

# The rise of open innovation in Chinese academia: a systematic review of the literature

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**The recent open innovation (OI) literature underscores the importance of understanding how OI is implemented across diverse institutional contexts. China has captivated OI scholars, representing a distinctive business environment that challenges established theories and frameworks. Building on translation theory, this study systematically reviews how scholars affiliated with Chinese institutions have conceptualized the concept of OI. We used a systematic approach to analyze a final sample of 202 articles, unveiling insights into themes, approaches, and implications. Our primary findings highlight a concentration on themes such as external knowledge search for enhancing firms’ performance, the escalating role of innovation ecosystems, and the significance of local business, traditional Chinese culture, and innovation policies in shaping these dynamics. In contrast to recent trends in the broader international OI literature, concepts such as the role of users, universities, platforms, and social innovation are not extensively explored. Lastly, we suggest various avenues for future research to enrich OI scholarship.**

## 1. Introduction

Since the publication of Chesbrough’s seminal book in 2003, open innovation (OI) has evolved into a comprehensive term encompassing all innovation activities influenced by elements in an organization’s external environment. This includes leveraging external discoveries, engaging in collaborative R&D projects, and profiting from innovation through out-licensing agreements (Chesbrough et al., 2006). Subsequently, a substantial body of empirical studies has explored firms’ inbound, outbound, and coupled OI practices (Gassmann, 2006; Enkel et al., 2009; Chesbrough and Di Minin, 2014; West and Bogers, 2014; Dabić et al., 2023; Saura et al., 2023).

The field of OI has expanded even beyond the corporate level, including new areas such as policy,

ecosystems, and platforms, and more generally, it tends to be seen as an umbrella term covering a vast field of knowledge (Di Minin and Cricchio, 2024; Radziwon and Chesbrough, 2024). However, this diversity in perspectives introduces a potential for confusion and conceptual drift, as ideas and practices tend to evolve when adapted to different contexts and over time (Spyridonidis et al., 2016). Managerial practices and concepts, including OI, are particularly susceptible to these shifts. The inherent fluidity of knowledge – understood as new ideas or scientific developments – means it rarely remains static; instead, it transforms to align with specific situational needs, as argued by translation theory (Czarniawska-Joerges and Sevón, 2005; Ansari et al., 2010).

Translation theory underscores the importance of both the actors involved in the translation process and the varied contexts in which this process

occurs (Wæraas and Nielsen, 2016). This theoretical lens highlights that the meaning and implementation of managerial concepts are not uniform but are shaped by the specific institutional and cultural environments in which they are enacted (Dimaggio and Powell, 1983). This evolution necessitates the development of OI models with broader applicability in different institutional contexts, as emphasized by recent scholarly efforts (Lewin et al., 2017; Chen and Chen, 2021; Chesbrough et al., 2021). For example, Chesbrough et al. (2021) have focused on the importance of the role of the government as an orchestrator of OI in China, highlighting the importance of China's institutional setting in shaping these dynamics. As argued by Dahlander et al. (2021), by becoming more sensitive to irregularities and changes over time and across different jurisdictions and geographies, OI research can better capture the dynamic and contextual nature of innovation processes. This success is also attributed to OI's phenomenological nature (Dahlander et al., 2021). While this has contributed to OI's success, the lack of strong theoretical foundations has also drawn criticism (Alexy et al., 2018). There have been calls in the literature asking for connecting OI to more general management theories (Randhawa et al., 2016; Laursen and Salter, 2020), but the dynamic nature of OI complicates this, increasing the risk of distancing research from grounded information. As a consequence, understanding how the concept of OI itself is elaborated and translated within different institutional contexts could help to strengthen the nature of OI as a dynamic concept that can be shaped according to specific needs (Dahlander et al., 2021).

Following this and basing our analysis on translation theory, we argue that it is equally important to consider how the concept of OI is drafted by a specific academic community working in a specific institutional context. Despite the need for research on how OI is translated in different institutional contexts, comprehensive analyses addressing this issue are lacking.

Our systematic literature review aimed at filling this gap. In particular, we want to answer the following research question: How is the concept of OI translated by scholars affiliated with a Chinese institution?

The decision to focus on China has solid roots. China's unique business environment for R&D spillovers challenges the applicability of existing theories to the Chinese context (Fu et al., 2021). The socialist market economy involves significant government involvement in driving R&D and domestic firm innovations (Guan and Yam, 2015). China's path to prosperity deviates from the Western model, emphasizing an active role for the government and differing perspectives on private property rights (Chesbrough et al., 2021). Developing

an indigenous theory based on local distinctiveness is crucial for understanding situations that Western concepts may struggle to explain, and Chinese scholars have advanced frameworks to disconnect from traditional Western theories in innovation management (Mu et al., 2021; Bruton et al., 2022). The 'Chinese characteristics' mark has become a typical way of trying to understand why and how a certain concept that developed in the West has found its way into the Chinese context but has never truly resisted in its traditional form (Chen et al., 2021a). The same can be said for OI, where scholars have argued that OI in China has been adopted as a new concept that builds on old established practices (Fu and Xiong, 2011; Corsi et al., 2021) or as a way for the government to easily communicate and orchestrate innovation activities (Chesbrough et al., 2021).

This study contributes to the OI literature by providing a comprehensive analysis of how OI is interpreted and adapted by scholars within Chinese institutions. This is crucial for understanding how OI evolves in different cultural and institutional contexts, thereby enriching the global discourse on OI. By analyzing a final dataset of 202 articles, this study establishes an empirical foundation that future researchers can build upon. First, we present descriptive statistics identifying the most relevant authors, highly cited articles, and key publication outlets. Subsequently, we delve into a keyword co-occurrence analysis to trace the thematic evolution of the OI concept in Chinese academia over the years and a co-citation analysis to unravel the theoretical foundations of our sample. Additionally, a content analysis categorizes the articles into 10 distinct thematic clusters, providing a nuanced understanding of how OI is adopted by Chinese academia. This comprehensive approach not only offers valuable insights for future research but also presents unique practical implications.

The paper is structured as follows: Section 2 presents the current state of the art on OI and deepens the literature on translation theory. Section 3 details the methodology employed in conducting our literature review. Section 4 presents the results, while Section 5 concludes the paper by offering discussions, outlining potential future research directions, and providing practical and theoretical contributions.

## 2. Literature Background

### 2.1. Open innovation: Origins and emerging trends

OI, as defined by Chesbrough et al. (2006), involves the purposeful flow of knowledge to accelerate internal innovation and expand external markets for

innovation use. Despite early criticisms of lacking distinctiveness from related research fields (Trott and Hartmann, 2009), OI has thrived due to its inclusive nature, providing the opportunity to integrate theory with new measurement instruments (Huizingh, 2011). Various authors (Enkel et al., 2009; Gassmann et al., 2010; Wynarczyk et al., 2013; West et al., 2014; Kovács et al., 2015) have identified clear literature foundations for OI, rooted in the absorptive capacity theory (Cohen and Levinthal, 1990), user innovation literature (von Hippel, 1988), dynamic capability theory (Teece et al., 1997), and the resource-based view of the firm (Barney, 1991).

This encompasses exploring knowledge and technology beyond the firm, integrating external knowledge within the firm through proper organizational and governance decisions, identifying the optimal business model to capture previously created value, and searching for external partners (Elmquist et al., 2009; Lichtenthaler, 2011). OI has also embraced non-pecuniary mechanisms (Dahlander and Gann, 2010), used by both public and private organizations to develop social values alongside economic ones (Chesbrough and Di Minin, 2014; Ahn et al., 2019).

Collaborations can manifest in various forms, such as intra-firm and inter-firm relations, or they can evolve within broader innovation systems. This evolution may lead to the creation of OI platforms, ecosystems, and smart cities (Cohen et al., 2016; Nambisan et al., 2018; Ferreira and Teixeira, 2019).

However, recent literature has shifted its focus to the ‘dark side’ of OI (Stefan et al., 2022; Dabić et al., 2023). This perspective highlights numerous challenges, such as appropriation, knowledge transformation, and stakeholder commitment (Audretsch and Belitski, 2023), which arise both at the individual and company levels during the OI process (Chaudhary et al., 2022) and at the conclusion of OI collaborations (Holgersson et al., 2022).

Another limitation of OI lies in flexible business models, or rather the lack thereof (Saura et al., 2023). Some challenges are less dependent on management issues and more tied to spatial dynamics. For instance, geographical proximity to partners proves crucial for the success of OI approaches (Ascani et al., 2020). Additionally, the current business environment introduces additional costs associated with openness. Handling the vast amount of generated data poses a significant challenge (Dahlander et al., 2021). External factors, such as exogenous shocks – including the COVID-19 pandemic – also contribute to these costs (Radziwon et al., 2022).

## 2.2. Translation theory and Chinese management studies

The theory of translation of practices and ideas offers a robust framework for understanding the movement and transformation of management concepts across different organizational and institutional contexts (Greenwood et al., 2008; Spyridonidis et al., 2016). This theoretical approach emphasizes the active role of actors in translating ideas as they move between different settings (Czarniawska-Joerges and Sevón, 1996). Unlike the diffusion of innovation model, which suggests a more linear and passive adoption process (Rogers, 1983, 2004), the translation model views ideas as dynamic and evolving, undergoing significant transformations as they are interpreted and recontextualized by different actors in a network (Wæraas and Nielsen, 2016). This approach posits that translation involves both ideational and organizational changes, driven by a genuine desire to imitate attractive or beneficial practices. However, imitation in this context is not merely an outcome but a driving force behind the translation process, leading to a variety of emergent practices (Czarniawska-Joerges and Sevón, 2005).

Recent scholarship has questioned the assumption that translation always results in transformation. Røvik (2016) and Spyridonidis et al. (2016) suggest that translation can also involve faithful imitation, where ideas undergo little to no change during their movement across contexts. This perspective acknowledges that the degree of transformation can vary widely, from radical changes to nearly exact reproductions of the original ideas, depending on the specifics of the recipient context (Ansari et al., 2010; Claus et al., 2021).

Translation processes have also been shown to influence institutional change. The process of translation involves not just the movement of ideas but also their interpretation and reformulation (Lawrence, 2017). Institutional translation, therefore, is not a monolithic process but one that varies significantly across different contexts, particularly across those with high institutional distance. This distance, defined by the dissimilarity between different countries’ regulatory, cognitive, and normative institutions, can complicate the translation process (Tracey et al., 2018; Claus et al., 2021). The complexity of translating ideas across high institutional distance is illustrated by the necessity to adapt practices to deeply entrenched local norms. Such adaptations are not only crucial for the acceptance of these ideas but also for their successful implementation (Wæraas and Nielsen, 2023).

Thus, institutional dynamics are pivotal for the adoption and diffusion of innovation, influencing how practices are perceived, legitimized, and integrated (Perkmann and Phillips, 2024). The adoption and diffusion of new practices are initially influenced by rational performance considerations, but as these practices gain legitimacy, institutional isomorphism takes hold, driving further adoption (Meyer and Rowan, 1977; Rogers, 1983). Institutions can both enable and constrain innovation by exerting isomorphic pressures, which lead organizations to resemble others facing similar environmental conditions (Dimaggio and Powell, 1983).

The translation and institutional approaches are visible in the diffusion of management studies developed by academics in China. The evolution of these studies reflects a nuanced journey influenced by the distinctive cultural context of China (Li et al., 2012). Initially, the application of Western theories in the Chinese context was prevalent, with limited success in grounded theory building (Tsui, 2006). Notable exceptions emerged, such as the 3-I pattern – imitation, improvement, and innovation – highlighting the learning process triggered by the lack of technology in the 1980s (Xu et al., 1998). This pattern evolved into the indigenous innovation approach, emphasizing breakthroughs through local intellectual property and R&D stimuli, integral to China's national innovation strategy (Chen, 1994; Mu et al., 2021).

Studies exploring Chinese culture, including the concept of yin–yang (Li, 2012), authority relations, and organizational structures, contributed to contextualizing management practices (Fang, 2012; Ma, 2012; Wu et al., 2012). Recent works underscore the need for indigenous frameworks, like political ideology and government planning, to comprehend Chinese management practices effectively (Liu et al., 2022).

Therefore, adopting translation theory serves as a framework to understand how scholars affiliated with Chinese institutions utilize the concept of OI in their research. Given the broadening scope of OI research, understanding how these scholars use the OI concept can significantly advance the literature on both OI and translation theory.

### 3. Data and methods

#### 3.1. Methodology

To categorize the themes of OI adopted by scholars affiliated with Chinese academia, we used a systematic approach. This allows us to collect data in

a reproducible way, see how the research has progressed over time, and detect themes, perspectives, or common issues (Snyder, 2019). To offer a comprehensive analysis, we combined both quantitative and qualitative methods, which have proven to be effective in innovation management research (Schmitz et al., 2017).

Our documents were collected from both the Thomson Reuters Web of Science (WoS) and Scopus databases, which are well-known for indexing a wide variety of high-level publications and are standard sources for conducting systematic reviews (Duan, 2023).

In this study, we adhered to the approach taken by Soll and Larrick (2009) and collaboratively established the criteria for including and excluding research papers. The search strategy was based on previous literature reviews on OI (Dahlander and Gann, 2010; West and Bogers, 2014; Kovács et al., 2015). The keyword search was conducted in the title, abstract, and keywords of the publications and was immediately limited to the 'business' or 'management' categories for WoS, and the 'Business, Management, and Accounting' category for Scopus. We used the following topic search:

TS = ('open innovation\*' OR 'open-innovation\*' OR 'openness' OR 'open business model' OR 'open service innovation' OR 'coupled OI' OR 'inbound OI' OR 'outbound OI').

Our initial dataset comprised 17,338 documents. We then applied the following limitations, resulting in updated document counts in parentheses: focusing on 'article' type of document (12,758 documents); considering publications and early views up to 2021, given that we collected the documents in early January 2022 (10,544); and including only those authored by scholars affiliated with Chinese institutions (785 documents). Within this dataset, 10 papers were in Chinese, while the rest were in English. No language limitations were imposed.

Building on West and Bogers (2014), we compiled a second list of articles by gathering all papers that cited Chesbrough's earliest work on OI (Chesbrough, 2003a, 2003b). This approach aimed to create the most comprehensive dataset possible.

By combining the two lists, we obtained a final dataset of 1653 documents. After eliminating duplicates, 839 documents were left. We then screened the documents to eliminate false positives.

Specifically, following previous literature reviews on OI and their inclusion criteria (Bogers et al., 2016; Hossain and Kauranen, 2016; Niesten and Stefan, 2019), we reviewed the abstracts of the papers one by one to determine whether they were



dealing with OI topics. The authors individually screened the content of a randomly chosen sample of 20 papers. To ensure consistency, the results were compared and discussed among the authors. This rigorous process was repeated twice to enhance the validity of the study's findings.

The most relevant instances of exclusion involved papers that utilized the concept of 'openness' in relation to trade or personal behavioral characteristics (e.g., managers' openness to change), or those that made only passing references to Chesbrough's work on OI while primarily focusing on different topics. In total, 637 papers were excluded, leading to a final dataset comprising 202 papers.

We conducted a bibliometric analysis to identify the structure and evolution of the scientific community and literature. To perform the bibliometric analysis, we used the Biblioshiny web interface for Bibliometrix, an open-source tool for executing

science mapping analysis of scientific literature (Aria and Cuccurullo, 2017). Specifically, we will present some descriptive statistics, a co-citation analysis relevant to identifying the major theoretical background of our dataset, and a cluster analysis based on keywords. This allows us to highlight the different themes of a given domain by representing each cluster on a plot known as a thematic map (Cobo et al., 2011).

We subsequently conducted a content analysis of the papers to describe the patterns and themes emerging from our dataset in greater detail. Given the diverse array of methods used to assess OI and its impacts, and our aim to incorporate both quantitative and qualitative research, the current study chose not to employ a meta-analysis that requires strict methodological conformity among the reviewed studies (Snyder, 2019).

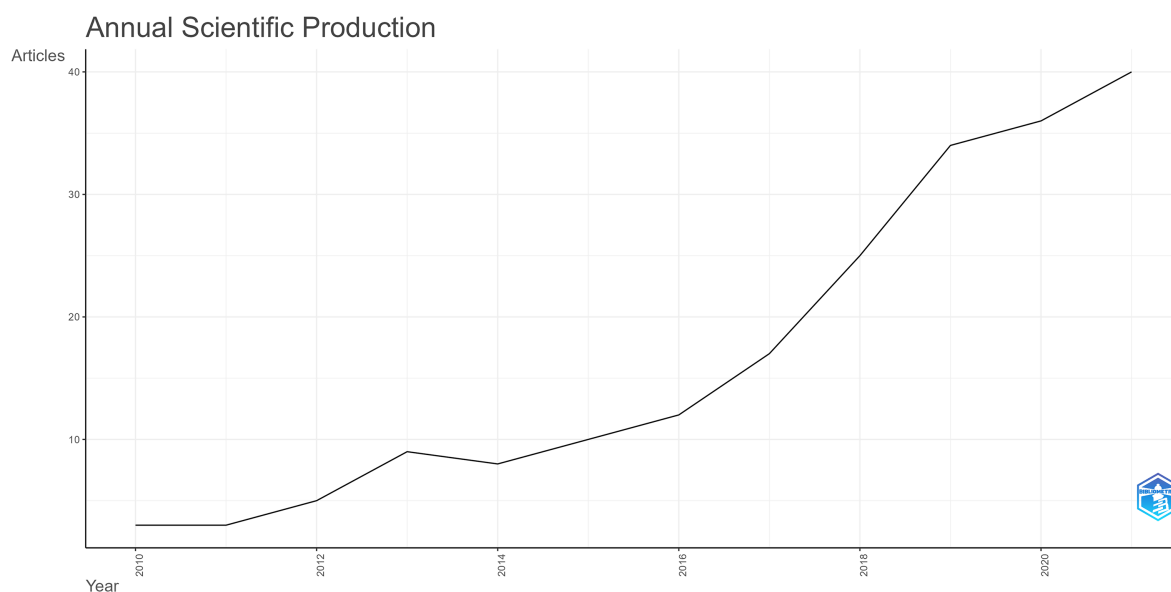
The articles were analyzed using descriptive coding and sub-coding techniques (Saldaña, 2013). The codes were initially based on predefined criteria, which were further refined and adjusted throughout the process. The next step involved categorizing the codes and identifying emerging themes as described in the following paragraphs. This thorough process of coding and analysis provided an accurate and comprehensive overview of the existing literature.

### 3.2. Data

The dataset includes a total of 202 papers, with the first publication dated 2010. Table 1 presents the key details of the dataset, while Figure 1 illustrates the

**Table 1.** Main information about the dataset

Description	Results
Main information about the data	
Timespan	2010:2021
Sources	78
Documents	202
Annual growth rate (%)	26.55
Average citations per doc	15.39
References	8858
Authors	454
Single-authored documents	14
Co-authors per documents	3.01



**Figure 1.** Annual scientific production.

annual scientific production. There has been a steady increase in the number of publications per year, with a sharp growth starting in 2016.

Table 2 displays the most relevant journals ranked according to the number of publications. The top 10 journals account for 46% (93 documents) of the articles. *Technology Analysis & Strategic Management* is at the top of the list with 25 papers (12.38%), followed by *Chinese Management Studies* and *Journal of Knowledge Management* with 15 and 9 articles respectively.

Tables 3 and 4 rank the documents by the number of local citations (LC) and global citations (GC), respectively, as extracted from the WoS. Local citations refer to the number of citations a paper received from other papers included in our dataset. Global citations refer to the total number of citations a paper in our dataset has received worldwide.

Table 3 presents the most cited papers based on LC. The number of LC significantly differs from the number of GC. For instance, there is a remarkable difference in the cases of Lau et al. (2010) and Zeng et al. (2010). These papers have received significant global attention (Table 4), but are not highly cited locally within our dataset.

Table 4 shows the most globally cited papers, providing insights into the topics that are highly valued by the international OI community. These include the relationship between collaboration networks and innovation performance (Zeng et al., 2010; Guan and Zhao, 2013; Xie et al., 2016; Wang and Hu, 2020), open business model (Hu, 2014; Wei et al., 2014, 2017), and the role of users (Lau et al., 2010; He et al., 2014; Wang et al., 2016). As our subsequent results reveal, while the first theme

is highly developed in Chinese academia, the other two do not receive the same level of attention (see Section 4).

## 4. Results

### 4.1. Thematic mapping

The thematic mapping was conducted using the Bibliometrix software, following the approach of Cobo et al. (2011). The dataset was divided into three periods of 4 years each: 2010–2013 (Figure 2), 2014–2017 (Figure 3), and 2018–2021 (Figure 4). This equal time division helps to understand the evolution of research themes more effectively.

The approach utilizes keyword co-occurrence analysis. By analyzing the co-occurrence of the keywords, it is possible to characterize the content of the papers. This analysis forms the basis for the thematic maps depicted in Figures 2–4. We manually filtered out non-significant keywords (e.g., enterprise, companies, consequences, future, and information) and redundant keywords given the scope of our research (e.g., OI, China). Additionally, we merged synonyms (e.g., ‘ambidexterity’ and ‘organizational ambidexterity’, ‘high-tech’, and ‘high-technology’). Each node in the thematic map represents a network created from keyword associations in research documents. These networks represent research themes corresponding to areas of interest emerging from our dataset. Node sizes are proportional to the number of documents in each theme and are labeled with the most significant keywords (Cobo et al., 2011).

**Table 2.** Most relevant journal by the number of publications

Rank	Sources	Articles	Percentage (%)	Cumulative (%)
1	Technology Analysis & Strategic Management	25	12.38	12.38
2	Chinese Management Studies	15	7.43	19.80
3	Journal of Knowledge Management	9	4.46	24.26
4	Asian Journal of Technology Innovation	8	3.96	28.22
5	Technological Forecasting and Social Change	8	3.96	32.18
6	International Journal of Technology Management	7	3.47	35.64
7	Management Decision	6	2.97	38.61
8	IEEE Transactions on Engineering Management	5	2.48	41.09
9	Journal of Business Research	5	2.48	43.56
10	Science Technology and Society	5	2.48	46.04
	<i>Others (68 journals)</i>	109	53.96	100
	<i>Total</i>	202	100	

**Table 3.** Top 10 most locally cited papers

Document	First author's affiliation	Local citations	Global citations	LC/GC ratio (%)	Normalized LC	Normalized GC
Zang et al. (2014)	Xi'an Jiaotong University	5	22	22.73	2.50	0.58
Zhu et al. (2017)	University of Science and Technology of China, Hefei	5	21	23.81	5.31	1.49
Wang et al. (2017c)	Dalian University of Technology	5	27	18.52	5.31	1.92
Zhu et al. (2019b)	Hefei University of Technology	5	25	20.00	9.44	2.85
Lau et al. (2010)	Hong Kong University of Science & Technology	4	220	1.82	1.20	0.85
Zeng et al. (2010)	Shanghai Jiaotong University	4	546	0.73	1.20	2.11
Guo et al. (2015)	Zhejiang University	4	15	26.67	6.67	0.88
Shi and Zhang (2018)	Harbin Institute of Technology	4	15	26.67	5.26	1.17
Guo and Wang (2014)	Zhejiang University	3	14	21.43	1.50	0.37
Hu (2014)	Hangzhou Dianzi University	3	47	6.38	1.50	1.24

**Table 4.** Top 10 most globally cited papers

Document	First author's affiliation	Global citations	GC per year	Normalized GC
Zeng et al. (2010)	Shanghai Jiaotong University	546	39.00	2.11
Lau et al. (2010)	Hong Kong University of Science & Technology	220	15.71	0.85
He et al. (2014)	Huazhong University of Science and Technology	103	10.30	2.72
Guan and Zhao (2013)	Chinese Academy of Sciences	93	8.45	3.99
Wei et al. (2014)	Xi'an Jiaotong University	70	7.00	1.85
Wang et al. (2020a)	Zhejiang Normal University	54	13.50	5.20
Xie et al. (2016)	Shanghai University	53	6.63	2.72
Wang et al. (2016)	City University of Hong Kong	51	6.38	2.62
Tian et al. (2020)	Jiangsu University	51	12.75	4.91
Wei et al. (2017)	Xi'an Jiaotong University	50	7.14	3.56

Nodes are plotted in a two-by-two matrix characterized by density and centrality, which classify them into four groups. Centrality measures a node's interactions with other nodes, reflecting a theme's importance in the development of the research field under analysis. Density measures the strength of internal ties among the keywords forming the node and represents a theme's development.

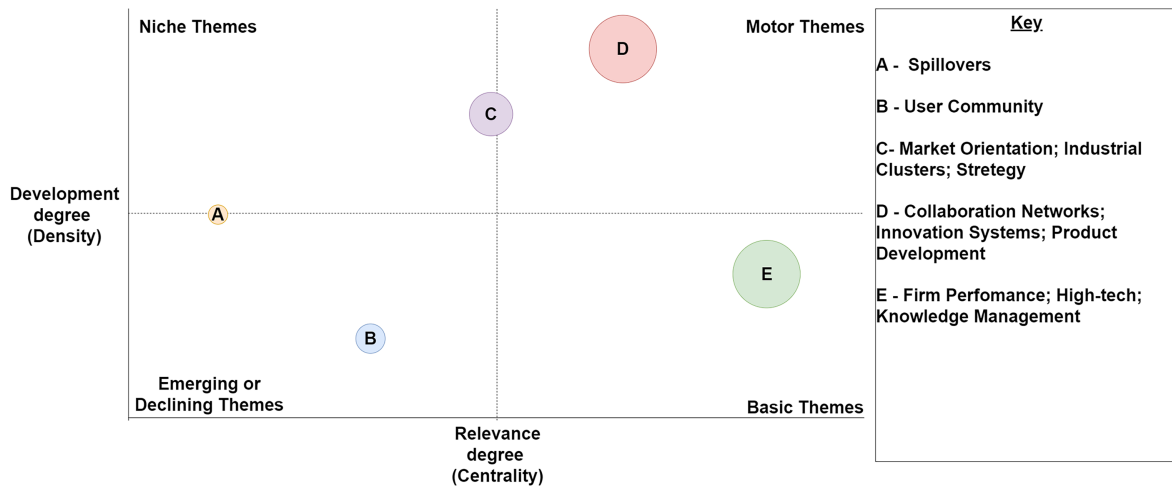
As a result, the matrix's quadrants indicate the themes' importance and development: the upper-right quadrant contains well-developed and important themes (motor themes). These themes are externally related to other themes that are conceptually closely related.

The upper-left quadrant contains niche themes with well-developed internal ties but weak external ties, rendering them marginal for the field.

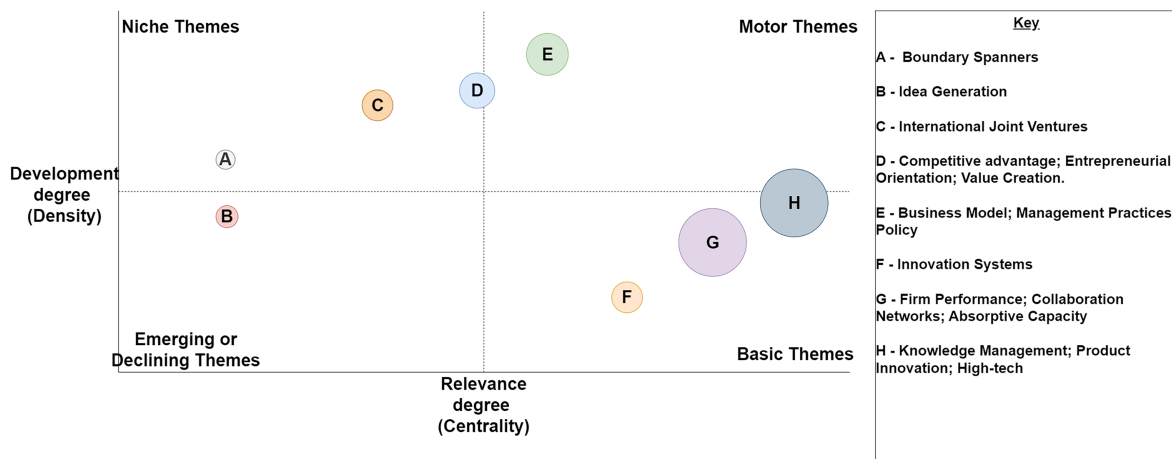
The lower-left quadrant includes weakly developed, marginal themes, indicating themes that are either emerging or disappearing.

The lower-right quadrant holds important but underdeveloped themes, which group transversal and general basic themes.

The theme of collaboration networks emerges as the predominant focus in the initial period. Although its centrality has diminished over the years, it remains one of the most developed themes, closely linked to the theme of innovation systems. Attention to firm performance aligns with one of the most developed themes but never achieves central prominence. Conversely, the user community consistently appears to be a less developed theme, gaining stronger centrality only during the last period (2017–2021).



**Figure 2.** Thematic Evolution by Keyword Plus (2010–2013). Each dot represents a theme. The size of the dots indicates the number of documents included in that specific theme. The labels describing the themes are listed in the key on the right. Each dot is identified with a letter, which does not indicate an order of importance.



**Figure 3.** Thematic Evolution by Keyword Plus (2014–2017). Each dot represents a theme. The size of the dots indicates the number of documents included in that specific theme. The labels describing the themes are listed in the key on the right. Each dot is identified with a letter, which does not indicate an order of importance.

Noteworthy is the emergence of themes during the last two time periods: business models and policies (2014–2017) and platforms (2018–2021). On the contrary, the intellectual property theme remains a niche, underscoring the challenge of associating OI practices with appropriability.

#### 4.2. Co-citation analysis

Figure 5 presents a co-citation analysis aimed at determining the literature foundation of the dataset (Zupic and Čater, 2015). Four clusters have been generated. The upper-left cluster (red) pertains to the core literature focusing on OI research developed after 2003 and encompasses numerous reviews and conceptual papers (e.g., Chesbrough, 2003a;

Laursen and Salter, 2006; Enkel et al., 2009; Dahlander and Gann, 2010). The second cluster in the bottom-left (green) is grounded in research connected to strategic alliances and network theories (e.g., Ahuja, 2000; Rosenkopf and Nerkar, 2001; Phelps, 2010). The third cluster in the bottom-right (blue) predominantly includes research on absorptive capacity and dynamic capabilities (e.g., Cohen and Levinthal, 1990; Teece et al., 1997; Zahra and George, 2002). Finally, the fourth cluster in the top-right (purple) incorporates publications mainly related to the processing of quantitative empirical research, such as structural equation modeling and multiple regression analysis (e.g., Fornell and Larcker, 1981; Anderson and Gerbing, 1988; Podsakoff et al., 2003).



### 4.3. Content analysis

Out of the 202 papers produced by Chinese academia, 42 (21%) do not have China as their empirical setting, while the remaining 160 (79%) do. As shown in Table 5 and Figure 6, we identified a total of 10 clusters. The papers without a China setting are analyzed in the Appendix A.

#### 4.3.1. China-setting papers

The 160 papers contained in this group are mainly distributed across Cluster 1 on external knowledge search (34 papers), Cluster 4 on organizational culture (22 papers), Cluster 5 on innovation systems (21 papers), Cluster 8 on policy and institutional factors (20 papers), and Cluster 9 on informal ties and Chinese culture (19 papers).

##### 3.1.1. Cluster 1 – external knowledge search

Most papers in Cluster 1 show a positive relationship between openness and performance in the Chinese context. They note that technology and management capabilities (Bo et al., 2019) and market environment (Ying and Fen, 2019) moderate this effect (Xu et al., 2012; Du et al., 2013; Ma and Liu, 2017; Zhang and Hu, 2017; Chen et al., 2018; Nan et al., 2018; Zhou et al., 2018b; Wang et al., 2018c, 2020a; Feng et al., 2020b; Duan et al., 2021; Lv et al., 2021). However, this does not apply to China's emerging firms or low-carbon ventures, as they tend to reduce reliance on external resources (Gu and Su, 2018; Wang and Jiang, 2019). Several studies stress the importance of external knowledge search for emerging Chinese firms in closing the technology and capabilities gap with industry leaders, especially through knowledge from foreign firms (Liu, 2010; Wu and Wu, 2014; Li et al., 2016, 2017; Zhang and Zhou, 2016; Hu et al., 2021). Foreign direct investment (FDI) serves as a short-term solution for knowledge acquisition, facilitating a shift from imitation to innovation over the long term (Guo and Chen, 2012; Guo et al., 2016; Hu et al., 2017; Guo and Zheng, 2019; Yang and Wei, 2019). However, not all firms can fully capitalize on this due to insufficient and inaccurate technological learning (Zhu and Chen, 2012). Overall, Chinese firms typically rely on external knowledge sources for radical, disruptive, and mostly incremental innovation (Zang et al., 2014; Guo et al., 2015; Chen et al., 2017; Jiang et al., 2020b; Xing and Sharif, 2020; Liu, 2021).

##### 3.1.2. Cluster 2 – business model

The papers in this cluster mainly relate outbound OI to innovation performance, showing their

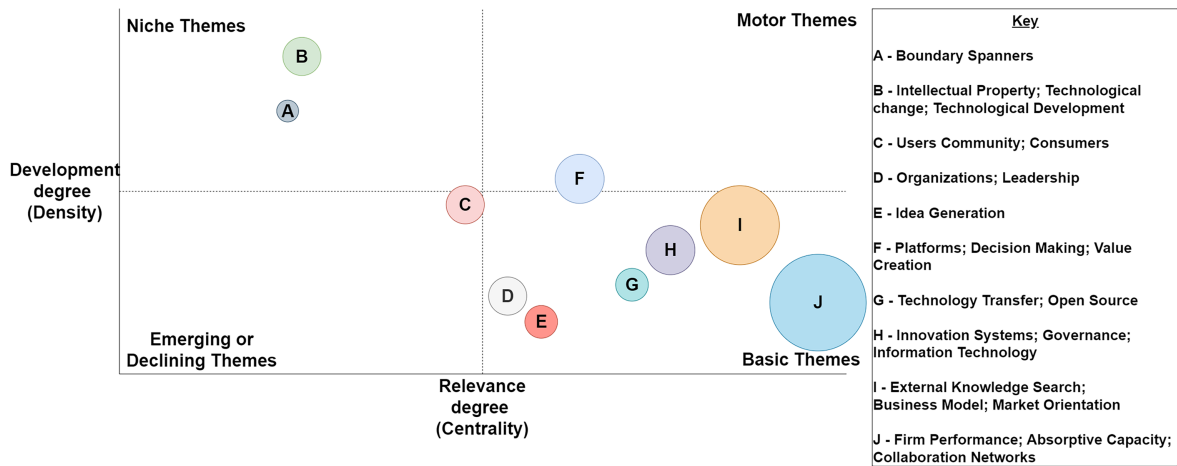
positive relation, especially in the long run (Hu and Chen, 2016; Wang and Xu, 2018; Fu et al., 2019; Zhu et al., 2019b; Guo et al., 2020; Zheng et al., 2020b; Liu et al., 2021a), even though inbound OI usually has a stronger impact (Wei et al., 2014, 2017; Yuan and Li, 2018; Liao et al., 2019a, 2019b). An open business model aimed at capturing the value of the knowledge created via the use of patents is essential for Chinese firms (Zhao et al., 2017), especially for those looking to shift from a patent accumulation strategy to the creation of high-quality patents (Cao and Zhao, 2013).

##### 3.1.3. Cluster 3 – the role of users

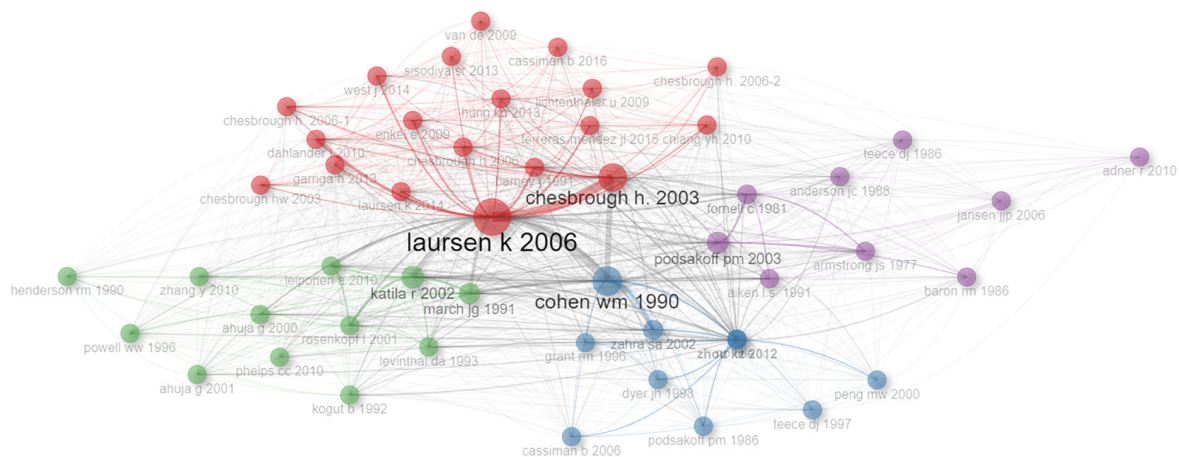
Most of the papers in this cluster relate to the use and management of the crowdsourcing mechanism to involve users in the innovation process and how this impacts firms' performance (Shao et al., 2012; Wu et al., 2018; Wen et al., 2020). Lau et al. (2010) find a positive relationship between supplier and customer integration in the innovation process and product performance. Conversely, Li et al. (2021) found that supplier involvement weakens this positive relationship. Finally, many papers focus on the antecedents driving users to join crowdsourcing events, their characteristics, their motivations, and their capabilities (Wang et al., 2013; Wen et al., 2019).

##### 3.1.4. Cluster 4 – organizational culture

Internal resources and structural attributes shape OI strategies for Chinese firms (Hu, 2014; Chen and Liu, 2019; Zhang et al., 2019). Strong absorptive capacities are crucial for acquiring and internalizing external technology (Xie et al., 2018; Wu et al., 2019; Sun et al., 2020; Wu and Ding, 2020). Prioritizing internal capabilities before adopting OI approaches is particularly important for state-owned enterprises (SOEs) (Gao, 2019). The acquisition of external knowledge influences employee centrality and creativity and improves learning, resource allocation, and organizational capabilities (Lau et al., 2013; Tang, 2016; Li et al., 2020). However, the personal attitudes of workers and top management moderate the relationship between openness and performance (Tang and Ye, 2015; Cheng et al., 2018; Hu et al., 2019; Wang et al., 2020d; Zheng et al., 2020a). Various studies indicate that the quality and structure of human capital, such as employees' education levels, moderate the relationships between OI and firm profitability, with variations based on technology level (Zhang et al., 2018; Li et al., 2019; Chen et al., 2021c). Chen et al. (2015) study on measuring intellectual capital and its impact on innovation performance found that Chinese firms do not need



**Figure 4.** Thematic Evolution by Keyword Plus (2018–2021). Each dot represents a theme. The size of the dots indicates the number of documents included in that specific theme. The labels describing the themes are listed in the key on the right. Each dot is identified with a letter, which does not indicate an order of importance.



**Figure 5.** Co-citation analysis.

to rely on foreign entities to acquire needed external knowledge, as it is available domestically. Firms engaged in both cooperative and independent R&D often struggle to exploit synergistic effects (Wang et al., 2019a), making absorptive capacities crucial for integrating and transforming acquired knowledge to avoid mere imitation (Song, 2015).

### 3.1.5. Cluster 5 – innovation systems

This cluster focuses on the geographic concentration of firms within industrial clusters, where both local and nonlocal knowledge searches positively relate to product innovation (Wu and Wei, 2013; Ai and Wu, 2016), with effects varying by cluster type. Intentionally formed clusters foster formal cooperation and global connections, while naturally formed ones lean toward informal cooperation and local ties. According to S.X. Zeng et al. (2010), cooperation with government agencies or universities has less

impact on SMEs’ innovation performance, while collaboration with firms, customers, and suppliers plays a more significant role. The importance of inter-firm collaboration is emphasized by various authors (Wang et al., 2016; Peng et al., 2013; Wang and Hu, 2020; Zhang and Zhu, 2020; Yuan et al., 2023).

The success of the Chinese innovation system depends on factors such as increasing basic and applied research, expanding the number of researchers, enforcing intellectual property rights (IPR) rules, boosting R&D funding, and strengthening smart manufacturing infrastructure (Al-Sayed and Yang, 2020). The high-speed railway industry exemplifies an innovation system in various stages of technology maturity, with policy guidance crucial for its development (Huang et al., 2019a; Mei and Zhang, 2021). Xie and Wang (2020) identified six OI ecosystem modes applicable in China

**Table 5.** Thematic content distribution of papers from Chinese academia

Cluster	Total	Non-China setting	China setting
1. External knowledge search	44	10	34
2. Business model	16	2	14
3. The role of users	18	11	7
4. Organizational culture	28	6	22
5. Innovation systems	31	10	21
6. University–industry collaboration	16	2	14
7. Platforms	8	1	7
8. Policy and institutional factors	20	–	20
9. Informal ties and Chinese culture	19	–	19
10. Social innovation	2	–	2
<b>Total</b>	<b>202</b>	<b>42</b>	<b>160</b>

through a grounded theory approach based on firms' centrality. Other authors analyze the role of centrality within ecosystems, revealing that knowledge search strategies depend on a firm's embeddedness, collaboration strength, and network density, both nationally and internationally (Sun, 2016; Xie et al., 2016; Xu et al., 2017, 2019; Lin et al., 2018; Xue, 2018; Su et al., 2019; Lyu et al., 2020; Xie and Wang, 2021).

### 3.1.6. Cluster 6 – university–industry relations

The establishment of strong collaboration between universities and industries, especially with diverse partners, is a distinctive feature of the Chinese environment (Yi, 2019; Huang et al., 2019b; Lin, 2021). Technological proximity significantly influences the formation of university–industry collaborations, particularly in the Beijing–Tianjin–Hebei region (Chen and Xie, 2018). In China, university–industry relations are transitioning from localization to specialization (Wang and Lu, 2021). Qiu et al. (2017) reveal that international collaboration between Chinese universities and developed countries positively impacts only top-tier regions, while domestic collaboration shows a more favorable outcome. Local and foreign firms establish connections with universities, but their approaches differ. Local firms forge university ties to compensate for R&D capabilities, with tacit knowledge transfer having a greater impact than explicit transfer on successful cooperation (Xu et al., 2014). In contrast, FDI firms establish ties to enhance their entry strategies and complement internal R&D capabilities (Xu et al., 2011; Ye et al., 2019; Zhou et al., 2021). Lai and Lu (2016) highlight financial support and education as major reasons for academic participation in university–industry collaboration, particularly in animation. Finally, certain Chinese universities have adopted innovative collaboration

approaches, such as establishing joint R&D centers or creating collaboration platforms (Lv, 2014; Li et al., 2018; Cheng et al., 2020b).

### 3.1.7. Cluster 7 – platforms

Sun and Wei (2019) state that for Chinese firms, a lack of capabilities and resources makes it difficult to build and manage a platform with a dominant firm at its core. Consequently, more platforms without leading actors and explicit boundaries are emerging. For start-ups, engaging in a platform-based ecosystem positively correlates with their innovative performance (Zhang et al., 2023). Both business-oriented and government-oriented platforms in China tend to be built around co-creation value and a high level of openness, which in turn increases platform performance (Su et al., 2018; Yu et al., 2019; Wang et al., 2020b; Gao et al., 2021; Zhao and Yi, 2023).

### 3.1.8. Cluster 8 – policy and institutional factors

A recurrent theme in this group of papers is the government's role in creating clusters and ecosystems, indicating that institutional pressure positively promotes OI (Zhao and Zheng, 2011; Xie et al., 2017; Zhong and Tang, 2018; Jiang et al., 2020a; Yan et al., 2020). Government actions, such as forming clusters and facilitating collaboration among firms across regions, demonstrate the positive impact of policies. Initiatives also include attracting talent from other regions (Ma et al., 2019), reinforcing the legal system (Jiang et al., 2020a), and establishing technology intermediary institutions for knowledge sharing (Wu and Xu, 2013).

Another consistent finding is the positive relationship between strong government ties and innovation performance (Chen et al., 2020; Lu et al., 2020; Zhang et al., 2017). This suggests that firms with strong political ties can effectively communicate their needs to government bodies (Bo et al., 2021; Liao and Tsai, 2019).

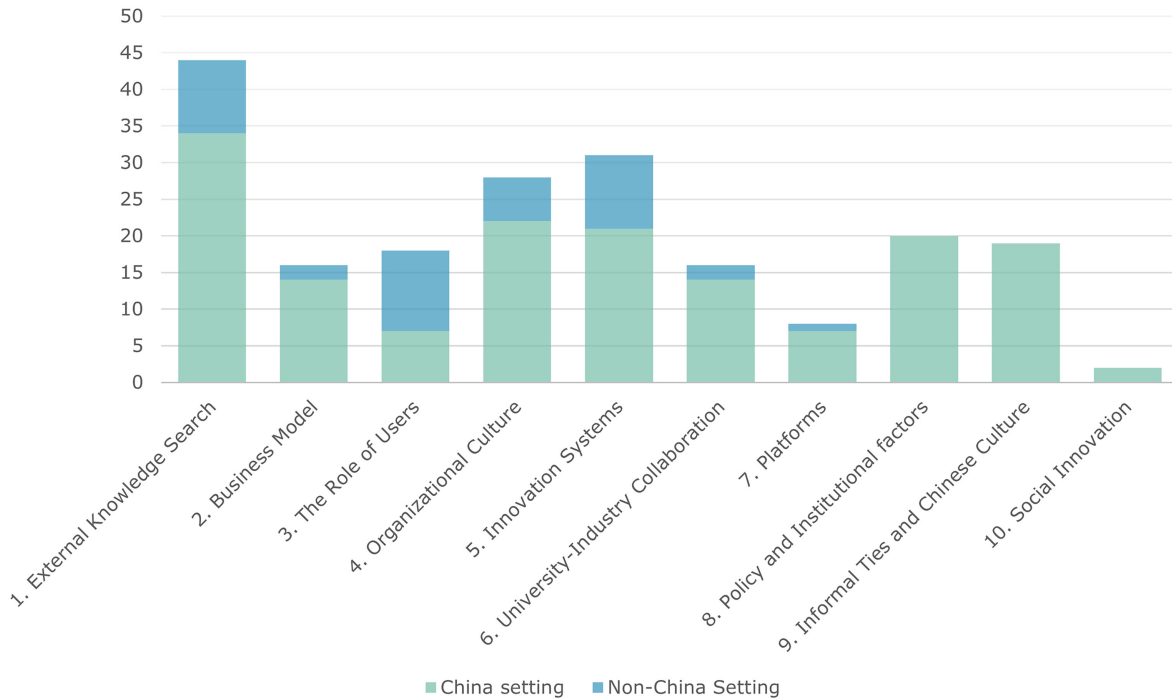


Figure 6. Thematic content distribution of papers from Chinese academia.

The interplay between firms adopting OI and the government in shaping policies is evident.

Moreover, the papers highlight that OI approaches in China are influenced by the country’s IPR system and related government policies, aiming to reduce uncertainty in technology transactions (Bao et al., 2020; Ma et al., 2021; Zhang et al., 2016; Zheng et al., 2018). This uncertainty varies based on the business environment and the Chinese provinces where firms operate, reflecting the internal diversity of a vast country like China (Wang et al., 2015b; Su et al., 2020; Yu et al., 2020; Bao et al., 2021).

### 3.1.9. Cluster 9 – informal ties and Chinese culture

In navigating external knowledge, especially tacit knowledge, Chinese firms predominantly rely on informal sources, emphasizing interpersonal trust and long-term relationships (Liu et al., 2011; Guo and Wang, 2014; Ruan and Chen, 2017; Huang et al., 2018; Zhang and Zhang, 2018; Cabrilo et al., 2020). This is particularly pronounced in non-R&D innovation pursuits (Ng and Law, 2015; Xie et al., 2019; Yu et al., 2021). Strategically managing these ties and avoiding opportunistic approaches is crucial, as they can negatively affect the relationship between OI and performance (Xie et al., 2015; Zhou et al., 2018a). Informal ties positively influence outbound OI and contribute to effective business models (Wang et al., 2017a; Zhu et al., 2017).

Managing informal networks requires active involvement from top management to exercise appropriate intra- and interorganizational controls (Lu et al., 2017; Jiao et al., 2019) and to maintain relationships with government agencies for technological innovation resources (Jiao et al., 2021). However, these relationships can pose challenges due to China’s cultural traditions, such as a strong emphasis on hierarchy and authority, which may hinder idea generation given the reliance on personal ties (*guanxi*) for market access and knowledge (Wang et al., 2018a).

Finally, Gao et al. (2015) propose a framework for Chinese OI grounded in ancient philosophies like Confucianism and Taoism, illustrating how collaboration patterns align with Chinese cultural principles.

### 3.1.10. Cluster 10 – social innovation

Hsu et al. (2018) found that OI in the service sector fosters social innovation. However, formal government intervention, often abrupt and unexpected, weakens mutual learning. Conversely, informal relationships enhance this effect. Wang et al. (2022) suggest the shift toward a socially integrated business approach stems from Confucian thought. Besides commercial interests, the ‘Confucian businessman’ aims to benefit society and improve people’s quality of life.



## 5. Discussions and conclusion

The main purpose of this study has been to understand how the framework of OI has been translated by Chinese academia. Our review responds to several literature calls related to identifying how managerial knowledge and concepts move and are adapted in different institutional settings (Wæraas and Nielsen, 2016). Specifically, in the realm of OI – which has been identified as a field of knowledge that has undergone numerous evolutions and adaptations (Radziwon and Chesbrough, 2024) – a critical need emerged to conceptualize the OI framework within diverse and distant institutional settings. This is crucial for understanding the contextual variations in framing OI and for bridging empirical findings with broader theoretical constructs (Dahlander et al., 2021).

Analyzing a final dataset of 202 articles, our findings indicate that Chinese academia has entered the discourse on OI relatively recently compared with the international literature, with most contributions emerging from 2016 onward. The earliest identified contributions date back to 2010, coinciding with one of the initial and still most relevant literature reviews on OI, published in *Research Policy* (Dahlander and Gann, 2010). Our dataset highlights a concentration of articles within a few academic journals, indicating a focused discourse within a distinct business community. Content analysis reveals that Chinese academia predominantly explores five main topics: the role of external knowledge search in enhancing firm performance, organizational culture, policy and institutional factors, innovation systems, and informal ties intersecting with Chinese culture.

We build on translation theory, which highlights the dynamic adaptation of management concepts and ideas across different institutional settings (Wæraas and Nielsen, 2016). In contrast to a straightforward adoption model, where concepts are merely transplanted, our findings suggest that the concept of OI within Chinese academia has undergone recontextualization that emerges as a need to align with local cultural, economic, and institutional realities (Czarniawska-Joerges and Sevón, 1996). This evolution reflects China's unique blend of a socialist market economy and government-led innovation strategies, which emphasize indigenous innovation frameworks (Chen et al., 2021b).

The interplay between regulatory frameworks, cultural norms, and government policies significantly influences how OI is perceived and operationalized within Chinese academic circles (Dimaggio

and Powell, 1983). This institutional context not only legitimizes certain OI practices but also shapes strategic orientations toward collaborative innovation that differ from conventional models (Chesbrough et al., 2021).

Chinese academia has translated OI more as a practical tool for firms to enhance their performance, supported by government policies aimed at fostering a conducive innovation environment. The synthesized OI model from our results illustrates a dual flow of innovation: top-down government initiatives and policies facilitate OI frameworks, while bottom-up efforts by firms drive internal innovation through external knowledge search and collaboration. This synergistic approach underscores how governmental support and firm-level initiatives collectively enhance innovation outcomes. Thus, OI in Chinese academia is translated not merely as a theoretical construct but as a strategic tool embedded within a supportive policy environment, enabling firms to integrate external insights and resources into their innovation processes. The synthesized OI model from Chinese academia offers insights into effective OI practices tailored to local advantages. It identifies the role of informal ties, a hallmark of Chinese culture, which intersects with formal innovation frameworks. By categorizing these practices under OI – even when focused on cultivating informal connections – the model aligns with both traditional and modern innovation paradigms.

In essence, Chinese academia's approach to OI integrates cultural nuances with strategic imperatives, reflecting a deep understanding of local conditions. Policies named after OI have not only clarified communication among stakeholders but also fostered substantial collaborations between public and private entities, significantly enhancing innovation and firm performance (Di Minin and Cricchio, 2024). This integrated model promotes genuine OI practices, fostering environments conducive to sustained innovation and competitive advantage.

Figure 7 traces OI's conceptual development within scholars affiliated with Chinese institutions. Initially focused on external knowledge search for technological catch-up, recent shifts emphasize robust innovation systems involving universities, domestic firms, and governments as key units of analysis. Emphasizing the role of individuals in forming crucial ties, this trend aligns with global OI practices while uniquely addressing local dynamics.

From a policy perspective, integrating OI promotion with local practices and enhancing coordination



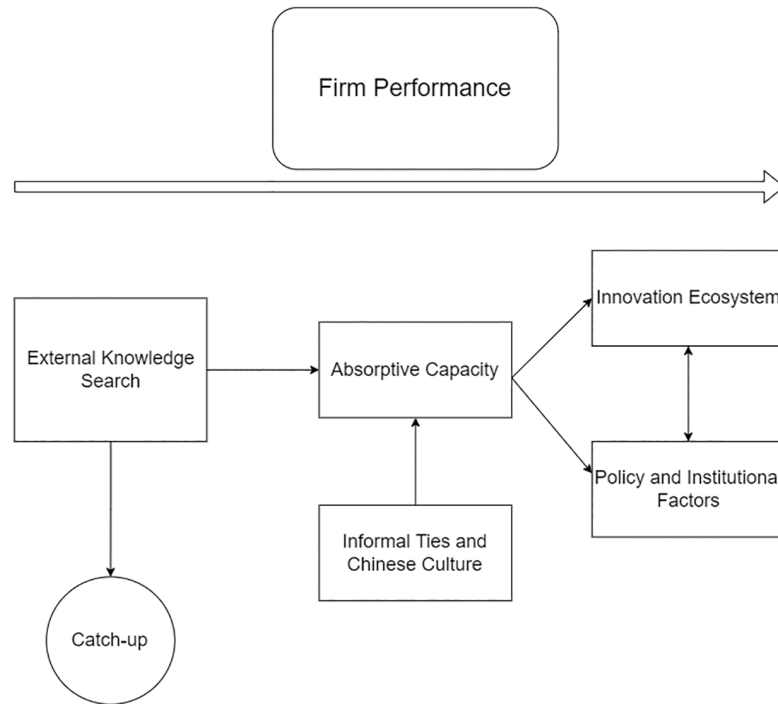


Figure 7. Harmonized open innovation model.

among stakeholders can optimize innovation ecosystems in China. This approach supports natural OI development, fostering synergy between top-down policies and bottom-up initiatives, thereby enhancing information dissemination and dynamic capabilities among stakeholders.

Scholars affiliated with Chinese institutions interpret the OI framework in ways that diverge from its conceptualizations elsewhere. This trend is first apparent in Tables 3 and 4, which indicate how the papers in our dataset cite each other and how they are cited globally, respectively. These tables reveal a lack of overlap between the most cited papers internationally and those cited domestically, revealing limited cross-community engagement. This is also apparent by comparing our co-citation analysis with previous bibliometric reviews on OI (Kovács et al., 2015; Randhawa et al., 2016), which identified four to nine theoretical foundation clusters. In our dataset, however, we observe only two main theoretical clusters – network theories and strategic alliances, and absorptive capacity and dynamic capabilities – alongside a methodological cluster and the core OI cluster. Notably, there is a relative neglect of the role of users and communities in innovation processes in Chinese academia. Investigating the incentives and motives driving individuals to engage in OI practices is a promising future area of research, particularly within the complex Chinese society

(Kovács et al., 2015; Bogers et al., 2016; Hossain et al., 2016; Ferrigno et al., 2023). Moreover, considering that China has the world’s largest number of graduates who return after studying abroad – who are one of the strategic innovation resources for the country (Chen et al., 2021b) – it would be interesting to understand the role of returnees in the development of OI practices, such as crowdsourcing, on the one hand, and their impact on the absorptive capacity of firms on the other.

Similarly, addressing societal challenges within OI practices, given China’s political and innovation agenda on the matter (Crupi et al., 2022), presents an opportunity to explore the linkage between social innovation and OI. Given the importance that social innovation has within the OI literature (Chesbrough and Di Minin, 2014; Ahn et al., 2019), we expect further research linking social innovation with OI within the Chinese framework that would particularly look into adapting their business model to social innovation in order to become sustainable in their effort to address social needs (Oeij et al., 2019). Social bricolage is one of the strategies implemented by Chinese companies to respond to social innovation initiatives (Crupi et al., 2022). The importance of informal ties, connected to traditional Chinese culture – as emerges from our dataset – could become a key element in further developing social OI practices.

Particularly regarding the role of traditional Chinese culture, our dataset reveals that it sometimes leads to difficulties in generating and acquiring new ideas due to the importance of hierarchy and opportunistic approaches from higher management (Xie et al., 2015; Wang et al., 2018a; Zhou et al., 2018a). This goes back to the more recent literature on OI failures (Stefan et al., 2022; Dabić et al., 2023), but they constitute a minority. Understanding how Chinese firms navigate rooted business culture and address these challenges, particularly in the context of open strategy-related decisions, represents an intriguing area for future research (Randhawa et al., 2016).

The primary focus of Chinese academia in OI remains on external knowledge search, reflecting a commitment to value creation over-exploitation, as evident in the limited attention given to business model topics. Further research on how OI is applied within the business model literature is indeed needed. Collaboration with foreign enterprises historically underpins this research stream. However, better alignment with studies on international alliances (e.g., Gassmann and von Zedtwitz, 1999; Hohberger et al., 2015) could be useful for examining the benefits and challenges of international OI dynamics.

In examining the innovation system, governmental influence is acknowledged, yet the vast geographical scope of China and hence the different regional institutional factors (He et al., 2019; Zhu et al., 2019a), prompts a call for research into how different government levels interact, adopting a multilevel governance perspective (Maggetti and Trein, 2019). Furthermore, understanding the interplay between public policy and OI ecosystems, especially the role of ecosystem orchestrators, requires empirical investigation (Jacobides et al., 2018; Radziwon and Bogers, 2019; Nylund et al., 2022). Additionally, the role of universities and public research institutions in constructing and developing such ecosystems, alongside their degree of control over the development of inventions and the extent to which universities shape the spread of OI should be further investigated (Perkmann, 2024). Expanding the research on this topic could lead to future studies exploring the different roles played by industry and academia in building their relationships, particularly regarding the roles of individual and team boundary spanners (Corsi et al., 2021; Kaiji et al., 2022).

### 5.1. Limitations

Despite employing a systematic approach, the findings are inherently influenced by the underlying research design and methods. Firstly, restricting the analysis to authors exclusively affiliated with Chinese

institutions and without international co-authorships may have introduced bias into the results. However, this methodological choice aligns with our primary research objective, which seeks to offer insights into the examination of OI within the purview of Chinese academia.

Secondly, the dataset includes only three papers written in Chinese. This limitation arises from the scarcity of non-English journals indexed by both Scopus and WoS. To address this constraint, future research endeavors could broaden the scope by incorporating scientific papers in Chinese from alternative databases.

Thirdly, we deliberately choose not to expand the research query to include other terms synonymous with OI. This choice was intended to maintain a focused approach to the core concept of OI, aligning with the methodology employed in previous reviews on the subject (West and Bogers, 2014; Ogink et al., 2023). Nevertheless, this limitation is partially mitigated by the inclusion of those papers that cite Chesbrough's seminal works on OI. Future research efforts could enhance this work by exploring additional concepts related to OI, thereby investigating how Chinese scholars may have applied OI principles without explicitly labeling them as such.

### 5.2. Managerial and policy implications

Our study examines how scholars affiliated with Chinese institutions have adopted the concept of OI, and the majority of papers set in China offer valuable insights for managers and policymakers. Specifically, the focus on external knowledge search underscores its importance as a key driver of innovation in China, providing a clear path for firms to integrate external knowledge to boost performance. Furthermore, the study uncovers the cultural challenges related to hierarchy and opportunism, advising managers to foster a collaborative environment that mitigates these barriers. The findings also emphasize the value of international alliances, guiding firms to strengthen global collaborations to navigate international OI dynamics.

For policymakers, the study highlights the need for creating supportive environments through policy frameworks that encourage collaboration between public and private entities and foster synergy between top-down and bottom-up innovation efforts. The importance of regional coordination and multilevel governance is underdeveloped, promoting better interaction among different government levels to support OI ecosystems. Strengthening university–industry collaborations and fostering international partnerships are additional policy recommendations.

### 5.3. Contributions

Our literature review contributes significantly to the OI literature and the translation theory literature. In terms of OI, the study elucidates the necessity of adapting OI strategies to fit specific cultural, economic, and institutional environments. This contextual adaptation underscores the theoretical importance of localized frameworks in enhancing OI effectiveness. Our study contributes to translation theory by analyzing how scholars affiliated with Chinese institutions interpret and translate the concept of OI. By examining a dataset where the majority of studies are set in China, we reveal how Chinese academia has recontextualized OI to fit local cultural, economic, and institutional realities. This focus on a Chinese empirical setting demonstrates a unique adaptation process that diverges from straightforward adoption models. Our findings show that Chinese scholars view OI as a strategic tool to enhance firm performance, supported by government interventions. This dual flow of top-down and bottom-up innovation processes highlights how global management ideas are transformed to suit specific local contexts. Through this analysis, our research enriches translation theory by showcasing the importance of local institutional contexts in shaping the adaptation and application of international management concepts.

### Acknowledgments

The authors are thankful to Philip Shapira, Muthu De Silva, Fu Xiaolan, and Ioana Stefan for their helpful feedback on earlier versions of this research project. We would also like to thank the participants of the World Open Innovation Conference of 2022 in Eindhoven for their valuable and useful insights and the comments of the two anonymous reviewers who helped in improving the paper during the review process.

### Conflict of interest statement

The manuscript has not been published, and simultaneous submissions to other journals have not been made. This research did not receive any specific grants from funding agencies in the public, commercial, or not-for-profit sectors.

### Data availability statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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## APPENDIX A

Content analysis of Non-China Setting papers

The 42 papers contained in this group are mainly disturbed across Cluster 1 on external knowledge search (10 papers), Cluster 3 on the role of users (11 papers), and Cluster 5 on innovation system (10 papers).

### A.1. Cluster 1 – External knowledge search

The papers in this group contain conceptual analysis that constructs some models aimed at clarifying either the relationship between inbound openness and innovation performance (Cheng et al., 2020a; Feng et al., 2020a) or the relevance of external knowledge search for building efficient innovation process (Wang et al., 2015a; Chege and Wang, 2019; Dogbe et al., 2020; Gong et al., 2020; Kashosi

et al., 2020). The more empirical papers tend to use patents as their data source and are either focused on emerging countries or the United States and prove that external knowledge search positively affects incremental innovation capabilities (Shi et al., 2020). In emerging countries, external knowledge search is used more as a substitute for internal R&D (Wang et al., 2020e). The work by Liu and Wang (2020) is the only one in this cluster that uses the movements of individuals across organizations as a way to measure knowledge flow and its relative impact on performance.

### A.2. Cluster 2 – Business model

This cluster comprises two papers. An empirical study, based on a sample of the US communications equipment industry, demonstrates that firms adopting attack strategies in patent lawsuits perform better than those employing defense strategies. However, an outbound open innovation (OI) approach weakens the positive effect, while inbound OI mitigates the negative effect for defenders (Chih-Yi and Bou-Wen, 2021). A theoretical paper argues that large firms are more likely to implement non-pecuniary outbound OI because larger firms, endowed with more resources, have the capacity to provide additional resources to their partners (Wang and Li, 2023).

### A.3. Cluster 3 – The role of users

This cluster mostly relates to the use of crowdsourcing, open-source software, or web-based interactions in general as different ways to involve users (Wei, 2012, 2013; Zhao and Xia, 2016; Liang and Hui, 2018; Rui and Guijie, 2018; Yu, 2020; Zhang and Du, 2021). The conceptual ones have for example drafted some models for understanding what kind of ideas coming from users are more successful when firms decide to open up the innovation process and how to select those ideas (Hou and Zhang, 2021). According to Tan et al. (2019), the size of the users involved in the open innovation process is not relevant since there is a tendency to converge to a product solution. Involving users in the innovation process is also affected by the capacities of top management and the founders' social capital (Yang and Zhang, 2018; Wang et al., 2018b).

### A.4. Cluster 4 – Organizational culture

Wang and Chin (2020) propose a conceptualization of the meaning of knowledge to then conclude with some practical suggestions to international managers to better manage knowledge in intercultural environments. The need for flexibility and externally oriented organizational culture is essential in ensuring the effectiveness of external involvement (Tian et al., 2020; Yang et al., 2021), even though Shi and Zhang (2018) from the Harbin Institute of Technology have found that organizational inertia is a contingent factor that should be considered when the goal is to improve radical innovation capability. The openness in innovation search is also determined by the absorption level of organizational slack (Wang et al., 2017c; Wang and Guo, 2020).

### A.5. Cluster 5 – Innovation systems

The more conceptual papers included in this cluster construct models using new approaches in semantic analysis

applied to patents text to identify R&D partners in an open innovation environment, a work that was later expanded taking into consideration technology similarity evaluation as well, creating a multi-pronged approach (Wang et al., 2017b; Wang et al., 2019b). Most of the studies in this cluster tend to focus on the importance of creating a network community and strong collaboration ties for strengthening innovation performance, a correlation that is enhanced when there is strong network embeddedness (He et al., 2014; Yao et al., 2015; Lyu et al., 2019; Han et al., 2020; Shi et al., 2020a, 2020b; Wang et al., 2020c; Wu et al., 2021).

#### A.6. Cluster 6 – University–industry relations

This cluster includes two papers. Jiancheng Guan from the Chinese Academy of Sciences and Qingjun Zhao from

Fudan University (2013), after analyzing the effects of multiplicative interaction between clustering and reach on members' knowledge creation and patent value, conclude, among other things, that university–industry–government collaboration should adopt the OI paradigm to boost the overall network performance.

The work of Ran et al. (2020), based on blockchain patents, proposes instead a solution to help small-medium enterprises (SMEs) identify, compare, evaluate, and select university partners.

#### A.7. Cluster 7 – Platforms

The only paper included in this cluster is the literature review on platform research conducted by Liu et al. (2021b), which underlines that the theme of OI is indeed one of the consolidated topics in platform research.