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THE IMPACT OF NETWORK RESOURCE ON FIRM'S PRODUCT AND PROCESS INNOVATION CAPABILITY

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Abstract

Innovation forces exists in small and medium sized enterprises as well in large ones. Competitive advantages of SMEs against large enterprises are their flexibility and speed of response to innovation. Innovation is a social process and does not happen in isolation. Hence, inter-organizational relationships which can be managed, can improve innovation and leads to growth and survival. This paper is drawn on the notion of network resource which is resultingfrom membership or participation in inter-firmnetworks in order to access other organizations' knowledge. The main object of this research is the investigation of network resource on firm's innovation capabilities. For this purpose, network resource with two dimensions: industrial and scientific network capital is investigated as an independent variable, Innovation capability with two dimensions (product innovation capability and process innovation capability) as a dependent variable. Descriptive correlation method is used in this study and the Measurement tool is a questionnaire which is tested betweenmanagers and experts from 158 high-tech SMEs in Tehran with random sampling. Pathanalysis with PLS software is used to analysis the data of this study. The results show that industrial network capital has influence on innovation capability

Keywords:

Network resource;
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1. Introduction

Today, the development of Small and Medium-sized Enterprises (SMEs) is recommended as a solution to cross the transition period for developing countries and even developed countries. Currently, more than 350 million industrial and business units with more than two billion employees work in more than 90 percent of the world's small and medium enterprises. SMEs are made up of enterprises engaged in manufacturing process with the idea of entrepreneurship and small capital utilization. Therefore, it seems necessary to address innovation, and methods in which these businesses increase their innovation capacity and capability. The high capacity of innovation in introducing new products and entering new markets makes corporations able to achieve the desired results of innovation and improve performance [33]. Innovation process is increasingly being considered as a systematic plan, this means that firms do not innovate in isolation but through a complex interactions of external actors [20]. Network researchers emphasize that innovation, be it started internally or externally, is a Complex process which may need knowledge flow between firms and other actors. [32,28].

Innovation is a social process and SMEs create valuable economic and social contribution because of their innovative capacity. Given the small size of networks and data, the main advantage of networking for SMEs is access to new markets and external technologies, accelerating the introduction of products to market and integration of complementary skills. Hence, the technology and market uncertainty may be effectively reduced in the process of innovation and leads to overcome the limits of internal technology systems [20].Recent researches has entered a new concept in innovation literature. This concept is called inter-organizational network. Focusing on network analysis draws attentions to the relationship between entrepreneurs and suppliers for entrepreneurial activities [24]. Entrepreneurs have ideas for testing, knowledge and qualifications to run the business, but require complementary knowledge and competencies to deliver a product or service to their customers.[14]

companies must simultaneously be able to create and commercialize a stream of new products and processes that expand technology frontier and also always be one or two steps ahead of the competitors [30].Therefore, innovation capability defined as the ability of continues transition of knowledge and ideas to new products, process and systems in order to enhance firm’s and

stakeholders‘benefit [23].The studies which are investigated in industries have identified a positive association between innovation and corporate performance. So, it seems necessary to identify and understand the firm’s’ required capabilities for successful execution of innovation in all aspects of business; that iscalled innovation capability [2]. Emerging theories such as knowledge-based view [13] and an extension of resource-based theory [25] recognizes that access, acquisition, exchange and knowledge creation is the main reason of networking with other agents. By taking into account the two resource-based and inter-organizational networking theories, it seems that firms have dual necessity to form and manage inter-organizational networks, producing valuable knowledge and information as well as the acquisition internal capabilities in order to beneficially exploit knowledge through innovation[16].The concepts of network resources expressed in order to better understand the benefits of inter- organizational networks that facilitate the flow of information and valuable resources.[2,15-16]Although a considerable attention has been given to understanding the nature and role of internal resources in providing competitive advantage and innovation, less attention has been given to network resource and its role in competitive advantage creation [16,25] and little attention is paid to social capital among businesses as individual institutions. The notion of Social capital includes the value obtained from a network based on socialization and sociability, obligation and trust can be built in these networks and do not includes investment in networks which is based on economic expectations among companies. While social capital is based on on trust and social obligations, the concept of “network capital”, is based on economic benefit and is referred to an investment in calculative relations through which firms gain access to knowledgeto increase expected economic returns[20].

This paper examines the relationship between different dimensions of network resources, including industrial and scientific network capital on innovation capability in product and process .Lack of attention to such issues may lead to a waste of resources and shortage of scientific evidence. Thus, given the vital necessity of industrial development in developing countries, including Iran, the main research question is “Does network source consisted of industrial network capital and scientific network capital impact on innovation capability in product and process?” answer to this question can provide researchers with a basis for future

research in the field and present policymakers a clear vision on directing resources towards fostering innovative businesses through facilitating inter relationships.

Literature review

Inter-organizational relationship

Inter-organizational relationship is one of the main characteristics of modern organizations. This relationship may be long-term or temporary. In some cases, these relationships are casually, but sometimes formalized by definition of rights and responsibilities of the parties. A network structure of crossing network of mutual cooperation will develop when an organization engaged on an inter-organizational relationship. Parties can be suppliers, contractors, customers, market / technology advantages, research and development companies, and investors. The current paper addresses inter-organizational relationship as formal cooperation agreements among organizations. Inter-organizational networks are network structure that has been established by several inter-organizational relationships.

Network resource

Network is an inter-organizational communication. This distinguishes between each dual relationship power between firms. Researchers have used different views to assess the strength of the relationship. Strong ties facilitate the resources or implicit knowledge exchange; while weak ties create information bridges for companies [12].

Network analysis and network theory is one of the prevailing theories about inter-organizational networks. This approach sees dual inter- organizational relationships as network infrastructure and takes network as something more than accumulation of dual relationships. The network structure is the pattern of relations among members. Position indicates the effect of a firm on other network members. Network analysis and social networks graph theory studies, tend to capture the essence of social networks based on three dimensions: the relation degree, inter-organizational relation power, and overall networks structure [37]. Communication degree concerns the number of inter-organizational relationships to a company connected. Network position is used in different areas such as power, authority, resources, capabilities and the number of relationships [36,39]. Researchers assess social network structural features analysis by

evaluating of the relative position of the firm compared to the other network members [5, 37]. Having used the theory of network analysis, the researchers were able to evaluate the effect of density, diversity and scale of competitive advantage of companies and individuals. A diverse, large and dispersed network is more efficient than a small and compact one [5,35].

Gulati [16] introduced the concept of network resources in order to understand the advantages that can be derived from the networks by firms in order to gain access to valuable information or resources possessed by their inter organizational parties. Similar to social capital, Gulati [16]also defined network resources as a concept to describe and understand the resources or capitals generated by inter-organizational networks. The concept does not distinguish between the types of relationships formed by networks necessarily affecting the nature of network resources or capital. For example, that network resources may be contractual, associational or family-based relations. The concept of network resources is directly like the concept of social capital by Coleman [6], moreover, interpersonal relationships, (as opposed to inter-organizational level), with external agents often form an important resource of the network. It states that network resources are pooled with social capital instead of being similar to social capital. In fat, the network resources are the firm level of social capital; although it seems that network resources include the individuals' social capital such as managers and employees.

Social capital and network capital

This section tries to distinguish between two types of network capital; first, social capital is created in the form of social networks in companies or other organizations through which knowledge may flow. Coleman [6].Knows social capital consisted of obligations and expectations depended on the social environment trustiness, the flow of information capabilities of social structures and normative functionalities coupled with sanctions. Coleman [6].argues that social capital is defined by its functions and suggests that this common functions is the creation of local trust. Second, network capital is specifically designed for firms in the form of more strategic and calculative networks to facilitate knowledge follow and enhance advantages [20].

When firmsintentionally invest in networks, these networks are more likely the development of relations which Williamson [43]refers to "calculative", as egocentric networks where the focal actor's ties are primarily motivated by expected economic benefits [18].The inter organizational assets are more accurately called network capital including investments in calculativee relations through which firms gain access to knowledge to increase in the expected economic returns [20]. This definition makes a clear distinction between the two types of network resources: network capital and social capital.

Network capital is rooted in economic rationality whereby the firm invests in a calculative networks to access to the required knowledge. Social capital resource is based on social rationality by which individuals invest in social networks to gain access to existing resources related to sociability and social expectations. This distinction is compatible with the view that social capital is not assumed as a calculated pursuit of advantage but Logic of emotional investment.Compared with the implicit emotional and social components of social capital, the mechanism through which network capital has been established are rooted in an economic and business rationality, whereby access to the knowledge is regarded as means to increase economic returns. This again is compatible with the view that profits of social capital are not often pursued purposely by the network actors. In description of The term "capital' the main distinction is, that network capital is firm level while resource while social capital concerns individual's relationship resources. In fact, an individual's social capital can be seen as a means to provide returns for firms. But this is most likely to be of comparably higher Importance in small firms [20].In relation to impact, the effect of network capital mainly relates to economic returns held through access to knowledge, and social capital to social returns, although in both cases other returns may appear as a by-product, such as the unplanned access to useful knowledge often eased through social networks.Kramer et al[22].have identified three basic dimensions of network capital including identify the partners, creation and exchange of knowledge and the support capacity to continual cooperation, respectively. The Mechanisms and the causes of network capital formation vary depending on the nature of collaborator, while industrial cooperation tend to happen in applied research and therefore their value is closely related to the market, collaboration with scientific partners and academic institutions occur in basic research

and seeking new ideas. Thus, network capital is divided into two namely as Industrial Network Capital and Scientific Network Capital.

Industrial Network Capital dimensions arementionedbelow:

Identification of industrial partners to create knowledge networks: an important aspect of network capital is firm's capability to identify and select potential partners to know where tacit knowledge is available, what skills a potential partner can offers as well what market is appropriate for offered skills, which include identification of competitors, customers, suppliers and research organizations (universities) that vary according to the project type and industry [22].

Knowledge creation and diffusion - knowledge creation capacity, and value creation from networks: the type of the processes through which knowledge is exchanged in a network differs in terms of product development stage and the nature of the partners.Generally, there are identified two types of collaboration firstly technology partnership mainly focusing on the R&D early stages at the pre-competitive level;secondly, specific collaboration on products which focus on next stages of the product/service development process.These collaboration could be bilateral or multilateral .Joint research agenda, shared facilities and personnel mobility and dynamics are mechanisms thatencourage the establishment of knowledge flow in pre-competitive research stage.Knowledge inputs to participate in the early stages of Product Research and Development are created by supplier or customer innovation workshops as the result of core competencies merger (interacting with the supplier) or deep insight on market demand (interacting with customers). Firms are willingness to cooperate with other companies and research institutions to cut costs and reduce risk and increase inflow of foreign knowledge and absorptive capacity [22].

Continuous collaboration capacity – network value lies in continuous relations with partners ensuring that accumulated knowledge will spillover to future collaboration [19].Some firms have used special management team such as R&D alliances and R&D relationship management in order to support and strengthen the network capital. Moreover, the management of intellectual property right is vital to increase continues collaboration capacity. In addition, determination of responsibilities and roles of the parties and their management prevents conflict [22].

The following concepts are used to describe the dimensions of scientific network capital*Identifying academic partners–create knowledge networks*: R&D collaboration with universities and scientific institution is of great value and there have been may attempts to establish such collaborations in regional and global scales. Scientific partners usually meet at conferences and their industry related events. (With the active participation in the scientific community, for example, production or publication of high quality research findings). The further institutional process would be development of university network capital related to the acquisition of new companies with already established collaboration (university spin-off) or (temporary) or mutual cooperation between industry and academia. Lack of academic institutions efficient mechanisms to promote their skills is one of the main obstacles to network formation. As a result, companies are trying to adopt specific mechanisms to identify the strengths of universities and design effective interactive ways. Ongoing relationships with the operation of patent offices in universities and private sector investment in ICT are tools for the systematic identification of qualified collaboration partners in scientific institutions. [22].

Knowledge creation and diffusion- capacity to produce knowledge and value creation of in networks cooperation with universities and research centers in the majority of cases occurs in the very early stage of the innovation. Most universities act as a filtering mechanism to identify new targets for the firms, as well as to validate and evaluate the commercial potential of an idea. Therefore, the cooperation leads to participation at basic perception of new research findings and strengthen its absorptive capacity by re- integrating these among firms' R&D network. Some companies have created a board composed of senior academic researchers from leading universities. The Advisory Board, in addition to enhanced network capital, is another way to provide the firm with knowledge inflow. Firms are also motivated to cooperate with universities to gain access to human capital and support talents creation. Maintaining such processes requires strong ties of universities, research institutes with the firm, which are mainly obtained through continuous research contracts, shared facilities, PhD findings, as well as access to industry data [22].

Continuous collaboration capacity: As for industrial *collaboration,* expressed, cultural differences, legal issues and synchronization of expectations, are the main obstacles to successful

collaborations [38,3,27]. Most companiesreporteddifficulties in engaging with the academic community, mainly due to an incomplete understanding of the business and industrial R&D process, as well as differences in professional structures incentive [22].

Innovation

Ability to develop new ideas and innovation is one of the firm's important priority. The emergence of the knowledge economy, intense global competition and significant progress in technology has led to innovation which increasingly be at the core of competitiveness. Innovation is a mechanism by which firms produce products/services, processes and systems to adapt to the market, changing technologies and required competitive methods. Increasing the level of commitment to innovation is required to sustain the current status and improves competitive position at lower-level.

Innovation capability

Innovation is the driving force of growth and change in industry. Innovation is a process in which entrepreneurs can seize profitable opportunities and merger factors of production to make the system effective. Innovation can increase organizational flexibly and ability to adapt the environment. Here, the question arises as to how companies develop their innovation activities. Innovation researches did not pay worthy attention to firms' innovation capabilities emergence, assumed that companies already have the capabilities and focused their attention on optimizing innovation. Undoubtedly, the effective development of innovation capability is one of the most important issues of the company and to adapt to globalization and incredibly dynamic and competitive market environment, it cannot be overlooked [40].Kim [21].defined innovation capability as the ability to create new and useful knowledge based on prior knowledge. Burgelman et al [4].defined innovation capability as a complete set of the organizational features that facilitate and support innovative strategies. The innovation capability refers to the new technology implementation or creation in systems, policies, programs, products, processes, devices, or services new to the organization [7,9]. Moreover, innovation capability can be called Firm's ability to absorb and use information form external sources to be turned into new knowledge [8]. Innovation capability is also called integration capability. Organizations with Innovation capability can model and manage key organizational features and resources to

successfully encourage innovative activities [26].Damanpour [10]states that the scope of the invention capabilities includes administrative and technical innovation. Technical innovation includes product, marketing, services and technology for the production, selling products or services directly related to the organization main activities [9]. Administrative innovation concerns the administrative structure and organizational processes that indirectly are related to the organization main activities and more directly related to its management. The innovation capability is defined as skills and knowledge needed for continuous absorption and improvement of existing technologies to create new knowledge [23]. Lawson and Samson [26] argue that innovation capability is the ability to continuously convert knowledge and ideas into products, processes and new systems for the benefit of the company and its stakeholders.Moore [34] Classified innovation capability into several features that include disruptive, applicative, products, processes, marketing, structure, and business model functionality; and linked the concepts to the market development life cycle. Chuang [7].categorized innovation capability as innovation in product and process, administrative (staff), marketing and organizational structure. Tsai, Huang, & Kao [41]Believe that innovation capability should be administrative innovation of business activities such as planning, organizing, staffing, leadership, and contorl and technological innovation of products, processes, and facilities used by the firm. Adler and Shenhar [1]defined innovation capability as the ability to develop and response and identified its four dimensions: Ability to develop new products and understanding market needs, ability to deploy the right technology processes in order to produce new products, Ability to develop and implement new products and technologies to meet the needs of the future, Ability to respond to unexpected activities of competing technology. The definition indicates that innovative capability is the ability to use a set of appropriate technologies for new products and meeting the market needs and at the same time responding to unexpected activates and technological and competitive conditions. In other words, innovation capability is not only eliminating the exiting problems of products and processes, but should also be able to respond to changes in the external environment.Lin et al. [31] , studied aspects of the field of innovation with an emphasis on the five factors of innovation capability that most studies have been done on, namely product innovation, process innovation, marketing innovation, service innovation, and administrative innovation.Product innovation is defined as developing and introducing new products to market or modification the existing ones in terms of performance, stability, quality, and

appearance[29].Process innovation involves the creation and mprovement of production methods, the use of new elements (eg input material, job description, information flow, and equipment) to the production process [10]. Marketing innovation refers to market research, pricing strategy, market segmentation, promotions and advertising, retailing channels, and marketing information systems [42].Services innovation is referred to manufacturers' engagment in various innovation activities to enhance customer satisfaction, after sales services, warranty policies, procedures and maintenance, and ordering systems [11].Administrative innovation: refers to the change in organizational structure and administrative processes such as personnel recruitment, resource allocation, and the structure of the duties, powers, and rewards [10,11].

2. Research Method

This is an applied and descriptive correlational study.data was collected using a questionnaire with high-tech companies as the study population. Random sampling was used and Cochran's method was used

to calculate the sample size, and a number of 158 questionnaires were completed by managers and experts of high-tech companies. The current paper examined two aspects of inter-organizational network capital (industrial network capital and scientific network capital) as independent variables and innovation capability of both product and process innovation as the dependent variable in a questionnaire of 36 questions using a five point Likert scale. Discriminant Validity was used to determine the validity of the questionare, using Average Variance Extracted (AVE) and Convergent Validity, as well. Table 1 shows that research variables are appropriately for divergent validity. The research instrument content validity was confirmed by six academic experts and two industrial experts. Composite Reliability and Cronbach's alpha reliability coefficient were used to assess the reliability, the coefficients specified in Table(1) indicates the reliability of research.Structural equation modeling technique was used for data analysis and Smart PLS software on hypothesis testing, given the research type andthe need to assess the impact of independent variables on the dependent variable. It should be noted that the convergent validity results showed that the Root Mean-Variance extracted for each construct structures is more compared to its correlation with other structures. Thus, the questionnaire enjoys required validity.

The proposed model is based on network resources aspects proposed by Kramer et al [22], including scientific network capital and industrial network capital, derived from Lin, Chen, & Chiu[31] research. In other words, theoretically, network capital is classified into two scientific network capital and industrial network capital. Furthermore, the innovation capability involves both product innovation and process innovation. Accordingly, conceptual model and hypotheses are developed below**.**

Hypothesis 1: Industrial network capital has an impact on product innovation capabilities.
Hypothesis 2: Industrial network capital has an impact on process innovation capabilities.
Hypothesis 3: Scientific network capital has an impact on product innovation capabilities.
Hypothesis 4: Scientific network capital has an impact on process innovation capabilities.

.3. Results and Analysis

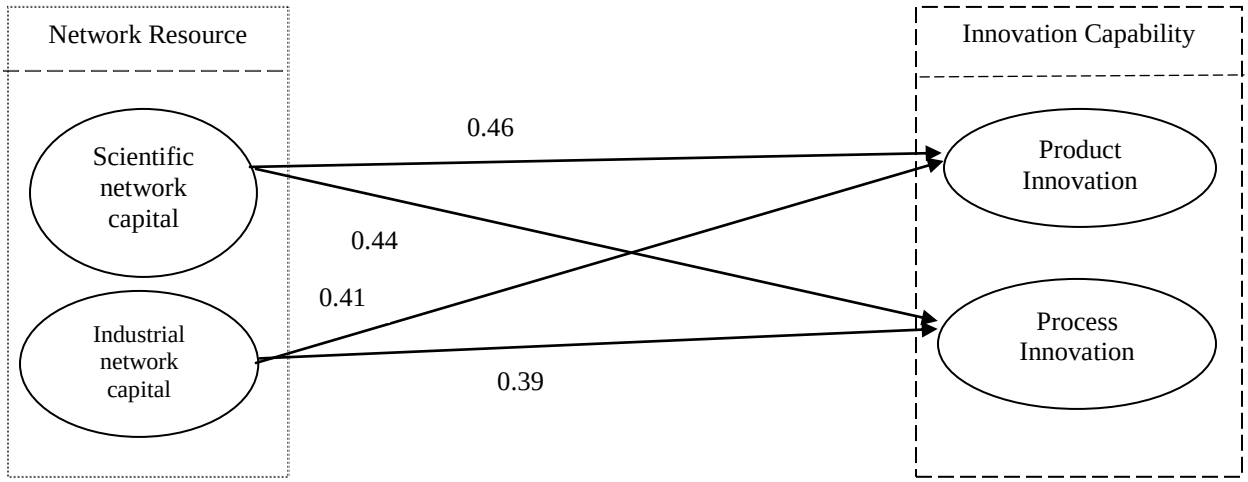

Figure 1.The conceptualframework

Table 1.Questionnaire technical specifics

Construct	**Composite reliability**	**Cronbach's alpha**	**AVE**
Industrial network Capital	0.95	0.94	0.52

Scientific network Capital	0.93	0.91	0.57
Process Innovation	0.89	0.81	0.73
Product Innovation	0.89	0.76	0.80

Confirmatory factor analysis was used to investigate the relationship between the observed variables (indicators and questionnaire items) with latent variables (dependent and independent variables). As a result, some of the questionnaire items were omitted at this stage. Hypothesis test was done using path analysis Figure 1.

Table 2 Depicts Hypothesis test results.

Table 2.Hypothesis test

Hypothesis	**Path coefficient**	**t-value**		**result**
1. Industrial network capital has an impact on product innovation capabilities.	0.46	accept	3.02	Hypothesis is supported
2. Industrial network capital has an impact on process innovation capabilities	0.44	accept	7.42	Hypothesis is supported
3. Scientific network capital has an impact on product innovation capabilities.	0.41	accept	4.71	Hypothesis is supported
4. Scientific network capital has an impact on process innovation capabilities	0.39	accept	11.76	Hypothesis is supported

PLS path analysis software was used to test the hypothesis. Generally, research path analysis model is significant. The PLS model Goodness of Fit of the model was obtained through the square root of the product of the average cumulative index of the mean square of the correlation coefficients between structures. In this research, given that GOF is calculated to be 0.61 and is greater than 0.36; so we can say that the model is a perfect fit.

Hypothesis 1 tested the impact of industrial network capital on product innovation.The resulting path coefficients show industrial network capital affect product innovation capability by 0.46.
Hypothesis 2 tested the impact of industrial network capital on process innovation. The resulting path coefficients show industrial network capital affect process innovation capability by0.44.
Hypothesis 3 tested the impact of scientific network capital on product innovation.The resulting path coefficients show scientific network capital affect product innovation capability by 0.41

4. Conclusion

The current paper examined the concept of network resources and dimensions that shape and strengthen it, and its impact on innovative capability. Innovation literature pays much attention to interact with other environmental elements to create new products or processes. Accordingly firms are not regarded as separated entities following their own strategies; but they are as economic actors working together to survive and grow. At least that cooperation is important as competition for survival. Besides, finding competitive advantage in many cases requires a collaborative process.Systematic approach to innovation, means that the innovation is basically obtained through actor's collaboration. Consequently, the following interaction is considered important:

- Companies inter-relations (industrial networks)
- Industry- universities relations (the industrial sector, the academic sector)

Customer's networks and alliances, suppliers, competitors, and other unrelated to the market members are important sources of innovation. These resources are also an effective tool to reduce risk, cost, achieve economies of scale, and reduce new product development time. Networking increases opportunities and access to key resources of the company such as information, capital, goods, and services that can enhance or maintain a competitive advantage

[17].The company's ability to absorb knowledge gained from membership in the network is a source of successful innovation [8]. Firms can strategically impact on their network capital. making a distinction between capital -based network (economic rationality) and social capital (social rationality), makes managers understand the complexity of interactive knowledge as well as to better understand the potential value of knowledge networks with industries and scientific institution.

supported research hypothesis (1) shows that the knowledge gained by firm through industrial networking improve innovation capability in the form of new products and services.In other words, capital achieved by interaction with industry environment and industrial cooperation impacts on learning from each other and can improve innovation capability in the form of new products and services. Supported research hypothesis (2) shows industrial network capital leads to improved process innovation capability. And firms can learn new methods of each other. Supported research hypothesis (3) shows scientific network capital which is obtained from firm's relationships with scientific organizations, especially universities, have an impact on product innovation, hence leading to improved products and services innovation.

Supported research hypothesis (4) shows scientific network capital impacts on process innovation capability, which is obtained from firm's relations with scientific and academia organizations have an impact on process innovation leading to improved process and products and services methods. It should be noted that effective relations between universities and industry will happen when universities with applied research attempt to transfer technology, this will not be possible except through embedding research in universities and also meeting the training needs of expert. The first realistic factor in the university-industry collaboration is to believe in the importance of issue and create ongoing and solid relationships for success. It should be noted that industry fails to develop in absence of defined targeted cooperation with universities. For example, one of the requirements for "university-industry collaboration is the establishment of research and development department in the industry. The university-industry collaboration requires providing industrial research opportunities, as well as creating research units by faculty members to provide dynamic mechanism at universities to solve industrial problems.

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