organization & culture, etc., within a company [48]. The Structural Perspective Model is unable to address external factors, e.g., industry changes, etc., and internal factors, e.g., innovation strategy, etc. [49]. The MINT Framework, also known as the “Measurement Inspiration for Innovation Teams” Framework, focuses auditing innovation at innovation team level rather than organization or firm level. It is created from large company cases and hence has limited value when using it to assess SMEs. The other weakness of this MINT Framework is that since it employs a host of quantitative measures to assess innovation team, it is unable to show the quality of ideas emerging from the innovation process [50]. The Business Growth Model takes into consideration of four interdependent elements, namely, stakeholder strategies, processes, resources, and organization and culture strategically and addresses

innovation holistically. However, the model is developed based upon large and international companies and thus not suitable for SMEs [11].

Ten Types of Innovation Model focuses on 10 factors of innovation that, if properly managed, could enable the companies develop competitive offerings and create distinctive values. However, it does not explicitly address some of the key innovation capability areas, e.g., organization & culture, resources, process, etc. [51]. Tidd et al. introduced the Innovation Diamond Framework, which considers the following five dimensions for innovation assessment: strategy, process, organization, linkages, and learning. Such an innovation audit tool puts together a new method or fresh approach to measure innovation capacity in organization [21]. However, it is observed that there are gaps and issues in using this model in the context of different cultures and in relation to different management styles or philosophies [52]. The diamond model will be suitable, when innovation process is at its infancy stage [48]. The A.T. Kearney House of Innovation Model takes an integrated approach to address innovation management. It links innovation strategy, organization and culture, innovation process and those enabling factors, including, Knowledge Management, HR Management, Project and Program Management, and Controlling and IT [23]. These elements interlink to produce innovation results. However, the down side of this model is that it is tied to one form of innovation model without taking into consideration of and capitalizing on the unique strength of other models [53]. In addition, the business impact of innovation management has not been fully captured in the existing model pertaining to assessments of innovation management performance.

In general, these innovation management frameworks/tools that strive to address the innovation management practices or capabilities at the firm level do not seem to have much academic rigor or offer little evidence that they have been applied or deployed successfully [54], [55].

This researcher observed that, although there are areas of commonality across these innovation management models, no one model covers every important dimension at firm level. This, in effect, suggests that there is a need to develop an integrative and synthetic framework to enable future work to build on results derived in previous studies [56].

E. Lack of Studies on Innovation Management in Service Industry in Particular in Retail Smes

Although many research studies acknowledge the importance of service innovations and the capabilities that enable them, there is a shortage of management frameworks that provide practical guidance to firms in the service sector [57]. Schilling and Werr highlighted that mass services, e.g., retailing, wholesaling, cleaning, etc., as well as service shops, e.g., different kinds of repair and maintenance, etc., are rarely represented in the current innovation management literature [58]. The current literature is often vague, fragmented, or employs diverse approaches and definitions, which has resulted in significant confusion and extensive knowledge gaps studying innovation in the service sector [59].

TABLE II
COMPARISON OF VARIOUS INNOVATION MANAGEMENT FRAMEWORKS AND ASSESSMENT MODELS (SOURCE: AUTHOR)

Author	Model	Limitations
Davila et al. [15]	Balanced Scorecard Linear Model	-focused on innovation process, e.g., R & D, etc., as a process flow rather than firm-level innovation; -not suitable for implementation when dynamic capability view and open innovation come into play.
Goffin & Mitchell [16]	The Pentathlon Framework	-developed based upon a dataset obtained from manufacturing companies, not appropriate or suitable for service industry; -unable to cover and thus address all key innovation capability dimensions within a company; -innovation process dependent.
Muller et al. [17]	The Structural Perspective Model	-unable to address certain important external factors, e.g., industry, etc., and internal factors, e.g., innovation strategy.
Regnell et al. [18]	MINT Framework	-created based upon large company cases, limited applicability to SMEs; -addressed innovation within the project team rather than firm or organization level; -quantitative measures unable to demonstrate the quality of ideas emerging from or channeled through the innovation process.
Collins & Smith [19]	The Business Growth Model	-based upon large and international companies, and thus limited application value to SMEs.
Doblin [20]	10 Types of Innovation Model	-with a focus on business model innovation; -missed out certain important innovation capabilities, e.g., culture, organization, resources, processes, etc.
Tidd et al. [21]	Innovation Diamond Framework	-missed out some important innovation capabilities and biased toward innovation culture and management style; -suitable to innovation process in its infancy stage.
Kearney [23]	Kearney's "House of Innovation" Model	-tied to and biased towards one particular innovation management model; unable to leverage on and reflect the strength of other models; -missed out or unable to capture business impact of innovation management.

There are few structured or formal approaches for the management of service innovation and existing frameworks are vague, inadequate, or simply taken from the manufacturing industry and fail to capture the unique attributes or characteristics of services. These inadequacies present challenges as well as opportunities to an integrated study with the potential to both advance theoretical knowledge and understanding of this discipline and provide clear pathway and direction to firms seeking to manage service innovation effectively [57].

The importance of the service sector in the Singapore economy has increased steadily over time. According to Trading Economics, in Singapore, services are the biggest sector of the economy, account for 72% of GDP, and provide jobs to 80% of 3 million Singaporean workers and employees [60]. The retail industry is an important pillar of Singapore's economy, as it not only generated over \$42.6 billion in 2013, but also employs the most Singapore citizens and has the biggest number of establishments in Singapore [13].

Therefore, carrying out this research study targeting retail SMEs will potentially have a significant impact on the Singapore economy as well as affect and influence the way by which the retail SMEs operate and thus innovate within the service industry. In addition, this research study will enhance the knowledge creation in innovation management in the service sector and the assessment framework will provide new perspectives and theory knowledge on innovation and innovation management in the service industry.

IV. CONCLUSION

Based upon the research gaps identified thus far, it is expected that the findings of further research study to establish and empirically test an innovation management framework or

assessment model suitable for service industry SMEs will be the first of its kind in the following aspects: (i) it is the first of its kind firm-level research study covering all aspects/dimensions of innovation management and their relationships; (ii) it will create new knowledge of and enrich understanding in innovation management in SMEs through its empirical study in retail SMEs in the Singapore context; (iii) it will offer a new perspective in innovation performance measurement through addressing two points: "how well an organization is managed from innovation management perspective" and "value creation for customers and stakeholders through innovation (in order to achieve sustainable business performance)"; (iv) it will create a new innovation management assessment model/framework, as new knowledge creation and theory development to enrich the body of knowledge in innovation management for SMEs; (v) last but not the least, it will certainly be a ground-breaking research in innovation management in SMEs in Singapore, in particular, in the service industry, in this case in retail sector SMEs.

Outcomes from this research into the comprehensive relationships between various factors/dimensions of innovation management and SME performance will have implications for owners of SMEs, trade associations, training organizations, government agencies, and research and teaching institutions. It is anticipated that the outcome will enable SME owners to create improvements in certain aspects of their innovation management practices and hence, to benefit a company sustainable business performance. Government agencies will be keen to adopt the assessment framework as a diagnostic tool to assess firm-level innovation and innovation management and in addition, government agencies will be interested in the research outcomes as an input into policy and to influence government-supported or government-driven programs for

SMEs. In a similar vein, trade association could benefit from the outcomes and could use them to empower the member companies. Lastly, this research could also galvanize the interests in using it in other service industry sectors or even conducting a comparative study of different sectors.

In summary, developing such an innovation management assessment framework for SMEs in the service industry will have positive contributions to both innovation management theory development and innovation management policy formulation and practical applications in SME business management.

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