International Journal of Business, Human and Social Sciences
ISSN: 2517-9411
Vol:11, No:5, 2017

Stating Best Commercialization Method: An Unanswered Question from Scholars and Practitioners

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***Abstract*—**Commercialization method is a means to make inventions available at the market for final consumption. It is described as an important tool for keeping business enterprises sustainable and improving national economic growth. Thus, there are several scholarly publications on it, either presenting or testing different methods for commercialization. However, young entrepreneurs, technologists and scientists would like to know the best method to commercialize their innovations. Then, this question arises: What is the best commercialization method? To answer the question, a systematic literature review was conducted, and practitioners were interviewed. The literary results revealed that there are many methods but new methods are needed to improve commercialization especially during these times of economic crisis and political uncertainty. Similarly, the empirical results showed there are several methods, but the best method is the one that reduces costs, reduces the risks associated with uncertainty, and improves customer participation and acceptability. Therefore, it was concluded that new commercialization method is essential for today's high technologies and a method was presented.

***Keywords*—**Commercialization method, high technology, lean start-up methodology, technology, knowledge.

I. Introduction

COMMERCIALISING new products and services is a backbone of any enterprises [1]-[3] because it makes companies prosper and sustainable [4], [1], [2]. It enables business organisations to generate and maintain sufficient profits and to satisfy the needs and wants of their customers. Commercialisation assists companies to utilise economies of scale, to leverage their resources and to improve their reputation [3]. It also contributes to job creation, technology advancement, a higher standard of living and most importantly, economic growth [5]. Therefore, there are several literary works on commercialisation [6]-[8] though few of these works contribute significantly to level of understanding of the concept which is supposed to be of high importance to academia and businesses [8], [9]. For example, when analysing more than 300 papers on it, only 8.3% contributes to its understanding [8].

To improve the discourse on commercialisation, this paper examined the methods of commercialisation. It aimed to point-out the best method of commercialisation based on scholarly articles and empirical data from practitioners. It focused on this question: What is the best commercialization method? Answering the question, this paper reviewed scholarly articles published between 1990 and 2015 as well as interviewed entrepreneurs and business advisors who are working on commercialisation of technologies. The answers to the questions provided a comprehensive literature review of commercialisation methods. They also indicated the common methods of commercialisation among practitioners. Interestingly, they led to proposal of "Lean start-up methodology" as a method of commercialisation. Therefore, this paper contributes to theoretical and practical knowledge of commercialisation.

The rest of this paper is structured as follows: theoretical background, methodology, findings and discussion, new commercialisation method, and contributions of the paper and limitations.

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II. Theoretical Background

Despite the fact that there are several studies on commercialisation, only few of them focused on the methods of commercialisation. In fact, most of the studies which investigated commercialisation methods concentrated on a specific commercialising item, industry or commercialising parties. For instance, [6] reviewed previous works only on "technology commercialisation or technology transfer" while other parts of commercialisation like knowledge was not included. Furthermore, some related studies also focused on investigating certain methods like [10] who conducted research on how academic spin-offs, corporate spin-outs and internal start-ups were used for technology transfer. It was also noted that there was less research on summarisation of different commercialisation methods as well as how these methods relate to different commercialising items. Due to these research gaps, this paper reviewed research articles on the topic and provided an overview.

A. Key Terms of Commercialisation Method

Commercialisation is heterogeneous; thus, several scholarly works are also complex and sometimes confusing. This was noted from having several terms associated with the commercialisation method. Some scholars called it "*technology transfer*" like [11]-[13]; while others like [14]-[17] called it "*strategy*". Similarly, [18], [19] named it as "*form*" and [20], [21] termed it as "*mode*".

In addition, it is called "route" according to [22], [23], as well as "*channel*" according to [24]-[27] regarded it as

"*knowledge transfer*" and [28], [29] regarded it as "*method*". Other names given to the term are "process" (e.g. [30], [31]), "*pathway/path*" (e.g. [32]), "*approach*" (e.g. [33], [34]), and "*mechanism*" (e.g. [18]). Despite the fact that there are many names for the commercialisation method, it was noticed that any tool or mean for conducting commercialisation is known as commercialisation method. Due to these multiple names, all above-listed terms were used in searching for related articles for this paper and they were regarded as "key terms".

B. Commercialising Items and Commercialising Parties

It is important to describe commercialising items and parties because they are integral aspects of commercialisation. Thus, the commercialising item is a "new development" which is being transformed for business purposes. According to [35], a scientific or technological knowledge which developed from research institutions is a commercialising item because when they are reformed, they become goods and services. These authors explained further that policy makers considered commercialising item as raw material for improving economic development. Additionally, [36] called it as a tacit knowledge which includes technological and managerial competences.

Other names used for commercialising items are invention (e.g. [30], [28], [37]), research (e.g. [20], [38]), research results (e.g. [39]), innovation (e.g. [40], [41]), patents (e.g. [42], [37]), and intellectual property-IP (e.g. [43], [44], [27]). Furthermore, some scholars modified commercialising item especially when "*technology*" is used. For example, [21] modified it with "*misfit*" which stated that there are some technologies which do not conform to present capability of the company. Likewise, [45], [46] modified commercialising item with "*disruptive*" while elaborating emerging technologies which companies might have competence to commercialise.

As it can be noted from the above, there are many terms associated with the commercialising item. These terms were also used in searching for relevant articles for the study. Apart from the commercialising items, people or organisation involved in the commercialisation is referred to the commercialising parties. These are research institutions, which include universities, laboratories, and research centres (according to [6], [35], and other scholars) and companies which include small, medium and large firms (according to [15], [17]). Therefore, these groups are regarded as commercialising parties in this paper.

III. Methodology

In relation to the objective of this study, two research methods were employed. The first method was systematic review research method. This method was used to synthesise previous scholarly works on commercialisation method. The second method was a qualitative method. This method was applied to provide empirical information on various methods among practitioners. This method used face-to-face and semi-structured interview.

The systematic review is described as a method which enables scholars to compile various literary works on a specific topic and provide a current state of knowledge [47], [48]. It is discussed as a method that reduces bias and facilitates transparency and clarity. Likewise, it is also discussed as method which improves the focus and unification of a research topic as well as assists academia and practitioners to have access to an overview of a topic [47], [49]. In view of these benefits, the method was used by searching for scholarly articles on these databases: Scopus, Web of Science, ProQuest [ABI/INFORM Collection] and Business Source Complete [EBSCO]. The above-mentioned terms on commercialisation methods, items and parties were used. Altogether, 812 abstracts were read from the database, but only 147 articles appeared to be relevant for this study and were selected for codification. After codification, only 53 articles were analysed for this study.

Selected articles were analysed by using these criteria: research theme, research nature, commercialisation term, item and party, and double reference. About research theme, selected articles were examined if their research goals and intending contributions were focused on commercialisation methods. Similarly, if the articles had research questions, their questions were checked in relation to commercialisation methods. For research nature, selected articles were checked if they were theoretical or empirical oriented. The focus on the research nature was to investigate if theoretical articles contributed to discussion of, at least, one of commercialisation methods; while, the empirical articles tested, at least, one of the methods. On the commercialisation term, selected articles were examined on how they used, at least, a term for commercialisation and consistent usage of the terms or different terms were also focused. For the commercialising item, there was focus on how the selected articles concentrated on, at least, an item for commercialisation. Further, selected articles were examined on how they stated at least a commercialisation party and role(s) of such party. Lastly, attention was paid to "double reference": if any selected article made reference to previous works, referred papers needed to be examined and they should replace the selected paper. Similarly, if the author of selected article referred to his or her previous work, the old work replaced the current paper.

TABLE I
DETAILS OF STUDY PARTICIPANTS

	Commercialisation Status	*Years of experience*	*Current business status*
P1	Entrepreneur	30	CEO
P2	Entrepreneur	40	CEO
P3	Advisor	15	Director of Government Organisation
P4	Entrepreneur	25	CEO
P5	Entrepreneur	25	Business Development Director
P6	Advisor	30	Director of a Venture Capital
P7	Advisor	20	IPR Manager
P8	Advisor	35	Manager of Government Organisation
P9	Advisor	40	Director of Government Organisation
P10	Advisor	30	Senior of a Government Organisation

On the qualitative method, 10 practitioners were selected

using this criterion - having knowledge in commercialisation, either as an advisor or entrepreneur, for more than 10 years. Table I shows their details. Their data were collected via face-to-face interview. The interviews took averagely 45 minutes. The interview processes were done in accordance with qualitative research guideline provided by [50]-[55]. Furthermore, collected data were analysed with content analysis method which based on the work of [51], [56]. These scholars explained that the analysis method consists of transcribing, codification and data presentation. This process was followed by focusing on different methods the study participants used for their commercialisation or they had knowledge about, summarising the methods and presenting their summary in relation to scholars' points of view.

IV. Findings and Discussion

A. Commercialisation Methods from the Scholars

When the aforementioned terms, items and parties were applied in searching, selecting and analysing relevant articles, 17 methods of commercialisation were identified. Some of these methods have synonyms according to their contextual meaning. For examples, spin-off has synonyms of start-up, new company creation, new venture, and corporate spin-out. Likewise, some methods have sub-methods such as licensing which has sub-methods of licensing-in and licensing-out. Similarly, some methods are like adjectives which modify their main nouns; for example, mobility which goes with mobility of people, and mobility of facility.

Apart from the above observations, it was also noticed that some methods are highly associated with certain commercialising item. For instance, consulting is common with commercialisation of knowledge while licensing is common with IP or technology. In a similar view, it is noticed that joint venture is often employed by the research institutions; while, companies prefer to use market entry for their new technologies. The main reason for these variations is the nature of the commercialising item and the roles of commercialisation parties in the commercialisation activities. Fortunately, these variations do not affect the outcomes of each method. The following Table presents an overview of the methods.

TABLE II
Overview of Scholars' Commercialisation Methods

	Method	*Commercialising item*	*Commercialising party*	*Articles*
1	General licensing [similar terms*: external technology transfer, and third-party commercialisation*]	Technology and knowledge	Research institutions and companies	[13], [14], [17], [18], [20], [22]-[24], [28], [30], [34]-[36], [42], [44], [57]-[60]
	Licensing-in	Technology	Research institutions and companies	[61]
	Licensing-out	Technology	Companies	[12]
2	Selling	Technology	Research institutions and companies	[14], [33], [35], [62]
3	Spin-off [similar terms: *start-up, new company creation, new venture, and corporate spin-out*]	Technology and knowledge	Research institutions and companies	[10], [13], [18]-[24], [27], [28], [33]-[37], [63]-[65]
4	Spin-in [similar terms*: internal development, internal approach, exploit technical leadership*]	Technology and knowledge	Research institutions and companies	[10], [20], [33], [66]
5	Joint venture [similar terms: *partnering, externalisation, cooperation, collaboration, and outsourcing*]	Technology	Research institutions	[14], [16], [21], [23], [24], [29], [32], [38], [41], [42], [61]
6	Publication [similar terms: *information dissemination either formal or informal discussion, meetings, conferences, and presentation, trade shows*]	Technology and knowledge	Research institutions and companies	[32], [34], [36], [67]
7	Training/Education	Technology and knowledge	Research institutions and companies	[11], [26], [36], [46], [67]
8	Consulting [similar terms: *consultancy*]	Knowledge	Research institutions and companies	[20], [26], [27], [63]
9	Venture capitalisation [similar terms: *equity carve out, and financing*]	Technology	Companies and research institutions	[20], [41], [45], [60], [68]
10	Sponsored project [similar terms: request research, *contract development, contract research, joint research, R&D contract, government contract*]	Technology and knowledge	Research institutions and companies	[24], [27], [32], [34], [36], [42], [60], [63], [67]
11	Mobility [similar terms: *people, technology, and facility*]	Technology and knowledge	Companies	[11], [18], [25], [69]
12	Switchback [similar terms: *Dynamic*]	"Disruptive" technology	Companies [and entrepreneurs]	[70], [40]
13	Prototyping	"Disruptive" technology	Research institution and companies	[46]
14	Market entry [similar terms: *competitive, and technology leadership*]	Technology	Companies	[66]
15	Business plan contest	Technology and knowledge	Research institutions	[42]
16	Acquisition	Technology and knowledge	Research Institution and Companies	[14], [13]
17	Entrepreneurship	Knowledge	Research Institution	[71]

B. Commercialisation Methods from the Practitioners

a. **Licensing**: This is when companies decided to give rights to use their technology or innovation or know-how to another party in return for, mostly royalty [6], [41], [14], [34], [44], [17]; sometimes part of the right could be licensed or the whole right [28]. This method enables companies to benefit from their innovation without investing too much. However, organisational and inventor's individual factors play important roles in employing this method [30]. Empirically, sampled companies in a study showed that they used this method as one of their main commercialisation strategies [14].

b. **Spin-off**: It is creation of new enterprise to utilise business potential of a technology or innovation. This method is usually employed when the owner of the spin-off company observes that there is no existing market for the innovation; or, when the existing companies in the market are unable to adopt the innovation [6], [34]. A spin-off can also be used when there is a need for new invention to be commercialised, especially if such invention is developed at a research centre. An entrepreneurial spin-off can be used also to transfer the know-how to a commercial market [19]. This method serves as an important strategy for companies because when the new technology is developed, it is imperative to decide either the owing company enters the market or collaborates with existing players. If the company decides to compete, a new spin-off starts [65]. In another perspective, the existing strategy or system in a company may not permit the use of a new innovation and in order to keep the existing system and simultaneously utilising the new innovation, a spin-off can be used; this situation is known as misfit-technology [21]. One of the advantages of the spin-off method is that when a new company is established, the new technology can be further developed by utilising external support such as an investor [39] because embryonic innovations need further development [44]. However, when the technology reaches a reasonable growth, the spin-off can collaborate with other existing enterprises or act as subcontract for them or even, can be merged with or acquired them [39]. Therefore, it is one of the best promising methods of commercialisation [35].

c. **Spin-in**: It is similar to spin-off but the main difference is that its establishment is within an organisation (i.e. it does not have a separate legal entity). It may be the creation of a new unit [6], [36]. This method is described as internal development [21] and exploitation of technical leadership [66].

d. **Joint venture**: As its name implies, it is business cooperation between companies to either own or manage a new venture. The new venture is usually created as a result of research collaboration which leads to a new technology or know-how with business potential [41]. It can be called partnering (as in [21]) and cooperation (as in [14]). From the descriptive results in our study, it revealed that most of the participating small and medium-sized enterprises [SMEs] used joint venture as their main commercialisation strategies [14].

e. **Selling**: It is a method when entire technology or know-how and their intellectual property are sold to another party. This method is common among small companies and start-ups because they do not often have sufficient resources to materialise their innovation [6]. Mostly and in contrary, multinational enterprises do have money to acquire new companies for which they think that their new innovation would improve their own business performance or to control unnecessary competition [39].

f. **Consulting**: This method is usually employed by the companies which engage in know-how based sectors or service industries. It is a method where the owing companies offer consulting services to needy customers. Likewise, this method is commonly used for the commercialisation of collaboration research between the companies and the research institution [63].

g. **Collaboration**: It is similar to that of joint venture. It is a business relation, in which its main purpose is to develop or utilise a new technology or know-how. It can be in the form of cooperation between a new start-up and SMEs or between SMEs and large firm or between SMEs [63], [41], [65]. It can be hierarchical or bilateral cooperation [16]. It is widely employed by companies for their commercialisation method or strategy [14], [15]. It is also known as strategic alliance (e.g. [41]), collaborative research [63] and cooperation [16].

h. **Acquisition**: It is a method where a company acquires another enterprise purposely to get other company's competence for commercialising its own technology or innovation. The method is useful when a company notices that another company can enable it to penetrate a market or make its innovation commercialised. This method is common among multinational enterprises [39]. In support, our study showed that many SMEs also acquire other companies as their commercialization method [14].

V. New Commercialisation Method and Contributions of the Paper

A. New Commercialisation Method – Lean Start-up

Although there are many commercialisation methods and no significant difference between scholars and practitioners, there is interest in applying new commercialisation methods [if available]. Possible reasons for this could be need for sustainability by business enterprises, and the need to use austerity measures by governments. Like [1], [2] explained, business enterprises are working towards their sustainability. This move compels them to commercialise their technologies and knowledge. In achieving their commercialisation goal, the enterprises are searching for new methods. For example, [7] found that ICT companies were using exhibitions to commercialise their new products.

In a similar situation, governments of different countries are implementing austerity measures. This policy is forcing research institutions to monetise their research results. Meanwhile, present research results are different from those of

the past due to technological advancements. Thus, research institutions are seeking new methods that can facilitate their commercialisation activities; especially, during this era of globalisation of the business environment.

In view of the aforementioned conditions and the findings of this paper which outlined how these methods are synonymous to one another, it can be concluded that there is no specific best method of commercialisation presently; however, there are expected to be new commercialisation methods in the future, especially if sustainability and austerity pressures continue. In this regard, there is a new method which well-established companies and start-ups are using nowadays to test their business models as well as to commercialise their innovations. The method is called "Lean Startup". This method is described as a means to achieve effective and efficient commercialisation of business ideas [72], [73].

Lean Startup has been tested empirically by scholars such as [73]-[75]. These scholars investigated the method in relation to commercialisation. Similarly, the method was tested in different industrial sectors such as healthcare (e.g. [74], [75]), biotechnology [76], education [77] and information and communication technology [78], [73]. Therefore, it will be more fascinating to examine how this method can be used for commercialisation purposes because the scholars (such as [72], [79], [80], [75]) mentioned that the method facilitates development of customer acceptable products and services as well as deal with extreme uncertainty condition of innovation commercialisation. More specifically, [73], [81] stated that the method facilitates commercialisation processes or activities of the start-up or small companies; hence, it will be good to know the extent of this claim.

C. Contributions of the Paper and Limitations

Apart from introducing a new commercialisation method, this paper has tried to contribute a theoretical knowledge of commercialisation by highlighting a list of different methods for specific commercializing items like technology and knowledge. Likewise, this paper contributes to the practice of commercialization by stating specific methods that are employed by the practitioners and presented a method. However, it has limitations. The first limitation is the probability of missing some relevant articles. For example, the author of this paper did not have access to articles and journals published by "Inderscience". The second limitation is the scope of the paper. This paper focused only on commercialisation methods which are a fraction of commercialisation studies. This hinders the generalisation of results of the paper. Nonetheless, these limitations do not affect the contributions of the paper.

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