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Commercialization Success Factors of University Research Output

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Abstract

The significance of university research had been obtaining a new concentration during the past few decades particularly, regarding their capacity to generate innovation and start-up companies. Universities are not only responsible for teaching and R&D activities but they are expected to commercialize the research result and also establish spin-off companies. This study attempts to illustrate the crucial factors that assist the commercialization process of university research result. This paper reveals that the success of university commercialization is influenced by several factors including researchers' perception, time, entrepreneurial team, networking, technology stage, funding, market research and TTO.

Keywords: Commercialization; university research output; success factors

1.0 INTRODUCTION

University research is an important source of significant technological innovations that have commercial value. From the knowledge economy point of view universities are known as talent promoters, which are operating towards building such capacities for nations and regions to survive and prosper in this context.[1] Hence, the commercialization of technological and scientific knowledge generated within universities, research centers, laboratories that are publicly funded research organizations, is increasingly regarded via policymakers as input for regional economic growth to be sustainable and developed.[2] Moreover, the commercialization of academic studies is treated to be as "the process in which ideas, knowledge, and innovations would be conveyed to tangible assets" [3] including benefits that satisfy society and economy at large scale. Nowadays studies on commercialization of research in university and introducing various models for university technology transfer are receiving more attention.[4-5]

2.0 STAGES AND PROCESSES OF UNIVERSITY RESEARCH COMMERCIALIZATION

University technology transfer is the process of converting research discoveries from university to industry into useful products or practical applications.[6] It usually involves two or more organizations, for example, university, industry, and government agencies. Common results of technology transfer are invention disclosures, patent filed, patents issued, licenses executed, and a number of spin off companies generated, among others.[6] The university-based technology commercialization processes includes discovery, presenting those discoveries to university commercialization arm, patentability evaluation, transferring and license IP to industry.[7-8] Fig.1 presented an extensive diagram on the process of technology transfer which was studied on the technology transfer in university settings in the U.S.[5]

3.0 SUCCESSFUL FACTORS OF UNIVERSITY COMMERCIALIZATION

3.1 Researchers' Perception

The influence of university researchers' perceptions toward commercialization manipulate their propensity to engage in this activity.[9] On the other hand, some features influence the perception of feasibility towards commercialization. They state the presence of confidence, commitment and stress act as an inoculation to self-efficacy, so that perceptions of feasibility and those aforementioned variables interact and influence each other continuously either to strengthen or weaken one another (Fig. 2).

What the model shows is that if the authors' formulation is correct, then the micro impact of perceived feasibility i.e. the researchers' perspective on the viability of commercialization is a dynamic state of affair.[9] Other features which influence the perception of feasibility towards commercialization has been the presence of business to complement technical skills of academic researchers; the importance of collaborative network; the dynamism of the university environment towards commercialization; and adopt an entrepreneurial policy by universities onto technological commercialization.

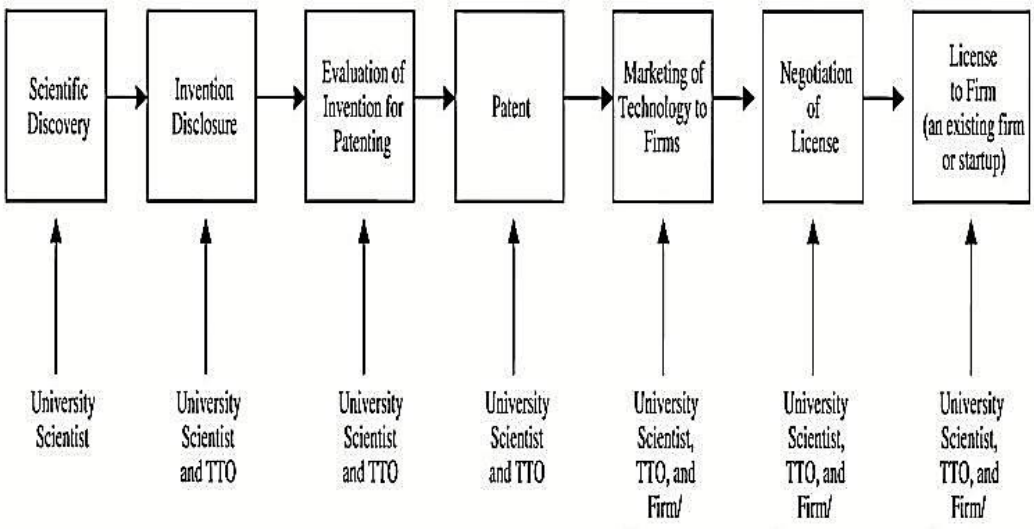

Figure 1 How a technology is transferred from a university to a firm or entrepreneur (according to theory)

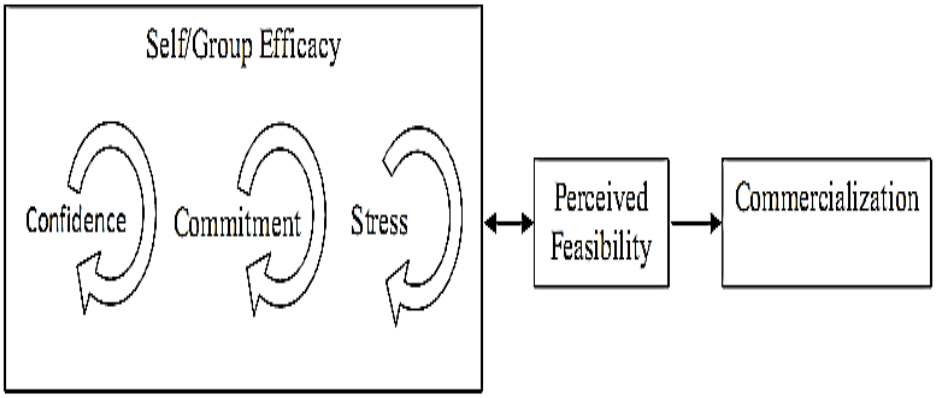

Figure 2 Model of emerging patterns in perception of feasibility

3.2 Time

The critical role of time in commercialization operations indicated in the study of some scholars.[7] It is suggested that the time to commercialize research, "would generate a competitive advantage".[7] The fact that university researchers sometimes hold back commercialization, limits awaiting opportunities for better deals from the business sector, and could backfire. The general understanding is that by accelerating the technology commercialization process within the boundaries of universities' policies on research commercialization, it is "assumed to be associated to new revenue generating" and increase knowledge acquisition and accumulation through learning from past experiences.[10]

3.3 Entrepreneurial Team

Extant studies that investigate established organizations show that greater uncertainty or complexity in the environment has made difficult for accomplishing one's goal alone and has increased the propensity to work in teams.[11] Another apparent situation that encompasses considerable uncertainty is entrepreneurship. Entrepreneurial teams often performs better than solo entrepreneurs.[12-13]

In the entrepreneurship literature, an increasing number of authors have highlighted founding team characteristics as potential key success factors. Founding teams with a high degree of commercial (sector-specific) experience show significantly higher growth rates in employment and revenue than those with low level of such experience.[14] On the other hand, the team 'behavioral integration' (among others, the ability to work to gather) to be found in start-up teams leads to a significantly higher rate of new product introduction in comparison with those founding teams that do not show high levels of integration.[15] Further, the quality of entrepreneurial groups carries important factors regarding to raising venture capital.[16-17]

3.4 Networking

Networking is a crucial aspect in the choice of commercialization route. In fact, the value of networks as part of the explanation for the entrepreneurial success is widely acknowledged.[18-27] Commercialization asks for various sources such as technical competency, industrial tacit knowledge, stakeholder knowledge, and identification of product feasibility, collaboration, distribution and relationships with outsiders.[28] Networks link new firms to resource providers such as venture capitalists, business angels, banks and advisers as well as to potential customers.[8] The link to financiers give a better chance to founders access to broader networks such as suppliers, customers and other resources that a new firm requires.[29]

Early network with industry give greater chance that the invention will be exploited.[30] The industry could advise and monitor the project according to the market needs.[8] Personal contacts are an effective way to attract companies to the universities' technologies. Universities' technologies are unproven and normally need further investment before any product can really sell into a market.[31] In addition, due to the technology being in its early stage, it is a very high risk. The invention that received early funding from established companies and where the inventors work together with industry teams, those inventions have a greater chance of being licensed to established companies.[8] Informal and formal networks with individuals and organization are important means of accessing finance, thereby giving more chance to spin-off formations.[32] Therefore role of formal and informal networks are vital in an entrepreneurial context.[26]

On the other hand, social and business relationships intertwined in the entrepreneur's personal network. Furthermore, characteristic of all the networking activities within the investigated empirical settings is that no financial transactions take place between the companies.[33] There are two major categories of networking activities: (i) business support and (ii) support services. The 'business support' activities include networking activities related to business-development advice as well as services related to business matters and the latter category encompass practical or technical support activities.[33] Therefore, network and collaboration with industry is important.

3.5 Technology Stage

Technology management operations mainly focus on forecasting what may happen in future for newborn technologies. In order to satisfy such objective there are many departments and agencies cooperating together such as universities, R&D agencies and venture capitalists.[34] Of course main issue regarding newborn technologies is that they are based on uncertain markets that followed by many risks. Thus these technologies require more investment to develop their underlying values.[29] Most of university technologies were at an embryonic stage at the time they were licensed.[35] Also technologies that have radical, tacit knowledge, of general purpose and strong IP protection usually lead to spin-offs formation. Whereas technologies at later stages of development would have moderate customer value, with codified knowledge, specific purpose and weak IP protection would tend to be exploited through licensing to established companies.[36]

Spin-off formation needs technologies that have made significant advances in a scientific field and that will have important economic value although they are at the very early stage of development.[29] Technology needs to be cutting edge and do not duplicate existing technologies.[29] Furthermore, the technology must be in demand and it is expected to bring in sustainability more profits than alternative technologies. Small and newest spin-offs always invest in uncertain technologies.[29] Most of the spin-off companies at the University of California were founded because established firms were unwilling to license these technologies.[37] Based on survey of 62 TTOs in the US and they found that established firms tend to license university inventions at the later stages.[35] Furthermore, it is detailed that small and medium size firms, which produce new and mid-stage technologies expecting more future success.[34]

3.6 Funding

The availability of funds to commercialize a newly patented technology is a critical issue. Patents, like R&D projects, are associated with many costs that mainly are spent to startup operation without any return at early stages, which in part are along with high risks and uncertainty. In addition technical issues, financial concerns, and resource availability are among the largest issues in R&D courses. In the later commercialization phase, financial needs are more tangible. Therefore, external financing is required to be conducted by private sector and also small firms as well.[38]

In addition, government's role in the early stage of the new product or prototype is highly critical especially by providing grants and sufficient funds.[29] Government assists founders to look for new ways of commercializing their research-based technologies.[29] Moreover, the government funding is considered as a critical basis for economic prosperity that is mainly because of less risk, which helps technology entrepreneurs at spin-off stage.[39] On the other hand, it is beneficial for academic researches through collaboration with industries which tend to establish a relationship with knowledge users and mobilize resources for the complement of public research fund.[40] In sum, availability of funding is one of the success factors in the commercialization of university research.

3.7 Market Research

A market research phenomenon considered as one of successful key in the commercialization process of research output. Industrial research teams usually take the research process from very beginning that they recognize a problem with reasonable solutions.[41] In general, existing literature on R&D management indicate four different forms that are known as generations of R&D strategies.[42--44] In this regard first type or generation of R&D is to find scientific shortcuts, next generation mainly focuses on whether those shortcuts are feasible or not, third generation satisfy customers' needs and wants for the products and services and finally fourth generation is known by its association with independent research agents. [43]

On the other hand, achieving competitive advantages through successful new product development and commercialization requires a convergence innovation, opportunity scanning, and exploitation capabilities.[45] In the marketing literature, having a market orientation and being market driven[46] have been widely accepted as precursors to creating competitive advantages through innovation and new product development.

3.8 Technology Transfer Office

TTO have been established by many universities in encouraging inventors to implement the commercialization strategies and supporting them through the commercialization process.[47] Via licensing to industry of inventions or other types of intellectual

property generated from university research, the TTO is enabled commercialize knowledge or technological diffusion conveniently. Dual agents can make the model through TTOs which is used to achieve scientific discoveries from faculty.[31] It also manages the commercialization process to industry for the university. When there are discoveries originating from inventors, TTOs can serve as several aspects. It is considered to assess the market potential, seek intellectual property protection in order to promise discoveries, link research inventors and potential technology licensees. Last but not least is managing and enforcing a contract agreement with industry and licensees.[7] Hence the structure of the TTO was important to the success of the transfer process.[48]

4.0 CONCLUSION

Universities make a great contribution to the national economic development. Generated technologies within universities work as an engine of the nation's growth. However, many research ideas and results produced in universities fail to align with firms' business strategies.[49] Technology transfer is a high-risk process since there is no guarantee that a technology development project will result in a successful product launch or the investment will generate sufficient return.[50-51-55] In this study, the roles of eight factors include researchers' perception; time; entrepreneurial team, networking; technology stage; funding; market research and TTO were investigated in the commercialization game. In fact, these factors accelerate the commercialization process and increase the chance of its success.

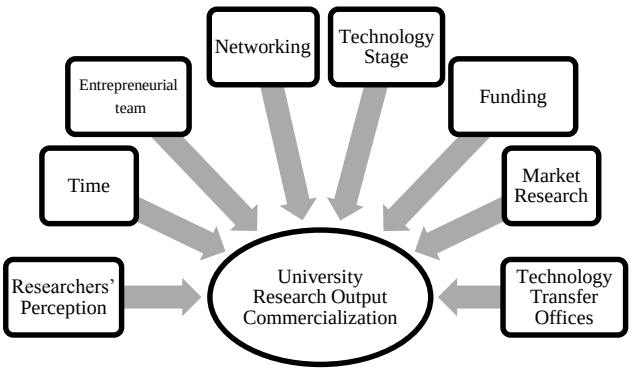

Figure 3 Successful factors of university commercialization

Therefore, based on this study university commercialization is not independent phenomenon. Several factors contribute in the success of commercialization process. Fig. 3 shows the impact of these identified factors on the commercialization of university research output.

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