Wayamba Journal of Management

Volume 14 Issue 01 June 2023

The Effect of Open Innovation on Firm Performance: Research Gaps

M.G.M Dilrukshi[1] and C.N Wickramasinghe[2]

[1]Department of Management and Entrepreneurship, Faculty of Management and Finance, Ruhuna University of Sri Lanka

[2]Department of Commerce and Financial Management, Faculty of Commerce and Management Studies, Kelaniya University of Sri Lanka

Abstract

Open innovation can be considered as the critical branch of innovation management. It is an emerging field of research that is important for achieving sustainable competitive advantages through enhancing firm performance. This study aims to identify the research gaps in the effect of open innovation and firm performance based on the systematic literature review process. Depending on the systematic approach current study expects to find out research gaps and it targets to develop a conceptual framework to minimize the identified research gaps in the effect of open innovation and firm performance for future empirical investigations. An extensive literature review was implemented to achieve the research objectives through the adaptation of the desk research strategy. The systematic literature review process explored the effect of open innovation and firm performance was not entirely positive. Further, it discovered the three research gaps between open innovation and firm performance mainly. A conceptual framework was developed to minimize the identified research gaps by identifying a new variable to the established relationship. The literature survey and logical arguments provide a solid foundation to build up the conceptual framework. It was proposed to be tested empirically in the research context of listed companies in Sri Lanka by future researchers.

Keywords: *Firm Performance, Open innovation, Research gaps*

Received: 31st March 2023

Accepted: 16th June 2023

Published: 30th June 2023

Corresponding author:
M.G.M Dilrukshi

E-mail address:
menu_gamage@yahoo.com

https://orcid.org/0000-0002-4221-0239

DOI:
https://doi.org/10.4038/wjm.v14i1.7599

pp: 127-145

ISSN: 2012-6182

Wayamba Journal of Management
Department of Business Management
Wayamba University of Sri Lanka

Journal Home Page:
https://fbsf.wyb.ac.lk/wayamba-journal-of-management/

Introduction

Open innovation (OI) is a new language to speak on innovation through collaborative efforts. It helps to brake-up organizational boundaries while sharing innovative ideas between organizations. The concept of OI was founded by Henry Chesbrough in 2003 as an alternative method to the traditional closed innovation system (Lu, Yu, Zhang, & Xu, 2021). After originating this concept practitioners try to apply this idea to their innovation system to enhance their firm performance (FP) through developing their firm innovation performance (Rajapathirana & Hui, 2018). Over the past decade, researchers have shown much interest in OI and they do believe that at least another decade of research is expected on OI theory and practice (Ramirez-Portilla, Cagno, & Brown, 2017). As a result of that, numerous researchers tend to identify the effect of OI and FP based on the different contexts (Hinteregger, Durst, Temel, & Yesilay, 2019; Liao, Fu, & Liu, 2020; Wang & Xu, 2018). However, previous researchers have provided inconclusive arguments on the effect of OI on FP. This incomplete literature and ongoing debate on the effect of OI and FP shows that there may be some facts that are not revealed by the existing literature (Dilrukshi, Wickramasinghe, & Edirisinghe, 2022). As well, some researchers criticize the OI theory by emphasizing its limitations (Bogers, 2011; Dekkers, Koukou, Mitchell, & Sinclair, 2019; Enkel, Gassmann, & Chesbrough, 2009; Trott & Hartmann, 2009). Moreover, when OI theory applies to practical situations shortcomings can be occurred due to contextual matters (Bigliardi, Ferraro, Filippelli, & Galati, 2020). Thus, potential researchers need to identify the drawbacks of the OI theory and should develop alternatives to minimize the gaps in the OI theory.

While researchers stated the importance of OI to enhance FP, there are still many gaps that have to be filled in the field of OI (Liao et al., 2020). Hence, it is essential to carry out theoretical and empirical studies for enhancing the body of knowledge on OI. By the year 2015, there had been some developments in OI research in developed countries, however, it is not satisfactory in developing countries like Sri Lanka. Especially, Bogers, Chesbrough and Moedas (2018) declared that there may be a tremendous growth in OI since 2015 with the combination of sustainable development goals (2015-2030) and OI. Owning to the critical usage of OI practices and considering on increasing trend of researching OI practices it was intended to write this research paper with the aims to review the literature and to identify the research gaps in the extant literature on the effect of OI and FP based on the systematic literature review process. As well, this study expects to motivate future researchers to carry out research by filling the gaps to expand the current body of knowledge about the OI and FP. Accordingly, this paper attempts to:

1. Examine the different types of relations among the variables of open innovation and firm performance based on the empirical findings in the previous literature.
2. Explore the research gaps on the effect of open innovation and firm performance through extant literature.
3. Develop a new framework using research gaps that can be investigated by future researchers.

Hence, this study provides a significant contribution to the OI literature in three ways. First, it allows to identify the different types of relationships between OI and FP in the previous literature. Second, this paper helps to identify the research gaps through the extant research findings. Third, it supports to develop a model by uncovering research gaps that can be raised for potential researchers. The remainder of this study is as follows: the next section draws on the literature on the keywords and the methodology of the study is included then. Following that, results were analyzed and findings were discussed later. In the last section, the conclusions of this study are given.

Literature review

This section briefly discusses the information on OI, FP and types of research gaps based on the identified keywords.

Open innovation

End of the twentieth century the traditional closed innovation system gradually decreased due to the mobility of skilled workers, global trends, competition, shorten product life cycles, lack of research and development (R&D) resources and changes in advanced technology (Aliasghar, Rose, & Chetty, 2019; Lu et al., 2021; Pilav-Velic & Jahic, 2021). Hence, firms started to search knowledge from the organizational boundaries. This new approach is called as the OI and firms applied OI as the alternative method to the traditional closed innovation system. OI is one of the most important business strategies that can be applied to achieve competitive advantages in a dynamic competitive business landscape (Lorenz, Benninghaus, Friedli, & Netland, 2020). OI helps to speed up the innovation process, fulfill customers' needs faster, and reduce the cost, risk, time and effort of the innovation process (Ferreras-Mendez, Fernandez-Mesa, & Alegre, 2016; Flor, Cooper, & Oltra, 2017; Xie, Wang, & Zeng, 2018). In this background, various scholars have defined the concept of OI based on various disciplines in different contexts throughout the extant literature (Cheng & Shiu, 2020; Lu et al., 2021; Wang & Jiang, 2020). As the father of OI, Chesbrough (2003) defined the concept of OI as "innovative ideas can come from both inside and outside the organization and can go to the market from inside or outside" at the initial stage. However, in generally, OI can be defined as the free exchange of knowledge through organizational boundaries.

The concept of OI has been divided into inbound and outbound innovation by Chesbrough in 2006 considering the knowledge inflows and outflows (Chesbrough & Crowther, 2006; Wang & Xu, 2018). After that Laursen and Salter in 2006 categorized the inbound innovation as OI breadth (number of sources used for OI) and OI depth (intensity of collaboration with each source) (Hinteregger et al., 2019). In the same year, Gassmann and Enkel divided OI as inside-out (outbound), outside-in (inbound), and coupled innovation (Pilav-Velic & Jahic, 2021) by adding a new dimension as coupled innovation.

Though OI is a popular research area in innovation management, some researchers found drawbacks of the OI theory (Bogers, 2011; Dekkers et al., 2019; Enkel et al., 2009; Trott & Hartmann, 2009). One of the major limitations of the OI theory is, though external knowledge enhances firm FP, it is not an easy automatic process (Xie

et al., 2018). Because it needs a specific mechanism. On the other hand, especially, firms invest in OI to create value for the organization it is no longer sustainable due to competition and imitation (Aliasghar et al., 2019). As a result of that, firms cannot gain long-term returns on firms' R&D capability. As well, knowledge sharing has the risk of losing intellectual property (Enkel et al., 2009). Further, it is difficult to select the most suitable partners and it is difficult to select which external knowledge is useful to the firm success since external knowledge combines with uncertainty (Bogers, 2011). External knowledge should match with firms' absorptive capacity and internal R&D (Greco, Grimaldi, & Cricelli, 2016). Moreover, over-searching creates time and management problems for organizations (Greco et al., 2016). However, researchers are trying to minimize the limitations and enrich the advantages of the OI model by developing different concepts.

Firm performance

The success of the organization depends on the firm's ability to enhance FP (Bigliardi et al., 2020). FP can be defined as the type of measurement which can be used to measure the goal attainment of the firms (Ferreras-Mendeza, Newell, Fernandez-Mesa, & Alegre, 2015). Performance measurement is essential for firms to investigate how organizational structure, strategies and planning contribute to firms' success (Ferreras-Mendeza et al., 2015). Peter Drucker stated that non-innovative firms can be considered as death firms. It implies that innovation is the major part that influences to decide the degree of firm performance. Hence, firms always try to enhance their FP by utilizing different business strategies. Increasing R&D investment and collaborating with outside partners, and searching for resources from external partners is essential to enhance FP (Hinteregger et al., 2019). Especially, access to external knowledge can be recognized as a critical source of the FP (Greco et al., 2016). Hence, OI can be considered as the most suitable strategy to enhance FP. Indeed, collaborative innovation allows enterprises to gain a competitive advantage and it provides long-term motivation to improve firm performance in the competitive market (Hou, Hong, & Zhu, 2019). On the other hand, it implies the efficiency and effectiveness of the OI adopted by the organizations (Ferreras-Mendeza et al., 2015).

Various researchers have used different dimensions to measure the FP as firms' success, firm growth, R&D performance, economic performance, financial performance, social performance and product or new product development performance because there is no consensus in the definition of FP in OI literature (Moretti & Biancardi, 2020). This evidence shows that firm performance has generated much interest in recent studies since FP is a major part of firm success. Hence, most of the authors measured firm performance based on radical or incremental innovative products (Greco et al., 2016). However, Moretti and Biancardi (2020) demonstrated that though innovation-related indicators provide the success of innovation it does not show the overall performance of the firm. As well, continuous measures or percentage measures do not directly address the firm overall performance. In line with these arguments, Moretti and Biancard (2020) used economic performance, financial performance and human capital performance to analyze the FP.

Further, Nazeer, Khawaja, Qazi, Syed and Shamim (2021) stated that many researchers have used financial and non-financial indicators to measure FP. However, Nazeer et al., (2021) have used perceived operational performance to measure the FP based on three dimensions as employees' perception of organizational capability to create new products, capability to enhance operational efficiency and capability to improve productivity levels. Moreover, Greco et al., (2016) utilized industrial firm performance and economic-financial firm performance to measure the FP. Nevertheless, Jeong, Chung and Roh (2019) emphasized that product and process innovations are mostly employed by the literature to measure the FP.

Research gaps

Research gaps in the eye of the beholder. One of the most challenging tasks of the research is to build the research on the development of the research gap. However, very few studies have been developed to identify the research gaps systematically. Accordingly, Robinson, Saldanha and McKoy (2011) developed a framework to describe the research gaps and it consists of five types of research gaps as population, intervention, comparison, outcomes and setting. After that, Muller-Bloch and Kranz (2014) developed a model based on the Robinson, et al., (2011) framework and Jacob's (2011) theory on research problems (Muller-Bloch & Kranz, 2014). As a result of that, they have identified six research gaps as contradictory evidence gap, knowledge void gap, action-knowledge conflict gap, methodological gap, evaluation void gap and theory application void gap. Later, combining the Müller-Bloch and Kranz (2014) and Robinson et al., (2011) models, D. Anthony Miles in 2017 conceptualized a new model and it consists of seven research gaps as evidence gap, knowledge gap, practical-knowledge conflict gap, methodological gap, empirical gap, theoretical gap and population gap (Miles, 2017).

Evidence gap

An evidence gap explains the contradictions in the research findings of the previous studies (Muller-Bloch & Kranz, 2014).

Knowledge gap

The knowledge gap can occur in two ways. First, knowledge does not exist in the real arena of theories. Second, the expected research findings may not exist (Muller-Bloch & Kranz, 2014).

Practical-knowledge gap

The practical knowledge gap arises due to the deviation between the actual behaviors of professionals or practices and the outcome of research findings (Muller-Bloch & Kranz, 2014).

Methodological gap

A methodological gap explains the conflicts in the methodology in the previous studies and the research methods may influence the research results (Muller-Bloch & Kranz, 2014).

Empirical gap

An empirical gap describes the conflicts in the research findings or propositions in the prior research (Muller-Bloch & Kranz, 2014).

Theoretical gap

The theoretical gap explains the gaps in the existing theory with the prior research (Muller-Bloch & Kranz, 2014).

Population gap

A population gap is a common gap that describes a population that is not adequately represented by prior research (Robinson et al., 2011).

Methods

A literature review is a scientific process (Greco, Grimaldi, & Cricelli, 2015). Hence, this study applied PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis) technique to select the articles for review. Identification, screening, eligibility, and inclusion are the four steps of the PRISMA and followed these steps to review the articles for identifying the research gaps.

In the identification stage, databases, search terms and search criteria were decided. Accordingly, Ebsco host, Elsevier, Emerald Insight, and Sage databases were selected for searching the articles. Then, "open innovation" and "firm performance" identified as the search terms and search criteria were developed by combining the main terms with AND operative and similar words combined with OR operative. At the initial stage, the search string was constructed as ["open innovation" AND "firm performance"]. Then, included synonyms of OI as "distributed innovation" and "openness" using OR operative to identify the relevant articles.

In the screening stage, paid attention to the inclusion and exclusion criteria. Accordingly, "empirical studies", "peer-reviewed journals", "English", "open innovation and firm performance" and "2015-2021" were considered as the inclusion criteria and "review", "qualitative", "books", "book chapters", "book parts", "expert briefing", "magazines", "conference papers", "non-English", "non-relevance to the scope of the current study" and "articles published before 2015" were considered as the exclusion criteria.

In the eligibility stage, the articles were analyzed based on the full text of each article. In this stage, considered methodological reporting since this study focused on empirical studies. Hence, paid much attention to the population, sample, methodology, methods, design and context.

In the final stage, the authors included 30 articles for the review and analyzed each article evaluating the research findings and key areas for future research from existing studies to identify the research gaps. Apart from that, researchers searched central bank reports, the Global Innovation Index and statistics from the Department of Census and Statistics to identify the gaps which match the Sri Lankan context.

Results

In this section, researchers were expected to present the findings of the literature review under three areas. First, it shows the different relations based on the OI-FP relationship with evidence. Second, it explains the research gaps highlighting the practice gap, theoretical gap and empirical gap. Third, this study presents a model to fulfill the research gaps by opening the black box of the effect of OI on FP.

Relationship between open innovation and firm performance

According to the literature review, Aliasghar et al., (2019), Jeong et al., (2019), Lazzarotti, Bengtsson, Manzini, Pellegrin and Rippa (2017), Lorenz et al., (2020), Lu et al., (2021) revealed a positive relationship between inbound innovation and FP. As well, some

studies found that inbound and outbound innovation has a positive relationship with FP (Burcharth, Knudsen, & Søndergaard, 2017; Hou et al., 2019; Wang & Xu, 2018; Zhou, Yao, & Chen, 2018). Further, many studies recorded positive results with FP considering OI as an aggregate concept (Expósito, Serrano, & Liñán, 2019; Natalicchio, Petruzzelli, Cardinali, & Savino, 2018; Noh, 2015; Ramirez-Portilla et al., 2017; Roldan Bravo, Montes, & Moreno, 2017; Xie et al., 2018). Moreover, some scholars investigated that inbound and coupled innovation have a positive influence on FP (Hinteregger et al., 2019) and some explored that inbound, outbound and coupled innovation has a positive effect on FP (Oltra, Flor, & Alfaro, 2018).

In terms of negative results, some researchers pointed out that OI has a negative effect on FP (Caputo, Lamberti, Cammarano, & Michelino, 2016; Wang & Jiang, 2020). As well, Flor et al., (2017) and Ferreras-Mendeza et al., (2015) identified negative effects between inbound innovation and FP.

Nevertheless, some studies found that inverted U-shape relationship between OI and FP. Accordingly, Bayona-Saez, Cruz-Cazares, Garcia-Marco and Gercia (2017), Zhang, Yang, Qiu, Bao and Li (2018) reported that OI has a U-shape relationship with FP and Kobarg, Stumpf-Wollersheim and Welpe (2018) indicated a similar relationship between inbound innovation and FP.

Regarding the mixed results, Liao et al., (2020) pointed out that inbound innovation has a significant effect on FP. However, outbound innovation has not a significant effect on FP. Cheng and Shiu (2020) also proved a significant and positive influence on inbound innovation and FP but it is not significantly and positively influenced to outbound and FP. As well, Zhou, Wang, Yao and Huang (2019) noted a positive relationship between inbound innovation and FP while a U-shape relationship between outbound innovation and FP. Further, Shi and Zhang (2018) indicated that OI breadth negatively influences radical innovation and OI depth positively influences radical innovation. Not only that, Bahemia, Squire and Cousins (2017) examined that OI breadth and partner newness has a positive result on product innovativeness and negative results on OI depth and product innovativeness. Nevertheless, Cheng and Shiu (2015) found that inbound innovation increases radical innovation and outbound innovation increases incremental innovation.

Research gaps on the effect of open innovation and firm performance

This study expects to describe research gaps on the effect of open innovation and firm performance based on the following aspects.

Theoretical gap

OI theory explains that FP can be enhanced through sharing knowledge between external partners (Chesbrough, 2003). However, firms cannot use knowledge as it is to enhance FP. Indeed, knowledge is essential to enhance firm FP. But it is not enough (Xie et al., 2018). As well, the knowledge-transferring process is not an easy automatic process. It needs a specific mechanism. However, OI theory is not explaining how external knowledge is converted into enhanced FP (Xie et al., 2018). Further, OI theory does not show the specific capabilities which are essential to develop FP (Liu, 2021; Xie et al., 2018). Due to these limitations in the OI theory, some

scholars have used other theories to explain the differences in the OI-IP relationship such as absorptive capacity (Aliasghar et al., 2019; Jeong et al., 2019; Xie et al., 2018), dynamic capability (Cheng & Shiu, 2015; Cheng, Yang, & Sheu, 2016; Liu, 2021) and learning theory (Cheng & Shiu, 2015) are the main theories used by the previous researchers. However, these theories fall short of explaining the IP differences from OI implementation. These arguments emphasize that OI theory does not provide exact solutions for these issues. This evidence shows that there is an issue that is not addressed by the existing theories. As a result of that, there is a theoretical gap that needs to be fulfilled.

Empirical gap

In the previous literature, scholars paid attention to the antecedents of OI or the consequences of OI (Xie et al., 2018). However, the effect of OI on FP is less studied. These limited studies show that the OI-FP relationship is not universally positive (Weerasinghe, Jayawardane, & Yapa, 2021; Yapa, Senathiraja, & Kauranen, 2018). Because some researchers have found that OI has a positive effect on FP (Expósito et al., 2019; Natalicchio et al., 2018; Oltra et al., 2018) and some revealed that OI has a negative effect on firm FP (Caputo et al., 2016; Flor et al., 2017; Wang & Jiang, 2020). As well, some scholars discovered a U- shape relationship between OI and FP (Bayona-Saez et al., 2017; Kobarg et al., 2018; Zhang et al., 2018). These incomplete literature and inconclusive arguments show that there is an issue that has not been covered by the existing literature.

On the other hand, many studies have investigated the direct effect between OI and FP while few researchers paid attention to the indirect effect (Cheng & Shiu, 2015; Liu, 2021; Zhou et al., 2018). Accordingly, some researchers discovered absorptive capacity (Aliasghar et al., 2019; Jeong et al., 2019; Xie et al., 2018), learning capability (Cheng & Shiu, 2015) and knowledge integration capability (Liu, 2021) influence the OI-FP relationship. However, these studies were unable to provide a concrete answer for the inconsistent results. In terms of OI, extant literature is highly focused on inbound innovation, but outbound and coupled innovations are less studied (Cheng & Shiu, 2015; Hinteregger et al., 2019; Mazzola, Bruccoleri, & Perrone, 2012). In terms of FP, many researchers paid their attention to product innovation but process, marketing and organizational innovations are poorly investigated (Hinteregger et al., 2019).

Apart from that, many OI studies are concerned on the high-tech manufacturing firms in developed countries and very less attention is paid to the other industries in developing countries (Bigliardi et al., 2020).

When it comes to the Sri Lankan context, few researchers investigated organizational innovation in Sri Lanka (Shanmuganathan, 2018; Washima, 2019; Wijesinghe, Hansson, & Ekenberg, 2021). However, very limited attention has been paid to investigate the OI. Among them, some examined on handicraft sector (Jayawardhana & Surangi, 2010) and some investigated on software industries (Yapa et al., 2018). This evidence shows that there are some issues that are not addressed by the existing literature.

Practice gap

Sri Lanka was introduced as the pearl of the Indian Ocean due to its richness.

However, it is still in the developing stage though it is passing seventy-five years after independence. The economic performance of the country can be measured through the gross domestic product. In 2011 there was an 8.4% growth rate and in 2012 it increased to 9.1%. But later the annual growth decreased to 3.4%, 5, 5%, 4.5%, 3.6%, 3.3%, and 2.3% for 2013, 2014, 2015, 2016, 2017, 2018 and 2019 respectively (Central Bank of Sri Lanka, 2020). These statistics clearly show that there is a declining trend in the GDP growth rate in Sri Lanka. One of the major reasons for this declining trend is the lower level of allocation for R&D. Economic performance of the country always combines with R&D allocation. However, Sri Lanka spends very less amount on R&D expenditure. In 1975 it allocated 0.4% as a share of total GDP on R&D. But after that, it is showing a diminishing trend in the spending on R&D as 0.3%, 0.2%, 0.18% for 1979, 1983 and 1996 respectively (Department of Census and Statistics, 2019). In line with this evidence, Wijesinghe et al., (2021) highlighted that total investment for R&D from GDP is 0.11% as of the most recent statistic in 2017.

As a result of that, the Global Entrepreneurship Index indicates a declining trend constantly. It was recorded as 31.1, 25.5, 20.93, 21.88 and 19.10 for 2015, 2016, 2017, 2018 and 2019 respectively (Acs, Szerb, Lafuente, & Markus, 2019). Not only have that, but Sri Lankan export income also gradually decreased due to the poor focused on innovation and technology. Evidence shows that about 98 percent of Sri Lanka's exports have been based on simple technology (Wijewardena, 2015). Although some Asian countries moved to the innovation economy from a knowledge economy to reach sustainable prosperity through complex production systems, however, Sri Lanka is still at a poor level (Wijewardena, 2015). Apart from that, economists believe that the innovative behaviour of employees may increase after the civil war. But this prediction is not realized yet.

Especially, Global Innovation Index shows the capacity for success in innovation each year. The Global Innovation Index consists of two sub-indexes as innovation input sub-index and the innovation output sub-index. It provides detailed information on innovation success depending on 129 countries around the world and it considered Sri Lanka as a lower middle-income country (Cornell University, INSEAD, & WIPO, 2019).

Table 1 indicated that Sri Lanka is not at a satisfactory level in terms of innovation. It implies that though Sri Lanka practiced OI it was not able to achieve innovation success. It indicates that the data presented by the Global Innovation Index does not support the claim. This evidence shows that Sri Lanka is facing a serious troubling condition in terms of innovation.

Proposed conceptual framework

The relationship between OI and FP is very complicated. Hence, the choice of new variables plays a significant role when developing a new model. Based on the knowledge given by the existing researchers the following conceptual model was developed (Figure: 1).

This new model consists of the independent variable, dependent variable and mediating variable. OI is the independent variable and FP is the dependent variable. Knowledge creation is the newly proposed mediating variable for the established relationship between OI and FP.

Because prior studies suggest the necessity of examining the different aspects of knowledge management between OI and FP (Wang & Jiang, 2020; Wang & Xu, 2018; Zhou et al., 2018). As well, they have declared that knowledge management may reduce the inconclusive arguments on the OI-FP relationship. However, knowledge management is a broader concept and it consists of many other dimensions. Hence, this study selected knowledge creation since knowledge creation is the starting point of knowledge management and a prominent variable in the knowledge management process (Nonaka & Takeuchi, 1995). Further, some literature review papers also revealed that knowledge creation is not tested yet as the mediating variable between OI and FP (Dilrukshi et al., 2022). Hence, this study assumes that knowledge creation has a more explanatory power to describe the OI-FP relationship. Apart from that, knowledge creation allows to convert external knowledge into FP providing a smooth internal transforming mechanism. As well, knowledge creation helps firms to gain more benefits through collaboration to enhance firm FP. Especially, internal workers are not willing to accept external knowledge from other organizations (Natalicchio et al., 2018). They try to make trouble inside the organization to prevent the knowledge-sharing process. However, knowledge creation allows to build motivation among employees to accept new knowledge from external parties. Thereby firms can prevent the "not invented here" syndrome through knowledge creation. As well, some scholars argue that beyond a certain point, the positive effects of OI can be converted to negative effects due to the high maintenance cost, coordination cost and managing cost of external knowledge (Greco et al., 2016; Kobarg et al., 2018; Zhou et al., 2019). However, if firms can gain maximum benefits from knowledge creation firms can reduce the negative effect of knowledge exchange. Further, fully depending on the OI model or closed model is no longer sustainable (Aliasghar et al., 2019). Because Chesbrough (2003) developed the OI model against the closed model. In a dynamic business environment, a pure black model or a pure white model is not suitable to achieve sustainable competitive advantages (Trott & Hartmann, 2009). However, knowledge creation contributes to develop a grey model while balancing a closed model and an open model. Hence, this study believes that knowledge creation is the best solution to avoid the issues in the existing theories, literature and practices. The proposed model is based on quantitative research using deductive reasoning. Accordingly, the following hypotheses were formulated.

H1: Open innovation has a positive and significant effect on firm performance.

H2: Open innovation has a positive and significant effect on knowledge creation.

H2a: Inbound innovation has a positive and significant effect on knowledge creation.

H2b: Outbound innovation has a positive and significant effect on knowledge creation.

H2c: Coupled innovation has a positive and significant effect on knowledge creation.

H3: Knowledge creation has a positive and significant effect on firm performance.

H4: Knowledge creation mediates the relationship between open innovation and firm performance.

Future researchers could be tested this model empirically based on the different contexts. When it comes to the Sri Lankan context, it is facing many obstacles in terms of innovation with limited resources, technology, infrastructure and capabilities (Yapa et al., 2018). Hence, it is essential to open up their boundaries to collaborate with others to enhance its FP. Sri Lanka spent a very low amount on R&D (Washima, 2019). It is a simple product-producing country based on simple technology (Shanmuganathan, 2018). Especially, Sri Lanka is facing the worst economic crisis since 2019 for the first time in history (Nazeeruddin & Baig, 2022). There is no crisis without an opportunity and crisis is the mother of innovation (George, George, & Baskar, 2022). Further, many researchers declared that OI is the best solution for enterprises to face economic downturns (Artic, 2013; Liu, Shi, & Yang, 2022). Hence, OI is the best solution to enhance the FP in Sri Lanka.

In the Sri Lankan context, this model is more suitable for the listed companies. Because OI is not a costless task. It engages with a maintenance cost, management cost and coordination cost to manage external knowledge. It implies that firms need strong financial background and sound management skills to implement OI apart from R&D cost. However, listed companies can implement OI practices comparatively to the small and medium-scale organizations in Sri Lanka due to their financial and management capabilities.

Further, the Sri Lankan stock market has earned a reputation in several aspects. Especially, Bloombery Newswire named the Sri Lankan stock and exchange as one of the best-performing stock markets in Asia and the fourth-best performer in the world in 2007. As well, India today also ranked Sri Lankan stock market as one of the hottest stock markets in the world in 2006.

Moreover, empirical OI studies have tested different industries and different business sectors within the Sri Lankan context. However, how OI practices influence the FP of listed companies in Sri Lanka is not yet tested. Hence, it is timely to investigate the effect of OI on FP based on the listed companies in Sri Lanka by potential researchers. Accordingly, the framework is proposed to test empirically in Sri Lankan context based on the listed companies.

Discussion

A literature review identified that the OI-FP relationship is not always positive and there may be other factors that influence to this relationship be stronger than the existing relationship. As well, inconclusive arguments and ongoing debate on the OI-FP relationship discovered many research gaps. The current study raveled three research gaps as theoretical gap, empirical gap and practice gap mainly. Further, this study developed a new conceptual framework incorporating knowledge creation as the mediating variable between OI and FP to minimize the identified research gaps. Accordingly, future researchers need to consider the following to minimize conceptual confusion.

(1) It is needed to find empirical evidence on the OI-FP relationship, based on the listed companies in Sri Lanka.

(2) It is important to further investigate how external knowledge is converted to FP, and under what conditions, based on the listed companies in Sri Lanka.
(3) It is essential to examine how external factors and internal factors influence the OI-FP relationship, based on the listed companies in Sri Lanka.
(4) It is supposed to find the mediating role of knowledge creation between OI and FP based on the listed companies in Sri Lanka.
(5) It is necessary to measure the OI based on the whole dimensions of OI and FP based on the context of listed companies in Sri Lanka.

Conclusion

OI is the best solution for preventing R&D issues and gaining sustainable competitive advantages in the competitive landscape (Bigliardi et al., 2020; Dilrukshi et al., 2022; Moretti & Biancardi, 2020). It attempted to identify the different types of relationship between OI and FP based on the different contexts, to present the main research gaps in the relationship between OI and FP and propose a new conceptual model to minimize the identified research gaps. The established objectives were achieved through a desk research strategy and it was possible to understand that OI-FP is not universally positive at times. Three research gaps were identified mainly as theoretical gap, empirical gap and practice gap. The proposed conceptual framework can be carried out by future researchers to fill the identified research gaps

Figures and Tables

Figure 1
Research framework

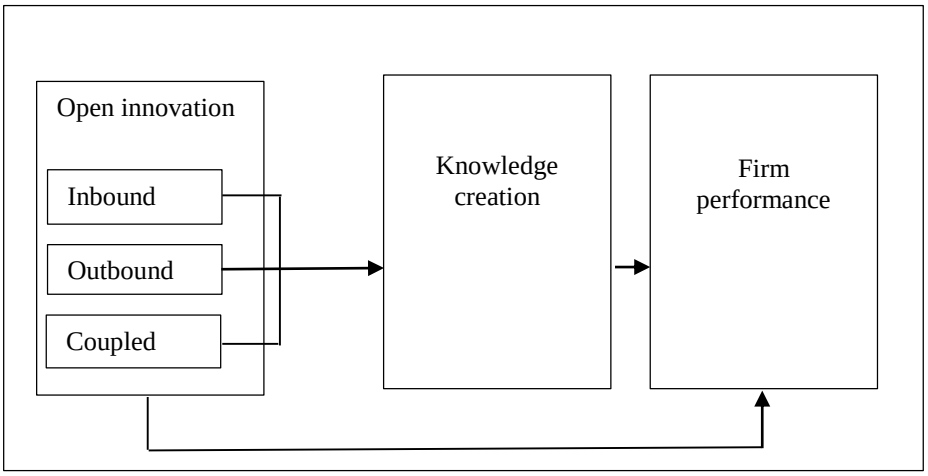

Table 1
Positions of Sri Lanka in the Global Innovation Index

Year	2021	2020	2019	2018	2017	2016	2015
GII rank	95	101	89	88	90	91	85
Innovation input sub-index	103	107	94	95	94	98	104
Innovation output sub-index	85	83	77	80	77	78	79

Note: Global Innovation Index Report published by GII, 2021

Table 2
Different types of relations between open innovation and firm performance

Author/s	Type of OI (Independent)	Type of FP (Dependent)	Findings
Lu et al., 2021	OI breadth OI depth	Innovation performance	OI breadth and depth positively relate to innovation performance
Wang & Jiang, 2020	Openness	Innovation performance	Openness has a negative effect on innovation performance
Lorenz, Benninghaus, Friedli, & Netland, 2020	OI breadth OI depth	Operational performance	OI breadth and depth positively relate to operational performance
Liao, Fu, & Liu, 2020	Inbound Outbound	FP	Inbound and outbound innovation positively relate to FP
Cheng & Shiu, 2020	OI	Eco-innovation performance	OI has a positive effect on eco-innovation performance
Hou, Hong, & Zhu, 2019	Exploration innovation Exploitation innovation	FP	Exploration and exploitation innovation has a positive impact on FP
Exposito, Serrano, & Linan, 2019	OI practices	Innovation outcomes	OI has a significant effect on innovation outcomes
Zhou, Wang, Yao, & Huang, 2019	Inbound Outbound	Innovation performance	Inbound innovation positively relates to innovation performance and outbound innovation has an inverted U- shaped relationship with innovation performance
Hinteregger, Durst, Temel, & Yesilay, 2019	Inbound Coupled	FP	Inbound and coupled innovation positively influence FP
Jeong et al., 2019	Inbound	Innovation performance	Inbound innovation has a positive effect on innovation performance
Aliasghar et al., 2019	Inbound	Innovation performance	Inbound innovation has a significant positive impact on innovation performance
Wang & Xu, 2018	Inbound Outbound	Radical innovation	Inbound and outbound innovation have a significant positive impact on radical innovation
Oltra et al., 2018	Inbound Outbound Coupled	FP	Inbound, outbound and coupled innovation have a positive impact on FP

Zhou, Yao, & Chen, 2018	Inbound Outbound	Innovation performance	Inbound and outbound innovation positively relate to innovation performance
Shi & Zhang, 2018	OI breadth OI depth	Radical innovation capability	OI breadth decreases the radical innovation capability and OI depth increases the radical innovation capability
Natalicchio, Petruzzelli, Cardinali, & Savino, 2018	OI strategy	Innovation performance	OI positively influences the innovation performance
Zhang, Yang, Qiu, Bao, & Li, 2018	OI	Financial performance	Inverted U-shaped relationship between OI and FP
Kobarg et al., 2018	OI breadth OI depth	Innovation performance (Radical, incremental)	Inverted U- shaped relationship between search breadth on radical innovation and search depth on incremental innovation
Burcharth, Knudsen, & Sondergaard, 2017	Inbound Outbound	Innovation performance	Both inbound and outbound innovation has a positive effect on innovation performance
Portila, Cagno, & Brown, 2017	OI practices OI models	FP	OI practices and OI models have a positive effect on FP
Lazzarotti, Bengtsson, Manzini, Pellegrin, & Rippa, 2017	OI breadth OI depth	Innovation performance	OI breadth and depth positively relate to innovation performance
Bahemia, Squire, & Cousins, 2017	OI breadth OI depth Partner newness	Product competitive advantage	OI breadth and partner newness positively influence product competitive advantage and OI depth has a negative effect on product competitive advantage.
Roldan Bravo, Montes, & Moreno, 2017	Orientation of OI	FP	Orientation of OI positively influences FP
Bayona-Saez, Cruz-Cazares, Garcia-Marco, & Gercia, 2017	OI strategy	Innovation performance	Inverted U- shaped relationship between OI and FP
Flor et al., 2017	OI breadth OI depth	Radical innovation	Positively impacts external search on radical innovation
Caputo et al., 2016	Inbound Outbound	Innovation performance Financial performance	OI is not beneficial for innovation performance and financial performance
Cheng & Shiu, 2015	Inbound Outbound	Innovation performance (Radical, Incremental)	Inbound innovation increases radical innovation and hinders incremental innovation, while outbound innovation improves incremental innovation and hinders the radical innovation
Noh, 2015	OI	Financial performance	OI positively impacts the long-term financial performance
Mendeza, Newell, Mesa, & Alegre, 2015	OI breadth OI depth	Innovation performance FP	OI breadth and depth positively impact innovation performance and OI breadth and depth negatively affect FP

Note: Dilrukshi, Wickramasinghe, & Edirisinghe, 2022

References

Acs, Z. J., Szerb, L., Lafuente, E., & Markus, G. (2019). *The Global Entrepreneurship Index.* Washington, D.C., USA: The Global Entrepreneurship and Development Institute.

Aliasghar, O., Rose, E., & Chetty, S. (2019). Where to search for process innovations? The mediating role of absorptive capacity and its impact on process innovation. *Industrial Marketing Management*, 199-212.

Artic, N. (2013). Open innovation as a chance to overcome economic crisis in hotel industry. *Tourisam in Southern and Eastern Europe*, 55-67.

Bahemia, H., Squire, B., & Cousins, P. (2017). A multi-dimensional approach for managing open innovation in NPD. *International Journal of Operations & Production Management*, 366-1385.

Bayona-Saez, C., Cruz-Cazares, C., Garcia-Marco, T., & Gercia, M. S. (2017). Open innovation in the food and beverage industry. *Management Decision*, 26-546.

Bigliardi, B., Ferraro, G., Filippelli, S., & Galati, F. (2020). The influence of open innovation on firm performance. *International Journal of Engineering Business Management*, 1-14.

Bogers, M. (2011). The open innovation paradox: knowledge sharing and protection in R&D collaborations. *European Journal of Innovation Management*, 93-117.

Bogers, M., Chesbrough, H., & Moedas, C. (2018). Open innovation: Research, practices and policies. *California Management Review*, 5-16.

Burcharth, A., Knudsen, M. P., & Søndergaard, H. A. (2017). The role of employee autonomy for open innovation performance. *Business Process Management*, 1245-1269.

Caputo, M., Lamberti, E., Cammarano, A., & Michelino, F. (2016). Exploring the impact of open innovation on firm performance. *Management Decision*, 1788-1812.

Central Bank of Sri Lanka. (2020). *Annual Report 2020.* Colombo: Central Bank of Sri Lanka.

Cheng, C. C., & Shiu, E. C. (2015). The inconvenient truth of the relationship between open innovation activities and innovation performance. *Management Decision*, 625-647.

Cheng, C. C., Yang, C., & Sheu, C. (2016). Effects of open innovation and knowledge-based dynamic capabilities on radical innovation: An empirical study. *Journal of Engineering and Technology Management*.

Cheng, C. C., & Shiu, E. C. (2020). Leveraging open innovation strategies for fueling eco-innovation performance in dynamic environments. *Sustainability Accounting Management and Policy Journal*, 1245-1270.

Chesbrough, H. W. (2003). *Open innovation: The new imperative*

for creating and profiting from technology. McGraw-Hill, Maidenhead, Boston, Mass: Harvard Business School .

Chesbrough, H. W., & Crowther, A. K. (2006). Beyond high tech: Early adopters of open innovation in other industries. *R&D Manag*, 229-236.

Cornell University, INSEAD, & WIPO. (2019). *The Global Innovation index 2019: Creating Healthy Lives-The Future of Medical Innovation.* Geneva: Ithaca, Fontainebleau.

Dekkers, R., Koukou, M. I., Mitchell, S., & Sinclair, S. (2019). Engaging with open innovation" a scottish perspective on its oppertunities, challenges and risks. *Journal of Innovation Economics*, 193.

Department of Census and Statistics. (2019). *Department of Census and Statistics Publication 2019.* Colombo: Department of Census and Statistics.

Dilrukshi, M., Wickramasinghe, C. N., & Edirisinghe, S. D. (2022). Impact of open innovation on firm performance: A literature Review. *South Asian Journal of Business Insights*, 51-72.

Enkel, E., Gassmann, O., & Chesbrough, H. (2009). Open R&D and open innovation: exploring the phenomenon. *R&D Management*, 311-316.

Expósito, A., Serrano, J. F., & Liñán, F. (2019). The impact of open innovation on SMEs' innovation outcomes. *Journal of Organizational Change Management*, 558-577.

Ferreras-Mendez, J. L., Fernandez-Mesa, A., & Alegre, J. (2016). The relationship betweenknowledge search strategies and absorptive capacity: A deeper look. *Technovation*, 48-61.

Ferreras-Mendeza, J. L., Newell, S., Fernandez-Mesa, A., & Alegre, J. (2015). Depth and breadth of external knowledge search and performance: the mediating role of absorptive capacity. *Industrial Marketing Management*, 86-97.

Flor, L. M., Cooper, S. Y., & Oltra, M. J. (2017). External knowledge search, absorptive capacity and radical innovation in high technology firms. *European Management Journal*, 1-12.

George, A. H., George, A. S., & Baskar, T. (2022). Sri Lanka's economic crisis: A brief overview. *Partners Universal International Research Journal*, 9-19.

Greco, M., Grimaldi, M., & Cricelli, L. (2015). Open innovation actions and innovation performance: A literature review of European empirical evidence. *European Journal of Innovation Management*, 150-171.

Greco, M., Grimaldi, M., & Cricelli, L. (2016). An analysis of the open innovation effect on firm performance. *European Management Journal*, 1-16.

Hinteregger, C., Durst, S., Temel, S., & Yesilay, R. B. (2019). The impact of openess on innovation in SME's. *International Journal of Innovation Management*.

Hou, B., Hong, J., & Zhu, R. (2019). Exploration/exploitation innovation and firm performance:

The mediation of entrepreneurial and moderation of competitive intensity. *Journal of Asia Business Studies*, 489-506.

Jayawardhana, A., & Surangi, H. (2010). Open innovation practices in women owned handicraft manufacturing SME's: A case from central province, Sri Lanka.

Jeong, S. W., Chung, J.-E., & Roh, J.-S. (2019). Impact of external knowledge inflow on product and process innovation of Korean SMEs: Absorptive capacity as a mediator. *Clothing and Textiles Journal*, 1-16.

Kobarg, S., Stumpf-Wollersheim, J., & Welpe, I. M. (2018). More is not always better: Effects of collaboration breadth and depth on radical and incremental innovation performance at the project level. *Research Policy*, 1-10.

Lazzarotti, V., Bengtsson, L., Manzini, R., Pellegrin, L., & Rippa, P. (2017). Openness and innovation performance: An empirical analysis of openness determinants and performance mediators. *European Journal of Innovation Management*, 463-492.

Liao, S., Fu, L., & Liu, Z. (2020). Investigating open innovation strategies and firm performance: The moderating role of technological capability and market information management capability. *Journal of Business & Industrial Marketing*, 23-39.

Liu, B. (2021). Matching external search strategies with radical and incremental innovation and the role of knowledge integration capability. *Baltic Journal of Management*, 765-784.

Liu, Z., Shi, Y. J., & Yang, B. (2022). Open innovation in times of crisis: An owerview of the healthcare sector in response to the COVID-19 pandemic. *Journal of Open Innovation: Technology, Market and Complexity*.

Lorenz, R., Benninghaus, C., Friedli, T., & Netland, T. H. (2020). Digitization of manufacturing: The role of external search. *International Journal of Operations and Production Management*, 1129-1152.

Lu, C., Yu, B., Zhang, J., & Xu, D. (2021). Effects of open innovation strategies on innovation performance of SMEs: evidence from China. *Chinese Management Studies*, 24-43.

Mazzola, E., Bruccoleri, M., & Perrone, G. (2012). The effect of inbound,outbound and coupled innovation on performance. *International Journal of Innovation Management*, 277-303.

Miles, D. A. (2017). A taxonomy of research gaps: Identifying and defining the seven research gaps. *Doctoral student workshop: Finding research gaps-research methods and strategies*. Dallas, Texas.

Moretti, F., & Biancardi, D. (2020). Inbound open innovation and firm performance. *Journal of innovation and knowledge*, 1-19.

Muller-Bloch, C., & Kranz, J. (2014). A framework for rigorously

identifying research gaps in qualitative literature reviews. *The thirty sixth international conference on information systems*, (pp. 1-19). Fort Worth.

Natalicchio, A., Petruzzelli, A. M., Cardinali, S., & Savino, T. (2018). Open innovation and the human resource dimension: An investigation into the Italian manufacturing sector. *Management Decision*, 1271-1284.

Nazeer, S., Khawaja, K. F., Qazi, S., Syed, F., & Shamim, F. (2021). How and when information proactiveness leads to operational firm performance in the banking sector of Pakistan? The roles of open innovation,creative cognitive style and climate for innovation. *International journal of innovation management*.

Nazeeruddin, M., & Baig, M. J. (2022). Sri Lanka's economic crisis- An eye opener. *International Journal of Multidisciplinary*, 1-2.

Noh, Y. (2015). Financial effects of open innovation in manufacturing industry. *Management Decision*, 1527-1544.

Nonaka, I., & Takeuchi, H. (1995). *The knowledge creating company.* New York: Oxford University Press.

Oltra, M. J., Flor, L. M., & Alfaro, A. J. (2018). Open innovation and firm performance: the role of organizational mechanisms. *usiness Process Management*, 814-836.

Pilav-Velic, A., & Jahic, H. (2021). The adoption of inbound open innovation practices in developing countries: empirical evidence from the manufacturing sector. *European Journal of Innovation Management*.

Rajapathirana, R. J., & Hui, Y. (2018). Relationship between innovation capability, innovation type and firm performance. *Journal of innovation and knowledge*, 44-55.

Ramirez-Portilla, A., Cagno, E., & Brown, T. E. (2017). Open innovation in specialized SMEs: the case of supercars. *Business process management journal*, 1167-1195.

Robinson, K., Saldanha, I., & McKoy, N. A. (2011). Development of a framework for to identify research gaps systematic reviews. *Journal of Epidemiology*, 1325-1330.

Roldan Bravo, M. I., Montes, F. J., & Moreno, A. R. (2017). Open innovation in supply networks: An expectation disconfirmation theory perspective. *Journal of Business & Industrial Marketing*, 432–444.

Shanmuganathan, A. (2018). Innovation in Sri Lanka. Retrieved from http://www.researchgate.net.

Shi, X., & Zhang, Q. (2018). Inbound open innovation and radical innovation capability. *Journal of Organizational Change Management*, 581-597.

Trott, P., & Hartmann, D. (2009). Why 'Open Innovation' is old wine in new bottles. *International Journal of Innovation Management*, 715-736.

Wang, X., & Xu, M. (2018). Examining the linkage among open innovation, customer knowledge management and radical innovation. *Baltic Journal of Management*, 368-389.

Wang, Z., & Jiang, Z. (2020). How R&D originality affects open innovation under knowledge spillovers? *European Journal of Innovation Management*, 604-628.

Washima, M. (2019). Impact of innovation on economic growth of Sri Lanka: An empirical study. *International Journal of Accounting & Business Finance*, 60-71.

Weerasinghe, R. N., Jayawardane, A., & Yapa, U. (2021). The impact of open innovation practices and moderating effect of inter-organizational networks on innovation performance of large firms in Sri Lanka. *Annals of Spiru Haret University, Economic Series*, 29-58.

Wijesinghe, C., Hansson, H., & Ekenberg, L. (2021). Determinants of ICT innovations: Lessons learned from Sweden and Sri Lanka. *Administrative Sciences*.

Wijewardena, W. (2015). Part5: Social market economy- Go for complex production system, facilitate entrepreneurship.

Xie, X., Wang, L., & Zeng, S. (2018). Inter organizational knowledge acquisition and firms' radical innnovation: A moderated mediation analysis. *Journal of business research*, 295-306.

Yapa, S. R., Senathiraja, R., & Kauranen, I. (2018). Improving innovation performance by convergence in open innovation: Evidence from software firms in Sri Lanka. *Vidyodaya Journal of Management*, 1-33.

Zhang, S., Yang, D., Qiu, S., Bao, X., & Li, J. (2018). Open innovation and firm performance: Evidence from the Chinese. *Journal of Engineering and Technology Management*, 76-86.

Zhou, H., Wang, K. Y., Yao, Y., & Huang, K.-P. (2019). The moderating role of knowledge structure in the open innovation effect. *Management Decision*, 2223-2238.

Zhou, H., Yao, Y., & Chen, H. (2018). How does open innovation affect firms' innovative performance: The roles of knowledge attributes and partner oppertunism. *Chinese Managemment Studies*, 720-740.