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POLICIES OF DEVELOPING HUMAN RESOURCES FOR UNIVERSITY SPIN-OFFS TO MEET THE 4TH INDUSTRY REVOLUTION REQUIREMENTS

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ABSTRACT

Creating University spin-offs (USOs) is considered one of the most effective ways to transfer scientific research results and promote national science and technology resources. However, several studies have identified factors limiting their growth: a lack of management skills among entrepreneurial teams. Therefore, human resources development in general and scientific and technological human resources, in particular, are the most critical factors to promote the development of USOs. This paper analyzes some general characteristics of human capital for USOs, finds some experiences to promote USOs' human resources development in China, and then gives some recommendations for USOs of Vietnam.

Keywords: Human Resource Development, Entrepreneurship Development, University Spin-Offs.

INTRODUCTION

For decades, entrepreneurship has been a significant factor in economic growth, diversification, and social cohesion. Moreover, entrepreneurship has been a critical instrument of technology innovation. The creation of new businesses generally has positive effects such as job generation, economic and social development, and innovation. Likewise, companies created within a university environment, known as 'university or academic spin-offs', have several advantages

over other, more traditional technology transfer mechanisms such as patents. Businesses of this type are usually located close to where they are created, thus fostering local economic development; they generate revenue that benefits both the founders and the host universities. They drive changes in institutions, increasing interaction between universities and their social environments. In addition, spin-offs provide alternative job opportunities for staff working in public research centers, who often find it impossible to further their scientific careers in such organizations or even to find a job in the first place (Bray & Lee, 2000)

While the role of universities emphasizes the internal force of the university for creative innovation, the part of the science and technology ecosystem and entrepreneurship in the universities shows the effectiveness of bringing science & technology (S&T) products from those to the outside and commercialize especially the role of university spin-offs (USOs). They all emphasize the university's role in innovation and entrepreneurship: (1) Entrepreneurship and inspiration; provide high-quality human resources (2) Cooperate with businesses and capture market needs. However, currently, some obvious weaknesses of Vietnamese universities are (1) Human resources and the gap between the university and the market: graduates lack experiences, foreign languages, and practical skills do not meet the needs of businesses. The improvements in teaching curricula have been slow, pushing schools and lecturers to "not speak the same language as the market"; (2) Motivation for innovation, entrepreneurship from lecturers is still relatively low. It is difficult for lecturers to inspire their students to start businesses and support connecting resources (Calvo, 2011).

Most university spin-offs (USOs) take the form of small technology consultancies. Attracting and retaining human capital, represented by senior professionals' stock, constitutes the cornerstone of their competitive edge. However, managing such human resources is complex and requires skills that entrepreneurs do not usually have. Therefore, this article intends to research some policies for human resources that should be taken into account in Vietnamese USOs to develop, attract, and enhance the value of their human capital.

LITERATURE REVIEW OF HUMAN RESOURCE AND USOS

Human Resources

Early studies make a clear distinction between human resources and social capital: human resource refers to the knowledge and experience of individuals, whereas social capital relates to the ability to extract resources (e.g., information or financing) from the external network (Davidsson & Honig, 2003). It refers to an individual's knowledge, skills, abilities, and experiences, which increase knowledge accumulation and business understanding (Unger, Rauch, Frese, & Rosenbusch, 2011). It also can be improved through education, training, and other experiences (Kaasa, 2009). Higher initial human capital endowments at startup have been demonstrated to increase the likelihood of a new Int Entrep Manag J venture's survival (Wetter & Wennberg, 2009). Furthermore, Human resource theory argues that firms with higher human capital should better plan, solve problems, and respond to the challenges imposed by the environment in which they operate (Florin, Lubatkin, & Schulze, 2003). The contribution of human capital to new company success runs via various mechanisms. As such, human capital is considered a resource that can directly affect the achievement of a sustainable competitive advantage.

Furthermore, as human capital is the primary source of a spin-off's credibility and legitimacy, higher human capital stocks significantly improve the ability to attract resources (Packalen,

2007). In this regard, Delmar and Shane (2004) have argued that credibility and legitimacy are most critical in the earliest development stages since disbanding depends most on the perceptions of external stakeholders rather than on actual financial performance. According to Drori et al. (2009), legitimacy stems from a venture possessing advantages over others; in the earliest development stages, human capital characteristics are one of the few variables available to assess this advantage. Therefore, credibility and legitimacy stem (primarily) from human capital. Higher levels of human resources usually lead to higher earnings at a personal level, making startups founded by people with higher human capital endowments less vulnerable to financial constraints (i.e., possible constraints in firm development) (Colombo & Grilli, 2005).

University Spin-offs

Shane (2004) defines USO "as a new company founded to exploit a piece of intellectual property created in an academic institution". His definition includes three essential aspects of a USO. First, a new and independent company has to be incorporated, i.e., a new legal entity has to be formed. Second, the company's products or services are based on intellectual property. Shane noted that this piece of intellectual property does not have to be protected (e.g., by patents or copyrights) or licensed. Many spin-offs exploit intellectual property without any protection. Finally, the intellectual property used must be created in an academic institution.

Meanwhile, Pirnay et al. (2003) report that research-based spin-off companies have been defined as new ventures based on the transfer of technology or academic knowledge developed by public research organizations, focusing on the commercialization of the research results. In this context, USOs are discussed from various perspectives, from the university or firm level. Despite the increasing attention paid to the USOs process and activities, however, most authors do not give a strict and precise definition of a research-based spin-off, thus making it difficult to compare the results of different studies

In new USOs, resources are limited, and a significant part of the spin-off's value is determined by its human capital stock. Although employees—if any—make up an essential part of a firm's human capital stock, in the early stages of USOs, the venture almost always coincides with the founding team or the top management team (Shrader & Siegel, 2007). Chief executive officers (CEOs) of new USOs should understand the technology and develop the business proposition for this technology. This combination of skills, knowledge, and expertise is difficult to find in academic researchers, making them often less suited to fulfill the challenging task. Especially in new ventures, the human capital stock can be increased by making use of additional sources of human capital, such as a board of directors, advisory board, external advisors, science park managers, and in the case of USOs, technology transfer offices (TTOs) (Mosey & Wright, 2007). An additional source of humans can be obtained by attracting experienced serial entrepreneurs to strengthen the key persons (George, Gordon, & Hamilton, 2010). Recent research by Parker (2013) has indicated that serial entrepreneurs' benefits contribute to venturing to disappear over time.

Furthermore, through entrepreneurial euphoria, the pros of serial entrepreneurs are sometimes over-emphasized concerning the cons. Overall, prior research has indicated that team formation currently fails in most USOs. For example, most USO teams are too technically oriented, which increases the need to understand better the effect of human capital in new ventures on their subsequent performance.

C. The Importance of USOs

China is considered a country with the system of USOs growing very fast (10% per year) in a short time from 1987 to the present. If in 2001 China had 280 USOs, by the end of 2008, this figure would have reached 548 USOs. The total area of USOs is about 20.08 million m². It is noteworthy that over the past 20 years, Chinese USOs have created a much larger number of jobs than the United States, corresponding to 792,590 employees (2001 - 2008) compared to about 500,000 jobs (1980-2001). The calculations also show that Chinese USOs have helped increase the commercialization rate of scientific research from 25-30% to over 70%, the number of intellectual property rights increased significantly. The quality of human resources has been enhanced with the contributions of many overseas Chinese students and scholars. According to statistics, a quarter of Chinese small and medium technology enterprises come from business incubators (Tang et al., 2011).

In the USA, USOs can employ a considerable amount of people. About 280,000 jobs have been created from university spin-offs since 1980" in the U.S. economy (Perez & Sanches, 2003). A gross effect of 300,000 jobs was created through MIT spin-offs (Roberts and Malone, 1996).

In Switzerland, ETH Zurich's spin-offs created since their incorporation close to 2,500 direct jobs in 2013, and 122 of the ETH spin-offs produced revenues of 585 Million EUR in 2013 alone. Since 1992 the number of created jobs per ETH spin-off has increased from 2 to 5 assignments per spin-off in 2013 (Pinter, 2015).

The Situation of Human Resource Development in USOS

A. General Characteristics of Chinese USOs and their Human Capital

Suppose human capital is considered the stock of personal knowledge that experienced employees possess. In that case, it is possible to assert that businesses created within a university context have a significant human capital component. In China, USOs are mainly built based on tacit, uncodified knowledge; the entrepreneurs' know-how underpins the potential development of such businesses (Henning et al., 2008).

As a framework of reference for the analysis, some data relating to general aspects of Chinese USOs will be shown, as will others relating to their human capital. For that purpose, the studies by Henning et al. (2008) were taken as the reference. Respectively, those studies analyzed about 70 USOs established in some universities in China (Table 1).

Table 1.

General Characteristics of USOs and their Human Capital (Henning et al., 2008)

General characteristics of USOs		
Average number of employees		8.01
Sales / Mean turnover volume (USD)		291,972
Average balance figure		378,779
Characteristics of technology inventors		
Mean number of people that develop technology		4.5
Source knowledge area	Technical teaching	50%
	Experimental sciences	25%
	Health sciences	9.2%
Percentage of inventors who are also business founders		80%
Role of the inventor in the business	Advisor/consultant	33%
	Director	32%
	Managing director	17%
Characteristics of business founders		
Mean number of people that set up a business		3.6
Mean age (years)		33.8
Percentage of doctors or higher		20%

Percentage of businesses having a founder with prior business experience in the USO sector	59.7%		
Percentage of businesses having a founder with prior experience of setting up businesses	32%		
The main reason for setting up a business	Identifying a business opportunity		
The main barrier to growth	Access to financial resources		

One advantage that can be found from the above data is that most of the creators of technology exploited by USOs play an active role in them. Henning et al. (2008) reported that 50% of the people that develop a technology ultimately become directors of their respective businesses, whereas 33% become consultants. It proves that the characteristics of the inventors have a significant impact on a company and its management. The mean age of USOs founders is relatively young, below 40, and "Identifying a business opportunity" is the main reason for creating them. It is also possible to see that the entrepreneur group is highly qualified; 20% are doctors and higher.

However, as the main factors limiting the growth of USOs, the research points to a shortage of financial resources. The second limitation is the lack of management skills connected with businesses' intellectual capital creation. Entrepreneurs of such companies also highlight it as one of the main problems. The people who usually create USOs have a high level of technical skills, but they do not have the required training in management.

This lack of university entrepreneurs' management skills may directly affect USOs, such as poor work team coordination, the inability to meet deadlines according to the business plan, the minimal market orientation of technologies and products created, small networks of contacts, and inadequate business management. Consequently, many USOs may not achieve any considerable growth. The failure of such businesses is often due to management team problems, basically because managing a business is very different from managing a research laboratory. Issues such as these, which USOs have to grapple with, may go some way to explaining why their growth has slowed down. These above problems, which USOs have to grapple with, can be explained why their growth has slowed down

This situation suggests that human resource management in USOs is essential. Instead of investing their assets, the value of USOs is mainly determined by the perceived value of their professionals' know-how and experience. In this respect, human training capital, which includes formal and informal, in USOs' value creation processes, is fundamental. It makes it possible to assert that human capital constitutes the cornerstone of USOs when generating their competitive edge. Consequently, its absence is one of their main barriers to growth. Therefore, it is necessary to identify management policies that allow those USOs' strategies to create and retain their human capital.

B. Some Experiences in Developing Human Resources for Chinese USOs.

To develop an innovation culture, China has established universities dedicated to innovation and has been often added the words "University of Innovation", "University of Innovation and Entrepreneurship," or "University of Startup and Business Administration" within or outside of existing universities. USOs and business incubators have increased about 18% in quantity and 20% in scale every year. Meanwhile, funds for innovation and entrepreneurship inside and

outside the universities have reached 1.02 billion and 1.28 billion Yuan. More than 3 million students have participated in innovation and entrepreneurship events every year. Seminars on innovation and entrepreneurship are held at universities several times a week. In China, innovative ecosystems have been built using models of Silicon Valley (including Stanford University), Massachusetts Institute of Technology (MIT), and Israel Institute of Technical Studies (Technion). Chinese has the concept based on a fundamental principle: "If you build it, they will come." (Lee & Yuan, 2018)

The Chinese Ministry of Education has issued specific policies to support innovation and startup, in which the policy allows students one year off to pursue a startup project. In 2015, the Chinese Ministry of Education instructed all universities to provide appropriate courses with accumulated startup credits (mandatory and elective) for all students. By 2016, 82% of Chinese universities introduced compulsory and elective courses on innovation and entrepreneurship. In addition, Chinese universities have started cultivating links between universities and industry areas. Chinese universities undertake these partnerships to facilitate innovation, moving products from basic research to commercial applications. They have established technology transfer offices (TTO) to contact the industrial sector. New policies governing faculty inventions are considered a challenge in allocating government-sponsored intellectual property (I.P.) (Lijie, 2017).

C. The Current Situation of the Human Resource Development of USOs in Vietnam

Vietnam currently has some human resources policies related to human resources for entrepreneurship activities and specific provisions in laws such as the Law on High Technology, Science and Technology, and Technology Transfer. For example, Vietnam has promulgated Law on Science and Technology No. 29/2013/QH13 (date: 18/06/2013), Law on Technology Transfer No. 07/2017/ QH14 (date: 01/07/2007), Science and Technology development strategy to 2020 No. 418/QĐ-TTg (date: 11/04/2012). In terms of intellectual property, Vietnam has enacted several laws such as the Law on Intellectual Property No.19/VBHN-VPQH (date: 11/04/2012), Competition Law No. 23/2018/QH14 (date: 12/06/2018). Vietnam has promulgated the Education Law 43/2019/QH14 (date: 14/06/2019). It can be considered that these are critical efforts of Vietnam in the legal aspect to create favorable conditions for scientific and technological development and innovation.

However, these regulations are general and have not explicitly been guided. Up to now, the system of legal documents guiding the implementation of spin-off business activities is still in the process of construction or not yet completed. Therefore, implementing the law is not feasible, and entrepreneurship activities can not operate powerfully. The investment in facilities and human resources for science and technology organizations in general and USOs, in particular, has not been paid adequate attention for many years, so many organizations do not have sufficient capacity to operate under the autonomy mechanism. USOs must depend on the university; therefore, their parent organization must decide. That is why it is still tricky for USOs to operate by autonomy mechanism and not motivate the organization to operate.

Although according to Decree 54/2016/ND-CP, the state encourages science and technology organizations to change operations under autonomy mechanism, the implementation of this Decree is challenging to apply to USOs in universities. Currently, USOs usually operate on the university campus; therefore, they cannot have enough facilities to operate when switching autonomy. Moreover, human resources for USOs are not lacking, but qualifications are limited.

The reason is that universities' education and training methods are still limited for students' innovation capacity, and it will not be easy to create a quality scientific and technological staff to meet the commercialization of research results requirements. Education programs, measures, and policies to train entrepreneurship for students, lecturers, especially researchers and engineers in Vietnam, have not been available yet.

The knowledge of commercialization and its importance is new; almost nobody knows about it. There is the fact that USOs are small enterprises that do not have enough financial capability to hire highly qualified personnel and relevant professionals from outside so that they have to take advantage of the on-site human resources. At the same time, coordinating with on-site personnel will speed up the approval or evaluation procedures from the University for Entrepreneurial Activities will be faster. Due to being a new field, the experience is not much without the government's attention; therefore, human capital does not have the financial resources and opportunities for training and development.

Because of the reason mentioned above, the progress of implementing the USOs is often slow because human resources in USOs are part-time and lacking entrepreneurial spirit therefore many part-time staffs have limited time for USOs. This problem can be explained that most of these people work at the school, only part-time at the USOs, therefore the focus of this human resources is not much. One more reason is low salaries make it difficult to find professional managers. Only those dedicated to their career and passion for USOs can operate in this field. Besides that, the staff's entrepreneurship is still low because they primarily do their training task. They always think that if they fail in the USOs' activities, there is still a chance to return to their primary work, so they do not have the motivation to develop and be passionate about the entrepreneurial activities (Truong, 2019).

Some Recommendations and Policies of Human Resources Development for USOs in Vietnam

A. Recruit to Different Knowledge Areas

USOs can recruit employees with different skills from different areas. The directors of such businesses have the direct opportunity to recruit staff from the departments in which technology has been developed. They can also recruit staff from other knowledge areas, facilitating the future growth and development of such organizations.

USOs should approach university graduates and researchers in knowledge areas different from those of their founders. In this respect, including people with more entrepreneurial profiles, such as graduates or students on master's degree or postgraduate courses in Business Administration and Management, would allow a USO's lack of business skills and knowledge of the market to be overcome. Other studies such as Labour Relations, Languages and International Relations could be sources of qualified staff, who would collaborate on a USO's management tasks or internationalization processes.

B. Knowledge Retention

USOs originate from certain research groups and departments of a university, so they know their members directly. This situation is maintained over time because many of their founders keep in touch with the departments in which technology has been developed. In addition, USO founders often use their network of contacts within a university to obtain information about students or researchers in other departments. Therefore, such links with source institutions mean that USOs have prior knowledge of the potential candidates they might employ and can identify

which could increase their stock of human capital in the future. Thus, when taking on new staff, one of the significant problems is eliminated: information asymmetry.

For USOs to continue counting on universities as potential sources of employees, known directly or indirectly, such businesses and their directors should maintain links with source institutions. In this respect, the proposal is to strengthen shared facilities, the temporary employment of staff, and promote cooperation agreements.

C. Flexible Employment

This policy means USOs should temporarily employ students and researchers. USOs can learn about the fundamental skills of university members employed in them. It also allows a degree of labor flexibility and certain advantages about employing people in the future. To strengthen the use of this policy of this type, which allows doctoral students to be employed to undertake internships in businesses. It will be necessary to increase the dissemination of such policy and highlight the positive outcomes obtained from these or earlier ones. For example, In Spain, a support program called the incorporation of doctors into enterprises (IDE) ran from 1997 to 2001 and was replaced by the Torres Quevedo program for doctors and technologists. This program offers three-year subsidies when R&D staff (doctoral students and technologists) are employed by businesses, technology centers, entrepreneurial associations science and technology parks. This program aims to stimulate the supply and demand for researchers and foster the transfer of R&D outcomes and their implementation in the productive system. The impact of the program was positive. Several years after forming part of it, six of the ten doctors still had stable employment in the same business (Rodeiro, Calvo, & Sara, 2012).

DISCUSSION AND CONCLUSIONS

A. For Managers of USOs

In order to effectively manage USOs, the role of the management team is crucial to ensuring ongoing local support and funding, attracting and evaluating customers. In the future, support the development of existing customers and support the smooth operation of mature customers (mature customer businesses and others). USOs are not only theoretical but also practical. Managing USOs is not as simple as managing a business. Therefore, it requires a well-trained management team with specialized knowledge in technology, able to lead and understand the technological needs of society. The management level of university spin-off directors and managers is an essential and direct impact on the success and failure of university spin-offs.

In order to build a successful USO, the manager of the USO must be the person who has set the proper guidelines and tasks for its operation and must have a profound, specialized qualification. Good spin-off university leadership and recruiting excellent staff for the management and operation of university spin-offs. When there is a management team with specialized knowledge in technology capable of leading and grasping the needs of society, the university spin-off will have many opportunities to stand firm. Moreover, opportunities for businesses to incubate development in the technology market will be more because the manager himself will have the right direction.

B. For Experts and Officers of USOs.

The experts and officers are the leading human resources of USOs. They will be consultants and guides, helping their businesses improve their ability to attract investment capital, capture business timing, working, and management skills. Besides, USOs' staffs also need to have good professional qualifications. The experts will first be the consulting team for managers of all

issues. Therefore, a team of good experts plus talented managers will help USOs survive and develop. In addition, the new USOs are just a group of technology ideas and are considered to study and seek development opportunities based on incubation. Even after incubation, USOs cannot survive without outstanding leadership and entrepreneurship. Therefore, training human resources is one of the most critical measures for the existence and development of USOs. This training may be domestic or foreign. Officers are sent to study and learn more about USOs' experiences, especially those with similar properties and conditions. Workshops, conferences, or study sessions will be opportunities to share experiences. In addition, the spin-off university cooperates with agencies to train personnel in fields such as law, business, intellectual property. Good personnel will be the main factor in helping USOs have the right direction, helping them have the human resources to work, do the business, and find their relationships outside USOs.

Conclusion

By studying and analyzing the actual situation of USOs in Vietnam, it can be seen that the USOs in Vietnam still face many difficulties, leading to not being able to develop strongly and sustainably. The main difficulties include: legal procedures in the establishment and development are complicated, awareness of the role of USOs at all levels is limited, financial resources are ineligible. There is not much investment condition in technical infrastructure, and finally, the problem of human resources has not met the requirements. To promote the establishment of science and technology enterprises, technology incubators in universities period from 2020 to 2025 in Vietnam, it is necessary for universities and related organizations to have the best view of the vital role of science and technology enterprises in general and USOs in particular. Investment in scientific and technological human resources means to do in sustainable development, directly raising the intellectual level and strength of the nation. Scientific knowledge and technological achievements and the selection of measures to build and manage science and technology human resources, in which build and improve the system of career titles in the field of science Learning and technology are a spearhead, which will create overall strength and a source of sustainable strength.

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