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Research Article

IDENTIFYING THE AFFECTING FACTORS ONTECHNOLOGY COMMERCIALIZATION IN IRAN INDUSTRIAL DEVELOPMENT AND RENOVATION ORGANIZATION USING MIXED APPROACH

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ABSTRACT
This paper aimed to identify factors that affect the technology commercialization in Iran Industrial Development and Renovation Organization (IDRO). For this purpose, the interviews and questionnaires were used to collect data; the theme analysis and factor analysis were used to analyze the data. The study population for interviews consisted of technology commercialization experts who were involved in the commercialization process from 2002 which coincided with the advent of IDRO into advanced industries, to 2013. To collect quantitative data, the study population consisted of all the experts in IDRO. The results of the qualitative study extracted 25 themes of interviews that were introduced as the factors influencing the commercialization of technologies by experts. The factors affecting technology commercialization in the Industrial Development and Renovation Organization of Iran were the factors associated with state and federal policies, organizational factors, factors related to the business environment, and commercialization related factors.

Keywords: *Commercialization, Technology Commercialization, Factors Affecting Technology Commercialization, Industrial Development and Renovation Organization of Iran*

INTRODUCTION
In the recent years, Technology and Transmission has received special attention from Governments and Education & Research Institutes because of the fact that the influence of acquiring technology and its effective advantages of its usage has been proven to be as a key factor in gross national product growing and countries economical and industrial productivity.
Creating value and wealth from technology solution requires the strength of the components of one chain named as value chain (which is consisting of research, development, innovation, production; marketing and services).
In the General Politics of Iran Development Fourth plan (such as its 9, 26, 29 and 36 Articles) the main emphasis is on the Technology, especially on high Technologies.
Even In the 27th Article of the Technology Development Fifth plan, Iran Supreme Leadership in The General Politics statement emphasizes on the Export Development Strategy Specially on high Technology areas services sections so as the Oil consumption and oil trade will be decreased and as a result, a strong power in business can be created.
Despite the Importance Technology Commercialization And the IDRO Role In the country's Economical and social Sublimation, it should be noted that Technology Commercialization is the most Complex and difficult phase in the process of translating idea to Phenomenon and will be encountered with a lot of risks, challenges and costs.
In spite of the important role of IDRO in country development and realization of the twenty years Vision goals, exploring of documents and evident of IDRO commercialization shows that from 2002 to 2013, this organization has been participated in executing of more than95 plans in the advanced industries. With respect to the performance of IDRO, this study is looking at using a combination approach to identify affecting factors in successes or failures of technology commercialization projects.

Research Article

Technology Commercialization Literature and Factors

In today's global economy, organizations are facing increasing competitive pressure. The technology commercialization is a common strategy which organization adopts to survive in this competition (Chen *et al.*, 2011). Technology Commercialization can be defined as the process of converting (transforming) technological capabilities to effective products and services that increase profitability and the social welfare. Technology Commercialization including technologies resources, leads to value-added for producing durable and up to market products and services (Krishnan, 2013).

Commercialization of technology is a complex process influenced by many infrastructure, technology and business, social, political and historical factors. Researchers have been pointed to the several factors that can be classified in categories.

Some researchers emphasize on the importance of understanding the differences between commercial facilitate or factors (Tushman and Rosenkopf, 1992).

Ettlie *et al.,* (1984) demonstrated the relationship between the organizational facilitate or and commercial types.

Researchers believe that variables (such as the growth strategy) that will be affected by diversity and considerations, size, complexity, formalization and centralization lead to the commercialization of fundamental innovation.

Other commercialization related factors which was studied experimentally are as follows: Hero's existence, resources scarcity, and formalization and the structural complexity (Damanpour, 1991; Day, 1994).

Souitaris (2003, 517) in its portfolio model, has been classified these factors into four categories:

A) Context Variables: from different theoretical perspectives, Organizations have been viewed as adaptive systems and this suggests that the Context Variables can have causal effects on the structure and strategy

B) Strategy related variables: company can be viewed as a network of decisions that have to be adopted for organization positioning in its environment and creating organizational structures and processes. It was at 1960s that the idea for organization's strategy was emerged.

C) External communications: the strategy related Variables of a company can be viewed as a network of decisions. Information Capturing and scanning is another identified factor in the researches that has a positive impact on the innovation rate. So, the following three sets of innovations related variables that have been introduced in this model include:

1. Factors associated with the company's stakeholder communication include:

-Customers: Personal meeting (Chiesa *et al.*, 1996; Rochford and Rudelius, 1992) Panel Discussion (Chiesa *et al.*, 1996), mail or telephone feedbacks (Chiesa *et al.*, 1996) or quantitative market research in order to capturing a more wide range of customers information (Khan and Manopichetwattana, 1989b), machinery and equipment Suppliers (Duchesneau *et al.*, 1979).

2. Factors associated with information collecting and scanning: these factors that can be found from resources such as public Agency (Carrara and Duhamel, 1995) or other companies (Alter and Hage, 1993; Bidault and Fiscer, 1994; Trott, 2003) who are the membership in professional associations (Swan and Newell, 1995), Subscription in scientific and commercial environment (Khan and Manopichetwattana, 1989b) attending trade fairs (Duchesneau *et al.*, 1979), access to and use of the Internet, the use of electronic databases and patent.

3. Organization Cooperation with third parties such as universities and research institutions (Bonaccorsi and Piccaluga, 1994: Lopez- Martinez *et al.*, 1994), Public and private consultants (Bessant and Rush, 1995; Pilogret, 1993); other companies in joint ventures form (Alter and Age, 1993; Swan and Newell, 1995); or concession (Lowe & Crawford, 1984) and national institutions as a source of capital risk (Eurostat, 1996).

D) Variables related to organizational field: bureaucracy theory (Weber, 1947), Classical management (Gulik and Ulrick, 1938) and organizational sociology (Blay and Schoenherr, 1971), all of them emphasize on the major impact of the organization structural features on its behavior.

Factors that have been described so far can be divided into two groups: environmental factors and organizational factors:

- Environmental factors are related to country social, economical, political, infrastructure conditions and access to services that they are out of the control of the commercialization project's administrator (executer) .Organizational factors include team management, human resources, infrastructure, financial, marketing, and technical capabilities, team members, project management and project characteristics.

For successful implementation of the commercialization project, identifying the factors affecting the performance is necessary. So as after resolution of critical factors, taking the proper action in order to control and create favorable conditions would be easy.

MATERIALS AND METHODS

Research Methodology

Since the present study is aimed at expansion of the current understanding of influencing factors on IDRO' s technology commercialization, it is a research practical.

In this study, both qualitative methods (themes analysis and focus groups) and quantitative methods (factor analysis, median test for one populations and Friedman test) were used.

The data in this study were collected by means of interviews and questionnaires.

The qualitative study populations were IDRO experts who were participated in technology commercialization projects from 2002 to 2013. The sampling method was Purposive or judgmental and data saturation was reached after 15 interviews.

Table 1: Demographic characteristics of respondents in the first phase of the Quantitative study

Row	Demographic variables	Options	Abundance	Percent
1	Sex	Male		27%
		Female		73%
2	Relationship	Single		-
		Married		100%
3	Age	Under 30 years		
		31 to 40		33%
		41 to 50		47%
		51 years and over		20%
4	The history of IDRO or organizations under its control	Less than one year		-
		1 to 5 years		-
		6 to 10 years		-
		11 to 15 years		80%
		15 years and over		20%

In this study, to assess the reliability of the results of the interviews, Retest reliability and inter-subject agreement was used. The results is shown in the below tables.

The Values above 60 percent indicates the reliability of the researcher interviews coding (Kvale, 1996).

In order to quantitative assessment, the results of the qualitative data were converted to the assumptions and based of them the research questionnaire was developed.

The questionnaire was about affecting factors on technologies commercialization and was consist of 25 questions. The questionnaire was about affecting factors on technologies commercialization and was consist of 25 questions. A five-point Likert-type scale was used where 1 – strongly disagree and 5 – strongly agree

The questionnaire data analysis was exploratory factor analysis, and confirmatory factor analysis was used to extract factors for assessing the results of the exploratory factor analysis and structural analysis. The reliability of the questionnaire was measured by Cronbach's alpha, which is shown in the following table.

Table 4: Questionnaire and variables Cronbach's alpha

Questionnaire	Cronbach's alpha	Dimensions or factors	Cronbach's alpha
Technology Commercialization Affecting Factors	0.894	Factors associated with the government and its policies	0.96
		Factors related to the business environment	0.886
		Organizational factors	0.915
		Factors associated with Commercialization	0.881

This study population was commercialization of technology experts and organizations under IDRO control. The number of these experts was 245 people and this study was conducted in 1392. Demographic information of 205 participated experts was as the following table.

Table 5: Demographic characteristics of respondents in the first phase of quantitative study

Row	Demographic variables	Options		Percent
1	Sex	Male	161	78.5%
		Female	44	21.5%
2	Marital status	Single	33	16%
		Married	172	84%
3	Age	Under 30 years	16	8%
		31 to 40	73	35.5%
		41 to 50	75	36.5%
		51 years and over	41	20%
4	The history of IDRO or organizations under its control	less than 1 year	-	-
		1 to 5 years	53	26%
		6 to 10 years	77	37%
		11 to 15 years	47	23%
		15 years and over	28	14%

Findings from the Qualitative Survey

The main question of in this section was "What are the factors that affect the technology commercialization?" The theme analysis was conducted based on data collected from the interviews. The results of the analysis are shown in the below table.

After analyzing the interviews data, 53 codes were identified. The codes were classified based on the themes similarity. A total of 25 themes were emerged from the interviews.

Table 6: Results of themes analysis of interviews related to factors that affect the commercialization

Business strategy and organizational policies and priorities	Expertise and commitment to professional and executive team	market Competitive environment	The protection of intellectual property	Policy and technical knowledge valuation method
Project financing and financial costs	Cooperating Regulatory and licensing agencies with organization	science and technology centers Cooperation with organizations and executives (knowledge owners)	Cooperation organization	government Supportive policies
collaboration with Research companies, universities and knowledge-based organizations	Organization Processes and mechanisms	Organizational Monitoring and control systems	Commercialization Duration	Market Attractiveness
Performer and his abilities	Risk investment funds	commercialization state Approval	State laws and regulations related to the commercialization	Country Production and manufacturing capabilities
Government regulations related to the commercialization	Project characteristics, and technology types and its progressive (level)	Political space (atmosphere)	Society Needs and demands	senior executives perspectives

Using the results of the theme analysis, a questionnaire including 25 questions was prepared; each question measured a single theme.

The questioner was distributed to all commercialization experts in IDRO and its affiliated organizations so as they express their opinions about the factors identified based on Likert scales.

In the aim to extracting factors and summarization of Collected Data, these data were examined through exploratory factor analysis and then to confirm the results of the exploratory factor analysis, confirmatory factor analysis was performed.

Findings from Quantitative Survey

An exploratory factor analysis was used to identify the main factors and data reduction and summarizing. KMO and Bartlett's tests revealed data sufficient and the possibility of Exploratory factor analysis performing.

Gaining Values greater than 0.7 for KMO indicates possibility of data factor analysis and usefulness of its results

The value of KMO sampling adequacy test was 0.873. This value showed factor analysis is justified.

When the Bartlett test is significant at the level of error less than 0.05, there is a significant relationship between the variables and new structure of the data may be discovered. In these tests, the significance level is less than 0.05, and therefore the factor analysis to explore the new data structure (factor structure) is appropriate.

Factor analysis was performed by SPSS on 25 questions. In accordance with the following table, 4 main factors were extracted. Approximately, this 4-factor Explain 69.84% of the 25 items variance related to factors affecting technology commercialization in the IDRO.

Table 8: The total explained variance

Sum of Rotated factor loadings squares			Sum of extracted factor loadings squares			The Initial eigenvalues			Component
Total %	Variance%	Cumulative%	Total %	Variance%	Cumulative%	Total %	Variance%	Cumulative%	
4.960	19.839	19.839	7.352	29.409	29.409	7.352	29.409	29.409	1
4.346	17.383	37.221	4.996	19.984	49.393	4.996	19.984	49.393	2
4.338	17.350	54.572	2.890	11.561	60.954	2.890	11.561	60.954	3
3.817	15.269	69.840	2.222	8.886	69.840	2.222	8.886	69.840	4

Table 9: Results of confirmatory factor analysis

Confirmatory factor analysis

Factors	Factor Load	T-Value
Factors associated with the government and its policies		
State laws and regulations related to the commercialization	0.91	16.84
Governmental regulations related to the commercialization	0.95	18.08
supportive Policies of national production	0.89	16.29
Political space	0.86	15.45
Regulatory and licensing agency collaboration	0.87	15.52
Approval of a state associated with the commercialization	0.82	14.10
Organizational factors		
Business strategy and organizational policies and priorities	0.90	16.24
The views of senior executives	0.83	14.49
organizational Cooperation	0.86	15.26
organization Processes and mechanisms	0.90	16.45
organization Monitoring and control systems (within the organization)	0.70	11.18
Expertise and commitment to professional and executive team within the organization	0.62	9.54
Factors related to the business environment		
market Attractive	0.71	11.30
society's Needs and demands	0.78	12.84
collaboration with Research companies, universities and knowledge-based organization	0.62	9.50
Production and manufacturing capabilities	0.79	13.15
Risk investment funds	0.72	11.41
Competitive environment of market	0.79	13.04
Science and Technology Parks Cooperation Owners)	0.69	10.79
Factors associated with the commercialization		
Financial costs and financing of the project	0.97	18.83
Performer and his abilities	0.62	9.61
Project characteristics, and technology type and advancement	0.74	12.27
Commercialization Duration	0.51	7.72
The protection of intellectual property	0.61	9.59
technical knowledge valuation Policy and method	0.92	17.00

Chi-square = 766.22; RMSEA = 0.078; X^2/df =2.84;
CFI = 0.91; IFI = 0.91; RFI= 0.86; NFI = 0.90; SRMR = 0.070

*Note: *P > 0.05 , ** P > 0.01*

•The first factor consisted ofitems2, 10, 16, 17, 21 and 23, which is 19.839% of the total variance (maximum)
•The second factor includes items3, 6, 11, 13, 18 and 20, which is 17.383% of the total variance.
•The third factor consisted of items 4, 7, 12, 14, 19, 22 and 25, which is 17.350% of the total variance.
The fourth factor includes items 1, 5, 8, 9, 15 and 24 which is 15.269% of the total variance.
These four factors were identified as contributing factors in the commercialization of technology in IDRO.
Now To confirm the results of the exploratory factor using confirmatory factor analysis, factors and related questions will be examined
All factor loadings are greater than 0.4. It can be said that of the test questions have a very well explanation power.
On the other hand, the significant magnitude of number (T-Value) is greater than 1.96, indicating model parameters signification. The chi-square value is 2.84 and degrees of freedom are between 1 to 3 values.

Conclusion

In this study we sought to answer this question that "What are the factors that affect the commercialization of technology in IDRO?" Based on the results of a qualitative study, 25 themes were identified as factors that affect the commercialization of technologies. The developed questionnaire based on identified factors was distributed to all of the commercialization experts.
The data collected from the questionnaires were analyzed using SPSS software and confirmatory factor analysis, and four factors were extracted.
The first factor consisted of national production supportive policy, the country's political atmosphere, cooperation between regulatory and licensing agency, commercialization related governmental approval, government regulations related to commercialization, laws and government regulations related to the commercialization items. All of these factors point to the laws and government regulations and government policies, therefore, were named as "Factors related to government and public policy".
The second factor includes 6 items that are Business strategy and organizational policies and priorities, senior executives Perspective, organizational Cooperation, organization Processes and mechanisms, organizational monitoring and control systems, Expertise and commitment of professional executive team.
These items are placed in the organization area and refer to organization whole and are not just commercialization issue, so, they are called as "organizational factors".
The third factor included market competitive environment, market attractiveness, needs and demands of society, collaboration with research companies, universities and knowledge base organization, national production and manufacturing capabilities, VC risks investment funds, and science and technology parks cooperation with organizations and executives (knowledge owners. This item refers to the outside environment and non-governmental organizations that are effective in the technology commercializing.
The factors were classified under the heading "Factors related to the business environment".
Finally, the fourth factor included financial costs of financing the project, project Performer and its abilities, Project characteristics, technology type and level, commercialization Duration, policies and procedures of technical knowledge valuation, and the protection of intellectual property.
All of these factors are related to commercialization, Therefore they were classified under the "Factors associated with commercialization" Heading.
After naming the factors, the results of exploratory factor analysis was confirmed via confirmatory factor analysis and LISREL software and showed that the factors can be measured by identified items.

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