LITERATURE REVIEW ABOUT UNIVERSITY – INDUSTRY COLLABORATION. A PROPOSAL MODEL FOR THE STARTUP ECOSYSTEM AT THE UNIVERSITY OF DANANG, VIETNAM

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Abstract - This article reviews the typology of university – industry links from higher to lower intensity and the benefits of the collaboration. The three different concepts of universities: Teaching University, Research University and Entrepreneurial University as well as the priorities for university – industry partnerships at different stages of economic development along them are reviewed. The article also reviews the challenge of bridging the university – industry division and what makes universities attractive as industry partners, what factors make successful partnerships. Finally, the paper suggests a partnership model which is built based on a solid inter-relationship among universities in the University of Danang (UD) and industries. The model aim is to create a healthy startup ecosystem in UD. Students having startup ideas, especially technical based startup ideas, would be the model's target. The responsibilities and rights of each partner in the model as well as the communication methods are stated. The future expansion of the model is also discussed.

Key words - university – industry collaboration; developing countries; startup ecosystem; model; UD.

1. Introduction

In recent years, there has been a significant effort from the University of Danang (UD) to increase the number of scientific publications as well as interactions with the industry. In the period of 2011-2015, the UD is in the top thirteen university with highest ISI scientifc publications in Vietnam. All university members in the UD have been actively seeking opportunity to sign MOU, hold conferences, meetings, social contacts, etc. with the industry. At UD, University of Science and Technology (DUT) and Univeristy of Economics (DUE)are two piorneers moving from traditional teaching university to research university by the year of 2020. The remarkable achievements acomplished in the past few years at UD require a thorough literature review about university and industry collaboration.

According to Rappert et al.(1999), there have been remarkable observations that universities around the world are adopting a policy of encouraging entrepreneurship and the university as an institution is moving toward a more entrepreneurial paradigm. Danang city has recently declared to become a entrepreneurial city in the future. The launch of the network Coordinating Council Danang Startup dated 26/10/2015 of the Municipal People's Commitee has expressed the determination of the city leaders in making Danang city towards entrepreneurship. Therefore, it is absolutely nessesary for the UD to promote a healthy startup ecosystem among its members and industry through out a proposal model stated in this paper.

2. Literature Review

When universities and companies collaborate sucessfully together, they create a powerful drive for innovation and economic growth. The top world-class research universities consider this strategic collaboration among the top priorities. The benefits have long been obvious to these institutions: substantial streams of external funding, enhanced opportunities for professors and graduates to work on groundbreaking research, vital inputs to keep teaching and learning on the cutting edge of a discipline, and the impact of delivering measures for pressing global challenges [1].Additionally, the combined credibility and influence of academia and industry can achieve benefical results for society more readily than when the sectors work in isolation [2].

There are many different objectives, scopes, and institutional arrangement in different types of university – industry links. Collaboration may be formal or informal, from formal equity partnerships, contracts, research projects, patent licensing, and so on, to human capital mobility, publications, and interactions in conferences and expert groups, among others [3]. Accordingto Perkmann and K. Walsh(2007), a typology of university – industry links, from higher to lower intensity is stated in Table 1 [4].

Table 1. *A typology of university – industry links, from higher to lower intensity*

High (Relationships)	Research partnerships	Inter-organizational arrangements for pursuing collaborative R&D, including research consortia and joint projects.
	Research services	Research-related activities commissioned to universities by industrial clients, including contract research, consulting, quality control, testing, certification, and prototype development.
	Shared infrastructure	Use of university labs and equipment by firms, bussiness incubators, and technology parks located within universities.
Medium (Mobility)	Academic entrepreneurship	Development and commercial exploitation of technologies pursued by academic inventors through a company they (partly) own (spin-off companies).
	Human resource training and transfer	Traning of industry employees, intership programs, postgraduate training in industry, secondment to industry of university faculty and research staff, adjunct faculty of industry participants.

Low (Transfer)	Commercialization of intellectual property	Transfer of university-generated IP (such as patents) to firms (e.g. via licensing).
	Scientific publications	Use of codified scientific knowledge within industry.
	Informal interaction	Formation of social relationships (e.g., conferences, meetings, social networks).

It can be seen on the table 1 that the lowest level of the cooporation mainly focuses on transfering knowledge in organizations through formation of social relationship, scientific publication and commercialization of intellectual property. At the medium level, the industry begins to penetrate more deeply into university. They both transfer and train employees and staff, they work closely to develop and commercialize technologies that are pursued by academic inventors. The characteristics of the rigid relationship are partnering in research, research services as well as sharing infrastructure.

University and industry has short-term and long-term collaboration. Short-term collaborations usually have on-demand problem solving with predefined results, whereas long-term collaborations consist of joint projects and public – private partnerships. Longer term collaborations are more strategic and open-ended, providing a multifaceted platform where firms can develop a stronger innovative capacity in the long run, building upon the capabilities, methods, and tools of universities [5].

There are different focus among distinct concepts of university. The teaching university focuses on training, the research university focuses on R&D, and the entrepreneurial university focuses on technology commercialization and spin-off. The university – industry partnership can happen at all of these university regimes.

Table 2. *Priorities for university – industry partnerships at different stages of economic development along the three missions of universities*

	Most developed countries	**Least developed countries**
Teaching university	Private participation in graduate programs Joint supervision of PhD students.	Curricula development to improve undergraduate and graduate students. Student interships
Research university	Research consortia and long term research partnerships to conduct frontier research.	Building absorptive capacity to adopt and diffuse already existing technologies. Focus on appropriate technologies to respond to local needs.
Entrepreneurial university	Spin-off companies, patent licensing. Entrepreneurship education	Business incubation services Entrepreneurship education

Between developed and developing countries, there are significant differences among the priorities and scopes of university – industry partnership. Poor quality of education and the lack of financial sources are the main concerns of university in developing countries. Building effective partnership in this context takes time and effort, because of the little experience in industry collaboration and limited managerial capacity in research of universities. Existing collaboration tends to be more informal and to focus on the recruitment of university graduates or staffing, interships, and consulting as shown in Table 2 [6].

Over years, academic institutions and enterprises have formed a variety of partnerships, the most popular of which include classroom and curricular activities, short-term intensive workshops, student and faculty on-site opportunities, employment opportunities, corporate-sponsored research projects, professional conferences and community organizations, presenting and publishing new methods and researches, corporate grants and philanthropic donations, advisory boards and liaison offices [3].

Partnerships need careful design, implementation, and monitoring to meet local, regional, and global needs, and to ensure that science benefits society [2]. Both universities and companies receive benefits from the collaboration: universities providing talent as well as technical based ideas, and the companies demanding them. In a sucessfull partnerships model, the role of university leadership is vital. University presidents need to make industry – university partnerships a strategic priority and communicate the message regularly to the entire academic community [1]. Additionally, research shows that the collaboration requires input at the highest level from both the company and university. It is important to build a joint steering group consisting of senior academics and company executives.

It is clear that university – industry linkage would boot up the skills development through education and training as well as the generation, acquisition, and adoption of knowledge through innovation and technology transfer. It is also critical for the promotion of entrepreneurship. The benefits can be seen in expanding the relevance of research carried out in public institutions, facilitate the commercialization of public R&D outcomes, and increase the mobility of labor between public and private sectors.

The *corporation* between industry and university is also important for fostering the skills development (education and training), the generation, acquisition, and adoption of knowledge, as well as the promotion of entrepreneurship. The benefits of university-industry linkages are wide-reaching: they can help coordinate R&D agendas and avoid duplications, stimulate additional private R&D investment (additional effect), and exploit synergies and complementarities of scientific and technological capabilities[6]. In developing countries, a research in Thailand showed that universities can improve their academic capacities if they interact with the private sectors. In the context of developing countries, universities can play an important role as an indegenous knowledge source. Fruitful university – industry linkages help local firms to import, modify and diffuse technology [10].

Industry – University linkages are important to enhance innovation also. According to Marrotta et al.(2007), there is a link between firm innovation and its

absorption capacity with research centers and universities. After analyzing the case of Chilean and Colombian manufacturing firms using data from innovation survey, they found that collaboration with university and research institutions is associated with an increase in the probability of introducing new product in Chilean and Colombian firms of 29 and 44 percent, respectively, and it can increase up to 58 percent in the case of Colombian firms interacting with research centers [9].

The long-term strategic partnerships could start at a point that allows industry to do something it cannot do itself. It should focus on university creativity and talent on enabling future innovations that can be taken to market by industry and deliver benefits to society within five to ten years [1]. It is suggested that the first step to build a good partnership is to assess the core academic strengths of the university and the core research competence of the company to identify opportunities to cooperate. Then, senior executives and university officals should work together to find out the key questions and challenges for both. The exchange of information between two parties is very important. Moreover, both need to understand the three different types of possible partnerships to select the most suitable one for the relation. These are strategic, operational and transactional partnership.

Strategic partnerships extend between five to ten years and require a broad, flexible agreement. The knowledge produced by the collaboration is likely to influence the university future research and teaching and a company strategy. Operational partners have a research project with a division or particular R&D lab and run for one to three years. They can be valuable for building ties that lead to a strategic partnerships. Transactional partnerships are fewer interactions, such as an executive agreeing to teach a course, which may lead to doing more and bigger projects together in the future. These, too, can ultimately give rise to a strategic partnership [1]. After deciding the type of possible partnership, the next step is to put the right people in charge. Universities must have people capable of building and managing partnerships. People is the most important factor that determine the success or failure of industry – academy partnerships.

It is suggested that universities must open to promote people in leading positions who are mentors and bridge-builders more than just a research pedigree. They should have a deep understanding of the two different cultures they need to bridge.

Beyond the teaching-research-entrepreneurial taxonomy, some authors have advocated for shifting the focus toward creating developmental universities which collaborate with external agents, (including firms) not necessarily with a focus on commercialization and profit-making but rather with the broader purpose of contributing to social and economic development [7]. A number of studies have been showing the factors that prevent university – industry linkages from success. Among them are the absence of long-term plans on technology development and human resource, the theory of many studies at universities and their mismatch to company needs, the lack of information about univeristy research to firms.

The absence of long-term strategy developement of many Small and Medium Enterprises (SMEs) is the most critical factor that affects this relationship in developing countries. Collaborations is costly and the returns only accure in the medium or long run, but firms seek short-term results and clear contribution to current business line [6]. A research done in Danang city, Vietnam showed that 97 percent SMEs did not have long-term plans;most have short-term plans such as week or month plans The owners usually look for short-term benefits, they do not have enough knowledge and capability as well as pay attention to long-term business plan [13]. A study done in 2009 in Thailand found that only a small minority of large subsidiaries of transnational corporation, large domestic firms and SMEs have capacity in R&D, while the majority is still struggling with increasing their design and engineering capacity. For a very large number of SMEs, the key issue is much more concerned with building up more basic operational capabilities, together with craft and technician capabilities for efficient acquisition, assimilation and incremental upgrading of fairly standard technology [10].

Normally, university researchers are not rewarded in their careers for collaborating with business. Teaching experience and publications continue to be dominant criteria in tenure track systems and salary scales, and in most universities cooperation with industry is poorly measured and not considered in tenure tracks.Partnerships between industry and university do not come naturally. It requires the effort from both sides, and the most important thing is the context – the economy, society and policy. Policymakers set the context. The role of goverment is vital [6].

In recent years, there has been a dramatic change in the way people think about collaboration between universities and industries. Before, both sides worked independently and did not see the benefits from the partnerships. In the present, The University of Danang has been working closely to institutes, companies as its long-term strategy is to become a research university. There are several memories of understandings (MOU) signed with big companies in order to collaborate on research and support students. Additionally, each university in The University of Danang is also looking for more partnerships with industries proactively. However, most of partnerships are in small scale and have little impact on students and society.

3. A Proposal Model for The Startup Ecosystem in The University of Danang

There have been remarkable observations that universities around the world are adopting a policy of encouraging entrepreneurship and the university as an institution is moving toward a more entrepreneurial paradigm [10]. As seen in the Table 2, entrepreneurial university is the next development step from research university, and the university-industry link exists in all three mission of universities. Entrepreneurial university is the highest form of the collaboration of educated students with entrepreneurship as well as established business incubation services. The UD vision to the year 2020 is to become research university in which DUT and DUE are the first two universities to complete the mission. It stressed

over time that universities need to be aware that, "the agenda has moved on from a desire to simply increase the general education of the population and the output of scientific research; ...(to a) greater concern to harness university education and research to specific economic and social objectives" [11]. These initiatives can be worked in collaboration with the industry at all three missions of universities. Therefore, a model for collaboration among the members of the UD and the industry is absolutely necessary.The important of building a university – industry partnership models for a startup ecosystem atUD is vital.

It is undoubtable that the sucessful models in developed countries are the great resources, however the context of socio-cultural environments of Vietnam needs to be considered carefully. Who is the target of the model? What are the short-term and long-term goals and how long? How many parties are involed in the model and what is the role of each party? How does the model work and what is the communication method? These are the key questions addressed in this article. The findings are based on the experience and views of senior industry executives and university officials involved in managing promising partnerships.

The model aim is to create a healthy startup ecosystem in UD. A startup ecosystem is formed by people, startups in their various stages and various types of organizations in a location (physical or virtual), interacting as a system to create new startup companies. These organizations can be further divided into categories such as universities, funding organizations, support organizations, research organizations, service provider organizations (like legal, financial services etc.) and large corporations.

In order to create a significant impact on society, it is important to have strong commitments from reputation universities, organizations joining the models. A proposal model for the startup ecosystem at the UD is shown in Figure 1.

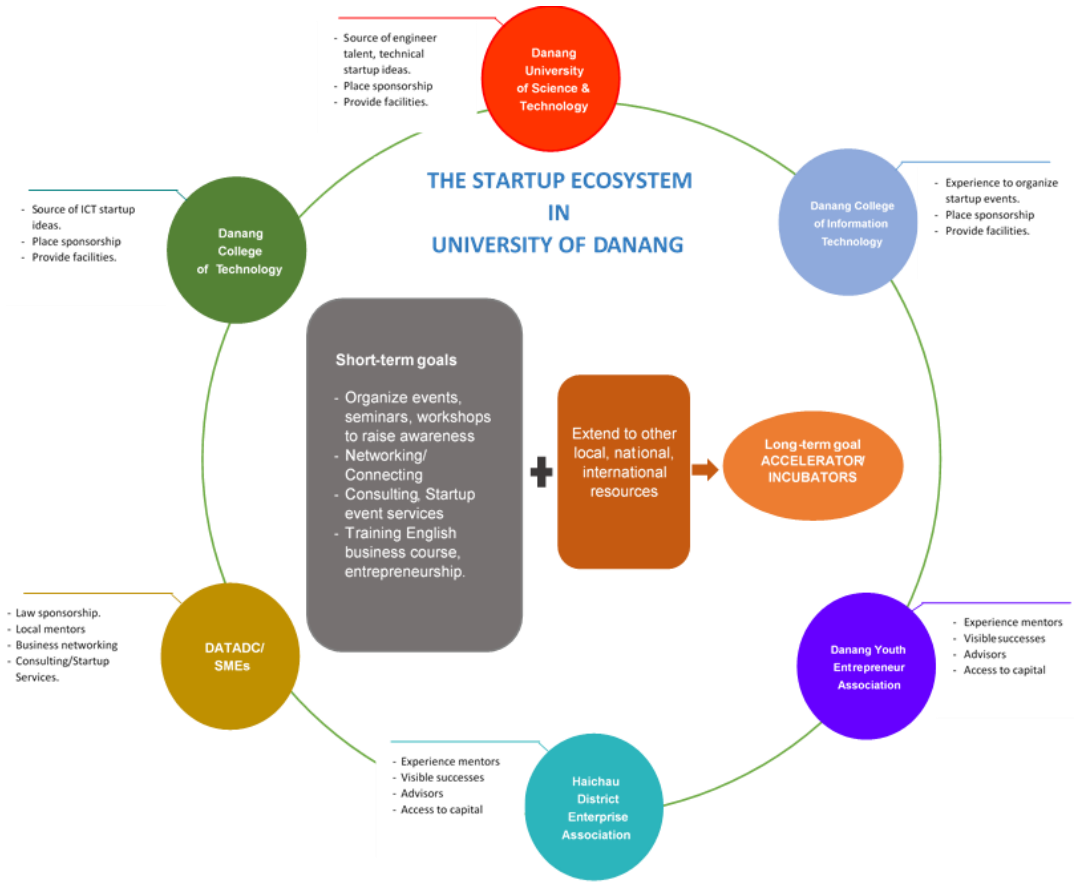

Figure 1. *A University – Industry Collaboration Model for a Startup Ecosystem inthe UD*

For universites, UD is a regional multi-level, multi-disciplinary university training human resources for the Central Area and Western Highlands of Vietnam. Engineering, technology, economics, education and foreign languages are training strengths of UD. Over the last 40 years, UD and eight members have provided the country with hundreds of thousands of technological experts, managers, educators, and experts. In the model, University of Science and Technology (DUT), Danang College of Technology and Danang College of Information Technology are chosen in order to capitalize the technological as well as innovative strengths of UD.

Among the three universities in the model, DUT is the largest university. It is one of the most important universities of technology in Vietnam as well as the only technological university in the Central and Western Highland of Vietnam. With 15,000 students, DUT is the main resource for technical based startup ideas. The College of Technology has been a well-known and prestigious career-application oriented technical vocational institution in Danang city. The College of Information Technology is a member of UD providing human resourse in IT field. Taking the advantage of being an affiliate of UD, the three organizations share commom

resources of the university. Universities play an important role in the proposal model as providing facilities as well as source of technical startup ideas. These ideas would be vital for local and national economic growth.Students and the youth with business startup ideas would receive the most benefits and supports from the collaboration.

The Danang Assistance & Development Center for SMEs is a social corporated organization which specializes on loan supports, rent, demand and supply match, business management consultants, event organizers on specialized business topics, training sessions organizers, startup activity supporters, discuss and review policies related to business and provide supporting services to enterprises in Danang. The Haichau District Enterprise Association and Danang Youth Entrepreneur Association play the roles as funding and supporting organizations.

Based on the analysis about current situation of Danang startup ecosystem, the model is divided into two stages. In the first stage, a corsortium including six members are built to raise student and society awareness about the critical role of startup. This goal could be obtained through serial activities, such as organising startup events in universities, building up a startup community, implementing training courses, creating a foundation for a favorable startup ecosystem in UD.

In the second stage, the consortium would be extended with cooperation to other local, national and international organisations and developed to become an accelerator/ incubator.The consortium will utilise all available internal and external resources to first develop startup culture, implement supporting/ training programs, suggest effective policies to systematically grow startup ecosystem in the UD so that it can drive economic prosperity for future generations In the long term, the consortium would be developed to become an incubator and benefits all parties within startup ecosystem which:

- promotes can-do", "take risks" culture to citizens.
- Introduces mentors, sponsors, promotion, networks, funds, etc. to startups.
- Helps investors access to talents, ideas.
- Develops entrepreuneurship courses and promote startup culture in educational institutes.
- Suggests authorities develop favorable, effective policies/ incentives.

The time frame for the first and the second stage is three years and five years, accordingly.Effective communication from the beginning of the partnership is vital. At the first stage, the ways of communication are monthly meetings, email and phones.During the expansion of proposed model, more regular meetings, webcasts, or even something as simple as causal coffee or drink are potential ways to help foster communication.

4. Conclusion

It is clear that university – industry linkage would boot up the skills development through education and training as well as the generation, acquisition, and adoption of knowledge through innovation and technology transfer. It is also critical for the promotion of entrepreneurship. The benefits can be seen in expanding the relevance of research carried out in public institutions, facilitate the commercialization of public R&D outcomes, and increase the mobility of labor between public and private sectors.

Partnerships between industry and university do not come naturally.It requires the effort from both sides, and the most important thing is the context – the economy, society and policy.

The collaboration between members of the UD and the industries focuses on creating a healthy startup ecosystem in the university. The partnership aims are to support students and the youth with business startup ideas, espcially technical based ideas, providing entrepreurship courses to students. In the first stage, the model goals are to raise awareness in the community through a series of events, seminars and training courses. In the second stage, the proposed model would be developed to become an accelerator/ capital venture . Communication is the potential challenge which could be seen when the model expands.

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