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Research Article

The Research Landscape of Open Innovation in Southeast Asia: A Bibliometric Performance Analysis and Science Mapping Study

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ABSTRACT

The study aims to explore the current landscape of open innovation in Southeast Asia (SEA), focusing on its potential to enhance innovation and technological development in the region. The research utilizes a multidisciplinary database, the Web of Science, and VOSViewer software for a Systematic Literature Review (SLR). The analysis is divided into two parts: (1) descriptive analysis, which examines the number of publications from SEA countries over the years, and (2) cluster analysis, identifying key themes in open innovation research. The findings show that open innovation supports both product and process development, offering substantial benefits for SMEs in Southeast Asia. The study highlights the importance of tapping external knowledge, technologies, and practices to overcome regional structural and technological gaps. It provides fresh insights into how open innovation operates in emerging economies, particularly in SEA, and strengthens the understanding of its value for SMEs and other firms.

Keywords: Bibliographic Coupling, Inbound Open Innovation, Open Innovation, Outbound Innovation, SMEs, Southeast Asia, Systematic Literature Review.

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INTRODUCTION

An approach to corporate management known as "open innovation" pushes companies to work together and exchange information with other entities. Companies that practise open innovation are aware that they are not always equipped with the necessary resources or expertise to address every issue that comes up (Huizingh, 2011). Open innovation gives companies access to a larger pool of ideas and information, which can result in more creative and practical solutions. It also lets companies share the price and risks of innovation with their associates and take advantage of their complementary skills and resources (Chesbrough and Appleyard, 2007). Because companies can experiment with different approaches and solutions and leverage external inputs and feedback, open innovation enables faster and more flexible innovation processes. This helps businesses build relationships with stakeholders, enhance their brand image, and have a positive social impact (Elmquist *et al.*, 2009).

Innovation ecosystems entail the cooperation and sharing of resources and expertise amongst different stakeholders, including government agencies, businesses, and academic institutions. Henry Chesbrough popularised the term "open innovation," which highlights the notion that businesses can draw advantages from both internal and external sources for innovation (Chesbrough, 2003) as represented in Figure 1. There are two primary categories of open innovation in national innovation systems and university-industry ecosystems: outward and inbound open innovation (Davari *et al.*, 2019). By increasing the circulation and dissemination of knowledge and technology, fostering collaboration and learning, enhancing productivity and competitiveness, and promoting entrepreneurship and economic growth, both inbound and outbound open innovation can help advance the university-industry ecosystem and the overall national innovation system (Leitão *et al.*, 2020; Michelino *et al.*, 2014).

Within the context of universities and industry, inbound open innovation pertains to the inflow of outside information and technology into academic settings. This could entail academic research projects involving industrial knowledge, accessing external research, and universities working in partnership with industries. Universities may influence research agendas and provide students with applicable skills by drawing on the real-world problems and practical ideas that industry presents (Corsino and Torrisi, 2023). For instance, companies

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finance research projects that accelerate innovation in areas of shared interest. Working together, researchers and industry professionals can exchange knowledge and quickly prototype ideas in collaborative spaces. Universities can commercialise their ideas by licensing them to industry partners, resulting in the establishment of new companies and economic expansion (Osorno-Hinojosa *et al*., 2022).

Inbound open innovation at the national level refers to obtaining outside expertise, technology, and industry best practises from worldwide sources. International cooperation, technological transfer, and the acceptance of technologies created elsewhere can be advantageous to developing nations. This boosts a nation's technological prowess and competitiveness by fostering a more vibrant and integrated national innovation system. To attract foreign talent and investment, governments and universities can work with their international counterparts on research projects of strategic importance (Oliver, 2022). They can also collaborate on open and welcoming environments for foreign researchers and entrepreneurs, which promotes innovation and knowledge transfer. Additionally, modifying and exchanging pre-existing open-source solutions can cut development costs and spur innovation.

In the university-industry setting, outbound open innovation refers to the movement of talented workers, technologies, and information from universities to industries. Technology licensing, spin-off businesses, and the commercialisation of academic research are some ways to make it happen. By converting scholarly knowledge into useful applications that advance businesses and society, universities support economic growth (Corsino and Torrisi, 2023). Domestic ideas are disseminated globally as part of outbound open innovation at the national level. This can involve encouraging the globalisation of domestic businesses, licensing intellectual property, and exporting innovations. Participating in international innovation networks can help nations become more influential, draw in foreign capital, and advance knowledge and technology globally (Oliver, 2022).

Southeast Asian (SEA) nations have become an important players in the ever-changing global economic scenario, greatly impacting innovation and advancement. Dahlander and Wallin (2020) attempted to analyse the dimensions of Southeast Asia's economic environment and how these countries involve significantly in international innovation initiatives. Southeast Asian nations including Indonesia, Malaysia, Thailand, Singapore, Vietnam, and others-are becoming more and more powerful economically (Michelino *et al*., 2014). These nations are important players in the global economy because of their advantageous geographic location, wealth of resources, and rapidly growing population. These countries work together to create a sizable market and production hub that draws in international capital and promotes economic expansion (Kuusinen *et al*., 2023). Significant technological improvements have been made in Southeast Asian nations, especially in the areas of information technology, telecommunications, and renewable energy. The governments in these nations have put laws in place to support research and development because they understand how important innovation is to be advancing economic growth. These advancements in technology not only help the area but also support worldwide creative projects (Kimura *et al*., 2019).

Southeast Asia's entrepreneurial culture has produced thriving start-up ecosystems. Innovation has flourished in nations like Singapore and Vietnam, producing a new breed of entrepreneur's keen to leave their mark on the world economy (Tonby, 2020). These ecosystems have been fostered by government initiatives and supported infrastructure, which have been crucial in creating a climate that is favourable for start-ups to flourish (Woetzel, 2018). The Southeast Asian (SEA) region stands as one of the most vibrant and rapidly developing areas globally, characterized by the progressive integration of its national economies into global knowledge networks. Detailed country profiles elucidate the structural dynamics of national innovation systems and their interplay with global knowledge flows, framed within the broader contextual determinants of innovation (OECD, 2013). A regional synthesis further highlights the current performance of the SEA region, emphasizing the circulation of knowledge both within the region and between it and established centres of knowledge production, including the European Union, Japan, and the United States. Additionally, the innovation performance of these countries measured using Global Innovative Index indicates the level of creative potential these South-East Asian countries hold. Recently, Singapore made it to the top 5 list of innovators globally whereas, Vietnam, Philippines, Indonesia are among the most impressive and fastest climbing middle-income economies over the past decade (WIPO, 2023). However, there are differences based on structural transformation and technological development, and open innovation is necessary to bridge this gap. Obtaining external expertise, technology, and industrial best practices can boost developing economies, and share the costs and risks of innovation.

Despite having the innovation potential, there is little evidence in the literature studying open innovation in South-East Asian setting. There are studies that discuss the viability of open innovation paradigm in these developing nations like Vietnam, Malaysia, Thailand (Smith and Perry, 2023). Unlike most of the developed economies, the diffusion of innovation in these developing economies is also limited attributing to the factors like- financial aid, managerial competencies, skilled manpower and access to external knowledge (Dabla-Norris *et al*., 2023). Further, being the importer of Intellectual property rather than the developer presents challenges for these developing countries to adopt the open innovation policies as the economic structure of these nations is constantly transforming and becoming interdependent. As a result, national innovation systems are

impacted and to boost the innovation landscape tapping of external and internal knowledge becomes essential.

As the term 'Open Innovation' continues to evolve, this analysis will prove to be instrumental for academic researchers and industry professionals. By synthesizing crucial insights and identifying the research gap within the existing literature, it attempts to facilitate a more informed scholarly contribution. Additionally, this study enables the systematic gathering and quantification of themes pertaining to OI in SEA context, revealing the overlooked areas and thereby encouraging scholarly endeavours into this domain, as it attempts to address the following Research Questions (RQs):

RQ1: How has the publication output related to OI grown in Southeast Asian countries?

RQ2: Which leading journals or key publication sources are most prominent in this field?

RQ3: What are the main themes and emerging topics most discussed in OI literature by SEA countries?

Based on these RQs, the following objectives were defined:

1. To determine the growth of literature related to OI through the years.
2. To identify the prominent publication outlets/source of publications preferred by the authors of SEA countries.
3. To identify the important conceptual and thematic structures present within the literature.

METHODOLOGY

The study is based on Systematic Literature Review (SLR) using bibliographic details of the publications to evaluate and map the structure of knowledge (Tranfield *et al*., 2003), in the open innovation domain. Also, systematic review is advocated over other review techniques attributing to its objective nature. Further, adopting bibliometric approach authors tried to establish connection between research paper and different variables associated with the research paper to fulfil the set objectives through co-citations, co-authorship, key terms and publication outlets (Ebrahim and Bong, 2017).

To perform the analysis, data was extracted using Web of Science database because of its multidisciplinary coverage (Zhu and Liu, 2020). The search was done using the query in search bar as "Open Innovation" under the criteria *topic* which retrieves the records by looking into titles, abstract, author keywords for the given search term.

Inclusion and Exclusion Criteria

Initially, the retrieved records using the keywords "open innovation" were 3734. The documents were then selected for the study, after setting the inclusion and exclusion criteria. The retrieved records were refined for articles and review articles only (3523 records) as they provide standardized metadata, and consistent citations that are easy to access during analysis. Further, they include reference list that helps in efficient science mapping and identifying themes. Document types other than these two were excluded from the analysis due to the inconsistencies with the bibliographic data. Final published publications were included in the study excluding the early access articles to be consistent with the citation data. The publication data was considered for all the years indexed within the database. Dataset includes articles and review articles that are in English language only.

Further, to extract the publication contribution by Southeast Asian countries as per the scope of this study, dataset was refined using country field (for all indexed years). Southeast Asia has eleven countries having diverse culture: Brunei, Myanmar, Cambodia, Indonesia, Malaysia, Philippines, Singapore, Thailand, Vietnam, Timor-Liste and Laos. However, for Laos and Timor-Liste no records were found in the database. Final 122 records attributed solely to Southeast Asian (SEA) countries except for the two countries was selected for this study with at least one author having affiliation to the SEA countries. The reason for the selection of South-East Asian countries is related to the diverse ecosystem of innovation because of its unique demography and emerging economy. These innovative approaches have gained momentum recently and might prove to be beneficial for the open innovation approaches in their collaborative endeavors of these countries (Dabla-Norris *et al*., 2023). After refining the retrieved results, publication records were downloaded in tab delimited form for further analysis. The corroborative approaches of content analysis and bibliometrics were used to provide a thorough assessment of the literature in the concern subject domain (Carvalho *et al*., 2013; Rossoni, 2023).

After careful selection and downloading, the records were pre-processed for any irregularities in key terms, names of authors and publication title duplication etc. The next part of the methodology followed quantitative analysis of the data and network visualization employing software like VOS Viewer 1.6.17 and R's function Biblioshiny 4.1.3. The software visualizes and clusters the given records using various attributes present within the records through data mining techniques at the backend. To have precise clusters of literature published, bibliographic coupling was performed attributing to its advantages over other approaches (Boyack and Klavans, 2010). Using citation analysis, this method ascertains similarity between records and outlines current trend within the domain (Jarneving, 2007). 122 records were imported to VOS Viewer where, using bibliographic data from Web of Science database, network map was created. After which, Bibliographic coupling of the dataset was performed where, the threshold for citation per document was set to 10 alongside upgrading the minimum size of the clusters to 8. Finally, 58 articles were selected for the formation of 4 clusters. The color and size of the nodes depict the category and strength

of the publication within the visualized network map (van Eck and Waltman, 2010). With the identification of 58 core articles through bibliographic coupling, we tried to identify the trend of open innovation literature by analyzing these four clusters in depth.

The systematic protocol used for this study is illustrated in the Figure 2.

RESULTS AND ANALYSIS

Descriptive results

Growth of publications and top contributing journal for publications and citations received

Figure 3 showcases the progression of scientific literature on Open Innovation by south-east Asian countries. Though the concept of innovation was coined around 2003 (Chesbrough, 2003), the popularity of the concept among SEA countries was set around 2010 as is evident from the analysis. In the initial years, the contribution made were fewer in numbers like two to three publications till 2014. However, publications saw an exponential growth from 2020 to 2022 as depicted in the graph with 17 publications in 2021 to almost double (31) in 2022 where they were at peak. If we bifurcate the publication trend throughout the taken years, Phase one i.e., 2010-2016 contributes only 15.57% of the total publications whereas second phase i.e., 2017-2023 contribute 84.43% articles. This clearly indicated that the popularity of the domain literature has accelerated during the past decade.

Within the time span of 2010-2023, 122 articles were published in 70 diverse journals. The journal with higher number of articles was Sustainability (10 publications) followed by 'European Journal of Innovation Management' (7 publications) and Technovation (6 publications) as demonstrated in Figure 3 alongside the citation gained by those journals. Whereas Table 1 shows top 15 journals with highest number of citations.

Table 1 showcases the top journals with highest number of total citations received for the research articles on open innovation domain published within that same journal. Further, it suggests that the number of publications does not necessarily play a role in the gaining citation whereas, the reputation of the journals might have a prominent influence on the citation gain. As shown in Figure 4, the average citation per article is highest for small business economics journal i.e., 31.18. For example, only one article is published in Small Business Economics journal, but the citation gain is much higher (343) than the top journal in terms of publication count i.e., Sustainability with 10 publications and 86 citations only. Similarly, Research Policy having highest number of total citations (426) to its name has only two articles related to Open Innovation by these SEA countries.

Cluster analysis results

A subfield of scientometrics, where coupling is done based on how often two research papers are mentioned together and how much they are mentioned the same. This method of mapping the structure and content of scientific literature is frequently preferred by the policy makers (Jarneving, 2007). This method helps to identify the coherent themes within the literature and identify core documents by forming the cluster using cited references (Boyack and Klavans, 2010). For this study, quantitative evaluation was done using Biblioshiny function of R software and network visualization was conducted using VOSviewer version 1.6.17.

Selecting "bibliographic coupling of authors" with threshold of 10 documents per author. The most interconnected authors are represented in network map as shown in Figure 5 and further presented in Tables 2-5 with detailed explanation of each four clusters. Upon generating the network, VOSviewer employs a visual representation in which researchers are depicted as circles. The size of each circle corresponds to the number of publications, with larger circles indicating a higher publication count. The

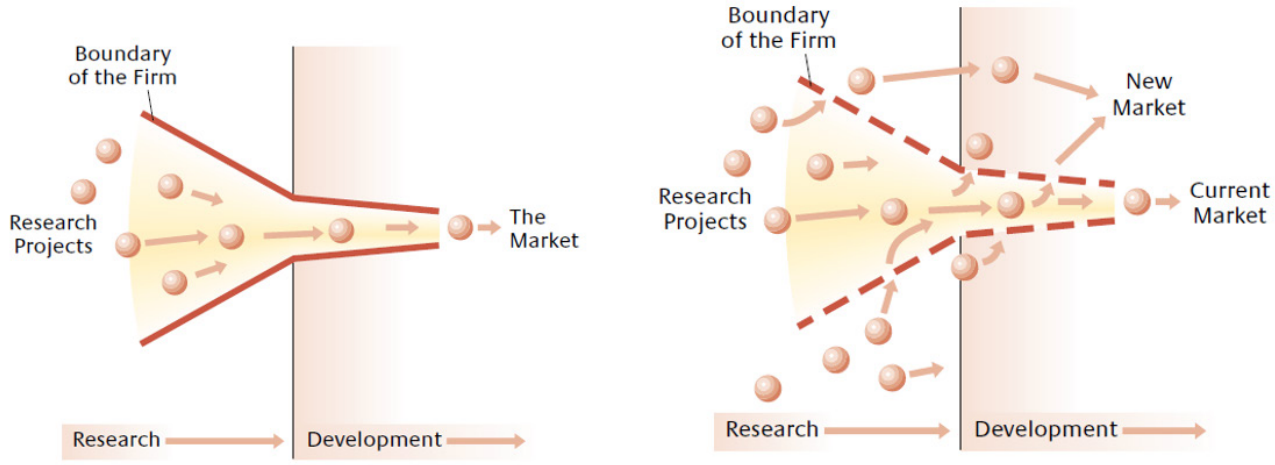


Figure 1: The Knowledge Landscape in Closed and Open Innovation respectively (Chesbrough, 2003).

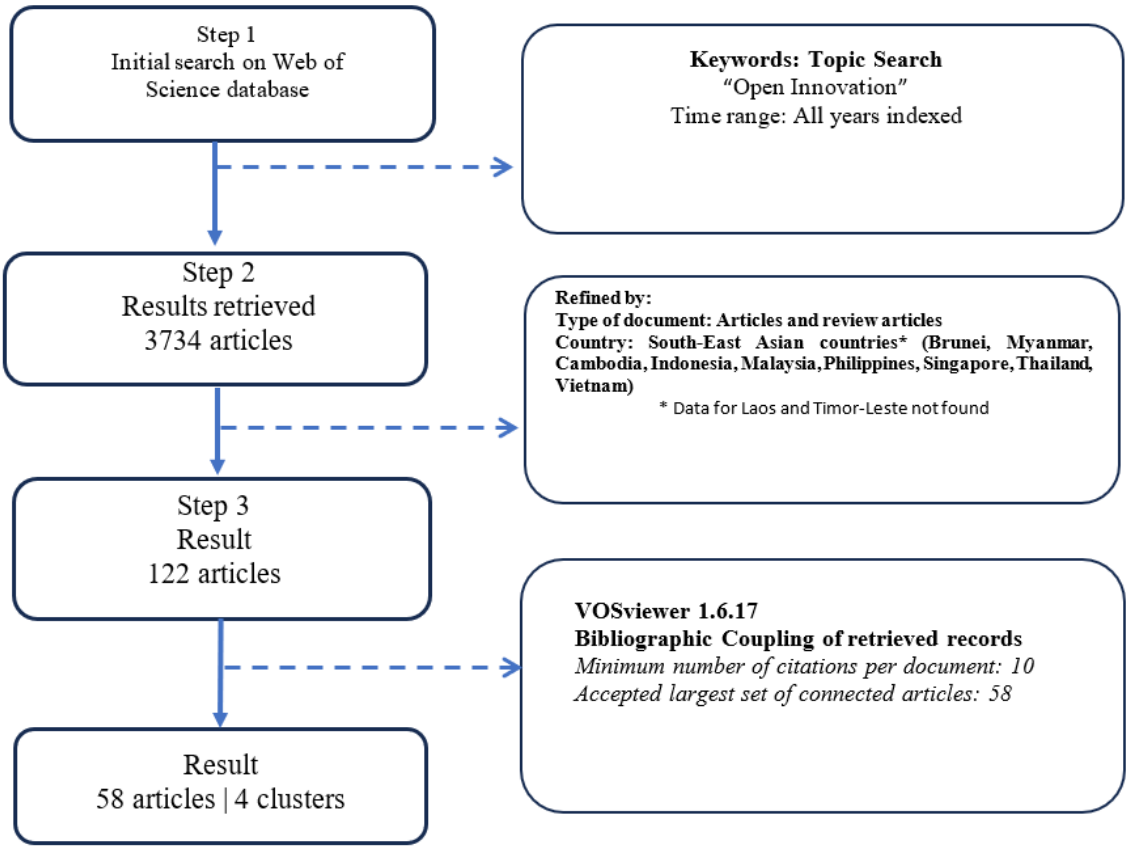


Figure 2: Systematic review protocol.

spatial proximity between researchers reflects the strength of their bibliographic coupling, signifying the extent to which they reference the same scholarly works. Further, the visualization is color-coded into 4 clusters representing different themes.

Cluster 1: Potential of Open Innovation in the emerging market

Table 2 incorporates 20 articles that are being coupled based on their bibliography and this cluster (red) focuses on the effectiveness of open innovation in the emerging market, value co-creation for the science-based market and patterns related to open innovation. The article titled *"Managing open innovation projects with science-based and market-based partners"* received highest citations within the cluster 1. This article examines the association between the open innovation activities and monetary benefits in research projects (Du *et al*., 2014). The authors detail about managerial skill as a vital aspect regarding the success of any form of open collaboration project based on science and market. For instance, the financial accomplishments are positive when market-based projects are managed formally/tightly, whereas projects that are based on science-partnership lead to higher profit even if they are not managed tightly. Additionally, from a multidisciplinary perspective too, the managerial capabilities are important to identify potential and profitable innovations at project level and high technology markets that are emerging globally (Wu *et al*., 2016).

Science-based collaborators, coordinate linkages, service providers are a few external sources that significantly influences the innovation ecosystem of the developing economies in synergy with internal research and collaboration activities (Chen *et al*., 2016). Firms in developing economies often collaborate with larger firms of developing countries to advance their technological potential and create a value chain on the global market. The process of knowledge accumulation is challenging during innovation and here inter-firm collaboration, and open innovation becomes essential for the small firms to acquire knowledge (Yap and Rasiah, 2017).

Factors like governmental support and size of the firms are also taken into consideration to evaluate their impact on the open innovation process carried out by the firms focusing on two types -radical and incremental innovation (Jugend *et al*., 2018). The findings suggest that governmental aid benefits (highly) the firms that are working towards creating new markets and break thorough technologies than the ones inclined towards incremental innovation. Government fundings remarkably enhance the innovation outcomes of public research institutions and companies (Cheah and Ho, 2020). Moreover, the success of

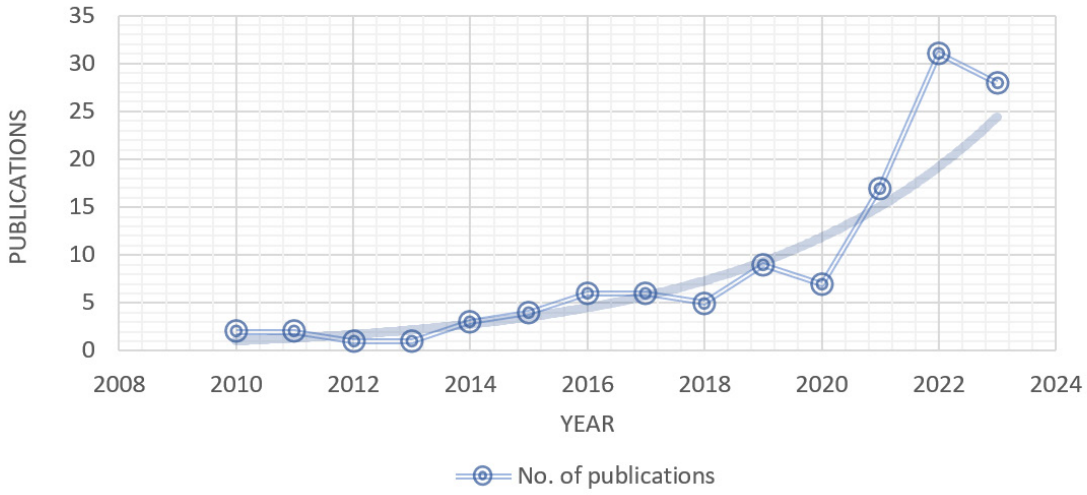


Figure 3: Growth of articles published about open innovation by the South-East Asian/countries over the years.

Table 1: Top journals with the highest number of total citations for articles published on open innovation.

Name of Journals	No. of Citations
Research Policy	426
Small Business Economics	343
International Journal of Management Reviews	235
Information & Management	178
Advanced Engineering Informatics	161
R&D management	148
European Journal of Innovation Management	147
Technovation	139
Journal of Strategic Information Systems	130
Mis quarterly	129
Technological Forecasting and Social Change	89
Sustainability	86
Internation Journal of Production Research	76
Aquaculture	54
Quality & Quantity	53

these collaborations is partially linked with the public research institution's managerial prowess.

Lopez-Vega *et al.* (2016) advocates deeper understanding into the search heuristics to tackle problems encountered in open innovation. The authors investigate on how enterprises search through innovation intermediaries in open innovation projects. Although, number of studies have been conducted to understand the search behaviour of the larger firms, however, the search pattern of SMEs for external knowledge is not clear. But, a study by Chaochotechuang *et al.* (2019) reveals that mostly SMEs searched nearby surroundings (inbound OI) for new ideas and learned by practically implementing it. Whereas, for critical problems they gaze distant sources to tackle the issue considering the monetary risks aligned with innovative activities. Alongside public institutional knowledge resources, depth of the search strategy too is positively related with the financial performance in process innovation (Cheah and Ho, 2020). Industries can leverage comprehensive search approach to enhance monetary performance through structured product and process innovation management.

Open Innovation Alliances (OIA) for co-creating new technologies is also pivotal for institutions involved in OI (Han *et al.* 2012). Rigorous task of co-creation can be made easy by adopting the open collaborative approaches for innovation. Additionally, the market value of the enterprises peaks when it intersects an OIA depending on radical innovation and the level is higher when decision authority and access is meagre. Likewise Rogbeer *et al.*, (2014) delved into different aspects of partnerships (foreign, technological scope and heterogeneity of partners) to understand the effectiveness of these engagements to acquiring knowledge in open innovation. Diversity in international alliance is found to be beneficial for the *knowledge convergence*. One of the important partnerships that is deemed to be important in innovation in university-industry collaboration. Outsourcing knowledge and technology from the public institutions is an effective way to innovate (Ho *et al.*, 2016) and in return commercialize the technology created within academia. Referring to the GET-Up initiative in Singapore, authors advocated the open usage of resources by the SMEs and welcome the public sector to innovate through mobilization of researchers.

To improve open innovation, it is necessary to understand the organisational structure and work culture. Though the effectiveness of open innovation depends on the organizational culture, it is not studied in detail in the emerging economies. The flexible culture of organization has a positive effect on the inbound and outbound OI, whereas the conventional hierarchy dismays

OI (Scaliza *et al*., 2022). It is suggested that the organizations promote creative and fluid knowledge management in their ecosystem to invigorate OI. To ensure the courteous flow of knowledge, it is also necessary to ascertain how the organization absorbs information and adopts to changes occurring within the organisation. The absorption and adoption capabilities are influenced by the time available and the scale of disruption occurring within the organisation (Mariano and Al-Arrayed, 2018). Moreover, these disruption cause unevenness into the absorption of information.

Apart from the organisational level evaluation, investigated individual's value during open innovation in telecommunication sector in Vietnam and how they interact with internal and external sources of knowledge to enhance their products and services (Badir *et al*., 2020). Additionally, authors investigated the impact of managerial behaviour on both individuals and creativity, in general. Lim *et al*., (2010) studied three big companies to understand innovative outputs in the form of their patenting activities. It was found that these traditional companies are more active in the areas where they are competing. Despite competing, these firms prefer to cooperate and depend on external knowledge for innovation. Moreover, small firms are suggested to perform *'co-opetition'* with the bigger and established firms adopting open innovation (Corbo *et al*., 2023). Besides inbound OI studies, it is necessary to understand the workflow of the outbound OI to apprehend the effectiveness of the public research institution's projects. It is found that project with adequate resource allocation and higher innovation prospects tend to have better commercialization adaptation (Cheah and Ho, 2021). Knowledge diffusion channels in public research institutions and industries are now inculcating open science into open innovation where Do-it-yourself laboratories are one of the flourishing models. DIY laboratories enhance innovation by creating better opportunities (Cheah *et al*., 2020).

Another aspect besides the market level analysis, i.e., diffusion of innovation within the social context is also studied. Yun *et al*. (2011) explored how leveraging OI for emergency management innovations and involving public sector into management could significantly contribute to the social well-being and foster change into the society. Developing countries like Thailand face difficulties while innovating because of the technological and financial constraints which hinders their advancement in the global value chain. To overcome these constraints, it is suggested to indulge in interorganizational collaboration alongside open innovation environment facilitated through government's flexible policy implementations (Techakanont and Charoenporn, 2011).

A prior study by Cohen and Levinthal (1990) explained absorptive capacity as an enterprise's ability to identify and utilise external knowledge for commercial profit. This directly explains why individual behaviour and learning capabilities emerge so prominently in the SEA OI literature here. Further, Zahra and George (2002) researched on understanding the difference between the *actual* and *potential* absorptive capacity, a distinction that holds relevance in SEA region context, where the intent to absorb external knowledge is there but lack organizational routine helping in innovative outcomes.

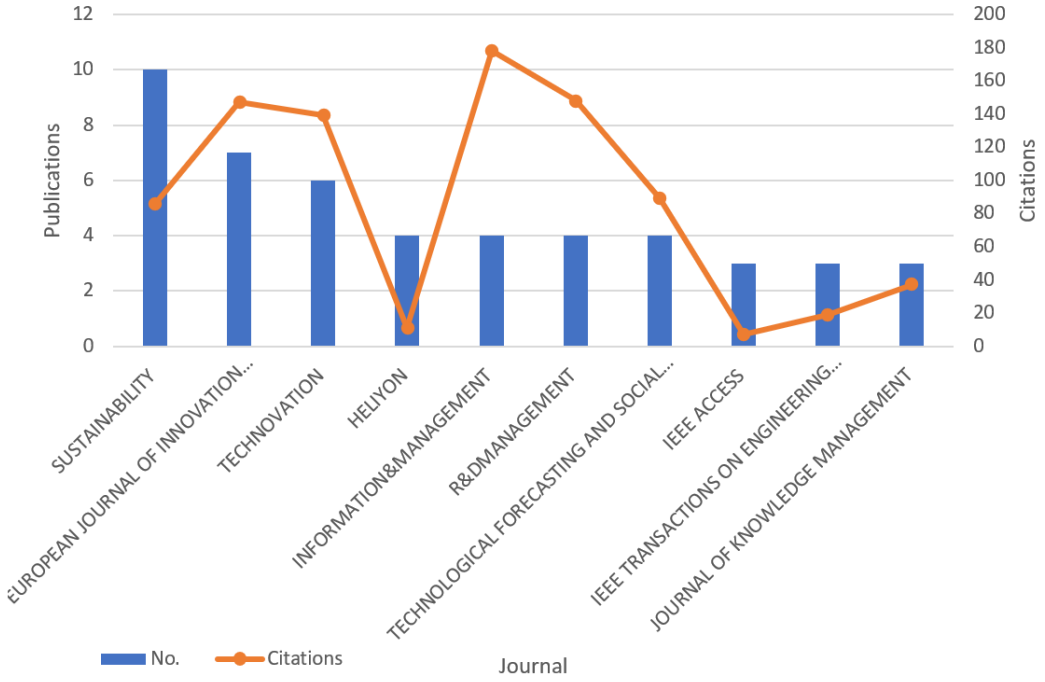


Figure 4: Journals with highest number of publications and respective citations received.

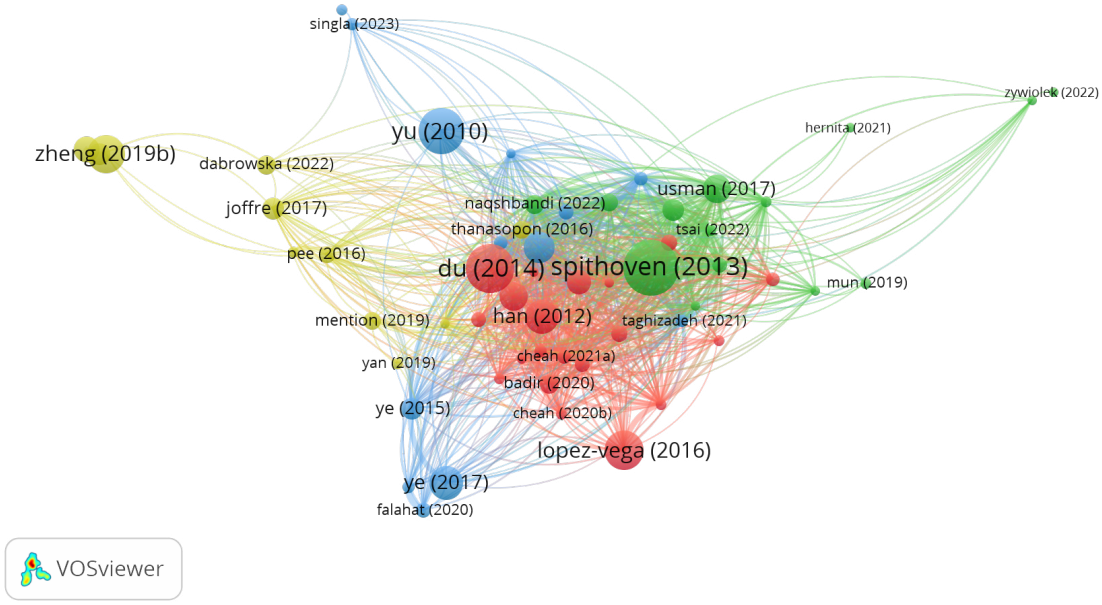


Figure 5: Network Visualization of articles using Bibliographic Coupling.

Cluster 2: Open Innovation and Small and Medium Enterprises

The 14 articles in cluster 2, i.e., green color cluster (Table 3) mainly focus on the innovativeness in the SMEs and influence of open innovation on enterprise's performance and productivity. These articles support the engagement of open innovation (inbound and outbound) which have high potential at launching products and services in the small enterprises (Lee *et al*., 2010). Although small and medium enterprises are revolutionary contributors to the innovation ecosystem (Davari, 2019; van de Vrande *et al*., 2009), there is limited insights into how these enterprises utilize the external and internal source of knowledge (Siregar and Marpaung, 2023). A study by Lichtenthaler (2008) indicates that there are small enterprises which are still practicing closed innovation. In 2013, Hemert *et al*. through their study suggested that cooperation among innovative sources is necessary not only in the initial stages of innovation but also at the output stages (usually neglected by the policy makers and researchers)where commercialization takes place. Further, it also discusses about the importance of collaboration partners (Universities, industrial partners, researchers) in the advancement of innovative activities. Similarly, Spithoven *et al*. (2013) argued that open innovation is more effective in small enterprises than in larger enterprises. The author investigated the different facets of the OI and its impact on the innovativeness of small firms using survey data of firms based in Belgium. Also, when measured against their employment size, the small firms seem to rely more on Open innovation practices compared to larger enterprises.

SMEs adopt open practices to foster commercialization and protect IP through collaboration with the larger firms. These small firms and startups can further harness the external and internal resources of the larger firms to overcome the challenges of resource inadequacy (Usman and Vanhaverbeke, 2017). Here, authorities of the small firms are to play a pivotal role in the successful open innovation partnership through policy implementation. Organizational factor is another facet that strongly influences the types of open innovation practiced by the enterprises (Naqshbandi *et al*., 2015). Managerial connections and their absorptive capacity to learn new things also impacts the outbound and inbound open innovation activities within the organization (Naqshbandi and Jasimuddin, 2022). Managerial ties with academic institutions and government support inbound open innovation whereas connection with other firms seems to be of no significance except for the electronic and aerospace firms that have positive impact on outbound OI (Naqshbandi and Kaur, 2014). Inbound OI (in context to M&A) strategies are expressed as an important procedure for acquiring new technologies (Mun *et al*., 2019). However leveraging outbound OI for technology-driven initiatives (Salampasis and Mention, 2019) is also encouraged. Meng *et al*. (2021) explored the impact of technology adoption on SMEs managed by female entrepreneurs. Female-owned enterprises are found to be active practitioners of open innovation to meet market demands. OI indirectly affects SME's performance based on how they form the connections and with whom (Tsai *et al*., 2022). External factors like covid 19 compelled small enterprises to integrate open innovation in their existing business models for effectiveness (Jabeen *et al*., 2023). Further, to maintain the relevancy in the

Table 2: Articles grouped under cluster 1.

Title	Author (Year)	Journal	Total Citations received
Managing open innovation projects with science-based and market-based partners	Du (2014)	Research policy	254
Where and how to search? search paths in open innovation	Lopez-Vega (2016)	Research policy	172
Value cocreation and wealth spillover in open innovation alliances	Han (2012)	MIS quarterly	129
The interaction between internal R&D and different types of external knowledge sourcing: an empirical study of Chinese innovative firms	Chen (2016)	R & D Management	94
Relationships among open innovation, innovative performance, government support and firm size: comparing Brazilian firms embracing different levels of radicalism in innovation	Jugend (2018)	Technovation	65
Employee-level open innovation in emerging markets: linking internal, external, and managerial resources	Badir (2020)	Journal of the Academy of Marketing Science	42
Open innovation and patterns of R&D competition	Lim (2010)	International Journal of Technology Management	31
Relationships among organizational culture, open innovation, innovative ecosystems, and performance of firms: evidence from an emerging economy context	Alves scaliza (2022)	Journal of Business Research	30
Effective industrial policy implementation for open innovation: the role of government resources and capabilities	Cheah (2020)	Technological Forecasting and Social Change	26
Open-innovation effectiveness: when does the macro design of alliance portfolios matter?	Rogbeer (2014)	Journal of International Management	24
Commercialization performance of outbound open innovation projects in public research organizations: the roles of innovation potential and organizational capabilities	Cheah (2021)	Industrial Marketing Management	21
Technology upgrading of small-and-medium-sized enterprises (SMEs) through a manpower secondment strategy a mixed-methods study of Singapore's T-up program	Ho (2016)	Technovation	20
Search strategy, innovation, and financial performance of firms in process industries	Cheah (2021)	Technovation	16
Development and social diffusion of technological innovation: cases based on mobile telecommunications in national emergency management	Yun (2011)	Science Technology and Society	15
Catching up and leapfrogging in a high-tech manufacturing industry: towards a firm-level taxonomy of knowledge accumulation	Yap (2017)	Knowledge Management Research & Practice	15
External knowledge search paths in open innovation processes of small and medium enterprises	Chaochotechuang (2020)	European Journal of Innovation Management	13
How the effect of opportunity discovery on innovation outcome differs between DIY laboratories and public research institutes: the role of industry turbulence and knowledge generation in the case of Singapore	Cheah (2020)	Technological Forecasting and Social Change	13

Title	Author (Year)	Journal	Total Citations received
Inbound open innovation for pharmaceutical markets: a case study of an anti-diabetic drug in-licensing decision	Wu (2016)	Journal of Business & Industrial Marketing	11
Evolution of automotive clusters and interactive learning in Thailand	Techakanont (2011)	Science Technology and Society	10
Combinations of absorptive capacity metaroutines: the role of organizational disruptions and time constraints	Mariano (2018)	European Management Journal, 36(2), 171-182	10

competitive market enterprises need to evaluate their research and development practices to avoid redundancy. Moreover, promoting technological resources sharing through Skilled and trained human resource (Hernita *et al*., 2021) to maximize the benefits and help businesses grow (Zhang, 2020). Apart from cocreation of new technologies and knowledge, services are also important for a firm to perform well holistically. In 2015, Foroughi *et al*., advocated the open service innovation, where costumers are kept in the loop to improve services. In summary, the articles in the cluster support the adoption of open innovation into small enterprises by collaborating and networking to enhance their innovative endeavors.

Existing theory of Open Innovation by Chesbrough (2003) was primarily developed in large and resource-rich firms, whereas it was first tested in the context of SMEs by Van de Vrande *et al*. (2009) and the study indicated that these small and medium enterprises do engage in open innovation but because of the resource constraints and lack of managerial skills, they are limited. The SEA literature mirrors these findings, including the developing-economy aspect, indicating cocreation as the strategic preference and a structural necessity arising from limited R&D funds and the venture capital market.

Cluster 3: Antecedents of Open Innovation

Since its introduction by Henry Chesbrough in 2003, the idea of open innovation has gained significant traction and use in the area, especially after 2010. A notable surge in research grants and patent applications targeting social issues like climate change has been observed in the countries of Southeast Asia. Open innovation approaches have been adopted throughout Southeast Asia due to several causes, such as changes in cultural norms, economic policies, and technical improvements. Using information from foundational works, Dan and Chieh (2008) and Ye and Kankanhalli (2015) projected the trajectory of open innovation in the area. Ye and Kankanhalli (2015) revealed a preference for open innovation when it results in cost savings, brand enhancement, and access to trained personnel. They also offered insights into the cost-benefit analysis carried out by enterprises when contemplating crowdsourcing.

The importance of IT capabilities in influencing Southeast Asian countries' innovation landscapes is highlighted by Cui *et al*., in 2015. These nations can improve their economic performance and innovation output by taking advantage of the flexibility and openness of IT. Innovation has exploded throughout the area, with nations like Vietnam, Philippines, Singapore, Malaysia, Thailand, Indonesia, India, and Sri Lanka setting the standard 2021 Innovation in South and Southeast Asia (https://clarivate.com/lp/2021-innovation-in-south-and-southeast-asia/). These nations have a variety of growth engines, each with a distinct emphasis and specialty. This variety builds strength and resilience, creating the groundwork for novel ideas and methods (https://clarivate.com/lp/2021-innovation-in-south-and-southeast-asia/). A model that investigates the variables impacting participation behaviour in a crowdsourcing scenario is presented in Ye and Kankanhalli's 2017 research paper. According to the paradigm, advantages including monetary remuneration, skill development, autonomy, and enjoyment are what motivate people to participate. However, expenses like cognitive fatigue and knowledge loss have a detrimental impact on it. Participation is also significantly increased by trust, which is lowered by knowledge loss and increased by financial benefits.

Further, global virtual team (GVT) performance is impacted by a variety of team climates, including cohesion, confidence, and knowledge, skills, and abilities. These team climates also have an impact on human dimensions like trust and creativity. Research on GVTs and open innovation can be improved by integrating the input-mediator-output-input paradigm with adaptive structuration theory (Wei *et al*., 2018). Open service innovation is tempered by the effect of leadership styles through relationship-based employee governance. Moreover, state-owned businesses are more affected by association-based employee governance and leadership styles than are non-state-owned businesses (Ahmed *et al*., 2018). The managers should establish connection-based employee governance and adopt suitable leadership styles to enhance their abilities in open service innovation. Increased incentives and support for open service innovation should come from the authorities, especially for state-owned businesses (Ahmed *et al*., 2018).

Understanding overseas markets, customers, competitors, and rules is known as international knowledge, and it is positively impacted by institutional assistance, which includes financial, trade mobility, informational, and training support. SMEs who have made larger commitments to export gain more from institutional backing and international knowledge. More and better institutional support should be provided by governments to SMEs committed to exporting; SMEs management should seek out and utilise institutional help to acquire and utilise global knowledge (Falahat *et al*., 2020). The impact of open innovation on operational performance is negatively moderated by environmental dynamism, meaning that the positive effect of open innovation is diminished in environments that are more uncertain and dynamic. Technological skills positively influence open innovation which further improves operational performance (Taghizadeh *et al*., 2021). As per the study, Small and Medium-Sized Enterprises (SMEs) can enhance their operational performance by implementing open innovation techniques and improving their technology capabilities. This is because SMEs can deal with environmental uncertainties and dynamism by being more adaptive and proactive (Taghizadeh *et al*., 2021). To improve their competitiveness and performance, SMEs should develop a stronger entrepreneurial culture and a stronger focus on the market (Falahat *et al*., 2021).

These businesses can benefit greatly from venture capital, and this effect is increased when venture capital firms are more experienced in the field, have a higher shareholding ratio, and are syndicated. Three mechanisms exist for venture capital to support open innovation: it provides more financial resources, enhances absorptive capacity, and strengthens executive incentives. Furthermore, depending on the sector, region, and property rights, venture capital's influence on open innovation varies greatly (Yi *et al*., 2023). Additionally, Ciasullo *et al*. (2022)

Table 3: Articles grouped under cluster 2.

Title	Author (Year)	Journal	Total Citations received
Open innovation practices in SMEs and large enterprises	Spithoven (2013)	Small Business Economics	343
How start-ups successfully organize and manage open innovation with large companies	Usman (2017)	European Journal of Innovation Management	87
What organizational culture types enable and retard open innovation?	Naqshbandi (2015)	Quality & Quantity	53
The linkage between open innovation, absorptive capacity and managerial ties: a cross-country perspective	Naqshbandi (2022)	Journal of Innovation & Knowledge	42
Do managerial ties support or stifle open innovation?	Naqshbandi (2014)	Industrial Management & Data Systems	34
Technological adaption and open innovation in SMES: A strategic assessment for women-owned SMES sustainability in Bangladesh	Meng (2021)	Sustainability	26
Open innovation and SME performance: the roles of reverse knowledge sharing and stakeholder relationships	Tsai (2022)	Journal of Business Research	15
Discovering business diversification opportunities using patent information and open innovation cases	Mun (2019)	Technological Forecasting and Social Change	14
The role of open innovation in fostering SMES' business model innovation during the covid-19 pandemic	Jabeen (2023)	Journal of Knowledge Management	13
Trust in renewable energy as part of energy-saving knowledge	Zywiolek (2022)	Energies	12
From a-value to value-multiplication: leveraging outbound open innovation practices for unrelated diversification in the sensor industry	Salampasis (2019)	Technology Analysis & Strategic Management	11
The role of open service innovation in enhancing business performance: the moderating effects of competitive intensity	Foroughi (2015)	Current Science	11
Technology-sharing strategy and incentive mechanism for R&D teams of manufacturing enterprises	Zhang (2020)	Physica A: Statistical Mechanics and its Applications	10
Economic business sustainability and strengthening human resource capacity based on increasing the productivity of small and medium enterprises (SMEs) in makassar city, Indonesia	Hernita (2021)	Sustainability	10

Table 4: Articles grouped under cluster 3 (blue color cluster).

Title	Author (Year)	Journal	Total Citation received
A reflective review of disruptive innovation theory	Yu (2010)	International Journal of Management Reviews	235
Solvers' participation in crowdsourcing platforms: examining the impacts of trust, and benefit and cost factors	Ye (2017)	Journal of Strategic Information Systems	130
Information technology and open innovation: a strategic alignment perspective	Cui (2015)	Information & Management	109
Investigating the antecedents of organizational task crowdsourcing	Ye (2015)	Information & Management	51
Modelling the effects of institutional support and international knowledge on competitive capabilities and international performance: evidence from an emerging economy	Falahat (2020)	Journal of International Management	27
Managing virtual teams for open innovation in global business services industry	Wei (2018)	Management Decision	25
Does venture capital help to promote open innovation practice? Evidence from China	Yi (2023)	European Journal of Innovation Management	20
Roles of leadership styles and relationship-based employee governance in open service innovation: evidence from the Malaysian service sector	Ahmed (2018)	Leadership & Organization Development Journal	20
Technological capabilities, open innovation and perceived operational performance in SMEs: the moderating role of environmental dynamism	Taghizadeh (2021)	Journal of Knowledge Management	18
The international natural product sciences taskforce (INPST) and the power of twitter networking exemplified through INPST hashtag analysis	Singla (2023)	Phytomedicine	18
Analysing the importance of international knowledge, orientation, networking and commitment as entrepreneurial culture and market orientation in gaining competitive advantage and international performance	Falahat (2022)	International Marketing Review	16
An open innovation approach to co-produce scientific knowledge: an examination of citizen science in the healthcare ecosystem	Ciasullo (202)	European Journal of Innovation Management	14
The impact of board size on green innovation in China's heavily polluting enterprises: the mediating role of innovation openness	Zhao (2022)	Sustainability	11

suggested enterprises should use Business Model Innovation Canvas (BMIC), to analyze their current business model, identify innovation hotspots, and select appropriate innovation options and recommends that policymakers should support the development of 3D printing and business model innovation in the clothing industry (Ciasullo *et al*., 2022).

Ultimately, the breadth of innovation openness - that is, the degree to which businesses go outside their own walls for inspiration and resources - mediates the favourable effect of board size on green innovation. State-owned businesses and non-state-owned businesses have a greater relationship. By offering actual data supporting the importance of board size and innovation openness, the paper adds to the body of knowledge on green innovation. To improve their capacity for green innovation, businesses should broaden the diversity of their board members and foster greater innovative transparency (Zhao *et al*., 2022).

Institutions influence how firms operate and innovate. In Southeast Asia, formal systems such as Intellectual Property laws, government support for R&D, and regulations differ considerably across countries (North, 1991). As a result, many firms depend

more on internal factors and informal practices like strong leadership, entrepreneurial culture and crowdsourcing to support open innovation (DiMaggio and Powell, 1983). This explains the emergence of these factors as important antecedents in cluster 3.

Cluster 4: Open Innovation and Technological Exploration

Table 5 lists 11 publications that are related to cluster 4 (yellow one) and address how technological advancement and globalization have intensified the competition among organizations to stay relevant in the national innovation system. Consequently, this has placed much emphasis on technological innovation within the core strategies of the organizations. Setting business goals while taking into consideration the technological capabilities is becoming crucial these days (Carvalho *et al*., 2013). And making decisions without considering these technical factors for innovation would not work in the long term/ be sustainable. This digital transformation has led to changing the physical form of businesses and are now becoming more digital and connected with their products and services. Organisations are advised to gather and analyse workforce and train data, as well as offer educators more individualised, adaptable, and efficient learning solutions through 'Smart Product Service Systems (Smart PSS) (Zheng *et al*., 2019). Earlier, in 2019, Zheng *et al*. had tried to suggest a new paradigm for product development considering the dynamic needs of the costumers i.e., Smart, Connected Open Architecture Product (SCOAP) which integrates IT-driven innovation, flexible design, and lifecycle co-creation to satisfy specific consumer needs (Zheng *et al*., 2019).

Furthermore, during the design and commercialization stages, co-creation of ideas and decisions involving customers in e-commerce product development, can prove to be effective in boosting product performance, quality, and sales (Pee, 2016). Simultaneously, it is important to consider the constraining and facilitating factors while co-creating in communities led by organisations online (Priharsari and Abedin, 2021). Using the socio materiality perspective, the authors found that factors act accordingly depending on individual's perception, communities, and surrounding environment. Besides that, open system could be utilised to improve project management, service quality, cost, and profit (Yan *et al*., 2019) in online services. Improvement of the managerial competencies is being discussed in detail in cluster 1. Despite that there is lot of uncertainty during the early stages of creating something new which is often called 'fuzzy -front end.' And evaluation of this Fuzzy-Front End (FFE) of service is necessary to study how transparent (open) is the process of gathering ideas from external /internal environment of the organisation during the initial stages of innovation (Thanasopon, 2016). This openness during the early stages impacts the whole process of innovation within the organisation.

Alongside organisational perspective on creation of value product in this transformation era, there is a need to delve into other important elements involved in Digital transformation (DT). It is essential to study how DT impacts the innovation ecosystems as well as individuals in various disciplines and at different societal levels (Dąbrowska *et al*., 2022). The authors suggest through their work a PIAI framework that helps explains how people view, interpret, act upon, and impact DT and consequently open innovation. Adopting social technology and ambidexterity can improve performance of the organisation. Where, quick absorptive

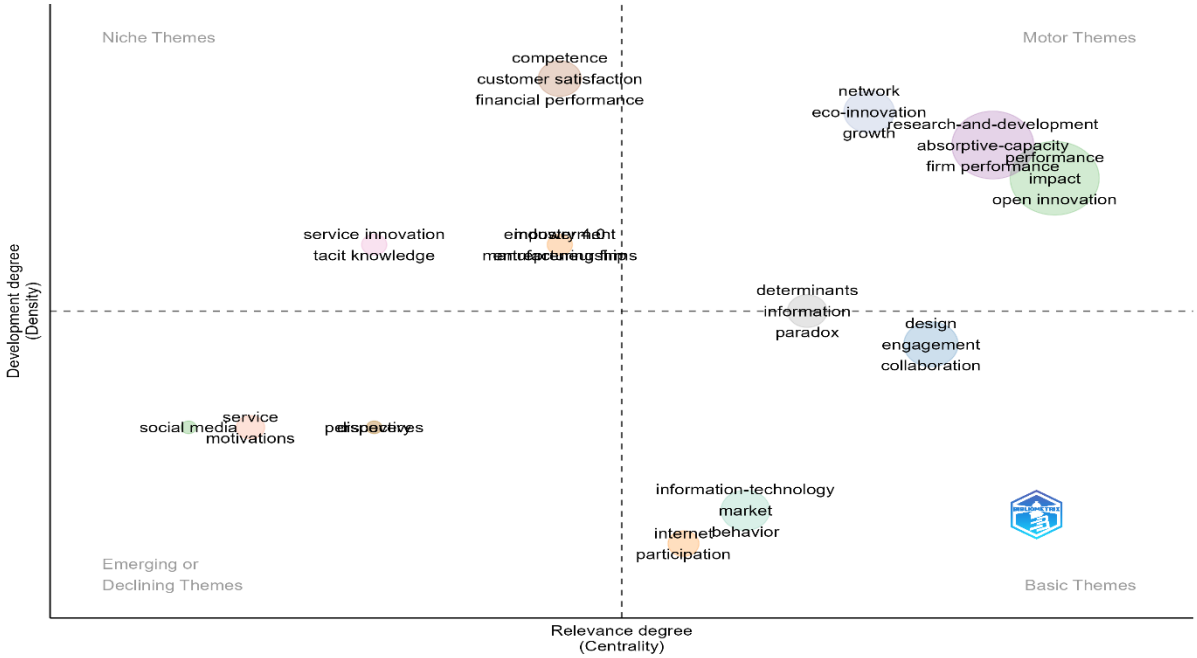


Figure 6: Thematic analysis of the literature on open innovation.

Table 5: Articles grouped under cluster 4.

Title	Author (Year)	Journal	Total citations received
A survey of smart product-service systems: key aspects, challenges, and future perspectives	Zheng (2019)	Advanced Engineering Informatics	161
Smart, connected open architecture product: an it-driven co-creation paradigm with lifecycle personalization concerns	Zheng (2019)	International Journal of Production Research	76
How is innovation in aquaculture conceptualized and managed? a systematic literature review and reflection framework to inform analysis and action	Joffre (2017)	Aquaculture	54
On-farm experimentation to transform global agriculture	Lacoste (2022)	Nature food	52
Digital transformation, for better or worse: a critical multi-level research agenda	Dabrowska (2022)	R & D Management	40
Using social media to leverage and develop dynamic capabilities for innovation	Mention (2019)	Technological Forecasting and Social Change	36
The role of openness in the fuzzy front-end of service innovation	Thanasopon (2016)	Technovation	34
Customer co-creation in b2c e-commerce: does it lead to better new products?	Pee (2016)	Electronic Commerce Research	30
What facilitates and constrains value co-creation in online communities: a sociomateriality perspective	Priharsari (2021)	Information & Management	14
Knowledge-based decision support system for improving e-business innovations and dynamic capability of it project management	Yan (2019)	Knowledge Management Research & Practice	13
Sustaining organizational performance through organizational ambidexterity by adapting social technology	Mardi (2018)	Journal of the Knowledge Economy	11

capacity rather than collectivism-based collaboration interposes the relationship between social technology use and ambidexterity in open innovation environment (Mardi *et al*., 2018). Moreover, firms can benefit from social media by perceiving, grabbing, and reconfiguring opportunities and resources. In 2019, (Mention *et al*., 2019) proposed a theory that explains how open innovation dynamic capabilities and stakeholder participation in social media effect innovation outcomes.

Digital technologies are harbinger of change and are impacting our lives, from product creation to consumption. Same is with other sectors, apart from business co-creation and product enhancement, where use of diverse innovation approaches should be encouraged. Like in aquaculture research and development domain, creating a transparent innovation process that considers a range of social, economic, and environmental aspects and involve stakeholders at all levels is demanded. Openness as well encourages multidisciplinary research partnerships to tackle the many obstacles and prospects of aquaculture innovation (Joffre *et al*., 2017). Similarly, On-Farm Experimentation (OFE) is a novel approach to agricultural research and innovation that involves farmers and researchers in actual farms, has the potential to enhance global agriculture. The Open initiative's strategy of customising training and support to the requirements and preferences of the stakeholders is something that the OFE can adopt (Lacoste *et al*., 2021) to revolutionize the agriculture globally by resolving the issues related to food security, climate change, and environmental sustainability.

The results suggest that firms in the SEA region face an exploration deficit, whereby the need to engage in technological transformation, accelerated by the post-pandemic digital economy, competes with the pressure to prioritise short-term performance and efficiency, limiting their ability to experiment and innovate. (March 1991) exploration-exploitation theory suggests balancing both their existing knowledge and trying new technologies. The theme of the clusters advocates the importance of customer involvement in Open innovation, which will reduce the risks, lower the innovation cost, and make exploration easier for companies with limited resources.

Thematic analysis

In order to explain the conceptual structure and potential themes in simple terms, biblioshiny function of R programming was utilized for this study (Derviş, 2019). Thematic analysis enables scholars to explore underdeveloped areas, assess topic

relevance, and inform funding priorities. This approach enhances understanding of a field's intellectual structure, facilitating informed academic and policy decisions. Thematic visualization of documents is quartered into themes (Basic, emerging/declining, niche, and motor) based on the centrality and density where, former indicated the relevance and significance within the broader research landscape and later, reflects on the level of their theoretical and empirical development. Thematic analysis helps categorize research topics based on their importance and stage of development, making it easier to understand how different areas contribute to academic discussions.

Motor themes are both well-developed and highly relevant, meaning they shape the core of the research field and influence future studies. Examples include absorptive capacity and open innovation, which are central to innovation and business performance. Basic themes are important but not yet fully explored, such as market behavior and collaboration. These topics have strong potential for further study and development. Niche themes are highly specialized and deeply researched but have limited influence on the broader academic field. Topics like customer satisfaction and entrepreneurship fall into this category, as they are significant within their domains but do not strongly connect to larger research discussions. Finally, emerging, or declining themes include topics that are either gaining traction or becoming less relevant over time, such as social media and service motivations. Their future role in research depends on whether they continue to evolve or fade in importance.

DISCUSSION

Performing systematic investigation, this study attempts to highlight the important themes in the domain of open innovation. Further, analyzing and scientifically mapping the literature to get deeper insights into the research trend and perception of South-East Asian countries regarding open innovation. Figure 3 indicates the growth of publication throughout the years (2010-2023) and shows how the subject area initiated in 2010, elevated in 2020 and peaked around 2022 attributing to the boom in digital economy post pandemic in Southeast Asia (Vyas, 2022) and later slow around 2023 because of the strict monetary policies, rising inflation and low commodity pricing (Michelino *et al*., 2014). Differing on the level of development, these nations provide a vast variety of opportunities for the establishment of business and innovation.

From the systematic review and postulating on the first cluster few of the external, internal, and interpersonal factors are identified to be requisite and should be taken into consideration. Majorly articles examined the interfaces between OI and firm's potential regarding collaboration done externally and internally (Le *et al*., 2019). Most of the articles are attributed to management domain catering to managerial activities, as is evident from the high-quality journals they are choosing to publish their work. Although, the managerial competencies are important to handle the open collaboration project effectively and benefit financially (Du, 2014; Wu *et al*., 2016) other external factors like governmental support (Cheah and Ho, 2020; Techakanont and Charoenporn, 2011), size of the firm (Jugend *et al*., 2018), open alliances for co-creation (Han *et al*., 2012) with different partners (Rogbeer *et al*., 2014) like public research institutions (Cheah and Ho, 2020, 2021) as well need consideration into the open innovation research. The success of any organization depends on individuals (Badir *et al*., 2020), their search characteristics (Chaochotechuang *et al*., 2020; Lopez-Vega *et al*., 2016) and their absorptive capabilities to adopt changes within and outside the organization in an open setting (Mariano and Al-Arrayed, 2018; Scaliza *et al*. 2022).

In the second line of investigation, the extent of and trend towards open innovation in Small and Medium Enterprises is clustered and discussed in detail. This cluster in alliance with the findings of (van de Vrande *et al*., 2009) tries to fill in the gap in the quantitative research regarding the indulgence of open innovation in SMEs and its impact. The articles in this cluster advocate the effectiveness of Open Innovation on SME's performance and productivity (Spithoven *et al*., 2013) through collaboration. Furthermore, involving costumers in the production and co-creation loop (Foroughi *et al*., 2015) to maintain relevancy (Jabeen *et al*., 2023) and maximize the benefits in the current developing market (Zhang *et al*., 2020). However, in order to overcome the resource inadequacy, small firms could collaborate with larger firms and leverage their internal and external resources (Usman and Vanhaverbeke, 2017) using their own managerial skills (Naqshbandi and Kaur, 2014) and absorptive capabilities (Naqshbandi and Jasimuddin, 2022) to acquire new technology (Mun *et al*., 2019).

The third string of research as represented in the cluster 3, inculcates diverse studies examining various facets of innovation, including disruptive innovation's evolution, influence of crowdsourcing (Ye and Kankanhalli, 2015), IT flexibility (Cui *et al*., 2015) on firm's Open Innovation. Moreover, effects of leadership's role (Ahmed *et al*., 2018), SME's internationalization (Falahat *et al*., 2020), funding (Yi *et al*., 2023), entrepreneurial culture (Falahat *et al*., 2021), and openness on sustainable open innovation and it services (Zhao *et al*., 2022). These studies attempt to offer insights for policymakers, businesses, SMEs to enhance their strategies by inculcating strategic decision making and conducive open environment for innovation and growth.

Last thread of literature addresses technological exploitation using open innovation strategies. In this dynamically transforming and competitive time, inclusion of technological innovation should be mandated within the core strategies of the firms. Moreover, for the effective use and integration of technology individuals

should be trained and skilled to tackle the problem (Zheng *et al*., 2019) and develop products considering the specific needs of the costumers (Zheng *et al*., 2019). Costumers being the vital part of the product development should be involved in the early stages of open innovation process (Pee, 2016). While co-creating, lot of uncertainty prevails (Thanasopon *et al*., 2016) and it is necessary to study the openness during digital transformation and its impact on various social levels (Dąbrowska *et al*., 2022).

Whereas, Thematic analysis categorizes research topics into four quadrants based on their development and relevance. On analyzing and visualizing the literature based on themes present within the documents (Figure 6), it was found that absorption capability, firm performance, R&D, and its impact on open innovation are motor themes i.e., these areas are well researched (higher density) and important (higher centrality) whereas design engagement collaboration, market behavior, and internet participation are basic themes with higher relevancy yet are not fully advanced. On the other hand, customer satisfaction, competence, financial performance, service innovation, tacit knowledge, entrepreneurship, and empowerment are niche themes. Within the literature social media, perspective, and service motivation as some of the emerging/declining themes having potential to advance in near future. By leveraging Biblioshiny for thematic mapping, scholars can attain a more comprehensive understanding of the intellectual structure of a discipline, thereby making informed decisions regarding their research endeavours.

This study is the first systematic analysis of Open Innovation research, particularly focusing on the Southeast Asian region, providing insights into the intellectual structure of the field. The results of this systematic analysis could be utilized by the managers of the SEA- based firms, particularly small, medium enterprises. The results underscore the strategic value of investing in absorptive capacity. Managers could actively collaborate with public research institutions and larger firms to offset resource constraints, as highlighted across clusters 1 and 2. Further, policymakers can prioritise formalizing IPR frameworks to incentivise knowledge sharing, develop targeted funding schemes for SMEs - led innovations and invest in upskilling the employees to minimise the digital divide.

CONCLUSION

The study shows that the initial work on OI in SEA context was performed in 2010, while the concept dates to 2003 when Chesbrough suggested corporate managements to indulge into open search and gather of resources to perform innovative activities. Attributing to the demographic diversity, policy structure and interpersonal perception regarding openness in innovation it becomes necessary for us to study the OI domain in South-East Asian context. However, there have been many studies conducted from a global perspective, but the focus towards South-East Asian countries is somewhat limited because of its developing state and other legal, political, and financial restrictions. So, upon identification of this gap, we tried to ascertain the level of research that is carried out to promote the open innovation concept in the economic setting of these developing nations.

The current study performed analysis and bibliographic coupling of the document affiliated to southeast Asian countries on open innovation. Based on the systematic review through bibliometric analysis, 4 clusters were obtained: 1) Potential of Open Innovation in the emerging market, 2) Open Innovation and SMEs, 3) Antecedents of Open Innovation and 4) Open Innovation and Technological Exploration. To our understanding, this is the first-hand study which tried to apprehend the subject and its allied themes in depth to gain insights that could be further utilized by the policy makers, researchers to identify the potential themes in the field of study. Moreover, these open innovation themes could be used to accelerate the rate of knowledge diffusion, encourage inter-firm collaboration in SMEs, and promote entrepreneurial culture to boost the economic growth.

Future research could be done to further explore the dynamics of the identified clusters- OI in SEA's emerging markets, SMEs, antecedents, and technological exploration, considering cultural, legal, and financial factors. Like, comparative studies across South-East Asia to identify best practices, while research on regulatory barriers can inform policy reforms. Understanding cultural influences on openness, tracking OI's evolution through longitudinal studies, and examining sector-specific applications in industries like manufacturing, agriculture and tourism can provide deeper insights. Finally, developing targeted policy recommendations and incentives for SMEs will be crucial in fostering OI adoption and driving economic growth in SEA.

ABBREVIATIONS

DT: Digital Transformation; **FFE:** Fuzzy Front End; **GVT:** Global Virtual Team; **IP:** Intellectual Property; **IPR:** Intellectual Property Rights; **IT:** Information Technology; **M&A:** Mergers and Acquisitions; **OI:** Open Innovation; **OFE:** On-Farm Experimentation; **R&D:** Research and Development; **RQ:** Research Question; **RQs:** Research Questions; **SEA:** Southeast Asia; **SLR:** Systematic Literature Review; **SME:** Small and Medium Enterprise; **SMEs:** Small and Medium Enterprises; **SCOAP:** Smart Connected Open Architecture Product; **Smart PSS:** Smart Product-Service Systems; **TRM:** Technology Roadmapping.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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