

IDENTIFYING THE ENTREPRENEURSHIP COMPETENCIES EFFECTIVE IN COMMERCIALIZATION OF TECHNOLOGY A CASE STUDY OF NANOTECHNOLOGY BUSINESSES

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ABSTRACT

Today, organizations around the globe are facing different threads as a result of globalization endangering their survival. Intense competition and technological advancements has put increasing pressure on businesses leading knowledge-based businesses to rely more on human resources (HR). These businesses, as a result, are trying to increase the profitability of their HRs. Businesses, and particularly entrepreneurs, active in competitive environments has come to the fact that competency of the entrepreneur has an increasing importance.

The adaptation and instant development of competency-oriented approaches and, more than anything, applying it to development programs, are the advantages of these approaches.

The main purpose of this research is the identification of the competencies of entrepreneurs effective in the commercialization of nanotechnology businesses. The present paper particularly aims at investigating the nature of competencies possessed by the entrepreneurs of nanotechnology businesses. The identification of effective competencies of nanotechnology entrepreneurs might be helpful in planning effective policies to promote the commercialization of the technology. Accordingly, using the related literatures at hand, we have tried to develop a proper framework for conducting this research. Afterwards, the research framework was designed using the data gathered from the case study and also from the interviews. The data was used to design the questionnaire.

The analysis of the data shows that competency has three dimensions including awareness, knowledge and skill. The results obtained from the questionnaire and the interviews shows that the knowledge dimension includes 4 criteria and 11 sub-criteria, awareness 4 criteria and 27 sub-criteria and the dimension of skill includes 3 criteria and 27 sub-criteria.

In the quantitative stage, the sample population of the study were selected from the managers and employees having expertise in nano businesses. Simple sampling was used as the sampling method for the study. The instrument used for gathering the data was questionnaires and the validity of the research was measured using experts in the qualitative stage. The reliability of the

questionnaires was confirmed using Cronbach's alpha as equal to 82%. Mean and Friedman test was, respectively, used to analysis the data and then confirmation and ranking the criteria.

KEYWORDS: entrepreneurial competencies, commercialization of technology, nanotechnology businesses.

INTRODUCTION

Nineteen sixties in USA is considered a challenging decade for commercialization of technology. Widespread federal investments in the development of technology transfer, increasing demand for changing the technology transfer programs and more response in the field of commercialization of technology in line with not fulfilling the industries, are considered the dominant characteristics of this decade (iturriaga and Cruz, 2008).

Entrepreneurs see the commercialization of the technology as knowing the required processes.

The relationship between entrepreneurial competencies and technology transfer processes requires competent entrepreneur to the profession (Iturriaga and Cruz, 2008). Therefore, regarding the importance and increasing interest in this trend and to administer an effective competency-oriented technology transfer, some questions challenge the mind. That's why a need to identify entrepreneurial competencies and efficacy of the individual and the business is felt. Here is the main question of the present research: what are the entrepreneurial competencies effective in the commercialization of nanotechnology businesses?

REVIEW OF THE RELATED LITERATURE

The theoretical framework of the study

Silvia Chung and Horn Mun Cheah(2009) have developed a framework or entrepreneurial competencies. The framework constitutes three elements of skills, knowledges and values. Value is the main pillar of the model. And skills include didactic capabilities, inter-personal, intellectual, personal, management and administrative. Knowledge, on the other hand, includes the subject, content, subject plan, training and education and the individual itself, and attitude include achievement-seeking, innovativeness, self-control and self-esteem. Values constitute learning ability, vigilance and attention, interest in diversity, commitment and dedication to the profession, cooperation and teamwork spirit, ongoing interest in learning, perfection and innovativeness.

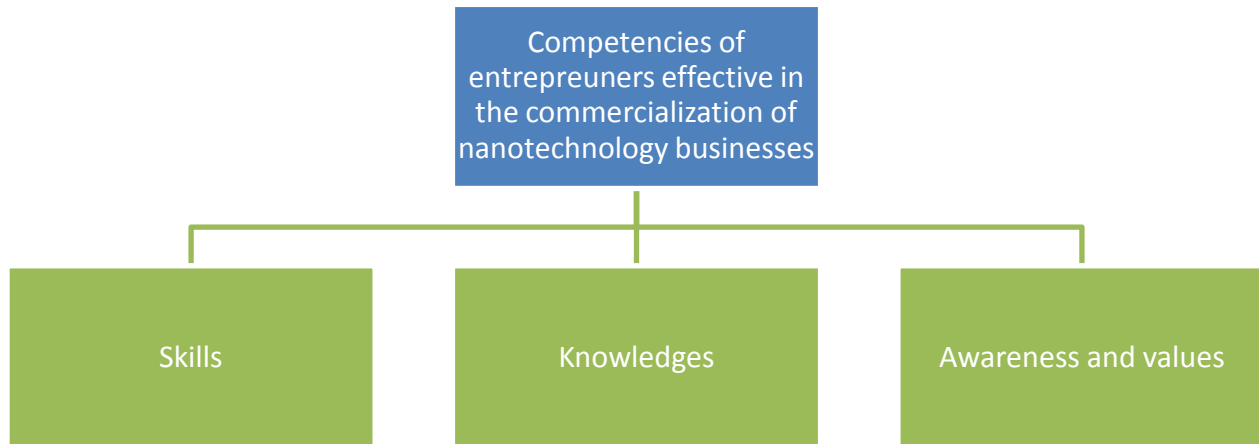


FIGURE 4-2: THE THEORETICAL FRAMEWORK OF THE STUDY

RESEARCH HISTORY

Researches conducted by Sanchez (2004) considers entrepreneurial competencies as a set of entrepreneurial characteristics required for a successful and compatible with the environment entrepreneurship which include attitude, belief, knowledge, skill, ability, personality, expertise (social, technical and managerial), thinking and behavioral orientations as well as the ability to identify the relationship between managerial skills, entrepreneurial styles and business type.

The findings of Byham and Moyer (2002) show that, regarding the unique requirements of big entrepreneurial firms, a competency-based approach is needed for the evaluation of organizational human resources. They recommend the substitution competency-based approach with the traditional profession analysis for a number of reasons: first, the behavioral set in the organization is identifiable for the promotion of the firm. Second, the prediction and identification of new opportunities is difficult. Third, entrepreneurial activities occur rarely and on an arbitrary basis. Hence, the traditional analytical methods cannot be helpful. A competency-based framework, therefore, can be helpful in developing supportive systems such as performance measurement, motivation, and communication programs for enhancing the required behaviors and actions.

Semler and Chiu (2004) argue that the more coordination between beliefs, values, knowledge and skills, capabilities and the personality of the staff, the more will be their job satisfaction and performance. The more coordination between personal traits of the entrepreneur and entrepreneurial requirements (such as establishing new firms through transferring the data into marketable items.), the more likely organization's success will be. The higher the level of the personality traits of the entrepreneur (such as self-efficacy, the ability to identify the situations, personal perseverance, personal and social assets, unique social skills), the efficacy of the entrepreneurship is increased and as a consequence the possibility of being achieving success.

Another research conducted by Barney (2010) on the effect of entrepreneurial competencies effective on the success of small businesses in the developing countries, shows that entrepreneurs

believe themselves as the creator of critical opportunities in organization. Business perspective and their personal beliefs is the ruling method in the organization. The entrepreneur should manage the internal and external resources carefully. While some resources are available in the environment, finding a way to those resources and gathering them is the entrepreneur responsibility.

In a research titled "The development of a framework based on a competency for entrepreneurial behavior among teachers", the competencies related to teachers' entrepreneurship is studied. The research literature investigates six competencies (entrepreneurial knowledge, vocational adjustment, occupational self-efficacy, innovative thinking, skill network and teamwork skills) and the results show that each competency has a meaningful relationship with entrepreneurship. Three groups of personal characteristics belong to special competencies and are effective in performance. These include a unique set of experts, knowledge and skills required for a better performance in a specific area like entrepreneurship. Knowledge is considered a competency. Entrepreneur success prediction is included in creative thinking...To develop new investments and maintain innovation, entrepreneurial competencies are considered according to organizational capabilities.

The competency-oriented approach is valuable and is a way to spread organizational entrepreneur (Schleicher, 2010).

In a study called "Human resources management in small businesses" it is argued that in an unbelievable technological advancement, HR is the key success factor for all firms and particularly entrepreneur firms (Taher, 2006).

In another paper titled "The characteristics of competency through a concept of modeling", it is argued that, regarding the fast competitive environment, today firms need to fulfill the needs of the new customers. To keep the competitive advantage, firms need to develop specific competencies. The effect of competency on performance is the ground for innovation and product development and, thus, is required for a fast improvement. Competency management aims at identification and evaluation, acquisition and development of the required competencies through teaching and developing specific skills (Taher, 2007).

Tomas Man et al. in their research "The concept of competition of between SMEs, with a focus on entrepreneurial skills" mentions that an entrepreneur with skill approach in SMEs could help the organization in competitions as well as bring about a better performance. Entrepreneurship in SMEs is the performance of a firm. Entrepreneurial skills are beyond personal traits, skills and knowledge. Therefore, as a set of capabilities of an entrepreneur has an undeniable role in successful achievement of activities. Personal and psychological characteristic as well as managerial skills and technical knowledge is mostly considered as the most effective factors in SME performance (Dahlstrand, 2007).

In a research conducted by Ennis (2008) it was shown that innovation, more than anything, is necessary for the firm survival in a changing environment and is a helpful characteristic for the business.

Findings of another research titled "The role of social entrepreneur competencies in their success" show that some of personal traits of the entrepreneur such as self-efficacy and propensity for entrepreneurship has a significant role in the success of the entrepreneur. Social competency, in addition has a key role in the achievement and the success of the entrepreneur (Selmer and Chiu, 2004).

Jens et al. (2009) in other researches show that innovativeness and entrepreneurship depend upon the leadership of competency and the correct way is possible through the competency model. The findings of these researches show that leadership of competency depends on the communication and data processing abilities and business leaders are selected through simple processes. The project presented in this research provides a simpler model for the use in business regulations and also a new attitude to competency management (Jens et al., 2009).

3. RESEARCH METHODOLOGY

The present research is considered a practical research. The data is gathered through combinational research method. In the qualitative stage we will examine the qualitative data collection in the case study. In the quantitative stage the survey method is used.

1.3. STATISTICAL POPULATION

In the qualitative stage of the research, the statistical population is experts in the technology commercialization. Expert in this research is defined an individual familiar with technology commercialization, has cooperation in, at least, three technology commercialization outputs and has teaching experience in the field of academic entrepreneurship and technology transfer. The statistical population in the quantitative stage includes managers and graduates of nanotechnology businesses.

3.2. SAMPLING METHOD

In the qualitative method the sampling was limited. It was done to the saturation level; a list of experts was prepared by the researchers, then the respondents were called and they were informed about the meeting subject. Then, meetings were held at their offices and interviews were done. Finally 18 individuals cooperated in the research and the data for research was gathered.

In the quantitative stage, since the employees and business managers were limited, the statistical sample was calculated and gathered according the sample volume estimation in unlimited population (Sarmad et al., 2003, p. 187). A hundred and fifty individuals responded. Measurement error (ϵ) in the formula which shows the precision of the estimation is 8% and certainty level 0.95%. To maximize the sample volume, p and q values were assumed 0.5. This way, the questionnaires were distributed among the respondents and finally 137 questionnaires were gathered (return rate, 91%).

3.3. SAMPLING METHOD

In the qualitative method, sampling was targeted (purposeful); the list for all experts was prepared and the respondents were told about meeting time and subject. The sampling method in the quantitative stage was random.

3.4. DATA COLLECTION METHODS

In the qualitative stage, authentic journals and library studies were used for data collection. Also, half-structured interviews with experts about competency factors affecting the commercialization of information technology were done to collect data. As multiple validation resources, documents related to commercialization of nanotechnology businesses were reviewed. In the quantitative stage, data was gathered with the help of interviews done with the managers and employees of nanotech businesses. Measurement scale in the questionnaire was the five scale Likert questionnaire ranging from "Completely disagree" to "Completely agree".

3.5. VALIDITY AND RELIABILITY MEASUREMENT METHOD

In the qualitative stage, we tried to increase the measurement validity through documentation of the data and methods during the plan and usage of quality standard methods. And the reliability was reached through consultation with experts in the area. In the quantitative stage, to measure the validity of the measurement instruments the Cronbach's alpha method was used. As it could be seen in the Table 1, Cronbach's alpha value for attitudinal factors is 0.96 (very good), for skill factors 0.80 (very good) and knowledge-related factors 0.84 (very good). The validity of the research was tested using the experts in the qualitative stage.

TABLE 1: THE CRONBACH VALUES OF THE QUESTIONNAIRE

Scale	No. of questions	Cronbach's alpha coefficient
Attitude factors	44	0.96
Skill factors	15	0.86
Knowledge factors	20	20

Data analysis in the qualitative stage was done through content analysis and in the quantitative stage it was done using the statistical mean tests and Friedman ranking.

DATA ANALYSIS (RESEARCH FINDINGS)

In this section, a comprehensive table, just the same as Table 3, is obtained for each interview. This table shows the above mentioned factors affecting the commercialization performance of academic researches.

Effective competency factors of entrepreneur in technology commercialization activities (topics, aspects and components) (researcher-designed)

Mean & significance	components	aspects	subject
3.625	Feeling and identifying the need	Innovativeness (3.87)	attitude
3.714	Product profitability		
4	Producing a valuable product		
3	Entrepreneur awareness		
3.5	Seizing the opportunity		
3.125	Doing the tasks on informal ways		
3.4	Market entrance speed		
3	Processing different ideas and creating opportunities		
3.875	Hard goals	achievement-seeking (3.24)	
3.714	Having perseverance to achieve goals		
4	Determining the business objectives by the individual itself		
3	Selecting the objective by the individual		
3.5	Consulting the experts		
3.125	Job satisfaction		
3.4	responsibility		
3	Being volunteer for additional tasks		
3.875	Average risk		
3.714	Business feedback		
4	Instant awareness of the business evaluation results		

3	Self-perception	Self-esteem (3.45)	Knowledge
3.5	Self-perspective		
3.125	What we do know about how others		
3.4	Having or lacking a feeling of self-control (life perspective)	Self-control (3.45)	
3	The belief in the fact that people are responsible for their problems		
3.875	The belief in the role luck plays in personal achievements (being fortunate)		
3.417	Previous knowledge (success and failure in commercialization processes)	Implicit knowledge (3.98)	
3.167	Previous (experience) knowledge		
4	Mental models		
3.417	Special knowledge (educations)	Explicit knowledge (3.77)	
3.167	Courses and workshops taken		
4	Technical knowledge (occupational awareness)	Personal knowledge (3.65)	
3.417	Self-study		
4	Personal actions		
	Business knowledge	Group knowledge (3.59)	
3.417	Market and business environment knowledge		
4.2	Self-control and inner discipline	Personal skills (3.45)	Skill
5	Risk-taking		
4.333	perseverance		
4	Resistance and assiduity		

3.714	Foresight management	Managerial skills (3.59)
4	Change management abilities and change-orientedness	
3	innovativeness	
3.5	Planning and goal-deterimnantion	
3.125	Decition-making	
3.4	Personal relation and negotioation	
3.714	marketing	
3.714	Financial skills and accounting management	
4	Project management	
3	Development management	
3.5	Supplying the supply chain and suppliers	
3.125	Sale management	
3.4	Control & observation	
3	Word-of-mouth relations	
3.875	Environment supervision	
3.714	Business management	
4	Technology management	
3	Interpersonal skills	
3.5	Writing skills	
3.125	Listening skills	
3.4	Organizing abilities	
3	Networking abilities	

3.875	Coaching skills		
3.714	Team-building abilities		

DISCUSSION & CONCLUSION

The literature in this area has taken different approaches to the the concept of entrepreneurial competency and its role in commercialization activities and considered different factors for entrepreneurial competency. Sanchez (2004) has emphasizes the importance of knowledge and considers the main knowledge competencies, including employees' skills, technological system, management system, and the value systems. Monie (2007) distinguishes among competencies related to market accessibility, integration and performance. Skill-related competencies and knowledge acquisition are the ability of the agency in producing, acquiring, transferring and using the knowledge gained (Jens et al., 2009). R&D has a key role in creating these competencies because it can facilitate external knowledge acquisition and extraction. Technological development in the agency is greatly affected by the ability of the agency in using the knowledge resources. These external resources could be obtained from rivals, universities or research institutions (Lockshin et al., 2009).

All in all, given the above competency definitions in the literature, we can take competency as having skill in deep understanding of scientific principles as well as production capability, acquisition, extraction and transfer of new knowledge (technology) and using it. This knowledge might be implicit in people and the results of it get incarnated in the processes and instructions. Finally, a comparison between the present research findings and previous researches shows that researchers in this area have more in common; the most comprehensive categorization, however, is the one by Ennis (2008) which is used by Wang et al. (2004).

We need to mention that other scholars like Lockshane et al. (2009) have also taken advantage of these aspects. And the present study covers most of the dimensions of competency.

SUGGESTIONS

In the end, since the present research is considered one of the first studies conducted on the entrepreneurial competencies in the commercialization of technology, the suggestions below are given with the hope to develop and deepen this part of the knowledge:

Further suggestions for scholars:

1. Doing exploration with the help of other qualitative strategies of the research.
2. Conducting case studies about businesses created in the other knowledge-based areas such as bio.
3. Applying the research findings to independent businesses and developing a comparative chance.

4. Planning performance measurement systems for measuring the entrepreneurial competencies effective in commercialization activities and presenting policies in line with organizational integration.

SUGGESTIONS TO POLICY-MAKERS

In addition to theoretical suggestions mentioned above, some practical suggestions are given for nanotechnology managers and policy-makers:

1. Improving these aspects and criteria in active entrepreneurs in the area of nanotechnology.
2. Supporting competency systems and attempting at implementing it to help entrepreneurs.
3. Reducing the negative environments related to competencies and identifying the strengths of the competencies as well as presenting comprehensive plans to improve them in nanotech businesses.
4. Supporting managers and entrepreneurs to reach positive objectives in the long-term
5. Spreading the aspects of competencies through identifying best practices in nanotech businesses and motivating entrepreneurs to apply the practice.

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