

A Systematic Literature Review on the Success Factor of Innovation Commercialization Performance

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Abstract— This paper explores and describes some of the directions within the field of innovation commercialization collaboration. The directions are derived from the results of examining 182 research articles that had been published from year 2007 to year 2013 from various established databases. From the systematic literature review process, six main factors have been identified as success factors of innovation commercialization. The factors are organizational resources, knowledge management, strategic orientation, organizational support, contextual factor and lastly collaboration.

Keywords- innovation; commercialization; collaboration; successful factors.

I. INTRODUCTION

For many years, numerous studies have investigated the commercialization performance of new inventions or innovations across countries. Innovation commercialization is arguably the most important challenge faced by most small and medium-sized companies. New technologies have rapidly emerged over the last century, consistent with the increasing number of research institutes and research universities, and the more and more intense competition in the market. Hence, innovation becomes vital in promoting economic growth and its new market demand continues to expand, other than being viewed as a prerequisite for staying afloat in a competitive climate and as something significant to be upheld by an organization in order to survive the rapidly-changing customers' needs [1]. As Drucker has pointed out, innovation is beyond the science or technology—it is something that is able to create value [2] through the process of commercialization [3].

Even though many findings have highlighted the successful story of innovation, however, the failure rate of commercialization success of innovation is still at an alarming level. In fact the majority of studies confirm that innovation meets with success at the level of research and development (R&D) and early phase of new product development (NPD), however it does not necessarily lead to the success in commercialization [4]. Under the same line of argument, [5] stated that the successful commercialization of an innovation is one of the most crucial agenda that needs further exploration.

Thus, for that reason, further investigation on previous studies of commercialization success will take place, systematically beginning with the next section, which talks about the motivation of this research followed by the research methodology in section III. The result and discussion will be presented in section IV and the conclusion of these findings will be discussed in section V.

II. MOTIVATION

It has been said that a firm which applies the networking strategy for new product commercialization can form a network with its external partners to accumulate network resources, which in turn can enhance the probability of project success [6]. This clearly shows that collaboration is one of the factors that lead to commercialization performance. However, according to [7], articles that explicitly refer to commercialization network are still limited. Most of the innovation studies only concern with the NPD and R&D network. However, there is an argument that the concept of commercialization network is slightly different from that of the innovation and R&D network [7] due to the differences in related activities. In fact, [8] has stated that in the product development phase, the technical expertise of a technologist comes into play, whereas in the market development phase, other skills like marketing and customer familiarity are essential.

Therefore, to further investigate the issue of commercialization collaboration, a systematic literature review (SLR) was conducted for two purposes: (1) to identify what factors which affect the performance of innovation commercialization in the past seven years, (2) to investigate the direction of collaboration study in the context of innovation commercialization, and (3) to examine the extent of the strength of the relationship between commercialization collaboration and performance indicator.

III. RESEARCH METHODOLOGY

The main focus of this paper is to reveal the directions for studying innovation commercialization. These directions have been compiled using the Systematic Literature Review (SLR). SLR is purposely used to map out areas of uncertainty in the research and to recommend opportunities for future research [9]. In this study, a total of 182 different studies or articles

have been categorized and the resulting categories signify areas for potential outlook guidelines. SLR was conducted to answer the following research questions; i) What are the factors that have been addressed in previous innovation commercialization performance researches? ii) What are the most and the least studied phases and what else is missing? iii) What are the types of collaboration that have been studied in the commercialization of innovation researches and how strong the relationship between collaboration and commercialization performance?

A. Selection of Papers

The purpose of using the SLR was to discover variables that have impelled the success of innovation commercialization. The process began with the selection of a dependent variable (commercialization performance). To identify related studies, a few databases like EBSCOhost and Web of Science that belongs to the frequently-cited, high-ranked journals which are from different disciplines, were selected. In the next step, a search was conducted to include literature that has been published within a seven-year period, starting from 2007 until 2013. The samples of published studies were published in 58 different journals. The highest number of articles reviewed was in the areas of Research Policy, Technovation, Journal of Product Innovation Management, Industrial Marketing Management and Journal of Technology Transfer. Several articles from ISI proceedings have also been selected. A total of 18 ISI proceeding articles have been extracted from 9 different conferences. By screening the papers according to commercialization performance, the researcher has precisely obtained 182 articles.

As mentioned above, commercialization is part of the innovation process. In this respect, the researcher has decided to limit the search to articles that have indicated commercialization performance as an indicator for innovation success. Several articles stress that innovation success can be measured using different types of measurements, such as number of publications particularly by using patent data, product novelty and product speed to market. Based on the definition however, commercialization means transforming R&D projects or innovation into saleable or marketable products. Thus, articles that have employed these types of measurements were eliminated from the list.

IV. RESULTS AND DISCUSSION

A. Overview of Studies

From Fig. 1, it is clear that the concept of commercialization performance has attracted many scholars and the number of studies has continued to rise every year. Although the number of researches conducted in 2012 was slightly lower than in 2011, the percentages for 2012 and 2013 remained high. This signifies that the commercialization of new innovations remains an important research agenda that requires further studies.

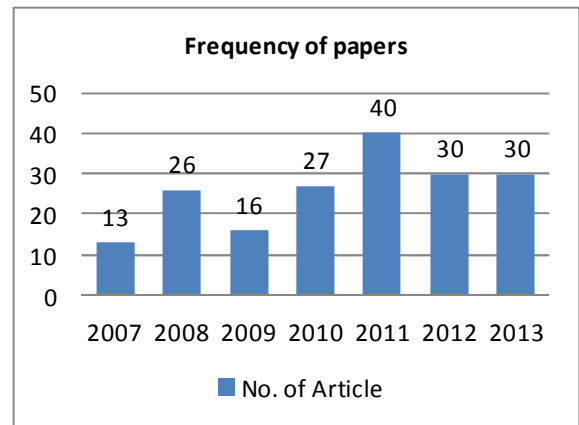


Fig 1: Number of reviewed studied with respect to publication year

In the first stage of this SLR, all types of papers have been included, and they were further divided into four types: qualitative, quantitative, mixed and conceptual. Fig. 2 shows that the quantitative method is the most common method used in these articles, followed by qualitative, conceptual articles and mixed methods.

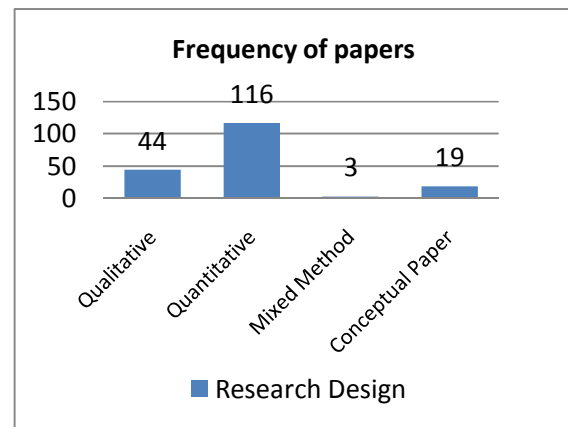


Fig 2: Number of reviewed studied with respect to research design

B. Innovation Commercialization Success Factors

The central goal of this study is to generalize success factors in innovation commercialization. In response to this, in the next stage of the SLR, the studies reviewed were screened further to include only quantitative findings that have specifically discussed cause-and-effect relationships. For exploratory reason, the findings do not typically simplify the population at large, thus, a qualitative study has been excluded. As a result, six main factors were identified from the literature that leaves a significant effect on commercialization performance. The factors are organizational resources, knowledge management, strategic orientation, organizational support, contextual factor, and lastly collaboration.

The result in Fig. 3 indicates that contextual (23%) is the highest variable tested for successful commercialization. This shows that environment plays an important role to ensure that innovation is marketable. Some studies have used this factor as a moderator variable

[10]; while other studies have identified these factors as having direct relationships with commercialization performance [11]–[15]. According to [16] and [17], the external environment created by governments such as its capital situation and labor, may also affect the innovation market [18]–[21].

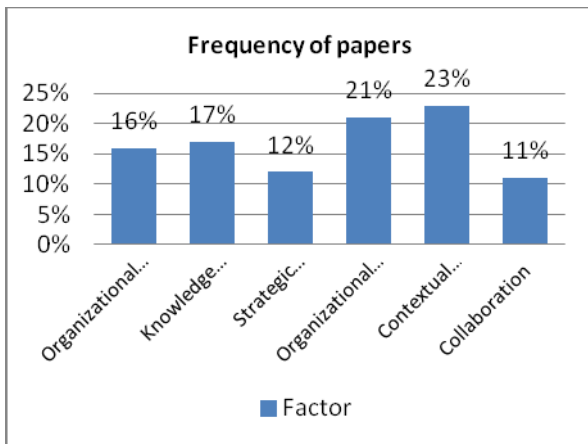


Fig 3: Percentage of Factors that Effect Commercialization Performance

The study also indicates that organizational support is very important, for firms to accelerate their innovation in the marketplace and this has been tested quite frequently (21%). The commercialization of new innovations requires effective and appropriate support, which could enhance its performance. Organizational support or perceived organizational supports refer to how an organization takes care of its human resources in the hope that the latter will be driven to fulfill their organizational goals [22]. From this current review, the types of organizational support that may affect commercialization performances include technology and information technology tools [23]–[25], top management support [26], [27], systematic patenting system [28], [29], organizational capabilities such as marketing [30], [31], manufacturing [30], research and development [30], learning or training [30], new product development capabilities [32], rewards [17] and ultimately, organizational innovativeness [26], [33]–[36].

About seventeen percent of articles investigate the effect of knowledge management on innovation performance. Knowledge determinant is compulsory to speed up commercialization [16]. It is defined as a process of discovering, capturing and leveraging the collective knowledge in an organization to facilitate its competitiveness/competitive edge [37]. Some studies have suggested that knowledge management may enable firms to improve their commercialization performance [11], [27], [38]–[49]. In this research, several types of knowledge have been identified, i.e. knowledge on market, knowledge integration, knowledge exploitation, knowledge exploration, as well as explicit and tacit knowledge. Conclusively, firms with innovative products require these types of knowledge in order to accelerate their innovation commercialization and increase their performances.

Results obtained have proven that organizational resources can have a positive relationship with innovation commercialization performances. Approximately 16% of the studies have highlighted the positive effect of human resources [21], [26], [27], [50]–[54], financial resources [37], [40], [41], and lastly technological resources [55] and [56] towards the performance of commercialization. Hence, particular attention should be given to resources from a tangible perspective, which consists of human resources, financial resources, and technological resource.

The orientation of a firm plays a vital role in the commercial performance of a new innovation. Based on the current SLR in this study, approximately 12% have found that strategic orientation is one of the factors which attract researchers to study its relationship on commercialization. There are a few types of strategic orientation that was widely discussed in previous researches which significantly affect commercialization performance, such as market orientation [57], entrepreneurial orientation [58]–[62], technological orientation [62], network orientation [62], research orientation [18] and industrial orientation [18], [42].

Apart from these types of strategic orientations, the least discussed idea is the impact of networking orientation towards innovation commercialization performance. It is believed that firms that have strong relationships with external partners may increase the chances of innovation success. The relationship between collaboration and performance results is shown below:

TABLE I. RELATIONSHIP BETWEEN COLLABORATION AND PERFORMANCE RESULT

Type of Collaboration	Author(s)	Year	Country	Region	Result
University and industry	Van Hemert	2013	U.S	USA	Significant
Diversity of partner	Von Raesfeld	2012	Netherland	Europe	Significant
Intra-firm	Brettel	2011	Germany	Europe	Significant/not significant
	Bercovitz	2011	U.S	USA	Significant
	Song	2010	Japan/US	Asia/USA	Significant
	Song & Swink	2009	U.S	USA	Significant
	Swink & Song	2007	US	USA	Partial
	Luca	2007	China	Asia	Partial
Inter-firm	Lai	2012	Taiwan	Asia	Not Significant
	Wu	2012	China	Asia	Significant
	Zeng	2010	China	Asia	Significant
	Lin	2009	Taiwan	Asia	Significant
	Cousin	2007	UK	Europe	Significant
Scientist and businesses	-	-	-	-	-
Intermediaries and firm	Zeng	2007	China	Asia	Significant
Firm and public /	Lai	2012	Taiwan	Asia	Significant

Type of Collaboration	Author(s)	Year	Country	Region	Result
society / customer					
Triple Helix	-				
Scientist and university	-				
Government and firm	Zeng	2007	China	Asia	Not Significant

Collaboration is defined as a joint organizational entity, infrastructure, business processes, resources, and relationships, which supports a shared effort to provide collective benefits, regardless if it is a program, service or a product [63]. After the subsequent analysis of all acquired articles, the researcher has confirmed that eleven percent of the articles have discussed on collaboration, in the context of commercialization as shown in Fig. 3. By reviewing and analyzing the acquired literature related to collaborations in innovation commercialization, only 13 articles are quantitative-based studies, as illustrated in Table I and a total of ten different types of collaborations were identified.

TABLE II. RELATIONSHIP BETWEEN COLLABORATION AND PERFORMANCE INDICATORS BASED IN REGRESSION COEFFICIENT

Type of Collaboration	Author(s)	rc	Very Weak	Weak	Moderate	Strong	Very Strong
University and industry	Van Hemert	0.15	X				
Diversity of partner	Von Raesfeld	0.06	X				
Intra-firm	Brettel	0.35		X			
	Bercovitz	0.08	X				
	Song	0.64 (Japan) 0.23 (U.S)	X		X		
	Song & Swink	0.43		X			
	Swink & Song	0.15	X				
	Luca	0.12	X				
Inter-firm	Wu	0.06	X				
	Zeng	0.70			X		
	Lin	0.40		X			
	Cousin	0.22	X				
Intermediaries and firm	Zeng	0.25	X				
Firm and public / society / customer	Lai	0.32		X			
Frequency of each category			9	4	2	0	0
Weighted Ration			60%	27%	13%	0%	0%

As mentioned, the next objective is to examine the strength of the relationship between commercialization collaboration and performance indicator. It has been measured based on the regression coefficient (rc) in previous studies which use the Structural Equation Modeling (SEM) and linear regression. To understand about the strength even more, the analysis has been divided into five levels; very weak (0.00-0.30), weak (0.31-0.50), moderate (0.51-0.70), strong (0.71-0.90) and very strong (0.91-1.00).

The analysis results in Table 2 show that the regression coefficient (rc) of the relationships is between 0.06 (very weak) and 0.70 (moderate). The overall mean for rc is 0.38, which is categorized as weak. In particular, the weighted ratio of category are 60% (very weak), 27% (weak), and 13% (moderate). This results have further indicated that 87% of the results show a weak relationship. It can be concluded that there are still inconsistent results from the relationship even though most of the results are significant.

V. CONCLUSION

This paper presents an SLR on the influential factors in innovation commercialization performance. It also identifies the collaboration study status in the commercialization context of this study. Conclusively, the comprehensive literature review has identified six main factors that may lead to the success of innovation commercialization. The analysis results conclude that, very few empirical studies have investigated the relationship between collaboration and commercialization performance. Moreover, the result shows that there is still an inconsistent result of the relationship between collaboration and commercialization performance. According to [64], inconsistent results can be explained by the exclusion of mediators and moderators in the research design. Thus, based on this gap, further investigation of both the mediating and moderating effect between collaboration and commercialization performance will be conducted. Ultimately, the researcher believes that this paper would be valuable in providing future directions of innovation commercialization studies and also in contributing to all involved parties as well.

ACKNOWLEDGMENT

The authors are thankful to the Faculty of Economic and Management and Graduate School of Management, Universiti Putra Malaysia and Universiti Tun Hussein Onn, Malaysia for providing the necessary facilities invaluable for the completion of this paper.

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