THE DISCIPLINE OF COMMERCIALIZATION

A DISCIPLINA DE COMERCIALIZAÇÃO

Shahab Eshraqi [1]
Reza Bandarian [2]

Resumo: *O conceito "comercialização" é definido e usado de várias maneiras e condições que podem ser consideradas com definições opostas ou pelo menos completamente diferentes. Tal variedade de definições e características da comercialização pode enganar estudiosos e administradores para perceber e explorar as descobertas dos pesquisadores. Mencionamos um padrão de identificação do conceito "comercialização" baseado em quatro dimensões: sujeito, objeto, meta e estratégia de comercialização em um estudo bibliográfico revisado. Neste estudo, revisamos a literatura sobre a comercialização, em artigos publicados nas revistas, listados na classificação Q1 e que possuem índice SJR de mais de um no site Scimago Journal & Country Rank.*
Encontramos um padrão de descobrir o conceito "comercialização", com base no qual definimos o caminho de comercialização. Além disso, enfatizamos que o caminho de comercialização é dinâmico e não estático, o que pode levar pesquisadores a estudar os fatores que afetam os caminhos de comercialização.
Palavras-chave: *Comercialização, Estratégia, Caminho de Comercialização.*

Abstract: *The concept "commercialization" is defined and used in various ways and conditions that can be considered with opposite or at least completely different definitions. Such a variety of definitions and characteristics of the commercialization may mislead scholars and managers to perceive and exploit the findings of the researchers. We mentioned a pattern of identifying the concept "commercialization" based on four dimensions subject, object, goal and strategy of commercialization in a reviewing literature study. In this study, we reviewed the literature on commercialization, in published papers in the journals, listed in the rank Q1 and which have SJR index of more than one in the Scimago Journal & Country Rank website.*
We found a pattern of figuring out the concept "commercialization", based on which we defined commercialization path. Furthermore, we emphasized that commercialization path is dynamic rather than static, which can lead further researchers to study the factors affecting the commercialization paths.
Keywords: *Commercialization, Strategy, Commercialization Path*

[1] Ph.D. Student in Management of Technology, Alborz Campus, University of Tehran, Tehran, I.R. IRAN
Email: shahabeshraqi@ut.ac.ir

[2] Professor Assistant, Commercialization and Business Development Department, Technology Management Division, Research Institute of Petroleum Industry, Tehran, I.R. IRAN
Email: bandarianr@ripi.ir

Introduction

Although many scholars have worked on the commercialization in the innovation process, the origin of the term commercialization is fairly vague. Most of the scholars have consensus that the core of concept "commercialization" is exploiting something and earning financial benefits out of idea, knowledge, technology or product/service. By reviewing the literature, we found a variety of definitions and procedures of the commercialization. According to some of them, the concept "commercialization" is used just in the context of universities, technologies or scientific knowledge developed in them [1-9]. In return, according to an opposite approach, some scholars define the term commercialization as exploiting a technology in production systems of firms [2, 10-18]; and some believe that the commercialization is the process of development, production, distribution and marketing of a products/ services [10, 19-23].

Furthermore, the position of commercialization is not clear. Some scholars believe that the commercialization is a step of innovation [24, 25]; others believe it often consist of development [12, 15, 16, 18, 26, 27], Some place it after production [10, 28] and some others regard it to be the subset of innovation management. Others note that the commercialization is the subset of marketing, specifically for marketing a new product/service [11, 19, 26].

However, much turbulence or disorderliness can be found in the definitions of the concept "commercialization", and as a result, we can distinguish a discipline in the definitions and functions. Accordingly, we explore the definitions and functions mentioned in the papers published in the top academic journals in the world to make a discipline of the commercialization by categorizing the definitions and functions. This study contributes to the literature of management of innovation by providing the integrated view on the commercialization of a knowledge, technology or product/ service by anyone including individuals, universities or different types of firms. The result sheds light on the dark side of characteristics of commercialization, viewed in the literature, which can mislead and confuse researchers and innovators.

Methodology

We believe the variety of definitions of the commercialization has been caused by ambiguity around the cases of the studies. As a result, the commercialization have become somewhat of a catch-all when considering commercialization from a range of fields; such as from technology to product, or from individuals to established firms with the different goals and strategy options.

In this study, we reviewed the literature on commercialization and use all of them in the study to catch all of the definitions. Then, we scanned the papers and put them in a framework, which distinguishes the cases by different dimensions.

The search of the literature was concentrated on papers published in journals, listed in the rank Q1, which have SJR index more than one in the Scimago Journal & Country Rank website [29] in the subject-area business, management, and accounting. We limited our search to the papers having the word "commercialization" or its derivatives[1] in their titles and their major references.

In the first step of the study, we reviewed the selected papers to identify the diversity of definitions and functions. We emphasized on the functions including processes, strategies, and methods as the pieces of puzzles. The words stated by scholars to define the concept "commercialization" are not enough because the deep study presupposes gathering and analyzing huge facts [30] in various views and perspectives.

In the second step, we identified distinctive dimensions of the characteristics of the concept "commercialization" to classify this term. In this step, we found four dimensions, based on the frame of traditional WH-questions, including the subject (who), object (what), goal (why) and strategy (how) of the commercialization. We removed one Wh-question, "where", because it refers to developed or developing countries, and most of the selected papers are written by scholars living in developed countries. However, the last Wh-question, "when", is not clearly mentioned in the papers, it is considered in the last step of the study and we will further discuss it.

Finally, the third step was assigned to analyzing the data gathered in the previous step. We formulated a table to figure out diverse approaches behind the linkages. The approaches are the

1 Such as: commercialisation, commercializing, commercialize, and commercialise

result of the review, knitted by cognitive points based on our experiences and mentality. In this section, we found a vacuity of some concepts to explicate the approaches. By scanning the literature on the concept commercialization, we found three concepts: reactive commercialization, proactive commercialization, and concurrent commercialization. However, these concepts are not pointed in the papers of top journals; they can help open the Gordian knot. These concepts are rooted in the WH-question "when". Therefore, all the five WH-questions are used in the review method.

Object (What)

The literature emphasizes the commercialization paths of such different items as products/ services, technologies, new business models or knowledge. The issue seems more complicated when we know an Object can be developed and commercialized by various entities including universities and companies; i.e. a university can generate knowledge, develop a technology or establish a spin-off firm to develop products/services and what matters is how to commercialize them. Likewise, an individual innovator may try to make benefit of an idea (an innovative business model or a product/service) or as a scientist, one may want to commercialize his/her knowledge based on his/her applied research. We can state same more examples of technology-based firms, innovative firms, and manufacturers. Reviewing the papers leads us to find four types of the Objects, as shown in Table 1.

Table 1: classification of commercialization Object

#	Description	References
1	Knowledge	[4, 5, 9, 13, 31-48]
2	Technology	[1-3, 6-8, 11-18, 26, 27, 32, 33, 35-37, 42, 43, 46-81]
3	Product/ service	[2, 10-12, 19-25, 47, 48, 55, 58, 64, 75, 82-93]
4	Innovative Business Model	[23, 47, 48, 56, 58, 71, 81, 94, 95]

Knowledge

It is extremely difficult to define knowledge. Generally, it can be defined as "facts, information, and skills acquired through experience or education, which is the theoretical or practical understanding of a subject" [96]. In terms of commercialization, knowledge refers to scientific facts and know-how obtained through academic research.

Technology

The concept of technology is still obvious in the literature. Drejer presented three different perceptions of technology, including the tool, system, and value [97]. The perception of technology as a tool is commercialized in such things as machines, computers, chips, genetic engineering, computer integrated manufacturing and robotics, methods, processes, and techniques, whereas in the two latter perceptions of technology, it is not explicitly defined [97].

Product/ service

However, in the context of marketing, product refers to anything that can be offered to a market to satisfy a want or need of customers [98], In manufacturing, it refers to anything produced in a production system and sold as finished goods [99]. Furthermore, service refers to a process consisting of a series of activities that takes place in interactions between the customer and service employees and/or physical resources, goods and systems of the service provider, which are provided as solutions to customer problems [100]. In the literature, the concept "product" mostly encompasses the concept service [99]. In case of commercialization, the Object can be the introduction of new product/service to a market, whereas earning financial benefit from a prevalent product/service is a matter of marketing.

Innovative business model

A business model refers to the core architecture of a firm [101], how value is created or appropriated [102], or the method of doing business through generating revenue [103, 104], and consists of customer value proposition, key resources and processes, and a profit formula [105]. The concept "innovative business model" refers to a business model resulting from an innovation in the components, ranging from incremental changes in individual components of a business model to disruption of a business model [106]. Commercializing an innovative business model can be pursued by innovative firms or individual ones.

Subject (Who)

The scholars have attributed the subject of commercialization activities to different people. The difference in the subject of commercialization leads to the different roads. In reviewing the papers, we recognized that each theory or proposition relates to one or more subject; such as an individual, a university or a firm, in various types including technology-based firm, innovative firm and whatnot. Identifying the subject of the commercialization in each theory or proposition explains the fundamental differences related to the context of the commercialization and justifies the divergence; as a result, it can be assumed that characteristic of the commercialization for an individual innovator with limited resources is far from the activity in a university, and so for a firm. By studying the papers, we found three types of subjects mentioned by scholars, as shown in Table 2.

Table 2: classification of commercialization subject

#	Description	References
1	Individual innovators	[2, 3, 6, 8, 9, 19, 23, 33, 42, 43, 45-48, 56, 71, 94, 95]
2	Universities	[1-9, 31, 33, 34, 37-43, 45, 46, 59, 73, 75]
3	Firms	[2, 6, 8, 10-27, 32, 35-37, 44, 46-55, 57, 58, 60-70, 72, 74-95]

Individual innovators

An individual innovator is the one who proceeds to commercialize something such as an idea or knowledge, personally with an extreme limitation on resources. However, since the commercialization process is fairly complex and requires a lot of complementary assets such as generic (i.e. money) and special (i.e. complementary technologies or distribution channels) resources, an individual innovator is unable to do it on his/her own [107] or he/she loses to the imitators [47].

Universities

A university may develop a technology or generate knowledge in the academic laboratories, exploited in production procedures. Universities play a vital role in the innovation ecosystem [108-110] This role places universities as the focal point of growth and opportunity in industries [111]. So, clearly, playing this crucial role depends on success in the commercialization of the technology and knowledge.

Firms

Firms range from technology-based and innovative firms to manufacturers, in any size such as small, medium and large, and in any stage of the life cycle from startups to established ones. A technology-based firm is an agent who introduces innovation, promotes technology transfer, intensifies market competition, and speeds up industrial evolution and ultimately induces economic growth [112-117]. Many scholars stick the word "new" to the beginning of the term and point new technology-based firm, where the word "new" applies to the firm, to the technology, or to both [118]. In the case of commercialization, the approach new technology in a new or incumbent firm

is considered.

Innovative firm refers to those involved in continuous innovations by possessing sustained innovative capabilities. It deals with opportunities and challenges of the market economy through a series of innovations in management, marketing, execution and even technology, and obtaining sustainable survival and development [119]. The survival of this firm depends on earning financial benefits from its activities, known as commercialization.

Goal (Why)

Different goals of commercialization can be enumerated in the literature. In the review, we recognized that innovators commercialize for such distinctive goals as increasing the market share, improving entrepreneurship, earning the direct financial benefits, problem-solving, and improving the business. The variety in the origins of goals led to different paths of commercialization. Classification of commercialization goals is shown in Table 3.

Table 3: classification of commercialization goals

#	Description	References
1	Increasing the market share/ entering to a market	[2, 8, 11-13, 15-22, 25-27, 32, 35-37, 42, 44, 49, 51-58, 60-66, 70, 72, 74-81, 83-95]
2	Entrepreneurship	[1, 3-7, 23, 31, 34, 35, 37, 42, 46-49, 56, 59, 66, 71, 75, 81, 92, 94]
3	Earning direct financial benefit	[2, 4-6, 8, 9, 14, 17, 31, 33, 35, 36, 38-43, 45-48, 50, 51, 59, 61, 67-69, 71, 73, 75, 93]
4	Problem-solving	[4, 35, 44, 52, 56, 74]
5	Improving the business	[2, 4, 10, 35, 44, 52, 53, 56, 63, 74, 82, 85, 86]

Increasing the market share/ entering to a market

One of the goals of commercialization is increasing the market share or entering a new market [120]. However, the role of technology [121] and innovation [122] in competition has long been recognized. The high level of innovativeness in new products increases market share. Radical innovations have greater value than incremental innovations, and new product concepts have greater value than process innovations [123-125].

Entrepreneurship

Entrepreneurship is regarded as another goal of commercialization [126, 127]. Scholars define the term entrepreneurship in numerous and very distinctive ways. Malecki [128] categorizes definitions of entrepreneurship into three different groups: short moment during the time when a new firm is born or when an existing one is developed via new innovations; business start-ups with no stress on newness or innovativeness; small firms in any stages [129]. Because of the role of innovativeness in the commercialization, the first definition of entrepreneurship can be used in this issue.

Earning direct financial benefit

Some scholars consider earning direct financial benefit as the third goal of commercialization [126, 127]. Earning direct financial benefit refers to selling the Object of commercialization and earning money. The theoretical basis of this goal is rooted in Teece's theory [47, 48], nominated two opposite concepts "contract" and "integration". One can suggest that the lowest level of the contract is earning direct financial benefit via a sale process and the concept integration mentioned to the concept entrepreneurship.

Problem-solving

The fourth goal of commercialization can be assumed as problem-solving [130]. Problem-solving refers to cognitive processes to reach some goals [131], consisting of identifying needs,

analyzing factors contributing to the problem situation, designing strategies to meet those needs, and implementing and evaluating the strategies [132]. The role of innovation [133] and technology [134-136] in problem-solving is well understood. However, the commercialization of problem-solving relates to exploiting an innovation or a technology, selling the solution to others is another way of commercialization.

Improving the business

While the prior goal such as increasing the market share and problem-solving is based on improving the business, we can emphasize the goal "improving the business" in itself can be identified as a goal. For example, Lai, Cheng [137] note some firms develop and exploit technologies for improving the quality or reducing the cost of products, which can be viewed as commercialization because improving quality refers to fulfillment of the needs of customers via exploiting innovations [138] and similarly, reducing cost is accompanied by innovations, especially when the firm aims to avoid the reduction in quality [138].

Strategy (How)

Lin, Jiang [139] characterized the commercialization strategy as "the question of the boundaries of the firm, and in particular of vertical scope by which the innovators should weigh up the benefits of relying on internal production against the costs and risks of using the market to choose the appropriate value-creating architecture". In this paper, we define commercialization strategy as "series of operation alternatives that a company is faced with them for transferring a product or technology to the market" [23, 92, 140]. We extracted the classification of commercialization strategies from the review, as shown in table 4.

Table 4: classification of commercialization strategies

#	Description	References
1	Licensing	[2, 5, 6, 8, 9, 14, 31, 33, 35, 36, 42, 43, 45-48, 50, 51, 53, 59, 61, 67, 68, 71, 73-75, 93]
2	Strategic alliances	[4-8, 17, 19, 23, 31, 34-42, 44, 47, 48, 52, 53, 56, 58, 66, 69, 74, 75, 77, 79, 92, 94]
3	Equity in a spin-off	[6, 7, 31, 35, 46, 58, 59, 79, 94]
4	Production and Sale	[1-3, 6, 10-13, 15-27, 32, 35, 46-49, 51, 54-58, 60-65, 70-72, 75-91, 93-95]

Licensing

A license is a permission that allows others (the licensee) to use an intellectual resource (i.e. know-how) issued by the owner (the licensor) for a fixed duration of time [141]. Licensing is a commercialization strategy, taken by who do not have complementary assets [47] or who earns the additional profit apart from exploiting technology in the production processes [53, 74].

Strategic alliances

Strategic alliance refers to linking specific facets of the business of two or more firms, where this link is a trading partnership that enhances the effectiveness of their competitive strategies [142]. It can be considered as a commercialization strategy choice where required assets are owned by two or more firms or when they want to share the risk of commercialization.

Equity in a spin-off

Spin-off refers to the creation of a new company, based on knowledge transfer [143] or supplementary assets [144]. However, there are many reasons for establishing spin-off firms; we found this option as a strategic choice of commercialization.

Production and Sale

Some scholars focus on the manufacturers, so what they do can be named as the production

and sale strategy [19]. In this strategy, firms try to produce and market new products/ services. Similarly, technology-based firms or universities can choose this way. They can sell what they developed without any attempt to register as a patent, which cannot be considered under the licensing strategy.

Findings

Reviewing the selected papers and formulating the table according to the dimensions. By eliminating the empty cells (series not found any papers pointed out in the review), we can see the results in Table 5.

Table 5: the abstract outline of the review results

Object	Subject	Goal	Strategy
Knowledge	Individual innovators	Increasing the market share/ entering to a market	Strategic alliances
		Entrepreneurship	Strategic alliances
			Production and Sale
		Earning direct financial benefit	Licensing
			Strategic alliances
	Universities	Increasing the market share/ entering to a market	Strategic alliances
		Entrepreneurship	Strategic alliances
			Equity in a spin-off
		Earning direct financial benefit	Licensing
			Strategic alliances
		Problem-solving	Strategic alliances
		Improving the business	Strategic alliances
	Firms	Increasing the market share/ entering to a market	Strategic alliances
			Production and Sale
		Entrepreneurship	Strategic alliances
			Equity in a spin-off
			Production and Sale
		Earning direct financial benefit	Licensing
			Strategic alliances
		Problem-solving	Strategic alliances
			Production and Sale
		Improving the business	Strategic alliances
			Production and Sale

Technology	Individual innovators	Increasing the market share/ entering to a market	Strategic alliances
			Production and Sale
		Entrepreneurship	Licensing
			Strategic alliances
			Production and Sale
		Earning direct financial benefit	Licensing
			Strategic alliances
		Problem-solving	Strategic alliances
			Production and Sale
		Improving the business	Strategic alliances
			Production and Sale
	Universities	Increasing the market share/ entering to a market	Strategic alliances
		Entrepreneurship	Strategic alliances
			Equity in a spin-off
			Production and Sale
		Earning direct financial benefit	Licensing
			Strategic alliances
	Firms	Increasing the market share/ entering to a market	Licensing
			Strategic alliances
			Equity in a spin-off
			Production and Sale
		Entrepreneurship	Strategic alliances
			Equity in a spin-off
			Production and Sale
		Earning direct financial benefit	Licensing
			Strategic alliances
		Problem-solving	Licensing
			Strategic alliances
			Production and Sale
		Improving the business	Licensing
			Strategic alliances
			Production and Sale
Product/ service	Individual innovators	Increasing the market share/ entering to a market	Production and Sale
		Entrepreneurship	Strategic alliances
			Production and Sale
		Earning direct financial benefit	Licensing
			Strategic alliances
	Firms	Increasing the market share/ entering to a market	Strategic alliances
			Production and Sale
		Entrepreneurship	Strategic alliances
			Production and Sale
		Earning direct financial benefit	Licensing
			Strategic alliances
		Improving the business	Production and Sale

Innovative Business Model	Individual innovators	Increasing the market share/ entering to a market	Production and Sale
		Entrepreneurship	Strategic alliances
			Production and Sale
		Earning direct financial benefit	Licensing
			Strategic alliances
		Problem-solving	Strategic alliances
			Production and Sale
		Improving the business	Strategic alliances
			Production and Sale
	Firms	Increasing the market share/ entering to a market	Equity in a spin-off
			Production and Sale
		Entrepreneurship	Strategic alliances
			Equity in a spin-off
			Production and Sale
		Earning direct financial benefit	Licensing
			Strategic alliances

Most of the scholars consider the commercialization as a matter of increasing the market share/ entering to a market for a product/ service, a technology, or an innovative business model by firms. Strategic alliances and licensing are pointed in many papers, and some theories focus on earning direct financial benefits. Surprisingly, commercializing the innovative business models by universities is not recognized in any paper. Likewise, the role of universities in problem-solving by developing the technologies or improving the production systems is neglected in the papers.

In this section, we note some words for distinctive kinds of subjects and Objects as below:

Individual innovators

The findings show most scholars who work on the commercialization implemented by individual innovators, regard technology and innovative business model as the Object of commercialization, rather than commercializing knowledge and product/service. Because of limitation in resources, most of the scholars emphasize on strategic alliance and few of them advise production and sale as the applicable strategic option for individual innovators. Individual innovators seeking knowledge commercialization pursue three distinct goals:

1- Entering the market and exploiting it to produce products/services: It can be provided to customers, in such a way that the innovator does not care about business development, but aims at producing products/services and creating value for customers. Researchers recommend “Strategic Alliance” Strategy for these innovators. Such innovators generally think of laboratory research and the creation of knowledge and state-of-the-art technology, aim to create changes in markets, and gain profit and value without the risk of investing in business development.

2- Entrepreneurship: Researchers say that some innovators are seeking to use their knowledge to set up a business. In addition to partnering with others, such people can choose product development and market entry through the launch of new businesses.

3- Earning direct financial benefit: According to innovation management literature, innovators who aim to earn financial benefit from their knowledge are advised not to engage in setting up a new business and choose one out of options such as licensing and strategic alliances.

An interesting point is that according to the findings, individual innovators who can produce/deliver a product/service or launch an innovative business model and, in other words, have production technology and distribution organization can have the same goals and strategies possessed by individual innovators who have the knowledge. The only difference is that scholars prescribe knowledge-based innovators strategic alliances option to enter the market, while recommending innovators with production technology and distribution systems, to focus on

production and sales.

Universities

We found that the scholars consider the role of commercialization of knowledge and technology for universities rather than products/services and innovative business models. Furthermore, strategic alliance and licensing are two strategies of commercialization, scholars mentioned for universities.

The universities that have production capability or can create innovative business models have not been referred to in literature. Hence, knowledge and technology are the only things that universities can commercialize. In most cases, researchers have recommended universities to strategic alliance; strategic alliance with other businesses to gain profit, impact the market, solve problems, and even bring about entrepreneurship for their students and professors. In addition, universities have the option of setting up spin-off companies for entrepreneurship for their students and their professors and licensing sales of knowledge and technology that can bring direct financial benefit to them.

Firms

Variety of commercialization for firms in the results is distinctive. Surprisingly, diversity of goals and strategies for commercialization of product/service is not supported by the findings. Companies can seek to commercialize knowledge, technology, product/service, and business innovative model. In literature, for all four objects of commercialization, common goals have been mentioned, such as entering the market/increasing market share, entrepreneurship and direct gain, and options such as strategic alliances, production and sales are recommended in most cases. In addition, the sale of licenses and the establishment of spin-off companies are mentioned as well.

On the other hand, goals such as improving business, resulting from new knowledge and technology, and problem-solving by using knowledge generation are also mentioned in literature and options such as selling licenses, strategic alliances, and production and sales have been prescribed.

Knowledge

The results show few scholars focus on commercializing the knowledge. Furthermore, most of them point to university as the source of knowledge, which can be considered rational. Some emphasize on knowledge of firms, and few ones address the knowledge of individual innovators. Respectively, licensing and strategic alliance are two strategy options advised by the scholars. They believe that individual innovators and universities tend to earn the direct financial benefits, while firms pursue commercialization of knowledge to increase the market share/ enter to a market or launch/improve a business.

Technology

Many scholars emphasize on commercializing the technology as a main Object of commercialization. In this view, technology is something that can be commercialized; knowledge and business model has no susceptibility to commercialization. On the other hand, a product is no more than a mix of technologies. So the term commercialization and technology are stuck together in many papers. Surprisingly, we found most of the scholars focus on commercialization of technology developed by individuals and firms vs. those developed by universities; however, we imagined technology is developed in laboratories of universities.

Product/ service

The fact that many scholars believe the term “commercialization of product” is malapropos, cannot hinder us to entail this concept when many scholars, recognized this concept and worked on it. Perhaps, it is imaginable that university and products/ services are not the issues of papers, and our findings confirm it; however, one can suggest todays, universities play a distinct role by making

services such as consulting, teaching etc.; what it seems to be neglected by scholars.

Innovative business model

Since the concept "innovative business model" is yet to be paid attention in studies, there is no wonder that few papers are found focusing on commercialization of innovative business models. Furthermore, these papers emphasized the role of individual innovators and firms in generation and commercialization of innovative business models.

Defining Commercialization Path

Teece and Pisano [145] define paths as the strategic alternatives available to the firm. Accordingly, we define the commercialization path as an option with four dimensions (subject, object, goal, and strategy) that chose by someone to commercialize something. The innovator can choose different paths for a case; for example, the innovator can commercialize the technology or produce a product and commercialize it. Likewise, he/ she can consider different goals and strategy for commercialization. Furthermore, it is an option to commercialize as an individual or to establish a firm. Historically, the term "commercialization path" was used in some scholarships, but it is yet vague and no one defines it clearly. By comparing the paths, we found two significant consequences; first, we found there are no points for some commercialization paths in the selected papers, published in top rank journals, which is represented by empty cells in the reference column in the table. One can suggest some paths can be considered as issues of further research, and we can extend the results for some paths to similar ones.

Second, we found out a point neglected in the papers: commercialization path is taken by innovators (individuals, universities, and firms), but when? Is there some condition affecting the innovator choice? In the view of the commercialization path, they plan and implement a strategy, based on what innovators try to commercialize and what their goal is. But we think unless we do not attend to the time of the decision opting a path the hypothesis is not exhaustive. Unfortunately, the papers we reviewed did not point to the timing of the decision. In deeper search, we met three concepts are related to our issue: reactive commercialization, proactive commercialization, and concurrent commercialization. However, the papers in which these concepts are used are not top rank and most of them are not indexed in social sciences citation; they can conduct us to more deeply review the papers.

Reactive/responsive commercialization refers to an approach which mentions that the considerations about the commercialization stage will begin after running an R&D project and obtaining the results [146]. This approach represents the view that decision on the commercialization path is taken after development phase. Proactive/ guaranteed commercialization refers to an approach that the commercialization activities are carried out before starting the R&D project [147]. This approach emphasizes taking decisions on the commercialization path before any spending of cost and time in research and development activities. Concurrent/ parallel commercialization refers to an approach where the commercialization activities begin before the inception of the R&D project and the commercialization considerations are completed stage by stage and in parallel with the R&D project [146]. This approach points to an evolutionary view of the commercialization path, which supports alteration in the commercialization path. According to this view, innovators change the commercialization path in the passage of time by analyzing the situations.

These approaches, especially the latter, led us to find out that the commercialization path is dynamic rather than static. Accordingly, we suggest the commercialization path can be changed based on the internal and external situations. One can see this evolutionary trend in the passage of time in the innovator manners. An individual innovator starts R&D and commercialization in an individual commercialization path, i.e. choosing a licensing strategy to earn money, and then to achieve required resources, he/ she may establish a firm and change the commercialization path according to the new origin of the innovator, i.e. producing and selling products/services. Furthermore, the firm may decide to add a complementary commercialization path such as establishing a spin-off firm, contracting a strategic alliance or selling the license of technology (called external commercialization in the literature). Similarly, another commercialization evolutionary

path can be considered.

The major question here is what internal and external situations affect the decision on commercialization paths. We can suggest some situations like technology life cycle, business life cycle, industrial structure and governmental rules as the internal and external situations; however, it can be the issue of further research.

Conclusion

The concept "commercialization" is used by many scholars in various conditions, in case of knowledge, technologies, products/ services, and business models and in different contexts firms, universities and individual innovators according to the variety of goals and strategies. We contribute this concept by reviewing the literature and figuring out commercialization paths based on the four subject, Object, goal, and strategy domains of the commercialization and defining the commercialization path as "a way that someone goes through to commercialize something to achieve a considered goal by implementing a strategy".

Furthermore, we pointed out to the evolution of the commercialization path and suggested it as a dynamic path, in which each of domains of the path can be changed according to some internal and external situations. former researchers emphasized on some factors affecting the commercialization decisions, i.e. commercialization strategy environment [23], appropriability regime [47, 48, 77], internal complementary assets [47, 48, 77], technology life cycle [47, 48, 78], organizational slack available [79], relational competences [11], marketing capability [76], commercialization intelligence [51], and etc. These factors can be regarded in further studies.

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