

New conceptual Model of Technology Entrepreneurship Process in Nano-food Science based Technological Firms in Science and Technology Parks

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Abstract

Nowadays, the uncontrolled population, decreasing of food resources and growing need of countries to supply food has caused that technological entrepreneurship researchers *have tend* to research about the new product development and technology entrepreneurship process. In the current highly competitive entrepreneurial environment, technological entrepreneurship process is called as the effective factor in the world markets. The complexity of the actors in competitive markets has forced firms' managers to understanding of the effective determinants that effect on technological entrepreneurship process. In this article, we investigate the effective factors of technology entrepreneurship in Science based technological firms that are settled in Science and Technology Parks and then eventually offered a new conceptual model of technological entrepreneurship process. The qualitative data was collected through interviews and applied methodology is adapted from in-depth interviews with 18 academic experts and managers of technological SMEs, policymakers and STP managers of active in food industry until theoretical saturation state achieved. The gathered data was analyzed using axial and open coding methods. The results show that the determinants of technology entrepreneurship process in active science based technological firms settled in Science and Technology Parks includes of five main factors and twenty and six axial factors. The main factors are consisting of organizational, external, institutional, technological and individual factors that are shown in new conceptual model of technology entrepreneurship process. The results of this paper can be used for the optimization of technology entrepreneurship process of science based firms of STPs active in food industry in the world countries.

Keywords: Technology Entrepreneurship Process, Food Industry, Science Based Firms, STP

Paper Type: Research Paper

Introduction

Establishing of science and technology parks (STP) is followed by the formation of the proper building infrastructure that will form the park basis, as well as accompanying infrastructure facilities in which the professional people would live and spend their time, and so create the environment to live and work in. The science and technology park is used to describe various efforts to stimulate the development of entrepreneurship through the establishment of knowledge-based small and medium-sized enterprises. The main goal of science and technology parks is that join to the economic and intellectual resources in the region in order to improve and enhance the existing companies' business conditions and to concentrate and gather knowledge in one place and apply them best form (Stanković, 2009).

Today's, the ever-increasing need of communities to supply food and the inadvertent population growth and reduction of food resources are one of the issues that have drawn more attention by policymakers, scholars, and researchers. With respect to the world population rising trend, shortage of foods, epidemics of diseases and the inflicted damages to environment have threatened human's future and at the same time demand for consuming the processed foods is going to increased (Braun, 2007). The shortage of lands for cultivation of grains and the world food rising price have caused creation of several serious concerns for the policymakers. In 1950, world population was about 2.5 billion and this figure reached to 6 billion at the beginning of twentieth century and according to the predication of UN, world population will reach to 11 billion by 2050. The deficit of food reversible resources in some countries on the one hand, and population rising trend on the other hand, will expose the countries to new crisis in the future (Iqbal & Merwe, 2009). The current trend of population increase and rising demand for high quality foods require 250% of the current food production at least and this quantity may not meet the given need with respect to world rising population in the future (Asia food information center, 2001). During ten recent years, human has encountered serious problem of food crisis so that population trend in the world as well as Iran has increased growingly the need for providing foods (Ghanbarzadeh et al, 2010). Thus, one of the serious problems for the future of food industries in developing countries is the mass supply of healthy with high quality that possesses nutrient appropriate value (Schaffnit, 2009). One of the new methods of increasing the food safety and secure production is using nanotechnology in the food industry (Joseph&Momison, 2006). The development of nanotechnology in the food industry is in its infancy when compared to other industries. In 2007, global market of nanotechnologies in food and beverage industry was estimated at 105 million US\$ that was generally in packaging section and is predicted to grow to over 135/2 billion US\$ until 2015 (Nanoposts report, 2010). Figure. 1 presents the revenue from sale of food and beverage products based on nanotechnology until 2015. The concept of "technological entrepreneurship" as a strategy for maintenance and excellence of sustainable parameters of competitive advantages in organizations and businesses has drawn researchers' attention (Tajeddini, 2010). Technology entrepreneurship lies at the heart of many important topics, including about launching and growing firms, regional economic development, Organization, risk tolerance of technology based on business, selecting the suitable stakeholders to take ideas to markets, and educating engineers, managers and scientists (Bailetti, 2012).

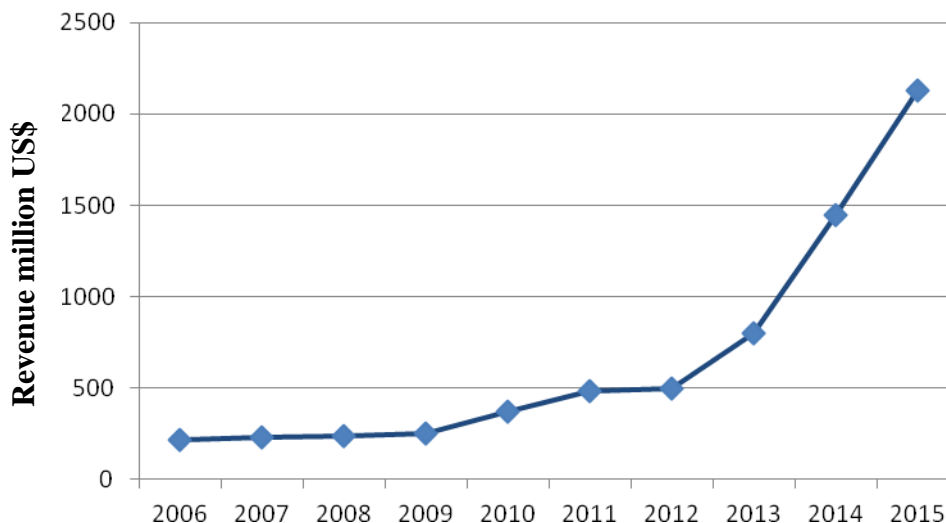


Figure1. Revenue from sale of food and beverage products based on nanotechnology (Nanoposts report, 2010)

Technology entrepreneurship has the key role for creation, growth, development, mature of technological science based SMEs active in nano-food industry. It is a tool that facilitates success in individuals, firms, regions, and nations (Bailetti, 2012). The main purpose of this article is "identifying effective factors of technology entrepreneurship in Science based technological firms that are settled in Science and Technology Parks and then eventually offered a new conceptual model of technological entrepreneurship process"

Theoretical Bases and Research History

Nano-food industry:

Food industries is one of the foremost industrial sectors in the countries, which interrelated to nutrient immunity of community members and with respect to the ever- increasing advancement in the fields of foods production, distribution and processing, increasing security level of nutrients may also possess importance in this regard. One of the new methods of increasing food is using nanotechnology in food industry (Joseph and Momison, 2006). Nanotechnology is a scientific deep horizon with high potential in manufacturing of products and processing new techniques (Emamifar and shahedi, 2006). Nanotechnology can be introduced as one of the emerging technologies in the today's world. Term "nano" was coined by Norio Taniguchi, a professor in Tokyo University of Science in 1974. He used this term to describe making some accurate materials and devices in which their size variations are at nano-meter level (Taniguchi, 1974). Nanotechnology can be defined as the science and engineering involved in the design, synthesis, characterization and application of materials and devices whose smallest functional organization in at least one dimension is on the nanometer scale (Sahoo et al, 2007; Sahoo, Labhassetwar, 2003; Emerich&Thanos, 2003; Weiss et al., 2006).

Along with rising interest of scientists, governments, and private sector in investment in this field, nanotechnology application and commercialization trend has been accelerated further and those governments and trading units, which could not innovate or use these technologies, will be doomed to failure and they will be omitted soon from competition scene (Warad and Dutta, 2006). At present, several newly- established and leading enterprises are active in the field of development and commercialization of nanotechnologies throughout the world (Oriakhi, 2004). Nano science and technology growth in Iran has dramatically increased and according to national nanotechnology council of Iran, it now stands 9th in the world and 1st in the Middle East in the field of nanotechnology. Nanotechnology concepts may provide a logical framework for developing perception of reactions and self- impressed behavior in nutrient elements at small scale. This may effect on structure and biological active properties of nutrients at large scale. Progress in trend of producing nano-structures and nano materials with appropriate formulaic properties may provide the possibility for production of stable nanoparticles with application in food industries and the affiliate industries. Nano has led to exerting changes in nutrient processes, design of modern techniques for production and reservation of healthy food as well as packaging foods and a method for improving food taste and color (Emamifar and shahedi, 2006).

Nanotechnology has numerous *applications* in food *industry*, Some of which includes disinfectant, antimicrobial surfaces, producing portable laboratory instruments, nano-sensors, biosensors, detection of nucleic acids or quality control metabolites and safety food such as identify pathogens in food, use of proteins for combination with other minerals to create new materials, use of Nanofiltration systems in food industry for selective passage of materials on the basis of shape and size, Nanocapsulation of various odors and flavors in nutrients for controlled release odors and flavors in food and packaging foods (Rashidi& Khosravi-Daryani, 2011; Valdes, 2009).

Science and technology Parks

The concept and term of Science Parks first emerged in the U.S. during the early 1950s when Stanford Research Park and the Research Triangle Park were established. A Science Park is designed to stimulate the formation and growth of knowledge-based businesses and other organizations normally resident on site (Ylinenpää, 2001).

As the presently most cost-effective business model that is based on knowledge and exchange of information, there are science and technology parks being establish everywhere in the world. Small investments can be returned through the creation of appropriate investment climate, which can spread very fast to the entire region and even the entire country where the park is located (Stanković, 2009). The main aim of technological parks is to ensure a joined environment, which accelerates interaction and communication between resources, ideas, people and facilities. This occurs between companies and big research organizations, for instance the university (Prodanet al , 2004). A science and technological park is a modern method of gaining new technological and applied knowledge and unifying the existing information at the local, organizational and structural levels. It offers a general solution where technology centers operate cooperatively with formed middle-sized and small Enterprises.

The goals of technological parks are consist of Forming of technologically innovative enterprises which are guaranteed infrastructure and appropriate working conditions due to the informational and consulting services, Connecting science with industrial usage and other fields, Development of economy by keeping and incorporating skilled workers and experts in addition to create interesting and creative jobs, To provide consulting services and create new technologies (Prodan, 2007), Development of technical faculties belonging to the University in the region.

Employment of larger number of young professionals and skilled workers who will be motivated to be in the region, Encouraging innovation and creativity and establishing and developing a favorable economic environment, Creating and developing the economy based on knowledge and innovation (Stanković, 2009). The services offered by technological parks can be different. However, the most frequent ones are Co-financing of business premises, Prestige, Possibility of informal contacts, General and administrative services, Consulting services, Entrepreneurial training, Funds (Prodan, 2007).

Innovation and optimization in the food industry:

The aim of each future-oriented company is to successfully develop and introduce new products and services to the market. Innovation is a broad and multi-dimensional concept, and can be described as the capacity to innovate, also in the future, along the whole innovation process of ongoing learning, searching and exploring, resulting in new products, new processes, new forms of organization and new markets (Lundvall, 1995; Kühne et al, 2010). Nowadays, innovation is an essential strategic tool for SMEs to achieve competitive advantage (Avermaete, Viaene, Morgan, & Crawford, 2004; Gellynck, Vermeire, & Viaene, 2007; Murphy, 2002; Kühne et al, 2010). Food companies are mainly oriented to the innovation process and use new technologies developed by high-tech industries (Capitanio et al, 2010). Most product innovations in the nano-food industry are radical or Incremental. This may be related to so-called consumer inertia that is to conservative consumer behavior to new food products (Galizzi & Venturini, 2008; Grunert et al., 1997). Indeed, innovation in the food industry is a rather complex process and can include different parts throughout the food system, from the development of new ingredients to the formulation of new food products, from the development of methods of food preservation to new ways of packaging. In addition, each firm can be involved at different stages, from basic research up to market penetration with new products to gain competitive advantage over other firms. In this background, the innovation pattern at the firm level is the result of factors that can be analyzed based on two different perspectives. Firstly, innovation can be analyzed as a process of development and change (Grunert et al., 1997; Teece, 1996). In this contents, the innovative process is directly influenced by the level of expenditure, by the method R&D is carried out and by the technological characteristics of the innovations, such as the degree of uncertainty related to their effectiveness and to market success, the level of knowledge, the degree of assignability of innovation, and the capacity of know-how within the organization (Christensen, 2008; Christensen & Lundvall, 2004; Teece, 1996). Secondly, innovation can be studied as the firm's ability to satisfy the needs and demands of its potential customers, using its resources, skills and capacities. In hence, innovation is related to the market orientation and marketing

activities. In the food industry this approach to innovation is especially important and with helping of new technologies that allow firms to respond to higher quality standards, with new ways to present more traditional products, with product diversification, that is the increase in the set of available goods, with new and different functions to be embodied in food products (Capitanio, 2011).

Technological Entrepreneurship

The field of technology entrepreneurship is in its early stages when compared to other fields such as economics and management. Bailetti (2012) introduced that technology entrepreneurship includes Organization, management, and risk tolerance of a technology based business, solutions for searching of problems, formation of a new technology venture, Methods in which entrepreneurs find resources and structures to exploit emerging technology opportunities, shared efforts to clarify vague data, joint understanding to maintain technology efforts, and resistant, coordinated effort to perform technological change and he believes this process is an intermediary that is distributed across different kinds of factors, each of which becomes involved with a technology and, process, creates inputs lead to transformation of an emerging technological path (Bailetti, 2012). KamaruDin & Sajilan (2013) stated that the effective factors on development of technological entrepreneurship process are consist of different factors such as Marketing (promotions, marketing, networks, collaborations and diversification), Management (business location and talent pool), Technology (hardware, software, content quality and intellectual property) and Entrepreneurship (entrepreneurship skills, business know- how, government assistance, access to financial resources). Pathak, et al., (2013), showed that Individual attribute, intellectual property rights, entrepreneurial behavior, foreign investment, and technological adoption effect on technopreneurship development. Burgelman (1996) deems technopreneurship is consist of commercial and technical dimensions, where technical dimension consists of research, development, inventions, innovation, and discovery of new technologies and the commercial dimension comprises of managerial capabilities, market development, product development/ process (Burgelman, 1996). Technology entrepreneurship is best understood accordingly, as a co-production phenomenon that draws from a team of specialized individuals from multiple fields, some or all of whom become embedded in the technology path they try to shape in real time (Garud and Karnoe, 2003). Shane and Venkataraman, (2004) defined technological entrepreneurship as the processes by which entrepreneurs gather organizational resources and technical systems (Shane and Venkataraman, 2004). Dorf and Byers (2005) explained technological entrepreneurship as a way of business leadership that involves identifying high-potential, technology-intensive commercial opportunities, gathering resources such as talent and capital and managing rapid growth and significant risk using principled decision-making skills (Prodan, 2007). Technological entrepreneurship is innovative application of technical science and knowledge individually or by a group of persons, who create and manage a business and take it financial risk in order to achieve their goals and perspectives. The engineers possess high technical skills in this regard but they often enjoy few skills in business and in terms of entrepreneurial thinking. He illustrated that effective factors on technological entrepreneurship contains universities, organization and enterprises, capital, market and customers, government

and advisers and finally new knowledge based companies (Prodan, 2007). Petti and zhang (2011) categorized the effective factors on technological entrepreneurship capabilities in three components, which are namely entrepreneurial, managerial and environmental component that evaluated the creation of value by technology and also they are related to private investors, talented individuals, education institution and value creation by business. Technological entrepreneurship is to invest in a project that gathers and mobilizes expert members with heterogeneous assets, which are related to advancement in scientific and technological knowledge, in order to create and acquire value for an enterprise (Bailetti, 2012). Table (1) is shown a summary of literature about the effective factors that is affecting on technological entrepreneurship process in technological firms.

Table 1. Summary of literature about the effective factors that is affecting on technological entrepreneurship process in technological firms

Researcher(s)	Year of publication	Effective Factors of T.E. (Technological Entrepreneurship) process
KamaruDin and Sajilan	2013	The effective Factors of TE development process are as follows: Marketing (promotions, marketing, networks, collaborations and diversification), Management (business location and talent pool), Technology (hardware, software, content quality and intellectual property), Entrepreneurship (entrepreneurship skills, business know-how, government assistance, access to financial resources).
Pathak, Xavier-Oliveira and Laplume	2013	Individual attribute, intellectual property rights, entrepreneurial behavior, foreign investment, and technological adoption.
Petti and Zhang	2011	Organization, institutes, external networks, and policy factors
Antoncinc and Prodan	2008	Government, universities, clusters, technological parks, Prestige, Corporations , Market/customers, and Advisors
Peng and Zhang	2008	Discover and exploit market opportunity of technology, exploitation of human resources and financial resources, motivational factors, policy, and innovation.
Chorev and Anderson	2006	Strategy, marketing, Financing, management, product, technology, and Entrepreneur.
Shane and Venkataraman	2003	Organization resource, technical systems, strategy for accessing opportunities in entrepreneur firms.
Preston	2001	Attitudes, management talent, patents, investors, flexibility, clusters, management team, motivational factors, and intellectual property.

Conceptual model of research:

The basic theoretical framework of this paper as shown in fig.4 that is extracted by (Petti & Zhang, 2011) conceptual framework.

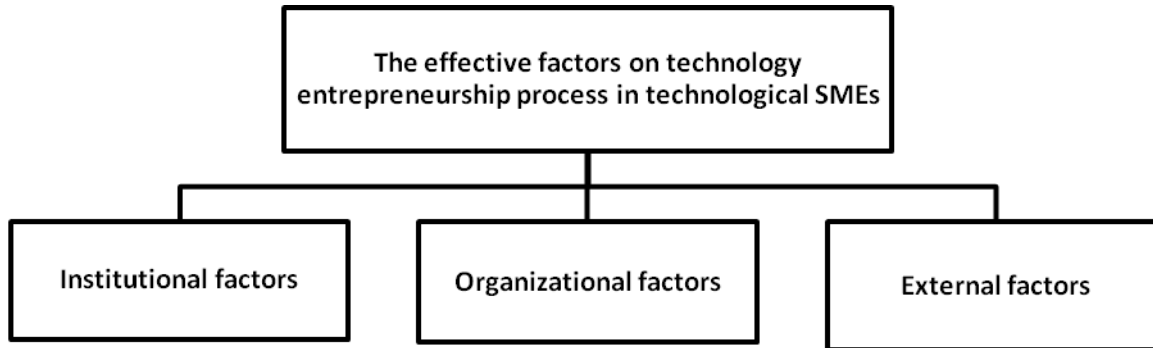


Figure 2.The conceptual model based on studies of Petti and Zhang (Petti& Zhang, 2011)

Methodology

Qualitative analysis

In this article to conceptual the process of technological entrepreneurship in active small and medium nanotechnology enterprise in the field of food industry, qualitative analysis method was adopted. The method of determining sample size at interview stage is based on snowball sampling technique and conducting interview with experts up to theoretical satisfaction (saturation) step and the logic for adequacy of data collection is purposed as the data perfection level. In this method, the given experts were elected by comments from other expert members that had several positions in their occupational field (Hamidi zadeh et al, 2006). The other advantage of this type of sampling technique is in that with a chain- like movement within a social network it searches for the experts (the responsible professors and specialists that are involved in this matter) who are involved in the given subject and they may not be found during random sampling (Heckathorn, 2007) and this process is continued until the researchers infer that data were saturated. With respect to time and available sources, if interview is intended to explore and describe ideas and attitudes of interviewees then 15 ±10 samples could be used for interview (Kvale, 1996). Given this objective some interviews were conducted with the presence of nine academic managers and professors who were knowledgeable to technological entrepreneurship in nano- food industry, which are presented in table 2.

Table 2: Statistical sample of interviewees of effective determinants of technological entrepreneurship process in Nano- food Science based technological firms in Science and Technology Parks

Interviewees	Education	Number of sample individuals
Members of academic who are working in science and technology park in nano- food science	Ph.D	6
Policymakers of nanotechnology	Ph.D.	5
managers of nano- food technological SMEs	5 Ph.D. , 2 M.S.	7

After the end of eighteenth interview, the researcher concluded that interviewees' information has become iterative and gone to the saturation level, therefore, it did not require continuing interviews. Then by using dimensional- inductive coding technique, the main and axial effective factors of technological entrepreneurship were derived in the field of nano- food industry.

As a result, 26 open codes were identified in the framework of 5 main codes, after conducting open and main coding of the resultant data from interview with experts. The given results were compared with the findings from other researchers based on Table 4 and it was characterized that results of researcher's study approved the findings in this paper. As it observed in Table 3, factors of first level are main code and factors of second level are open code and 5 groups of organizational, environmental, individual, institutional, and technological factors effect on technological entrepreneurship in nano- food Science based technological firms of Science and Technology Parks. The organizational effective factors on technological entrepreneurship include seven dimensions i.e. Infrastructures and resource organization, organizational strategies, management and leadership of organization, Organizational process, knowledge management, internal networks of organization at last experience and background of firms. External factors have six dimensions including technology development legislations and policies of government, market, capital situation, organizations and rival companies, intellectual Ownership registration Organizations, standard and License Issuing organization, and external organizational networks and nanotechnology supply chains. The institutional factors have five dimensions comprising of academic institutions, counseling centers, Guild Institutions, financial sponsor institutes for technology development, governmental institutions, private institutions, Non-profit institutions, and related institutions. In this paper we could find that individual factors have five dimensions including Demographic Characteristic, Individual Experience & skills, Psychological Characteristics, individual's Motives, and Entrepreneur's Personal Networks that effect on technological entrepreneurship in technopreneur firms in nano-food industry especially in Science and Technology Parks SMEs. And finally, the results has found that the new factor, "technological factors", comprise of three dimensions of technological readiness level

(TRL) and scope of technology, and type of innovation and Level of technology The derived results from interview are also given in the following table (table 3).

Table 3: A sample of coding the effective organizational factor on technological entrepreneurship process

main Coding Concepts	Open Coding Concepts	Verbal Statement of Interviewees	Interview Code	Frequency
organizational factors	Infrastructures and resource organization	Organizational infrastructure consists of two parts: hard and soft. The presence of suitable space in R&D plays a significant role in innovation of nano-food industry and also exiting of suitable places and equipments may be effective on safety and hygiene of food. Organizational technology and human resource are important in development of technological entrepreneurship. Use of Efficient and educated and elite people in Organizational human resource could increase the level of development of technological entrepreneurship in nano- food industry. Finance and capital resources could not be ignored in nano- food industries	I ₁ , I ₂ , I ₃ , I ₄ , I ₆ , I ₇ , I ₈ , I ₉ , I ₁₁ , I ₁₃ , I ₁₄ , I ₁₅ , I ₁₆ , I ₁₇ , I ₁₈	15
	Organization strategy	Market strategy and market orientation are considered as determining factors in development of nano- food industry. Most of food industrial enterprises may take reverse- engineering strategy and smart copying that has been highly accountable to their requirements.	I ₁ , I ₂ , I ₃ , I ₄ , I ₅ , I ₆ , I ₇ , I ₈ , I ₉ , I ₁₀ , I ₁₁ , I ₁₃ , I ₁₄	13
	Management and leadership	A type of management, which is experiential and scientific based and	I ₁ , I ₂ , I ₃ , I ₄ , I ₅ , I ₆ ,	14

		creating value, will play crucial role in developing technological entrepreneurship in nano- food industry that is related to food immunity.	l ₈ , l ₉ , l ₁₀ , l ₁₂ , l ₁₄ , l ₁₅ , l ₁₆ , l ₁₇	
	Organizational Process and	R& D process should be performed for developing new product in all organization but it has a symbolic role in small food companies and it plays significant role in parent companies.	l ₁ , l ₂ , l ₃ , l ₄ , l ₅ , l ₆ , l ₇ , l ₈ , l ₉ , l ₁₀ , l ₁₂ , l ₁₄ , l ₁₅ , l ₁₆ , l ₁₇ , l ₁₈	16
	knowledge management	Knowledge management is The first priority for developing for technological entrepreneurship, and also creation, protection, development and publish of knowledge can improve this field.	l ₁ , l ₂ , l ₃ , l ₄ , l ₆ , l ₇ , l ₈ , l ₉ , l ₁₀ , l ₁₁ , l ₁₃ , l ₁₅ , l ₁₆ , l ₁₇ , l ₁₈	15
	Organizational Internal Networks	The specialized social networks and Social virtual networks may be effective in technological entrepreneurship in nano- food industry.	l ₁ , l ₂ , l ₃ , l ₄ , l ₅ , l ₆ , l ₈ , l ₁₁ , l ₁₂ , l ₁₃ , l ₁₄ , l ₁₇ , l ₁₈	13
	Organizational Experience and background of firm	Despite of organizational experience in technological entrepreneurship field, the supportive organizational policies, social capital and team working of technological entrepreneurship will have better performance in food industry.	l ₁ , l ₂ , l ₃ , l ₅ , l ₇ , l ₈ , l ₉ , l ₁₁ , l ₁₂ , l ₁₃ , l ₁₄ , l ₁₅ , l ₁₆ , l ₁₇	14

After axial and open coding, effective factors on technology entrepreneurship process in Nano-food Science based technological firms in Science and Technology Parks are shown in table4.

Table 4. Summarized of main and axial coding factors

Main factors	Axial factors
organizational factors	Infrastructures and resource organization
	Organization strategy
	Management and leadership
	Organizational Process
	knowledge management
	Organizational Internal Networks
	Organizational Experience and background of firms
Institutional factors	University Institutions
	Guild Institutes and Counseling Centers
	Financial Sponsor Institutes for Technological development
	Governmental institutes
	Non profit institutes, private and related institutes
External factors	Government
	Market
	Capital
	Organizations and rival companies
	Organizational external networks
	Intellectual Ownership Registration Organizations, Standard and License Issuing Organization
	Technological factors
Technological Readiness Level (TRL)	

	Level of technology
Individual factors	Demographic Characteristics of SMEs manager
	Individual Experience & skills of entrepreneur
	Psychological Characteristics of entrepreneur
	Individual's Motives
	Entrepreneur's Personal Networks

DISCUSSION AND CONCLUSION

In this article, effective factors on technological entrepreneurship process in Nano- food Science based technological firms in Science and Technology Parks are evaluated, and eventually with using the results of the study offered a new conceptual model of technological entrepreneurship process in this field (fig.4) that includes five main factors and twenty six axial factors. The novelty of this paper is identification of two new factors, Technological and individual factors that they are defined as main effective factors on technological entrepreneurship process in in Nano- food Science based technological firms in Science and Technology Parks. These factors is considered as minor factors in previous researches. Individual factor includes demographic characteristic, individual experience and skills, psychological characteristics, individual's motives and entrepreneur's personal networks has the most effect on technology entrepreneurship process in Nano- food Science based technological firms in STP and individual factors effects in large enterprise is limited to management team of the firms. The results from literature interview showed that, the personal experience, educations, need for achievement, spirit of team work, need for independence, risk taking and the development of personal networks can be as the effective factors on the development of individual factors in technological entrepreneurship in the field of nano- food industry in STP. Paper results signify that motivational and psychological factors of the technological entrepreneurship are the key driver of success (prodan, 2007). Entrepreneur must develop own personal social networks for achieving success and accessibility of resources which enhances the survival and growth potential of new firms (Liaoa & Welsch, 2003) and, because of that, the personal social networks of entrepreneur are very important and they play a positive role in the development of entrepreneurship. The other effective factor on technological entrepreneurship is technological factor. This factor has been mentioned in this investigation at three levels of innovation type and technological readiness level, field of technology and level of technology. This factor has been considered as one of the minor factors in the previous studies; however, it is purposed as a major factor in this paper. Research results suggest that competitive advantage of active technological entrepreneurial enterprises in nano- food science in STP form based on two types of gradual and radical innovations. Similarly, the created Technological Readiness Level (TRL) in this area may have nine levels ranged from idea to mass production and sustainable products. External effective factors on technological entrepreneurship in Nano- food Science based technological firms in STP consist of

governmental factor, market, capital, organizations and rival companies, intellectual ownership registration organizations, standard and license issuing organization, and external organizational networks. Legislation, policies and supportive programs of government can facilitate technological entrepreneurship or hinder it in society. In prior investigation has mentioned about external factors. The government must hasten the formation of enterprises and stimulate the growth of SMEs. The development of SMEs can be enhanced by (1) macroeconomic policy, particularly a stable economic environment; (2) legislation which lays down desirable conditions for SMEs; (3) presenting support aimed at solving problems of SMEs and (4) boosting businesses and entrepreneurship and developing the entrepreneurial culture. The government must merge three crucial aspects if the support for the firms is to be successful: unity of strategy or policies, organizations and the service programs (Glas and Psenicny, 2000). In order to, reach a favorable ratio between the cost for the support and its effectiveness, it could be better government declare the aims of its policies clearly, and acceptable programs in a definite time frame and appoint effective mechanisms for conducting these programs. It is recommended that the government organize kinds of support which develop business environment which motivates technological entrepreneurship, simplification of procedures and tax cuts, development of new units, access to financial sources, information, consulting and guidance, help with technical and technological problems, links between SMEs and large companies, and the development of distribution networks and support with internationalization of business. It is advisable that the government offer support for development of technological entrepreneurship by helping private firms with favorable loans, tax cuts, favorable amortization costs, nonrefundable employment benefits and low costs for firms wishing to buy or rent business space and equipment, and also by developing business infrastructure: special financial institutions, chambers, technology centers, incubators, business zones and the rest.

Another effective factor of technological entrepreneurship is institutional factors. Meanwhile, one can imply some related institutions such as nanotechnology development headquarters in this field. These institutions can make people familiar with this industry more than ever by holding nano- food technical markets and thereby increase the capacity for attraction and elasticity of technology and its market and prepare ground for new idea to open technology oriented enterprises in nano- food industrial field. Of other effective institutions, which have been also implied repeatedly in previous studies, it is role of universities and counseling centers. Universities and other education institutions are an important source of new scientific knowledge (Lofsten and Lindelof, 2005). Nowhere is scientific discovery more prominent to new venture creation than university incubators and university centers. All the universities whether public or private, Science & Technological Parks and academic researches centers for improving the technological entrepreneurship regarding design and the development of new product as well as incubators and creation of social networks and scientific association inside these institutions may serve as an effective factor. The establishment of a university incubator is a popular policy aimed at improving venture creation. It provides entrepreneurs with the expertise, networks and tools they need to make their ventures successful (Pena, 2002).

Eventually, the last identified effective factor on technological entrepreneurship in this research is organizational factor. Paper results signify that the presence of appropriate space in research and development Unit has played an essential role in innovation for nano-food Science based

technological firms in STP and the existing suitable facilities and equipment is vitally important in food immunity and health and also, in Human Resources Management, employing effective and educated personnel and using elites may improve technological entrepreneurship level. Results of this paper show that the most important foreign investment sources for technological entrepreneurs in Nano- food Science based technological firms in STP, including individual and familial investors, is governmental financial aids and banks and one of the most popular source of them is venture investment. Also certain strategy in market and having knowledge about sectors and market tendencies are determinant factor in development of modern nano-products in food industry. Customers' knowledge about foods security along with using nanotechnology play key role in developing entrepreneurship in this field. Knowledge management is an important factor for improvement of performances and processes in this area. Eventually, conceptual new model of technological entrepreneurship process in active technological entrepreneurial SMEs is presented in nano- food field as follows. This model may be employed for all Nano- food Science based technological firms in Science and Technology Parks of the world. In order to make sure of the given results in this study, the derived results are compared with findings from other studies done by researchers in Table 4.

Table 5: Comparison among results of this paper with research findings from the other researchers

Main factors	axial factors	Compare with other researchers
Organizational factors	Infrastructures and resource organization, Organization strategy , Management and leadership of organization, Organizational process, knowledge management, Internal networks of organization, Experience and background of firms	kamarudin& sajilan(2013), Bailetti(2012), Petti& Zhang (2011), Antoncinc & Prodan(2008), Peng& Zhang(2008), Prodan(2007), Daslstrand(2007), <i>Chorev& Anderson (2006)</i> , Dorf& Byers(2005), Shane& Venkataraman(2003), Burgelman et al(1996),
Institutional factors	Academic institution, Counseling centers, Guild Institutions, Financial sponsor Institutes for technology development, Governmental institutions, Private institutions, Non-profit institutions, and related institutions	Petti& Zhang (2011), Antoncinc & Prodan(2008), Peng& Zhang(2008), Prodan(2007),
External factors	Government, Market , capital, Organization and rival companies, Intellectual Ownership Registration Organizations, Standard and License Issuing Organization, and External organizational networks	kamarudin& sajilan(2013), Bailetti(2012), Byers(2010), Petti& Zhang (2011), Antoncinc & Prodan(2008), Peng& Zhang(2008), Prodan(2007), Blanco(2007), Burgelman et al(1996),
Technological factors	Technological readiness level (TRL) and scope of technology, Type of innovation, Level of technology	kamarudin& sajilan(2013), Petti& Zhang (2011), Antoncinc & Prodan(2008), Peng& Zhang(2008), Prodan(2007),

Individual factors	Demographic Characteristic, Individual Experience & skills, Psychological Characteristics , individual's Motives, Entrepreneur’s Personal Networks	kamarudin& sajian(2013), Petti& Zhang (2011), Byers(2010), Prodan(2007), Dorf& Byers(2005),
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And finally conceptual model of technology entrepreneurship process in Nano- food Science based technological firms in Science and Technology Parks are shown as:

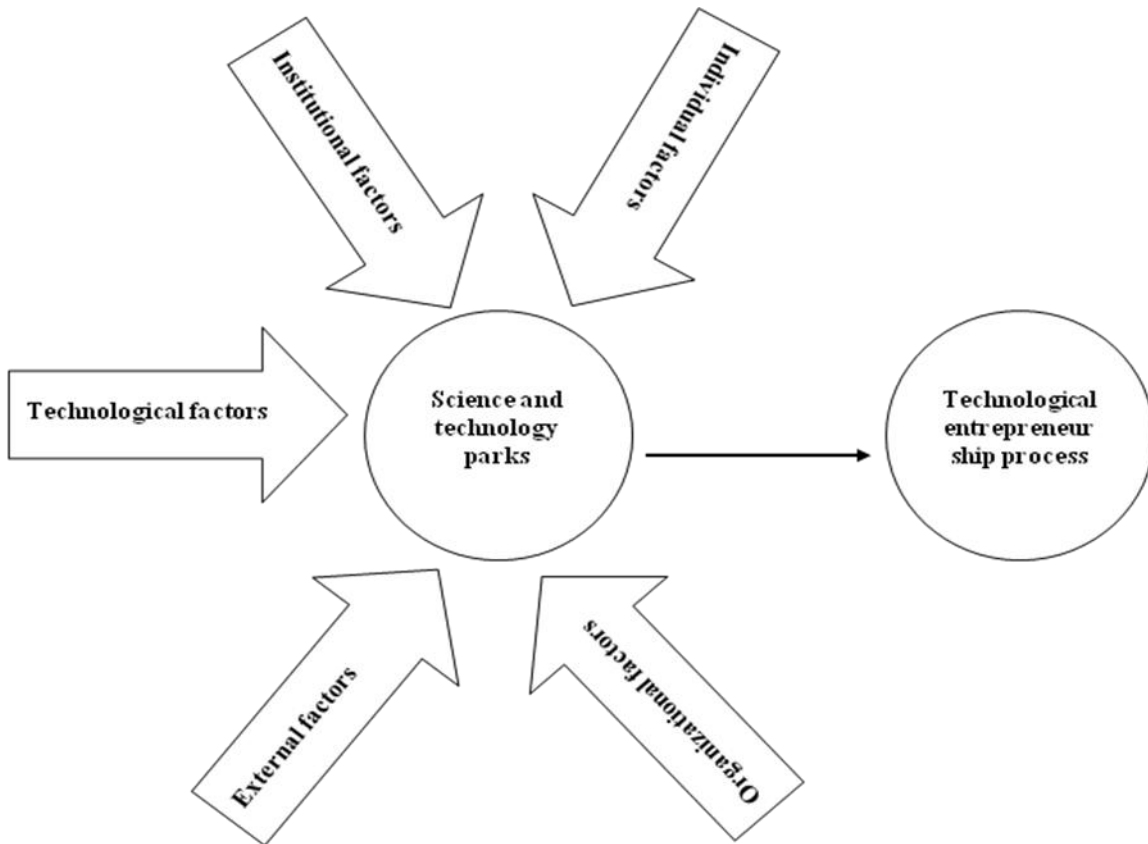


Figure 3.Conceptual model of technological entrepreneurship process in Nano- food Science based technological firms in Science and Technology Parks.

REFERENCES

- Aman, O. Tahir, M. Majid, I. Aziz, N. and Rahmiati, F. (2011). The success factors of food small medium entrepreneurs under the One District One Industry Programme: a case on food manufacturing entrepreneurs in Melaka. *Journal of Global Entrepreneurship*, 1(1), 44-64
- Antonicic, B. & Prodan, I. (2008). Alliances, corporate technological entrepreneurship and firm performance: Testing a model manufacturing firms. *Journal of Technovation*, 28, 257-265.
- Asia food information centre (AFIC). (2001). *Food biotechnology. A communications guide to improving understanding*
- Avermaete, T., Viaene, J., Morgan, E. J., & Crawford, N. (2004). The impact of firm characteristics and macroeconomic performance on innovation in small food firms: Case study from Belgium, Ireland and UK. In T. de Noronha Vaz, J. Viaene, & M. Wigier (Eds.), *Innovation in small firms and dynamics of local development*. Warsaw: Scholar Publishing House
- Bailetti, T. (2012). Technology Entrepreneurship: Overview, Definition, and Distinctive Aspects. *Journal of Technology Innovation Management Review*, 5-12
- Blanco, S. (2007). How techno-entrepreneurs build a potentially exciting future?. *Handbook of Research on Techno-Entrepreneurship*, (ed.) by Francois Therin, Edward Elgar, 3-25.
- Braun, J. V. (2007). *The world food situation new driving forces and required actions*. International food policy research institute
- Burgelman, R. A., Maidique, M. A., and Wheelright, S. C. (1996). *Strategic Management of Technology and Innovation*, Times Mirror Higher Education Group, Chicago.
- Byers, T. (2010). *Top Ten Elements of Technology Entrepreneurship for High-Growth Innovation*. Stanford.
- Capitanio, F., Coppola, A. & Pascucci, S. (2011). Product and Process Innovation in the Italian Food Industry. *Agribusiness*, 26(4), 503-518
- Chorev, S. & Anderson, A. R. (2006). Success in Israeli high-tech start-ups: critical factors and process. *Technovation*, 26(2), 162-174.
- Christensen, J.L. (2008). Knowledge-sourcing for product innovation in the food and drinks industry. In R. Rama (Ed.), *Handbook of innovation in the food and drink industry* (pp. 297-322). New York/London: Haworth Press
- Christensen, J.L., & Lundvall, B. (Eds.). (2004). *Product innovation, interactive learning and economic performance*. Amsterdam: Elsevier.
- Dahlstrand, A. L. (2007). Technology based entrepreneurship and regional development: the case of Sweden. *Journal of European Business Review*, 19(5), 373-386.
- Dorf, R.C., & Byers, T. H. (2005). *Technology ventures: From idea to enterprise*. New York: McGraw-Hill.
- Emamifar, A. Shahedi, M. (2006). *Food industry from nanotechnology perspective*. First conference of nanotechnology in environment, Isfahan Industrial University.
- Emerich, D. F., & Thanos, C. G. (2003). Nanotechnology and medicine. *Expert Opin Biol Ther*, 3(4), 655-663.
- Galizzi, G., & Venturini, L. (2008). Nature and determinants of product innovation in a competitive environment of changing vertical relationships. In R. Rama (Ed.), *Handbook of innovation in the food and drink industry* (pp. 51-80). New York/London: Haworth Press.

- Garud, R., & Karnøe, P. (2003). Bricolage versus breakthrough: Distributed and embedded agency in technology entrepreneurship. *Research Policy*, 32(2), 277-300
- Gellynck, X., Vermeire, B., & Viaene, J. (2007). Innovation in food firms: Contribution of regional networks within the international business context. *Entrepreneurship & Regional Development*, 19(3), 209–226
- Ghanbarzadeh, B., Speren, V., & Hosseini, S. E. (2010). impact of Pectin on physical and sensory characteristics of Tofu produced by coagulant of Calcium chloride and glucono delta-lactone. *Iranian Food Science and Technology*, 6(2), 134-144.
- Glas, M. and V. Pseniczny (2000), *Podjetnistvo – izziv za 21. stoletje*, Ljubljana: Gea College.
- Grunert, K., Hermsen, H., Meulenber, M., Kuiper, E., Ottowitz, T., Declerck, F., et al.(1997). A framework for analysing innovation in the food sector. In B. Traill, & K. Grunert(Eds.), *Product and process innovation in the food industry* (pp.1–37). London: Blackie Academic and Professional.
- Hamidizadeh, M. Hossienzadeh, M. (2006). Designing a model for identifying and accessing strategic capabilities, study: Iran Khodro Company. *Iran management science*. 1(4). 1-28.
- Heckathorn, D.D. (2007), Extensions of Respondent- Driven Sampling: Analyzing Continuous Variables and Controlling for Differential Recruitment, *Sociological Methodology*, 37(1), 151-207
- Iqbal, B. A. & Merwe, T. V. (2009). World food scenario: Emerging trends and issues. *Journal of Economics and International Finance*, 1(3), 72-77.
- Joseph, T., & Momison, M. (2006). Nanotechnology agriculture and food system. *Asian institute of nano technology*. Globalvisionpub.com
- Kamarudin, H. S& Sajilan, S. (2013). *Critical Success Factors of Technopreneurship in the Creative Industries: A Study of Animation Ventures*. *Review of Integrative Business and Economics Research*. 2(1), 1-37.
- Kühne, B., Vanhonacker, F., Gellynck, X. & Verbeke, W. (2010). Innovation in traditional food products in Europe: Do sector innovation activities match consumers' acceptance?. *Food Quality and Preference*, 21, 629–638.
- Kühne, B., Vanhonacker, F., Gellynck, X. & Verbeke, W. (2010). Innovation in traditional food products in Europe: Do sector innovation activities match consumers' acceptance?. *Food Quality and Preference*, 21, 629–638.
- Kvale S., (1996), *Interviews: An Introduction to Qualitative Research Interviewing*, Thousand Oaks, Calif, Sage Publications.
- Liao, J. and H.Welsch (2003), Social capital and entrepreneurial growth aspiration: a comparison of technology and non-technology-based nascent entrepreneurs, *The Journal of High Technology Management Research*, 14, 149–70.
- Lofsten, H. and P. Lindelof (2005), R&D networks and product innovation patterns: academic and nonacademic new technology-based firms on Science Parks, *Technovation*, 25 (9), 1025–37
- Lundvall, B. (1995). *National systems of innovation: Towards a theory of innovation and interactive learning*. London: Biddles Ltd
- Moraru, C.I. et al. (2003) *Nanotechnology: A New Frontier in Food Science*, *Food Technology*, 57, 24-29
- Murphy, M. (2002). Organisational change and firm performance. *OECD Science Technology and Industry Working Papers* (14), doi:10.1787/615168153531.

Nanoposts report (2010). *Nanotechnology in the Food and Drink Industries: Applications and Markets to 2015*. Nanoposts.com.

Oriakhi, C. O. (2004). Commercialization of nanotechnologies. Master's thesis of management of technology. Massachusetts institute of technology

Pathak, S., Xavier-Oliveira, E., & Laplume. AO (2013), Influence of intellectual property, foreign investment, and technological adoption on technology entrepreneurship, *Journal of Business Research*, 66, 2090–2101

Pena, I. (2002), 'Intellectual capital and business start-up success', *Journal of Intellectual Capital*, 3, 180–98.

Petti, C. & Zhang, Sh. (2011). Factors influencing technological entrepreneurship capabilities Towards an integrated research framework for Chinese enterprises Towards an Integrated Research Framework for Chinese Enterprises. *Journal of Technology Management in China*, 6(1), 7-25

Preston, J. T. (2001). *Success Factors in Technology-Based Entrepreneurship*. Massachusetts: Massachusetts Institute of Technology, MIT Entrepreneurship Center

Prodan, I. (2007), A model of technological entrepreneurship. In: *Handbook of Research on techno-Entrepreneurship*, (Ed) Francois Therin, Edward Elgar

Prodan, I., S. Dolinsek and J.Kopac (2004), 'Technology transfer and entrepreneurship in the traditional industrial environment', in A.Y. Hosni, M.T. Khalil and R. Smith (eds), *IAMOT 2004: 13th International Conference on Management of Technologies*, Washington: IAMOT.

Rashidi, L., & Khosravi-Darani, K. (2011). The Applications of Nanotechnology in Food Industry. *Critical Reviews in Food Science and Nutrition*, 51, 723–730

Sahoo, S. K., & Labhasetwar, V. (2003). Nanotech approaches to drug delivery and imaging. *Drug Discovery Today*, 8(24), 1112-1120.

Sahoo, S. K., Parveen, M. S., & Panda, J. J. (2007). The present and future of nanotechnology in human health care. *Nanomedicine: Nanotechnology Biology and Medicine*, 3(1), 20-31

Schaffnit, c. (2009). The global food equation. Food security in an environment of increasing scarcity. Deutsche Bank Research

Shane, S., & Venkataraman, S. (2003), Guest Editors' Introduction to the Special Issue on Technology Entrepreneurship. *Research Policy*, 32(2), 181-184

Stanković, I., Gocić, M., & Trajković, S. (2009). Forming of science and technology parks as an aspect of civil engineering. *Facta Universities Series: Architecture and Civil Engineering*, 7(1), 57 - 64. doi:10.2298/FUACE0901057S

Tajeddini, K. (2010), Effect of customer orientation and entrepreneurial orientation on innovativeness: Evidence from the hotel industry in Switzerland. *Journal of Tourism Management*, 31, 221–231.

Taniguchi, N. (1974). On the Basic Concept of 'Nano-Technology. Proceedings of the International Conference on Production Engineering, Tokyo, Part II (Japan Society of Precision Engineering)

Teece, D.J. (1996). Firm organization, industrial structure, and technological innovation. *Journal of Economic Behavior & Organization*, 31, 193–224.

Valdes, M., Valdes, G., & Garcia, C.J. (2009). *Analytical nanotechnology for food analysis*. Springer- verlag

Warad, H. C., & Dutta, J. (2006). *Nano technology for agriculture and food systems*. a review asian institute of nano technology

Weiss, J., Takhistov, P., & McClements, D. J. (2006, November 13). Functional Materials in Food Nanotechnology. *Journal of Food Science*, 71(9), 107-116

Ylinenpää, H. (2001). Science parks, cluster and regional development. *European Small Business Seminar in Dublin*.

Zhang, G., Peng X., Li J. (2008), Technological entrepreneurship and policy environment: a case of China, *Journal of Small Business and Enterprise Development*, 15(4), 733-751