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Research paper



Analysis of The Main Components Forming the Business Development Model of Technological Ideas in Iranian Research Institutes

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Abstract

The purpose of this article is to present the main components forming business development model of technological ideas in Iranian research organizations. This research is fundamental objectively (empirical fundamental research) and it is non-experimental in terms of data collection method (acquisitive research) and according to the research approach is qualitative. This research was implemented with a multiple case study strategy, which ultimately the research objective will be realized by identifying the steps, the activities of main beneficiaries and the contributing factors in the business development of technological ideas derived from case studies with each other and with the research literature. The study population included research institutes and government research institutes covered by the Ministry of Science, Research and Technology, Ministry of Health, Medical Education, or other executive agencies. Based on the systematic elimination sampling method, the Petroleum Research Institute, Agricultural Biotechnology Research Institute, Botanical Research Institute, Research Center of Medical Science and Technology, Pasteur Institute of Iran and the University Jihad were selected. Direct observation, interviewing and studying documents were used to collect data of this research. Tools of content analysis, within-case and cross-case analyzes were selected for analyzing information from several case studies for analyzing information and comparing research results with subject literature. The results showed that the main components forming business development model of technological ideas in Iran's state research institutes consisted of five main stages, 15 executive steps, 8 key activities, and beneficiaries, and intra and extra organization factors.

Keywords: *Business Development Model, Technology Ideas, Intra Organization, Extra Organization, Iranian Research Institutions.*

1. Introduction

The business development of technological ideas and their transfer from universities and research institutes to private sector industries and enterprises is a subject that has attracted the attention of many managers and active agents in the field of science and technology policy in different countries over the past three decades because the effect of achieving technology and its effective use has been proven as one of the important factors in increasing GDP and industrial and economic productivity of countries (Bandarian and Ghabezi, 2009). In the meantime, the participation of research institutes that often undertake responsibility for conducting research, development and provision of knowledge services and related to the technologies required for government and society not only promote the development of industrial competitiveness of countries, but also, on the other hand, by utilizing knowledge at the national level, these organizations are increasing their revenue day by day and reducing their reliance on government funding, thereby making way for government investment in providing more services to citizens in other areas (Taghvaei et al, 2009). In this research, it is attempted to be provided a framework for doing better the business development of technological ideas by identifying the main components of the business development model of technological ideas in research institutes of Iran.

Several researches related to the issue of business development in the country have been conducted in the past years, which are referred here: the status of the application of research results in Iran, the employer, the scientific council of the country by the Iranian Scientific and Industrial Organization in 1991, review how to commercialize the research achievements at the research centers covered by the Ministry of Industry and Mines, employer: Ministry of Industry, by Iranian Scientific and Industrial Research Organization in 2000, Review the status of commercialization of technology in the country (Mechanisms and solutions), by Mahdavi in 2005, business development of nanotechnology projects in Iran (Nano powders as an example), by Naseri in 2006, identifying challenges of business development of research findings of universities and research centers in the country, by Taghavi in 2010, and research titled factors influencing the success of business development of university technology by Yazdanpanah in 2010.

Investigating previous studies indicate that this research, either merely investigates the aspect of business development or problems such as this; the distinction between business research and business development of technology, the literature of the subject of research is not well studied (for example, all existing business development models are not investigated or compared), the use of research and research conducted has a significant differences with the concept of business development of research and technology findings, only prioritizing the major challenges

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affecting the business development of research findings of universities and research centers are investigated and no specific solutions have been proposed to overcome these challenges, and business development of technology has been considered synonymous with technology transfer. For example, in a dissertation in the field of nanotechnology, the author has examined only Walsh's model and avoided from examining the various patterns and methods of business development in various fields of advanced technologies such as biotechnology, electronics, information technology, aerospace, etc. (other than nano), and it is not clear why a pattern is used for the business development of technology in this dissertation.
Other projects conducted related to research topic are You (2001), Licensing Biotechnology Inventions (2007), Jolly (1997). The most important differences of foreign references referred in the present plan include the following cases: lack of proof of the effectiveness of the proposed business development models scientifically, the existence of institutional differences between developed countries and developing countries that not makes possible the use of developed models in these countries in developing countries.
And in the aforementioned projects, only an aspect of business development (for example, the sale of biotechnology-based products) has been studied.
Also, in previous studies, the process of business development of technology in government research centers has not been scrutinized in these research projects. Business development models have been developed in most cases in the business filed, not in the field of universities and research institutes, and, finally, the factors of business development of technology have not been studied in government research institutes.
But, according to what was mentioned, this research focuses on identifying the main components of the business development model of technological ideas in research institutes in Iran, and therefore essentially differs from many of the above-mentioned projects, especially in terms of the depth of examination of the concepts of business development in the field of library studies and in the applied field.

2. Definition of Research Terms

2.1 Technology

Porter points out economically: "Technology is the factor of converting inputs into outputs that generate competitive advantage through the production of value added." In fact, from the perspective of economists, technology is a science that is used in the production, business development and distribution of goods and services and a tool for improving human physical and mental abilities and a tool for converting simple sources into complex sources and goods. The dictionary and technology context have been interpreted as "practical or applied knowledge" (Bandarian, 2005)

2.2 Business Development

The process of transforming an idea into a durable financial achievement through the creation of a business or giving its score to another part is called business development

2.3 Business Development of Technology

A process in which a technology is introduced in the form of a product (service) or a new process that includes all activities from creating idea to prototype production and design, its testing, production, marketing, and sales of the finished product

2.4 Granting Score

A legal permission granted to a third party by owner of an invention or technical knowledge to use it at a given time and under certain conditions

2.5 Spin off Company

A new company founded in order to exploit a part of the intellectual properties created in an institution. Companies that are currently being developed by current or former members of a research center without the use of intellectual property created at the research institute is not included within this definition.

2.6 Research Organization

An organization whose main task is to conduct systematic scientific studies in one or more specialized fields that often achieve the facts, theories and new scientific principles using scientific and technical assumptions and various experiments.

2.7 Business Development Process

Although business development usually follows a complex and repetitive route that is full of false starts and deadly endings, successful business development will eventually be achieved through defined phases and passing through these phases. Knowing each phase in a particular business development project, the goals of each phase, and having enough resources to reach the next metal is crucial to success. Without having a map showing that you are here. The project's founders will face inappropriate goals, activities and expectations (Berger, 2004). The process of nationalizing these metals and doing special activities for business development is the process of business development.

3. Process Model

A model that explains a process, an action, or an interaction in a wide level.

4. Research Methodology

This research is fundamental objectively (empirical fundamental research) and it is non-experimental in terms of data collection method (acquisitive research) and according to the research approach is qualitative. This research was implemented with a multiple case study strategy, which ultimately the research objective will be realized by identifying the steps, the activities of main beneficiaries and the contributing factors in the business development of technological ideas derived from case studies with each other and with the research literature.

4.1 Population Studied

The study population included research institutes and government research institutes covered by the Ministry of Science, Research and Technology, Ministry of Health, Medical Education, or other executive agencies. The criteria used to select these institutions for case studies in this study are:
1- Have a grid. A, or B of the Ministry of Science and the best performance in the field of research and business development of technological ideas in recent years (between 2006 and 2016) in terms of indicators as the volume of research contracts concluded with other departments, the number of published scientific and research papers, the number of domestic and foreign inventions registered, the number of spin off companies established based on

reports provided by related government agencies such as the Ministry of Science or the Ministry of Health
2. The reputation of the research institute to have experienced faculty members, attract the best researchers and popularity among the ministries of science and health as the successful institution in the business development
3. A research institute is considered that its head is determined by government (state institutions of Ministry of Science, Ministry of Health, or Supreme Council of the Cultural Revolution), and all or part of the budget of this institution will be provided by the government, and will be used government facilities to implement research.
4. Specialized research activity in one of the fields of medicine, social sciences, humanities, basic sciences, engineering, or agriculture and natural resources
Based on these criteria, the Petroleum Research Institute, Agricultural Biotechnology Research Institute, Institute of Botany Research, Center of Research in Medical Science and Technology, Pasteur Institute of Iran and University Jihad were selected. It should be noted that the unit of analysis in this case study is the technologies that have been successfully commercialized in research centers. To select each case and conduct a case study, a letter was first sent to the highest authorities of selected research institutes and research centers. The scholar, after meeting with the authorities, while providing explanations about the research objectives, asked them to introduce one or more technologies to scholar that various strategies, such as concessions, production and sales of the final product, establish spin off company or doing project have been commercialized successfully while briefly describing the official process of the research institute about business development. Finally, the researcher selected and studied the issues in coordination with his supervisor, on the one hand, and with the guidance and approval of the principals or research and technology deputies of the research institutes.
The criteria of governmental institutions are the selection of the director of research institute by the government and the provision of all or part of the funds of research institute by the government. In addition, in order to better understand the way of business development of technological ideas in research centers and the recognition of successful or unsuccessful business development reasons in research centers, multiple case studies whose business development process has not been successful or still no money is paid from final customers for the technology was also examined to examine the reasons of failure and compare them with successful cases add to the richness of the proposed model. It should be noted that 24 case studies in this study were carried out that the reason for stopping in the twenty-fourth case study was the repetition of the patterns seen in previous studies, and since the researcher had reached saturation, the continuation of the research nor add a new issue to the proposed model. In the twenty-fourth case study, case study process was carried out.

4.2 Method of Data Collection

In order to collect the required data, first it was tied to select the top research center for business development (in accordance with the criteria mentioned in the previous section) for deep examination of the processes and factors involved in their business development, and since the unit of case analysis in this study is successful (and sometimes unsuccessful) business development projects in selected research centers from the beginning of 1996 to the end of 2016. Based on this, the business development process and the effective factors in intra and extra organization in each project led to the sale was reviewed and analysised.
In general, the following methods were used to collect data from this research.
*Direct observation
*interview
*Study and investigate documents

4.3 Data Analysis Method

The choice of method affects both the way of data collection and the way of analysis. In other words, the diversity of methods and tools for data collection causes pluralism in methods and analytical techniques. For this reason, in this research, various tools are used to analyze the information and compare the results of the research with the subject literature to present the proposed model that the most important are:
* Content analysis
* Within-case and cross-case analysis to analyze information from multiple case studies

5. Research Findings

Two dimensions of the business development model of the technological idea i.e. steps and activities, were specified by initial comparison or research literature. According to these two dimensions, it can be designed and provided a framework for a more detailed analysis of the business development process and achieve the final model, in which the stages of business development of the technological idea of horizontal dimension and the activities carried out during these stages is formed by vertical dimension of the framework. The below table is an analytical framework derived from the initial analysis of case studies and its comparison with the literature of research.

Table 1: The final framework for acquiring the commercialization process of case studies

stages of commer-cialization of technol-ogy (phas-es) activi-ties	Idea (Innovation from the front line)				Research			Adopting a commercializat ion strategy		New product development (service)			Enter the sales market	
	(1) Ideal form (recogn ition of stimuli and needs)	(2) Eval uate and selec t an idea	(3) Conceptual ization of technology in the form of a research project	(4) Appr oval of resea rch propo sal	(5) Condu cting researc h	(6) Maki ng a protot ype or pilot	(7)Eval uating a prototyp e or pilot	(8) Granti ng point or selling techno logy	(9) estab lish a comp any	(10) Increa sing the scale of produ ct produ ction	(11) Prod uct overv iew	(12) mass produ ction	(1 3) Sal es	(14) Continu ous product improve ment and after-sales service
A.Develop ment of technology and documenta tion of technical knowledge														

B. Technical and economic appraisal														
C) Marketing and conducting market research														
D - Synchronization and decision making														
E) Supply and allocation of resources														
F. protection of intellectual property and legal affairs														
G. Negotiation and Lobbying														
H. Outsourcing the development of technology														

5.1 Secondary Cross-Case Analysis

In this section, using the above table, information about all case studies conducted within this framework was placed in the order of each activity and analyzed again. Based on these tables, the total number of repetitions in the business development process in each chart of the above-mentioned analytical tables from case studies are collected together that are successfully commercialized and finally plotted in the table below. It should be noted that the following table also is allocated to the total number of repetitions of activities in the business development process of case studies that have not been commercialized.

On the other hand, in order to determine the sequencing of the stages of business development in the final model, information about each of the studies carried out in terms of sequence and the occurrence of the activities carried out in successful and unsuccessful case studies are presented in the following tables, respectively.

Based on the data from these two tables, the process of business development of all case studies is drawn step by step. The important point in these graphs is the sequencing of business development stages, in some cases jumping from one step to another, or return from a business development phase to the stage of previous business development. In its analysis, it should be noted that these jumps or backwards were due to the lack of exact implementing an activity or changing environmental conditions and the need to consider and re-examine the parameters in the previous phases. On the other hand, in some unsuccessful business development projects, failure to consider the sequence or failure to do some of the activities in each phase of the business development process or jump from that step led to failure of studied case.

The following tables, respectively, are allocated to the number of activities carried out at each stage of the entire business development process, derived from the business development analysis frameworks of successful and unsuccessful case studies, in order to identify what activities were done essentially in case studies and what activities should be considered by senior executives and researchers in the process of business development of technological idea in state research institutes in order to increase the likelihood of success.

Table 2: Total steps and activities conducted in the commercialization process of successful case studies (derived from the frameworks of commercialization analysis of successful case studies)

stages of commercialization of technology (phases) activities	Idea (Innovation from the front line)				Research			Adopting a commercialization strategy		New product development (service)			Enter the sales market	
	(1) Ideal form (recognition of stimuli and needs)	(2) Evaluate and select an idea	(3) Conceptualization of technology in the form of a research project	(4) Approval of research proposal	(5) Conducting research	(6) Making a prototype or pilot	(7)Evaluating a prototype or pilot	(8) Granting point or selling technology	(9) establish a company	(10) Increasing the scale of product	(11) Product overview	(12) mass production	(13) Sales	(14) Continuous product improvement and after-

										produ ction				sales service
. A.Development of technology and documentation of technical knowledge	9	6	24	1	24	18	16	6		11	9	5	10	7
B. Technical and economic appraisal	1	2	2	1	1				4			1		
C) Marketing and con-ducting market research	4	6						2	4		1	1	0	4
D - Synchronization and decision making	4	8	10	19	3	2	4	6	3	4	4	1		1
F. protection of intellectual property and legal affairs	2	4			18	2	2	2	1	4			1	
G. Negotiation and Lobbying			1	5	3	2	7	11	1	2	2	1	2	
H. Outsourcing the development of technology	3			1	3	1	4			1				

Table 3: Sequence of the steps in the process of business development derived from the business development analysis frameworks of agreed case studies

stages of business	Idea (Innovation from the front line)				Research			Adopting a commercialization strategy		New product development (service)			Enter the sales market	
development of technology (phases) activities	(1) Ideal form (recognition of stimuli and needs)	(2) Evaluate and select an idea	(3) Conceptualization of technology in the form of a research project	(4) Approval of research proposal	(5) Conducting research	(6) Making a prototype or pilot	(7)Evaluating a prototype or pilot	(8) Granting point or selling technology	(9) establish a company	(10) Increasing the scale of product production	(11) Product overview	(12) mass production	(13) Sales	(14) Continuous product improvement and after-sales service
Class 2 Grease Oil	1	2	3	4	5	6	7	8	9					11
DMD	1	2	3	4	5	6	7	8	9	10	11			
RIPI-REFSLM software	1	2	3	4	5	6	7	8	10	11				
drilling	1	2	3	4	5	6	7	8	9	10	12		12	9
Malling Merton	1	2	3	4	5	6	7	8						
Pomegranate machine	1	2	3	4	5	9	10	8						12
Kaolin	1	2	3	4	5	6	7	11						9

Scoop	1	2	3	4	5		7	8		8	9			
Fasciola diagnostic		2	3	4	5	6	8	7	7					
Acetal	1	9	10	11	12		14	8	6					12
	1	2	3	4	5		6			10				
Prenatal diagnosis of thalassemia	1	2		4	5	2	6	7					8	
Blood Bank Cord	1	2	3	4	5	6	7		9	12	13	12	11	8
	8	2	10	11	12				13	14	16	15		11
Consultant Statistics Project	1	2	3	4	5							5	7	
Red Crescent Human Resources	1	2	3	4	5									
HSE National Gas Company	1	2	3	4	5									7

stages of business development of technology (phases studied cases	Idea (Innovation from the front line)				Research			Adopting a commercialization strategy		New product development (service)			Enter the sales market	
	(1) Ideal form (recognition of stimuli and needs)	(2) Evaluate and select an idea	(3) Conceptualization of technology in the form of a research project	(4) Approval of research proposal	(5) Conducting research	(6) Making a prototype or pilot	(7)Evaluating a prototype or pilot	(8) Granting point or selling technology	(9) establish a company	(10) Increasing the scale of product production	(11) Product overview	(12) mass production	(13) Sales	(14) Continuous product improvement and after-sales service
Pars simulation software	1	2	3	4	5 10	6	7 9	8						
Surgical Retractor	1	2	3	4	5	6	10	8 12	11	9 12				
Hydatid cyst diagnostic	1	2	3		4	5	6	7					14	
Salmon vaccine	1	2	3	4	5	6	7	8		9	10	11		
collagen	1			4	2	3	4							
Comprehensive staff training software	1			3 6	4 7	8								

Activities Cases of studied	A.Development of technology and documentation of technical knowledge	B. Technical and economic appraisal	C. Marketing and conducting market research	D. Synchronization and decision making	E. Supply and allocation of resources	F. protection of intellectual property and legal affairs	G. Negotiation and Lobbying	H. Outsourcing the development of technology
	1-14-1-7-6-5-3-		1-8		5-1-14	7-8	3-2-7-8	
DMD	1-2-3-4-5-6-7-1-11-12-13	4-2-8	8	1-2-2-3-4-8	1-5-6-10-11	4-7-8	1-2-7-8	5-6-10
Light cement	2-3-5-6-7-8	8	8	4-4-8-6	5	4-7-8	1-3-5-7-13	7
Software Ripi - Refsim	1-2-3-5-6-7-8-1-11-12-14		1-12	4-2	1-2-5	5-8	1-3-7-13	

drilling	1-3-5-6-7-8-1-11-13	1	1	1-2-3-4	5-10	3-2	1-8	7
Malling Merton	2-3-5-6-7-8-14	8	8	1-3-6-6-16	5	7-8	1-2-7-8	
Pomegranate machine	1-2-3-5-6-7	8	7-14	3-4-5-7-8	5	7-8	1-7-8	5-7
Kaolin	1-2-3-5-6-7		14	4-4-8	5-7	7-8	7-12-12	
Fasciola diagnostic	2-5-6-7-10-11-12-1-14	2	12-13	1-2-1-11		9-12	1-7-8	1
stabilizer	1-2-3-5-6	2	7	7-8	5-7-8	8	2-6-7	1
Leishmanin	5-6-7-8-11-13		4	4-4	5-10	5-8	1-2-5-7-10-11	4
Prenatal diagnosis of thalassemia	1-2-5-6-7-8-14			4-5-8-11	5	1-11	1-6-8	4
Blood Bank Cord	1-3-5-6-7-10-11-12-13-14	11	10-11	4	5-10		1-4-7-9-10-11	1
San Mix	2-3-5-6-10-11-14		1	2-3-4-9-10-14	5	4-9-11	2-8-11	
Statistics Consultancy Project	4-13-14		12	2-4		6-8-22	1	
Human resources 5-5 red crescent	3-5		1	2-4-9	2-5	13	1-2-5	
HSE company gas				2	2-5	5	1-2-5	

Activities Cases of studied	A.Development of technology and documentation of technical knowledge	B. Technical and economic appraisal	C) Marketing and con-ducting market research	D. Synchronization and decision making	E. Supply and allocation of resources	F. protection of intellectual property and legal affairs	G. Negotiation and Lobbying	H. Outsourcing the development of technology
Pars simulation software	1-2-3-5-6-7	8	8	3-4-7	1-5	-5-8		5
Surgical Retractor	2-3-5-6-7-10			2-3-4-8	5-10	8	2-8	13
Hydatid cyst diagnostic	2-5-6-7		8	2	5		1-6-7-8-9	1
Salmon vaccine	2-3-5-6-7-10-11-12	1-8	1-8	4-10	2-5	7-12	7-8	10
collagen	1-5-6-7				5-7	6	1-3-7-8-10-11	
Comprehensive staff training software	1-3-5-6		1	2	5	5	7	5

By comparing statistics and classified information obtained from the above tables, the following significant results were obtained:

• The highest rate of repetition in the main stages of business development has been 5 which represents 5 main stages in the overall business development process. In some case studies, depending on the subject and the case study, at least two main stages were needed for business development, and the studies showed that in the cases that just one stage is passed, the process of business development was not succeeded.

• The sequence of the main stages is associated with a particular order, in most cases; steps are from one to five, respectively.

• In the overall process of business development, there are two decisions among the main five stages, which are usually taken by the highest authorities, research institutes, respectively. The first decision is made on approving the research proposal in the research institute. This decision forms the final step in the first stage. The second decision is on the adoption of an appropriate strategy for business development of technological idea developed at the research institute and the choice between one of the strategies of establishing company, selling a technological or product idea, continuing the development of a technological idea without the establishment of a company or the award of a technological idea to various applicants. This decision is about the unification of the business development strategy. If a particular strategy (such as establishing a company) is not fundamentally chosen, the next stages in business development may not be take place in practice.

• Based on the above tables, the number of activities that may take place on different stages of business development is 8 activities, depending on the case, fewer of these activities may be carried out in each case. The important point and its distinction with the stages of business development is that there are no particular arrangements and priorities in the activities of business development are seen at any stage of business development. This means, for example, in many case studies, a process that began or end with a specific activity is not seen. Rather, what activity is initially carried out at each step depends entirely on the conditions and type of technological idea that a decision is made by the project manager regarding the implementation and priority of the project.

• There is little difference between successful and unsuccessful commercialized development projects in terms of the process, activities, and business development stages except in some projects that have not been commercialized. Or some steps have not been taken in practice or some of the activities necessary for business development are not considered by the project manager. Of course, the quality and the way to di activity or use specific techniques and tools to accurate execute of each activity is another

reason for the success or failure of the business development projects of technological ideas. But in general, the sequence of stages, as well as the activities in the successful and unsuccessful business development projects, is roughly the same. In addition, there is a subtle point, though at first glance, there is no difference between successful and unsuccessful business development projects in terms of business development processes and stages, but by considering interviews and the documents reviewed during the implementation of this research, it is specified that although business development stages and activities may be done well. But other dimensions, apart from these two dimensions, have an impact on the business development process. These dimensions are the factors that all interviewees shadow in the business development process, which can cover even the lack of an activity in the business development process and cause the success of whole process of business development (such as the high lobbying power of the project manager with the main beneficiaries or the presence of customer in the private sector's technological idea), of course, the adverse of this issue is true so that ignoring these factors, although the processes are well organized and implemented, may lead to a failure of the business development project. (For example, the existence of a rival technological idea at a very low price in the market and the lack of attention of the project manager to this issue since the beginning of forming idea of executing project).

• According to the above tables, in some case studies, for example, because the prototype of the product from the project evaluator was rejected by the employer and ended with the initial funding allocated to the project due to a lack of exact prediction in the middle of the work, from the middle of the business development process, some of the research processes are backed and repeated again! But the sequence of stages is remained almost identical. Therefore, the slices in the business development process are usually due to shortcomings that derived from the lack of prediction and exact doing of some of the activities in previous steps, or to use an opportunity in the future that has been created one or more steps in the process of business development.

• From the point of view of the most frequency seen in the stages of business development, it can be said that in the first stage, the steps of knowing the motivators and the needs shaping the main idea, as well as conceptualizing the idea in the form of technological idea, have had the most frequency and importance. In the second stage, the step of research implementation as well as the step of evaluation of the prototype of the technological idea has great importance. In the fourth and fifth stages of the main process of business development, steps of increasing the initial scale of the product and sales have importance. The remarkable point is that based on the information in table 4-6, other than the steps of the prototype evaluation and sales, roughly these steps and stages in case studies that have not been commercialized have had importance.

• The above tables also point to other activities in different stages of business development from another angle. For example, the development of technological idea and documenting technical knowledge takes place in various stages of business development. But activities such as outsourcing of the development of technological idea, with technical and economic evaluation in most steps are not done or in projects that are done in a specific step in these activities are taken place. This issue is also important from another perspective. For example, the activity of supplying and allocating resources in the fifth step that the research is conducted can be seen in almost all case studies, whether successful or unsuccessful. Because without funding, there is basically no possibility of project implementation; the other point is that due to the lack of definition of some organizational posts in the organizational structure of Iranian state research institutes, practically some of these activities are not implemented in the process of business development systematically. If these activities (such as marketing and technical and economic appraisal of projects) have great importance in the business development of technological idea and the failure of some projects has been due to the lack of such activities from the very beginning of the project.

• For the perspective of what activities in the business development process are more important than other activities, review of the frequency of activities carried out in case studies (Table 4-5) shows that the development of technological idea and documenting technical knowledge, negotiation and lobbying, or various beneficiaries, and finally the coordination and decision making by the manager of project are more important than other activities. The important point is that based on the information in the table above, the activities are important in case studies that have not been developed commercially, further reflection on final point indicates that even if steps and activities business development is also well done, but there are other factors that, in the case of not paying attention to them in the business development process, they increase the probability of failure of the project. These factors are driving and deterrent factors of intra and extra organization that play a significant role in the process of business development as well as in interaction with the various beneficiaries and different interviewees have also referred to the role of these factors in the process of business development in all case studies. For this purpose, the table above is dedicated to summarizing and categorizing these important factors from the viewpoint of the various interviewees who have referred to important factors in each study in case studies.

It should be noted that the important factors in each case study were summarized after interviewing the managers and officials of the business development projects at each research institute and rewritten in case studies reports according to the research instructions. The numbers in the table below represent the degree of frequency of each factor by different interviewees.

It should be noted that by using the Parole Act, about 20% of the factors that considered important by almost 80% of interviewees in the process of business development and there is almost a consensus on their importance are presented as the main factors in the model of business development of technological idea in the state research institutes of the country in the final model. Based on this, the driving internal factors in the business development process in the order of the most frequency mentioned by interviewees are responsibility of the responsible person and members of the developed team of the technological idea, the availability of equipment and facilities for the development of technological idea, the ability of senior managers of research institute in lobbying with external beneficiaries, focusing on customer needs and the existence of risk morale in managers and employees of the organization.

On the other hand, based on the above table, the deterrent external factors in the business development process in the order of the highest frequency mentioned by the interviewees, the absence of a specific process and strategy for the development and business development of technological idea in the research institute have been the lack of transparent rules for the sharing of benefits from business development of the technological idea between the research team members, the lack of a prior business development experience in the project manager of the technological idea developer, the lack of necessary business and legal skills in the developing team of technological idea, and the lack of allocation of sufficient resources to research and development activities and business development of technological idea in research center.

Also, the driving external factors in the process of business development in the order of the most frequency mentioned by the interviewees are: the competitive and low price of the technological idea developed by the research institute in comparison with the idea of rival technologies, the existence of a market suitable for the technological idea, popularity and reputation and public trust, the society called the State Research Institute, the existence of state-sponsored policies and rules in investing and manufacturing products with advanced technological idea, and the existence of a private-sector capable company to gain technological idea point.

Finally, the deterrent external factors in the process of business development in the order of the most frequency mentioned by the interviewees are: the lack of familiarity of the active managers in the country's industry with the idea of developed technologies at the research institutes, non-specifying standards of the technological idea and the competence and neutrality of reference laboratories to determine and evaluate the standard of the idea of developed domestic technology, the desire to buy the idea of foreign technologies by managers and the lack of confidence in domestic products and the low possibility of protection of technological ideas for the unhealthy use of companies and the unreliability of industry managers of country in application and acceptance of the technological idea risk developed by the domestic research institutes in practice.

It should be noted that in the interviews and the documents studied in each case study, in addition to the internal and external factors, another dynamic factor has also been emphasized repeatedly and it is internal and external key beneficiaries. The internal and external key beneficiaries both have been somehow effective in the process of business development. Since in some of the business development models of technological idea, the beneficiaries are mentioned as one of the components of model, in addition, case studies showed that the behavior and actions of different beneficiaries causes to change the conditions and impact on the whole flow of business development of technological idea, and even change in the behavior of project managers and the authorities of the research institutes. Key beneficiaries are considered as a key element in the business development model.

Table 4: The frequency of internal and external factors on the process of business development of case studies conducted

Factor effect	Factor (number of frequency of case studies)	Internal		External	
		Driving	Deterrent	Driving	Deterrent
The curiosity and motivation of researcher and responsible of technological development team		7			
Knowledge and technical abilities of people and responsible of development team of technological idea		14			
Accountability of responsibility and team members of developing the technological idea		21			
Identify the development strategy of technological idea in the research institute from the beginning of the project definition		4			
Appropriate relationships between the members of the technological development team		12			
The support of senior managers of research institute from the business development of technological idea		8			
Identify the existence of an appropriate market for a technological idea before attempting to develop a technological idea		3			
The availability of equipment and facilities for the development of technological idea		16			
The ability of senior managers of research institute in lobbying with external beneficiaries		15			
The support of management of the research institute from the realization of the creative idea of the research team		8			
Investment and capacity building for the research institute for efficient human resources in the project		9			
Focus on customer needs		14			
Precise selection of members of the technological idea developer		1			
The experience of previous business development in the manager of the developer of the technological idea		4			
The existence of transparent rules for the sharing benefits of business development of the technological idea between the members of the project		1			
Existence of risk morale in managers and staff of the organization		14			
Strong leadership of project manager of developer team of ideological idea		3			
Precise selection of members of the developer team of technological idea		1			
The existence of a specific strategy for the development and business development of the technological idea from the beginning of the project		3			
The inability of the research institute's managers in lobbying with beneficiaries outside the research institute			2		
Lack of access to equipment and facilities for the development of technological idea			3		
Non-cooperation of intellectual property unit for registering invention			2		
The lack of culture and thinking of business development dominating the whole organization			1		
The lack of an agile business development team along with the technological development team of the technological idea			4		
Absence of clear rules for sharing the benefits of business development of technological idea between research team members			13		
Lack of a specific strategy process for the development and business development of a technological idea at the Research Institute			14		
Lack of previous business development experience in the project manager of the technological idea developer			12		
Lack of necessary business and legal skills, in the team of technological idea developer			12		
Weakness in documenting technical knowledge at different stages of development of technological idea			4		
Non-accountability of research team members			1		
Not allocating sufficient benefits to research and development activities and the business development of a technological idea at the Research Institute			7		
Failure to support the Research Institute's management from creative ideas of researchers			3		
Unawareness of research team from description of their duties when business developing the technological idea			4		
Lack of culture of innovation and entrepreneurship at the research institute			5		
The lack of invention registry unit at the research institute			4		
A lot of bureaucracy in the organizational structure of the research institute that prevents the advancement of business development activities			4		

The lack of the necessary capabilities in the research center to evaluate the technological idea		4		
The existence of foreign investment and investor for the development of technological idea			1	
The support of some people with political and religious influence of the country from the development of the technological idea			1	
The existence of suitable consumption standards for the development of technological idea			1	
Implementing the rules to maximize the power of domestic debates by the government			1	
The proper market for technological idea			14	
Appropriate initial allocation of resources from government sources for the development of technological idea			3	
The competitive and low price of the technological idea developed by the research institute compared with the idea of rival technologies			19	
Initial purchase (pre-purchase) of the state to help to develop the technological idea			3	
The presence of a competent and technical manager in a private company that receives points of technological idea			1	
existence of information networks and the promotion of the application of technological idea among final consumers			2	
The existence of state-sponsored policies and rules in investing and manufacturing products with advanced technological idea			7	
The existence of intermediate government centers facilitating the business development of technological idea			5	
The existence of political calm in the country's atmosphere			1	
Having external cooperation in the process of conducting investigations in order to excite researchers, for example, empower them			3	
Informing the public sector applicant for a technology idea to the Research Institute for taking part in holding tender			2	
The acquaintance and trust of the customers of the technological idea buyer with the capabilities of the research institute			1	
Providing special privileges to top researchers in the field of business development by external organizations			1	
The presence of the private sector's company to receive point of technology idea			7	
Funding necessary for the development of technology idea from government			4	
The boycott of products with a high technological idea from developed countries			1	
The existence of a government director interested in sponsoring and investing in the idea of technology developed at state research institutes				
The reputation and public trust in the name of the state research institute			1	
having a roadmap for developing a technological idea and value added chain in the industry			1	
Not specifying standards of the technological idea and the competence and neutrality of the reference laboratories to determine and evaluate the standard of the developed internal technological idea				8
Irregular imports of technological idea				5
Unhealthy competition among importers of products to the country				2
The uncertainty of the country's industry leaders in applying and accepting the technological idea risk developed by the domestic research institutes in practice				6
The complexity of the technological idea				6
Possibility of low protection of the technological idea for unhealthy use of companies				7
The existence of legal and bureaucratic administrative barriers of sale of equipment built with government money				4
The problems caused by Iran's sanctions to receive or pay money				1
The lack of strict implementation of the law of maximum construction power by the state				1
The lack of a culture of entrepreneurial of technological idea in community and among the research institute staff				5
The desire to buy the foreign technological idea by managers and distrust of domestic products				8
lack of familiarity of active managers in the country's industry to developed technological ideas in research institutes				10
Lack of access to financial resources for the purchase of the technological idea developed by the Research Institute through the final customers				2
Lack of allocation of adequate funding to research and development activities by the private sector				4
The statehood of many industries and the lack of a sense of need for research and development				1
Failure to offer special privileges to the top researchers in the field of business development by the government				3
Many rivals				1
importance of lobbying before concluding contract with government executives				1
Resistance of some of the country's executive and religious institutions to provide new technology services to the people				1
The impossibility of exporting the technological ideas to build research institutes and compete with Chinese goods				2
Failure to inform the public sectors of buying technological idea and holding tender with the research institutes				1
Lack of political calm				1
Disregarding business development in the field of humanities and providing special incentive policies by the government				2
Non-cooperation of the standard approval authority of ideological idea				1
Lack of initial buy of government to create a new market				1

Not considering point to business development technological idea by the research institute when evaluating the research institute by relevant institutions				1
Unavailability of the statistics and information necessary to conduct the necessary investigations				4

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Proposed model of business development of technological idea in Iranian state institutions

By summarizing the results of the analysis, the components of the order and the way of arranging business development model of technology idea is specified in the state institutions. Because of the activities carried out at each stage, a special sequence was found at each stage, activities are placed in a 7-sided form that in its center, decision-making and coordination activities as one of the key actions by the officials of the business development projects have been mentioned in state research institutes. It should be noted that being in the center of this activity, although in terms of the most frequency among activities is in the third place, but due to the fact that in interviews and examination of case studies, it became clear that the proper conduct of this activity has a significant role in the success of the business development process, it the center of this heptagon for attracting the attention of managers and authorities, state research institutes are placed, on the other hand, the rotation of these activities is also due to the emphasis on dynamism and the lack of clarity of the start of activity at the beginning of very step and every stage.

With these two elements (stages and steps of business development and activities), by summarizing all the information obtained from case studies and emphasizing on the most important factors and beneficiaries that have been seen in most case studies, two other elements, i.e. important factors as well as the beneficiaries of the business development process has also been added to the community model.

What is important in this graph is that this model is a comprehensive and public model for the business development of technological idea in state research institutes, however, depending on any specific field of technological and industrial idea, the driving and deterrent external factors according to the field of technological and industrial idea can allocate a separate layer of this graph, and these factors may change to some extent depending on the specific scientific and industrial field.

It should be noted that the high risk of the boundary of research center with its external environment is depicted. In addition, in this graph, internal beneficiaries are displayed by orange color, external beneficiaries with blue color, internal important factors with yellow color and external important factors in business development with green color. Also, in order to the optimal use of space and summarizing activities, the titles of the activities carried out at each step of business development are encoded with alphabet letters and a heptagon is organized as follows:

A. Developing technological idea and documenting technical knowledge
B. Technical-economic assessment
C. Marketing and market research
D. coordination and decision-making
E. Supply and allocation of resources
F. protection of intellectual property and legal affairs
G. Negotiation and Lobbying
H - Outsourcing of the development of technological ide

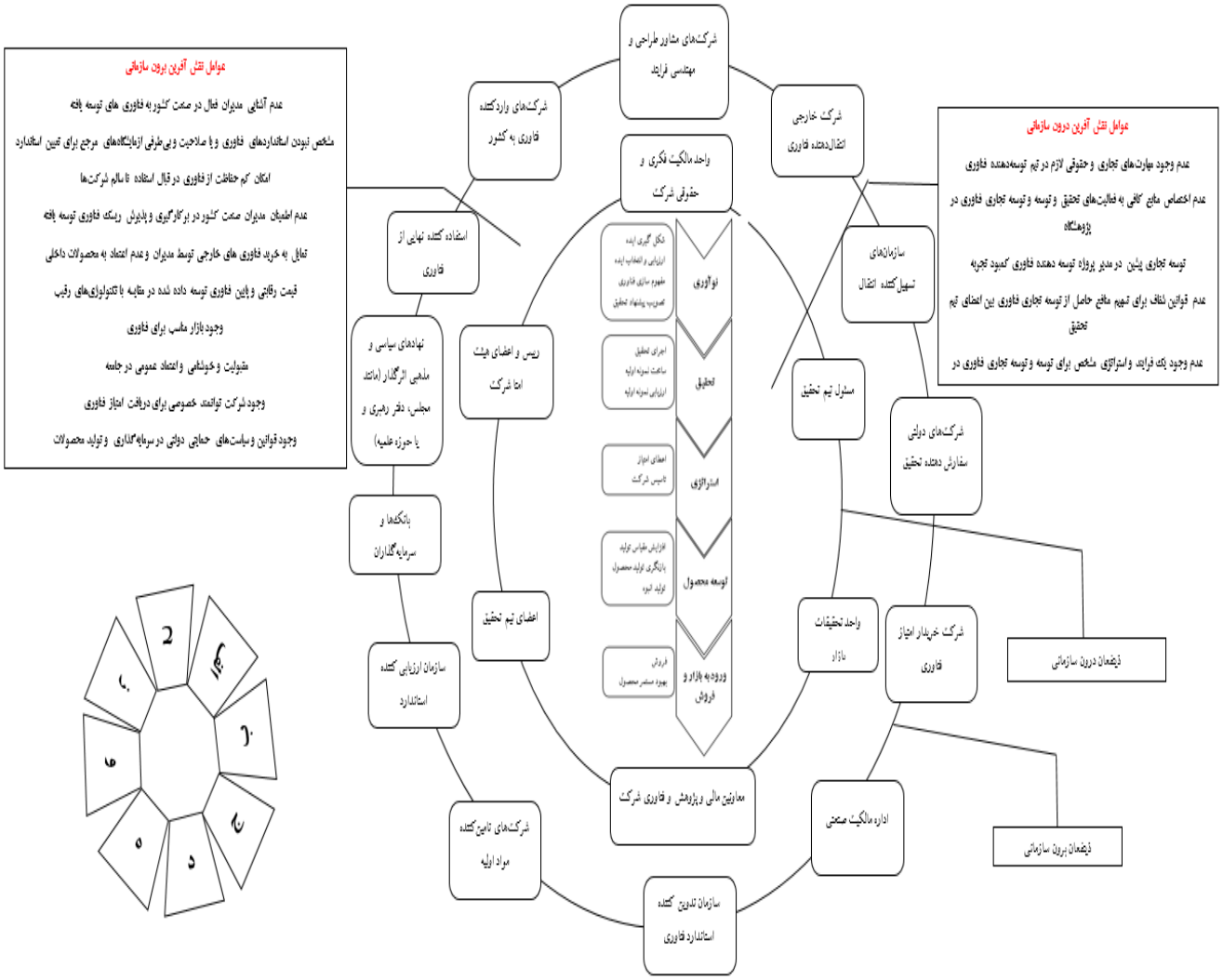


Figure 1: The main components forming business development model of technological ideas in Iran's research institutes

6. Discussion and Conclusion

By examining 24 case studies, it was specified that in any case where the commercial development of the technological idea has taken place (whether the business development was succeeded or this issue was not realized), the business development process includes a series of main stages is the idea (innovation) conducting research, adopting a business development strategy, developing a new product, and entering into market and sales. Each main stage consists of a series of executive steps that, in order to complete that step, these steps should be taken place in practice. In this way, the first stage includes the steps to implement, identify and form the idea of evaluating and choosing the idea of conceptualization of technology idea in the form of a proposal of research and decision-making of responsible management or officials on accepting a research proposal for its implementation at the research institute. The executive steps of the second main stage in the business development process include conducting research, building a prototype, and evaluating the prototype. In the third stage which the strategy of business development of the technological idea is taken, the research institute management among the three strategies of granting point, establishing a company or producing technological idea by the research institute selects a strategy that selecting this strategy follows the implementation step of this stage. In the case of selecting strategy of granting point, the technology idea will be assigned to a company or institute outside the research institute, and the business development process of technological idea ends here. But if one of two other strategies is chosen, the business development process goes into the fourth stage, which is the development of the new product. This stage involves the executive steps of increasing the scale of production, review the production of the product and mass production of the technological product. Finally, the fifth stage that is allocated to enter the market and sell the technology idea, two executive steps of sale and continuous improvement of the product and the production processes form its components.

On the other hand, as investigating and analyzing case studies showed, eight major activities are carried out at various stages of business development, including R & D, documentation of developed knowledge, internal coordination and decision making activities between the various departments of the organization and various beneficiaries to provide new services, market research, technical and economic assessment, outsourcing the development of the technological idea, the provision of the necessary resources such as human and financial resources, the compilation and registration of intellectual property, the regulation of the sale contract or the assignment of technological idea and doing legal reviews, and negotiation and lobbying with beneficiaries in and outside the public research institutes of country, these activities are done depending in what executive step from the business development process to be placed, and the amount of emphasis on the implementation of each of these activities depends on a variety of factors, but for the success of business development, these activities should be properly conducted in the business development process.

Therefore, the main components forming business development model of ideological idea in the Iranian research institutes are five

main stages, 15 executive steps, 8 key activities, and beneficiaries and internal and external factors.

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