

Innovations

Cross-Border Acquisitions and Technology Transfer: AMO Framework

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The research is funded by ICSSR-NIHSS joint research program.

Abstract: *Technological capabilities are defined as a set of skills that are technical, managerial, and organizational that firms require to effectively utilize hardware and software of technology. There are two types of technological capabilities required in any firm – production, and innovation. During acquisitions, acquirers transfer technology to the target to raise the target's productivity. This paper aims to conduct a systematic literature review. The paper also advances related propositions that are based on Scientometric and bibliometric analysis of all articles related to technology transfer in cross-border acquisitions. Articles related to technology transfer were downloaded from Scopus and later on, analyzed with the help of VOS Viewer. This facilitated the researchers to identify 4 clusters and main author keywords. These 4 clusters gave rise to 3 different strands of research. The first cluster is Merger, Technology Transfer Foreign Direct Investment, and Multi-national Enterprise, China. The second cluster focuses on Cross-border, Industry, and International Trade, the third cluster focuses on mergers and acquisitions, Knowledge Transfer, and Knowledge Management whereas the fourth and last cluster focuses on M&A and Innovation.*

Keywords: *Cross-Border Acquisitions, Technology Transfer, Innovation, International Trade.*

1. Introduction

Cross-border acquisitions is a much-researched topic and various dimensions are included in the same. These dimensions are innovation, knowledge transfer, and cross-border acquisition activities occurring in countries such as China, India, and other developing countries. Technology transfer is one of the important aspects of any cross-border acquisition. Besides knowledge transfer, technology transfer is one of the very significant aspects that has drawn the attention of scholars across various disciplines. Technology transfer from acquirer to target also gives rise to R & D activities. Researchers have focused on different aspects of technology transfer as reverse technology transfer from acquirer to target to enhance the target's productivity. Usually, technological transfer should increase the innovative activities of target firms though few studies have reported that there is no evidence of technology transfer from foreign investors to acquisition targets that could lead to higher innovations (Stiebale & Reize, 2011).

Certain cultural differences are being reported (Badawy, 2009) that disrupt the development of technologies. Cultural variations (Ng, Chatzkel, Lau, & Macbeth, 2012) can create constraints in the process of technology transfer. Further, we have attempted to present a bibliographic analysis that summarizes the research patterns of cross-border acquisitions and technology transfer. Through the following research questions, we have attempted to fill the research gap in bibliographic analysis of cross-border acquisitions and technology transfer.

RQ 1: How is technology transfer facilitated in cross-border acquisitions?

RQ 2: How does technology transfer promote innovation within firms in cross-border acquisitions?

RQ3: What is the role of international trade in technology transfer?

1.1 Keywords Analysis

Various available literature on different perspectives is being reviewed. Over the years, the cross-border acquisition has received great attention by the scholarly community. They are still in the process of evolution continuously including various dimensions in research. One such under explored dimension is that of technology transfer which is still evolving, though certain amount of research has already been done on that aspect.

1.2 Material Collection

Material collection has been done from Scopus which is a very wide database (Merli, Preziosi & Acampora, 2018). We used the key word Cross Border Acquisitions AND ("Technology Transfer") with which earlier 22 documents were received and after applying exclusion criteria for documents of "Book" and "Conference Paper" and limiting language only

to English, we received 17 documents. The number of documents received were less hence an attempt has been made to keep all the journal articles so as to enhance the area of our research.

2. Bibliometric Analysis

To answer our first research question of how technology transfer takes place in cross-border acquisitions, we conducted a bibliometric analysis of all the articles received by us. In order to study the format, information, patterns of research, a bibliometric analysis of all journal articles became mandatory. Bibliometrics term was first used by Pritchard in 1969 as the mathematical and scientific analysis of books and other means of communication. Bibliographic coupling based on sources was conducted. Minimum number of documents to be kept to be 1 so as to observe the impact of the journals based on number of citations.

Table 1: Most Impactful Journal Analysis

S. No.	Top Contributing Journal	Publication House	Total Publications	Total Citations	Journal Impact Factor
1.	Asia Pacific Business Review (2)	Taylor & Francis	1	117	2.011
2.	Journal of International Business Studies (4*)	Palgrave Macmillan	1	100	11.103
3.	Small Business Economics (3)	Springer	1	67	4.803
4.	International Journal of Industrial Organization (3)	Elsevier	1	66	1.739

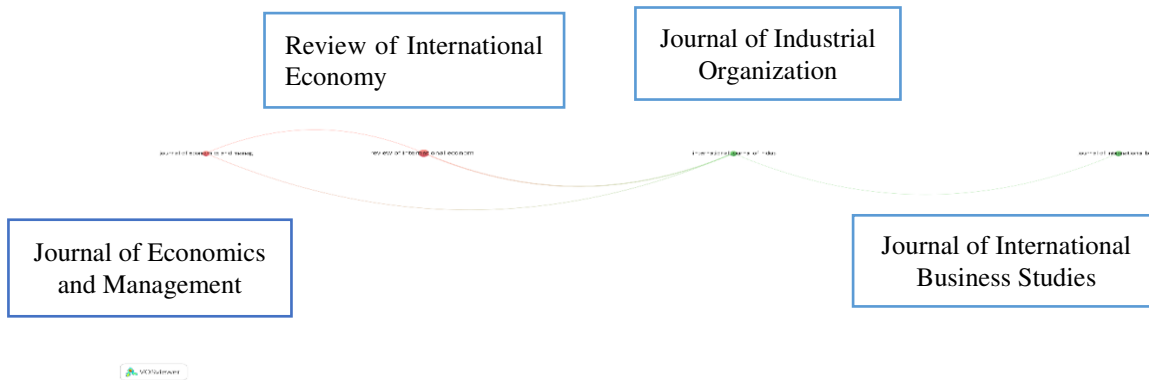


Fig. 1: Network Diagram for Most Impactful Journal Analysis

Review of International Economics and International Journal of Industrial Organization emerged as the journals with maximum link strength.

Citation analysis based on organizations facilitated us to know the impact or quality of articles produced and the number of times a work has been referred to by other scholars. This analysis was carried out on the basis of the organization through which we were able to assess the organization that is producing influential research on the topic of cross-border acquisitions and technology transfer.

Table 2: Citation Analysis Based on Organizations

S.No.	Organizations	Documents	Citations
1.	School of Management, Fudan University, China	1	117
2.	Wolfson College, University of Cambridge, U.K.	1	117
3.	School of Business, University of Hong Kong, Hong Kong	1	117
4.	Florida Atlantic University, USA	1	100
5.	INSEAD, France	1	100
6.	Lucas Graduate School of Business, SJSU, USA	1	100
7.	San Jose State University, California, USA	1	100

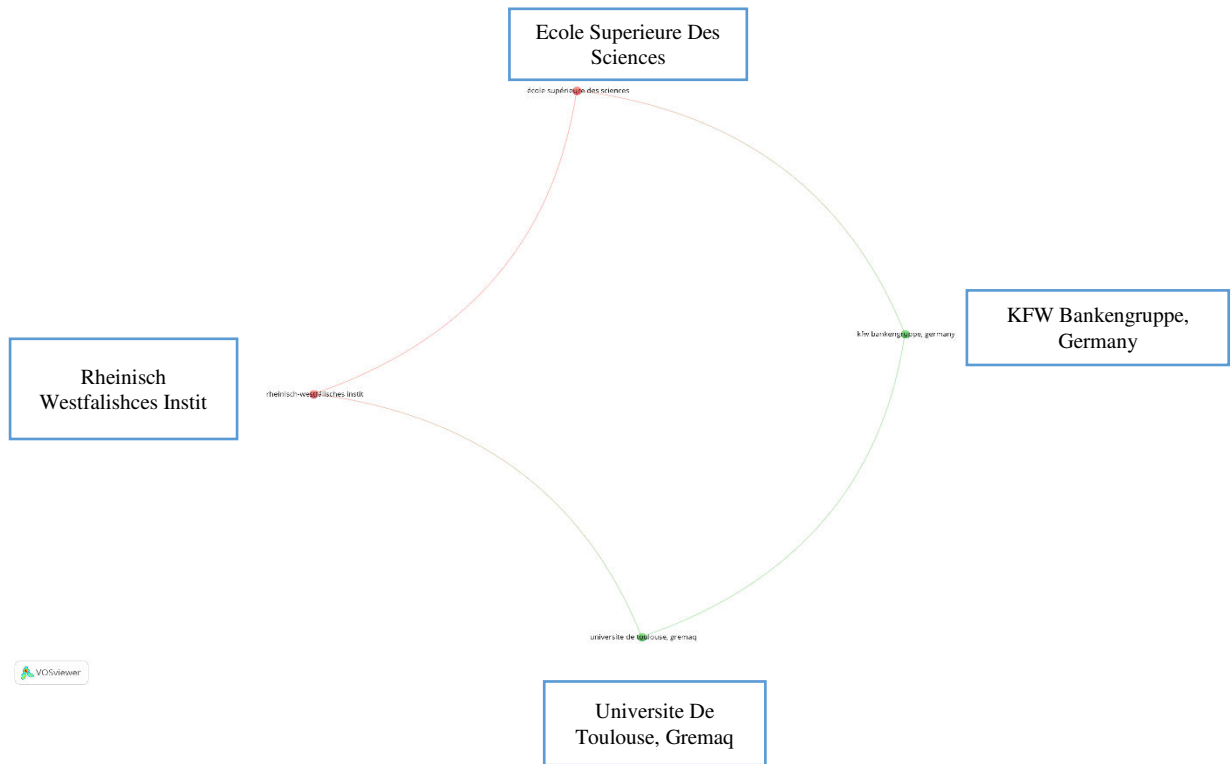


Fig. 2: Citation Analysis Based on Organizations

2.1 Author Influence Analysis

Co-authorship network of countries analysis was done to identify the country where most authors are collaborating towards cross-border acquisitions and knowledge transfer. The minimum number of documents of a country was kept at 2. France emerged as the country with the greatest number of citations at 136 forming a cluster with the USA. Hong Kong and the United Kingdom formed the next cluster with 123 and 122 citations respectively. Germany and China formed the third cluster with 124 and 80 citations respectively. This intellectual association can be known through author collaboration in the field of scientific research. We used VOS Viewer version 1.6.19 for viewing and creating desired Co-Authorship map. In VOS Viewer maps, the size and label of a circle of an item are determined by the weight of an item. Higher the weight, the higher the label and circle. The color of the label is determined by the cluster to which it belongs (Romero & Salido, 2019).

TABLE 3: Co-Authorship Network of Countries

S.No	Country	Documents	Citations
1.	Hong Kong	3	123
2.	China	6	132
3.	United Kingdom	2	122
4.	United States	6	132
5.	France	2	136
6.	Germany	3	80

TABLE 4: The Most Productive and Influential Authors

S.no	Name of the Authors	Affiliation	Country	Total Publications	Total Citations
1.	Hong N.S.	University of Hong Kong	Hong Kong	1	117
2.	Warner M.	University of Cambridge	U.K.	1	117
3.	Xu X.J.	Zhejiang University	China	1	117
4.	Brannen M.Y.	San Jose State University	USA	1	100
5.	Peterson M.F.	Maastricht University	Netherlands	1	100

2.2 Citation Analysis

Citation analysis on the basis of authors was conducted to observe the most productive and influential authors in the area of cross-border acquisitions and technology transfer. The number of times an article is cited in the work of other authors is a citation. Scholars from various stripes and convention and opinions giving significance to a certain piece of information or work establishes the impact or quality of an article. The minimum number of citations was kept to 20. We have considered those authors who have been cited either 100 or more than 100 times as more the number of citations, more will be any work qualitative and relevant in nature.

Table 5: Total Citations of Each Author

S.No.	Authors	Year	Name of Journal	Total Citations
1.	Hong N.S.	2004	Asia Pacific Business Review	117
2.	Warner M.	2004	Asia Pacific Business Review	117
3.	Xu X.J.	2004	Asia Pacific Business Review	117
4.	Brannen M.Y.	2009	Journal of International Business Studies	100
5.	Peterson M.F.	2009	Journal of International Business Studies	100

Table 6: Major Keywords on Cross-border Acquisitions and Technology Transfer

Cluster	Related Authors with Keywords/ Thematic Focus	Year of Publication	Beginning Year of Thematic Focus	Thematic Focus
1	Das	2002	2009	Merger, Technology Transfer Foreign Direct Investment, Multi-national Enterprise, China
	Tekin-Koru A	2009		
	Fuest C. et al.	2022		
	Li J.	2022		
	Ng A.W. et al.	2012		
2	Stiebale J. & Reize F.	2011	2001	Cross-border, Industry and International trade
	Stepanok	2015		
	Oliveira P. et.al.	2001		
3	Hayashi D.	2018	2018	Mergers and Acquisitions, Knowledge Transfer and Knowledge Management
	Han J. et al.	2018		
4	Triguero & Corcoles	2013	2013	M&A's and Innovation
	Kaufmann & Schiereck	2023		

2.3 Content Analysis of Four Clusters

To identify and understand the academic inclinations of cross-border acquisitions and technology transfer in recent times, a content analysis of three clusters was obtained from a Co-occurrence analysis of all keywords. The minimum number of occurrences of keywords was maintained at 3 as a result of which 8 keywords got selected. These 8 keywords were divided into 3 clusters. This content analysis was also done in order to answer our research questions 2nd and 3rd which are:

RQ 2: How does technology transfer promote innovation within firms in cross-border acquisitions?

RQ 3: What is the role of international trade in technology transfer?

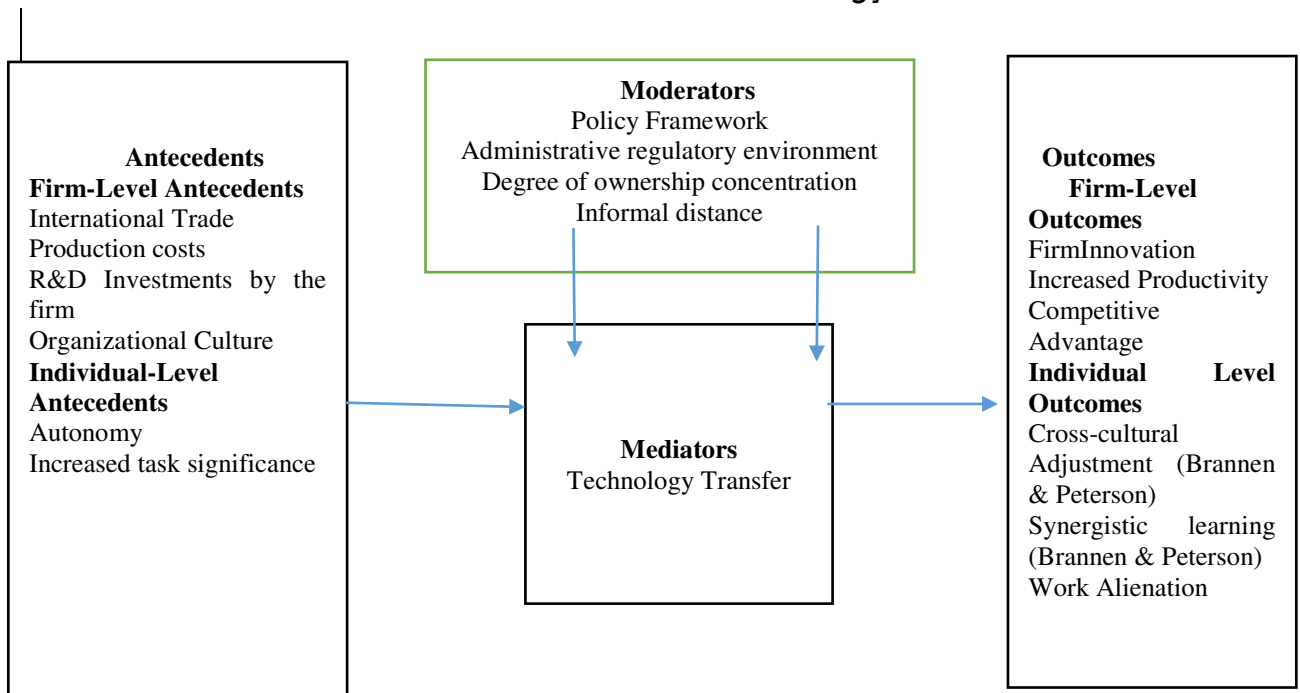


Fig.3: A-M-O Framework depicting Antecedents and Outcomes of Cross-border Acquisitions and Technology Transfer

4. Content Findings

This study led us to design an antecedent-mediator-outcome (A-M-O) framework so that RQ 2 and 3 of this study can be addressed. Drawing the insights from review, an extensive framework highlighting the role of technology transfer as a mediator linking antecedents of international trade, R&D investments by the firm, cross-cultural adjustment, and synergistic learning was built upon. This was further linked with the outcome of innovation.

4.1 Antecedents of Cross-Border Acquisitions and Technology Transfer

Foreign acquisitions are an integral part of international trade which seldom leads to innovation. Stiebale&Reize, 2011 in their study have

analyzed the impact of cross-border acquisitions on the innovative activities of the firm and highlighted that there is no innovation output by the target firm in the post-acquisition phase. However, the innovation output of the investor firm can be positively affected. There is no evidence showing any technology transfer in the form of innovation output during the post-acquisition phase. Another challenge is the short duration which does not provide time for spillover from the multinational parent after an acquisition (Stiebale&Reize, 2011).

4.1.1 Firm-Level Antecedents

International trade comes under firm-level antecedents as it is considered a primary vehicle for trans-border technology flows. The higher the trade share of a region, the higher the technology flows (Das G.G., 2002). Foreign acquisitions that come under the category of international trade promote R&D activities of the firm though the share of sales from product innovation is not always affected by R&D activities. Besides international trade, R&D activities, production costs, organizational culture also becomes a significant antecedent of technology transfer in the companies. Organizational culture only can promote absorptive capacity of the workforce i.e. how rapidly and easily they can imbibe novel learning and utilize the same for commercial use. Cultural dynamics of any organization can influence its intellectual capability development (Ng et al., 2012).

4.1.2 Individual-Level Antecedents

At the individual level, research is more related to degree of autonomy granted to acquired firms. Autonomy refers to the latitude of actions and freedom that managers have to formulate strategic activities such as implementation of organizational structure, determining corporate development strategy and execution of technology transformations (Tarba et al., 2019)

4.2 Outcomes of Cross-Border Acquisitions and Technology Transfer

Various studies have explored the relationship between cross-border acquisitions and technology transfer as to how technology acquired from targets countries can be put to use by acquirer countries.

4.2.1 Firm Level Outcomes

Firm-level outcomes ascertained in this study are heightened firm innovation, increased productivity and competitive advantage. This perspective has been strengthened in the studies as emerging market firms that are pursuing acquisition are able to promote green innovation (Li J., 2022). Literature review done on 85, 591 deals that occurred in 57 countries strengthens the fact that innovative firms in low innovation

countries are more likely to undertake cross-border deals as compared with innovative firms in high-innovation countries.

4.2.2 Individual Level Outcomes

Individual-level outcomes can spawn from a range of cross-cultural adjustment and synergistic learning on the positive side to work alienation on the negative side (Brannen & Peterson, 2009). The study done by Brannen and Peterson advocates that in order to remove pockets of alienation during post-acquisition phase in a firm, major systemic changes can be implemented upon supervisor's acceptance, employee's valued participation, organizational commitment, satisfaction of workers with their pay package, life and work they are doing.

4.3 Moderators of Cross-Border Acquisitions and Technology Transfer

Studies focus on four moderators that can affect innovative activities: Policy framework of any country, administrative and regulatory environment, informal institutional distance and degree of ownership concentration which are very important in promoting relationship between TDC M&A (Technologically- driven cross-border) and innovation. Regulatory environments render any acquisition or joint venture likely to happen as in the case of firms in USA (Georgieva D et al.,2012).

4.4 Technology Transfer as a Mediator for Cross - Border Acquisitions and Firm Innovation

Mediators are those factors that link antecedents with outcomes (Zahoor et al. 2022). This study has considered technology transfer as a major mediator. Technology transfer has been considered as a significant factor affecting international entry of a firm in a multinational market. Fig. 3 depicts technology transfer as a mediator that facilitates firm innovation, increased productivity and enhances competitive advantage of the firm.

Research Approach

This study is anchored within an interpretive and naturalistic paradigm. In fact the study utilized both observational and narrative approach and did not use much of experimental design, which are associated with quantitative research (reliability, validity, and generalizability) (Ethnography, Observational Research, and Narrative Inquiry, 1994-2012). Repetition of certain words, themes and concepts in a qualitative data is analyzed by a research tool known as content analysis. With the help of content analysis, researchers can derive conclusions about the messages within the text. It gives an insight into main expertise or viewpoint on which the author has worked upon. As an initial step, literature related with

cross-border acquisitions and technology transfer was searched in Scopus through which we could gather from Scopus through which only 21 documents were received. Exclusion criteria of book, book chapter and conference paper in the Document section was applied to this. Language was limited only to English. After applying exclusion criteria 17 documents were received. Three more research papers belonging technology transfer in cross-border acquisitions were included in that list as a result of which literature got increased to 21. This study on cross-border acquisitions and technology transfer has revealed four clusters symbolizing all keywords and concepts that have occurred in the literature. A discussion of clusters would be fruitful for comprehending the basic research themes present in the literature which is as follows:

Cluster 1: Merger, Technology Transfer Foreign Direct Investment, Multi-national Enterprise, China

Cluster 1 consists of 5 items in which main keyword of technology transfer is also present. The theme of technology transfer occurring during mergers and acquisitions is present as better educated workforce gelling more effectively with usage of new technology. With the help of better educated and skilled workforce, foreign improvement of technology is also feasible (Das G.G., 2002). Studies highlight that technology transfer can also be used as an optimal entry strategy for a multi-national firm (Tekin-Koru A., 2009). Discussion of this cluster reveals that academic inclination of the scholars from this cluster is towards emerging multinationals particularly in China where investors are keen on using FDI and acquisitions as a method of international expansion. Consequently, technology transfer also takes place from acquired to target firm. This cluster also mentions “China” and “foreign direct investment” the theme of which is present as main drivers which push Chinese investors towards targets with higher debt levels and lower profitability (Fuest C. et al., 2022). There are evidence-based studies from 229 Chinese firms that emerging markets are facing severe ecological and environmental problems during the periods of economic and political transition (Li J., 2022). Acquisitions also leads to undesirable technology transfer in Chinese emerging multinationals (CEMs) that has also gained attention for their rigorous activities on mergers and acquisitions and also creation of their own intellectual capital (Ng A.W. et al., 2012).

Cluster 2: Cross-border, Industry and International trade

The theme of cluster 2 focuses on international trade which has been all the more promoted by trade liberalization (Stepanek, 2015). The term “cross-border” signifies presence of this theme in all the studies gathered for this analysis. The term cross-border is relevant as it is the core of any

international trade and leads to industrial restructuring. Transfer mechanism becomes feasible only through cross-border interaction (Hayashi D., 2018). Innovation activities of the target firms also get a hype as a result of cross-border innovations (Stiebale J. & Reize F., 2011). “Industry” comes as a keyword in this cluster as mergers and acquisitions are occurring there which becomes a cause for their restructuring. Industries can provide a platform for either cross-border acquisitions or transfer mechanism (Hayashi D., 2018) or reverse knowledge transfer under government intervention (Su Y. et al., 2021). A model between international trade and foreign direct investment (FDI) has been developed (Stepanok, 2015) which explores the trade-off between achieving economies of scale through domestic production as compared to production abroad and foregoing variable costs as transportation costs and tariffs. “International trade” has emerged as a keyword in this cluster as FDI mostly consists of green field FDI and mergers and acquisitions.

Cluster 3: Mergers and Acquisitions, Knowledge Transfer and Knowledge Management

Different from previous two themes, cluster 3 focuses on theme of knowledge transfer and knowledge management taking place in the course of mergers and acquisitions. Transfer of know-how, R&D capabilities and managerial techniques from the parent company to the acquired company comes under the umbrella of knowledge transfer. High-tech knowledge intensive firms use their competitive advantage to leverage overseas resources. Knowledge has emerged as a key resource to upgrade industrial structure and improve its core competitiveness (Su Y. et al., 2021). There can be majorly two types of flow channels of knowledge i.e. one from acquired to acquirer and other from acquirer to acquired firms. Innovation capabilities that come under knowledge transfer is the best example of how knowledge flows from one firm to another enable recipient’s engagement in research and development (Hayashi, 2018). The flow of play an immense role in technology transfer (Hayashi, 2018). Knowledge management is another term that has emerged in this cluster. Under knowledge management, knowledge acquisition is also included which gathers strength with two actions of the firm- exploration and exploitation. This is a tradeoff between renewing the knowledge base of the firm with and exploiting already existing knowledge base of the firm. Though, there occurs a problem in exploitation of already existing knowledge base which leads to obsolescence (Hayashi, 2018).

Firms do encounter events of knowledge overlap (Han, J. et al., 2018) which occurs due to integration of knowledge bases of two firms. This knowledge overlap affects absorptive capacity of any organization positively. Knowledge base of the target firm can be divided into

similarities and complementarities to investigate the impact of knowledge overlap.

Cluster 4: M&A's and Innovation

Acquirers are willing to pay a higher premium for more innovative target firms. This is sometimes decided by nature of the acquirer firm. More innovative acquirer is likely to pay more price for innovative target firm rather than their less innovative peers (Kaufmann & Schiereck, 2023). Innovation activities lead the merger firm to create values and part of this value can actually be absorbed by competitors. Innovation activities do not occur in isolation, rather current innovation activities are interlinked with past innovative behavior (Triguero & Corcoles, 2013). Rival firms mostly exploit the moment of inertia of a firm entering into a merger.

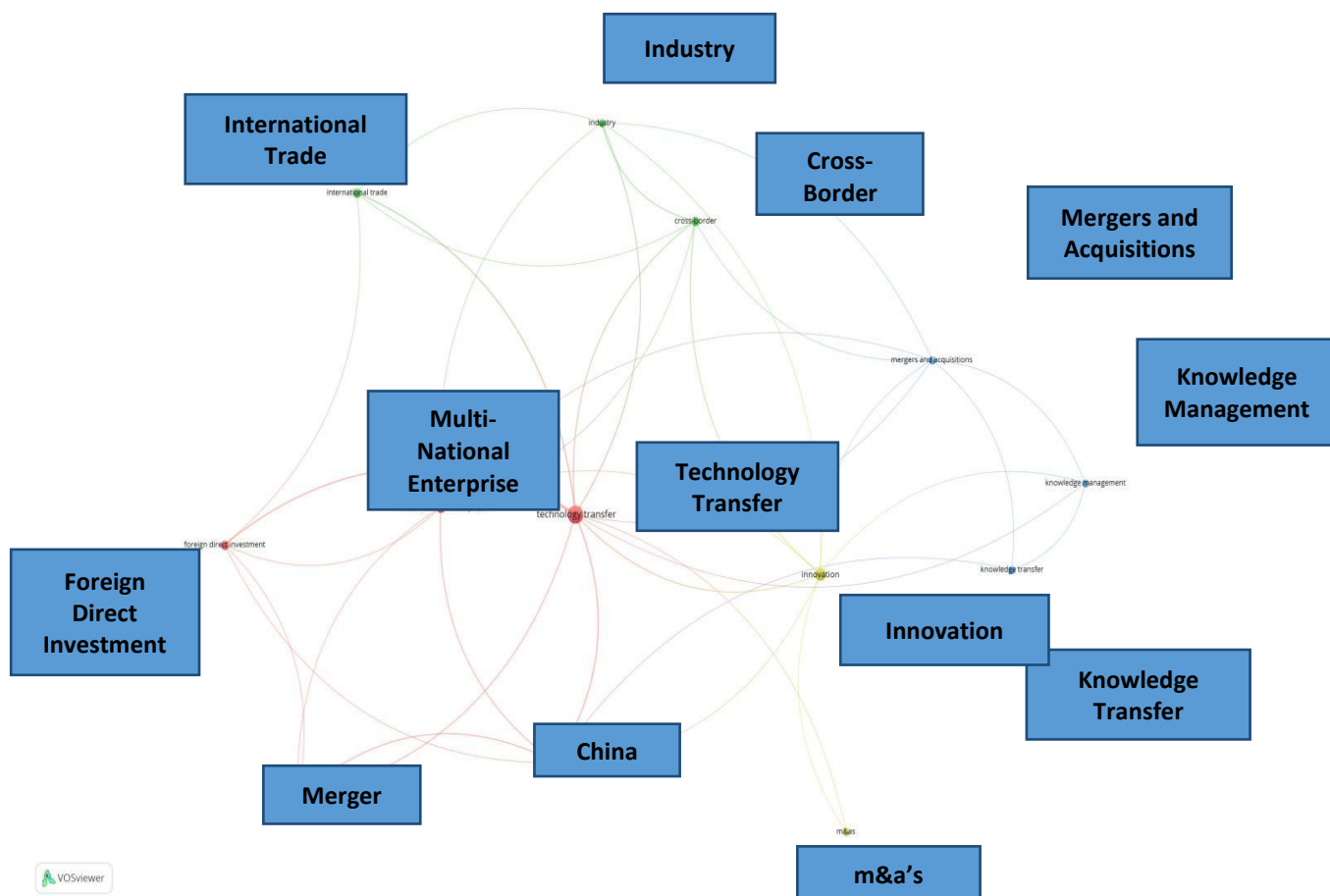


Fig.4: Cluster Diagram for Cross-border Acquisitions and Technology Transfer

Table 6: Major Keywords on Cross-border Acquisitions and Technology Transfer

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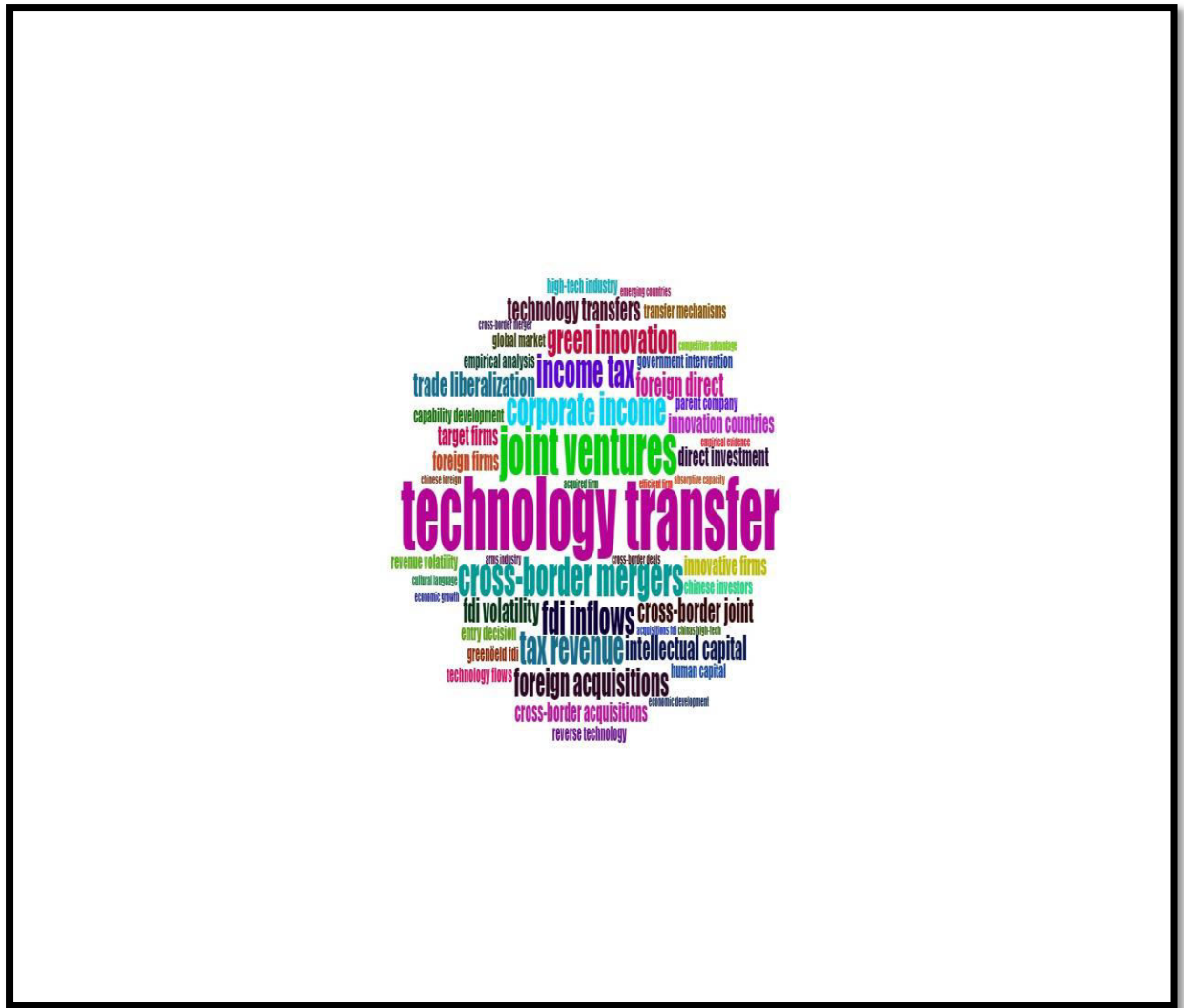


Fig. 5: Technology Transfer as a Keyword in Word Cloud

Future Research Directions

a. High Tech Industry and Emerging Countries: Chinese high-tech industry is continuously using cross-border mechanisms where all three players of government, parent company and its subsidiary are involved. Though researches on how high-tech industries in emerging economies are pursuing cross-border acquisitions and carrying out reverse knowledge transfer are very less. Study done by Suo Y. et al., 2021 deals with this subject of reverse knowledge transfer in Chinese high-tech firms. This emerges as a future research direction in which more such studies can be undertaken.

b. Cross-Border Acquisitions and Reverse Technology: Chinese Emerging Multinationals have recently gained attention due to increased

cross-border mergers and acquisitions. Taking an intellectual capital perspective, the dynamics of Chinese Emerging Multinational (CEM) is being explored in the process of cross-border M&A. Dynamics of capability development process enhances reverse technology. Reverse technology transfer is the transfer of new technical knowledge from foreign subsidiaries back to parent organization (Hakanson & Nobel, 2000). Besides, reverse technology transfer, the concept of reverse knowledge transfer (RKT) has also been mooted in the study of Suo Y. et al., 2021. RKT is in quite contrast to conventional experience of knowledge, which flows from the company's head office to its foreign branches. This is a transnational strategy that helps to acquire new knowledge in foreign branches and transfers such knowledge to the country of the company's head quarter.

c. Capability Development: Capabilities that are transferred from one organization to another in the course of cross-border acquisitions are of various types. Transfer mechanisms enable the accumulation of innovation capabilities by the recipient firm which can be further utilized by them in research and development. Capability transfer theme can be mainly seen as organizational mechanism influencing degree of knowledge flow in low carbon technology transfer (Hayashi D., 2018) and capabilities required by firms in emerging countries to successfully carry out acquisition in developed economy firms (Gao Y. & Li J., 2012). Other significant studies conducted on this topic focus on development of intellectual capital within Chinese Emerging Multinationals (Ng et al., 2012).

d. Government Intervention: This study reveals focus on the topic of government intervention in the study conducted by Su et al., 2021. Reverse knowledge transfer (RKT) from acquired to acquirer firms took place under strict government supervision where all three players of government, parent company and subsidiaries have different degrees of influence on each other. Studies conducted on reverse knowledge transfer occurring in cross-border acquisitions taking technology transfer as a variable are very less in number. Hence, there is a need to undertake more such studies either in high-tech or non-high tech firms. This can be considered as a significant research frontier.

e. Greenfield FDI, Entry Decision and Technology Flows: Green field investments are regarded as more profitable venture than cross-border acquisitions (Stepanok, 2015). Greenfield FDI has witnessed an upward trend due to trade liberalization. Cross-border acquisitions and greenfield FDI mostly go simultaneously to drive economic growth. Stepanok, 2015 has proposed an altogether different model which propose transfer of

technology and managerial expertise from more productive to less productive firms. For this transfer, greenfield FDI is purported to be more suitable than cross-border acquisitions. From the diagram of word cloud, this can be easily gleaned that research on entry through greenfield and technology flows is still in its nascent stage. Further researches are required on the topic of greenfield FDI and technology flows.

f. Revenue Volatility and Economic Growth:

Revenue volatility is controlled by FDI inflows and it affects economic growth. Technology transfer on its part enables foreign capital inflows. In turn if FDI inflows have higher volatility, revenue volatility will also be higher. This theme emerges as a new research avenue as there are very few studies done on how revenue volatility is affected by technology transfer during cross-border acquisitions.

g. Cultural Language: This is another emerging theme that deals with culture and language differences do exist between two countries entering into joint venture. This cultural distance adds value in cross-border acquisitions. This is a very significant theme as many times cross-border acquisitions do fail due to cultural clashes. Culture has been measured by Hofstede's dimensions such as long-term orientation, uncertainty avoidance, individualism or power distance (Georgeiva et al., 2010). This is also an emerging research frontier as studies based on this topic are very few in number.

h. Innovative Firms and Chinese Investors: It has been observed that target firms taken over by Chinese investors displays smaller growth in capital productivity but a higher growth in worker's compensation. Technology driven Chinese mergers and acquisitions (TDC-MA) show greater propensity towards green innovation (Li, J., 2022). Though many researches have been done on Chinese acquisitions and value creation, very few studies are present on Chinese acquisition promoting innovation. Therefore, it emerges as a research frontier.

i. Human Capital and Economic Development: In the literature gathered for this study intellectual capital has been kept synonymous with human capital (Ng et al., 2012)

Human capital is less researched topic in the context of cross-border acquisitions. A new research theme that emerges in the word cloud is human capital and economic development. Human capital can play an immense role in cross-border acquisitions. Though existing research and evidences do not clearly demonstrate how can it do so.

j. Arms Industry: Cross-border acquisitions research in arms industry is the most novel theme among all the other themes. This study could find only one research done by Skons & Wulf in the year 1994. This research is a breakthrough as it equates arms industry with the rest of the industry. Exports, FDI and international cooperation arrangements were the three forms of internationalization prevalent immediately in the post-Cold-War times.

3. Discussion

In this section, an attempt has been made to summarize the findings of this study of three research questions posed in the introduction section. With the help of this systematic literature review, we were able to ascertain publication trends in cross-border acquisitions and technology transfer. A most impactful journal analysis, organizations with maximum number of citation analysis, co-authorship network of countries analysis, most productive and influential author analysis, citation analysis of each author and content analysis of three clusters was carried out. Journal quality was also identified using Academic Journal Guide 2021. Journal from category 4* (Journal of International Business Studies), category 3 (International Journal of Industrial Organization & Small Business Economics), one from category 2 (Asia Pacific Business Review) are present. Content analysis in this area provides us with current research trends of cross-border acquisitions and technology transfer. It has also provided us with a sneak peak of how technology transfer occurs in international trade. Certain new perspectives that emerged in this analysis are that of green innovation, reverse knowledge transfer under government intervention from acquired firm to acquirer firm. Such reverse knowledge transfer is gradual diffusion of knowledge wherein inequality of the firm persists and the gap is to be bridged.

Cluster 1 has its origin in 2002 as we find the work of Das that foreign improvement of technology is feasible only with the help of a better task force. The main focus of cluster 1 is on technology transfer and in this vein study of Tekin- Koru can be quoted which cites that technology transfer can be used as an optimal strategy for the entry of a firm. This cluster also focuses on Chinese foreign direct investment, which is the main driver to push Chinese investors towards targets with higher debt levels and lower profitability (Fuest C. et al., 2022). Quite many times acquisitions also lead to technology transfer in Chinese Emerging Multinationals (CEM) that have gained attention for their rigorous mergers and acquisitions and creation of intellectual capital.

Cluster 2 is based on cross border, industry and international trade a which has origins in 2001 in the study of Oliviera P. et.al. They have based their study on IPO- based mechanism of acquisition for technology transfer

process. Study conducted by Hayashi D., 2018 focuses on knowledge flow in low-carbon technology sector. Knowledge flow and technology transfer are significant takeaways in international trade. It is a tradeoff between exploration of new prospects and exploitation of previous uncertainties. There is, however, a difference between the impact of both types of knowledge acquisition. While exploitation benefits the firm in the short run, exploration is for long-term benefits. Exploitation, though, results in firm suffering from obsolete knowledge. This research further focuses on wind-turbine manufacturers in India who have utilized technology transfer to build upon various capabilities. Mergers and acquisitions are occurring in any industry hence “industry” has emerged as a key term. Industries can provide a platform for either cross-border acquisitions or transfer mechanism (Hayashi D., 2018) or reverse knowledge transfer under government intervention (Su Y. et al., 2021).

The major themes of cluster 3 are “Mergers and Acquisitions”, “Knowledge Transfer” and “Knowledge Management.” The theme of cluster 3 is completely different from the above 2 clusters. It focuses more on knowledge management. Transfer of know-how, R&D capabilities and managerial techniques from the parent company to the acquired company comes under the umbrella of knowledge transfer. Innovation capabilities come under knowledge transfer is the best example of how knowledge flows from one firm to another and enable recipient's engagement in research and development.

Cluster 4 majorly focuses on M&As and innovation. Innovation activities lead the merger firm to create values and part of this value can actually be absorbed by competitors. Innovation activities do not occur in isolation, rather current innovation activities are interlinked with past innovative behavior. Hence, all clusters have different focal themes of research.

Sample of 229 Chinese cross-border acquisitions was considered for a study analyzing the impact of technology on environmental benefits and role of technology on green-innovation enterprise. Degree of ownership concentration is also taken into consideration which if higher positively promotes the relationship between **technologically driven cross-border mergers and acquisitions** (TDC-MA) and green innovation. It is also reported in this study that connections are either state-owned or politically-owned. The study concludes that political connection positively promotes the relationship between TDC-MA and green innovation whereas state owned enterprises have an opposite effect. This study also argues that informal institutional distance rather than formal has a positive interaction between TDC-MA and green innovation. Formal institutional distance has a negative impact (Li J., 2022).

Based on the above analysis, the following are significant findings against our research questions:

- a. It can be deduced from this analysis that technology transfer in cross-border acquisitions had started appearing from the year 1994 with research on military technology transfer among industrialized countries due to relaxation in government attitudes towards military technology transfer. It has developed in its full-fledged form in the recent years.
- b. An author-wise analysis through a co-authorship network of countries indicate that France is the largest contributor on the topic of technology transfer in cross-border acquisitions. It has a citation of 136. China and USA stand at number 2 with 6 documents and 132 citations each.
- c. After analyzing journal contribution and running most impactful journal analysis, it was found that Asia Pacific Business Review (117) has the most number of citations followed by Journal of International Business Studies (100). Number of citations is equal to the impact of journal on research fraternity.
- d. On filtering journals on the basis of quality, topmost journal was found to be from category 4* (Journal of International Business Studies), category 3 (Small Business Economics and International Journal of Industrial Organization), and category 2 (Asia Pacific Business Review).
- e. Hong N.S. from University of Hong Kong has emerged as the most cited author with 117 citations.
- f. Cluster analysis forms the backbone of our research and it can also pave the way for future research directions.
- g. Most of the research already highlighted in the cluster revolves around cross-border innovations, international trade, technology transfer, China and multinational enterprises.

Major Shortcomings of Current Research and Avenues for Future Research

With the help of our literature sample, this can be deduced that research on cross-border acquisitions was constantly growing and though there was a gap between 1994-2001, in the post 2001 years it has evolved. Work on technology transfer in cross-border acquisitions is still in progress so there are many avenues to be covered. We have, thus, proposed a few of them on which future researches can be undertaken.

- a. Cluster 1 deals with creation of intellectual capital and new product development through acquisition of technology from other firms. There is

more focus on extracting technology of the acquired companies and less on streamlining the cultural values of both acquired and acquirer company.

b. A very significant study of cluster 2 is based on low-carbon technology transfer by Hayashi D., 2018 which propounded exploration-exploitation framework and explored various firm and context specific factors that influence technological acquisition. This research was carried out only in wind industry which warrants this kind of research in other tech-based industry.

c. Significant study of cluster 3 delves on extensive economic development of China and resultant environmental pollution (Li J., 2022) and Chinese government action in shifting from production relying on human and natural resources to a production relying on science and technology. As this study is related environmental concerns, interaction affects of environmental regulations between TDC-MA and green innovation need to be studied besides ownership concentration and SOE and POE.

Cluster 4 deals solely with innovation and how acquirer firms solely focus on highly innovative targets in order to increase their profitability. There is more focus on gaining more and more innovative techniques and less on developing absorptive capacity of the firm.

Conclusion

This paper explores the potential research avenues after conducting a rigorous bibliometric and content analysis of the various research trends prevalent in cross-border acquisitions and technology transfer. The study has also developed a A-M-O (Antecedent-Mediator-Outcome) framework to provide a theoretical backbone to the study wherein technology transfer is taken as a mediator on one hand of which are the antecedents of international trade and production costs (firm-level) and increased task significance and job autonomy (individual-level). On the other hand are the outcomes of firm innovation, increased productivity and competitive advantage at the firm level and cross-cultural adjustment, synergistic learning and work alienation at the individual level. The outcomes of content analysis and content findings derived from A-M-O framework would further enable the researchers and organizations to better understand the immense role of technology transfer in cross-border acquisitions.

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