

PRESENTING A NEW MODEL FOR SELECTION OF TECHNOLOGY TRANSFER METHODS WITH QFD APPROACH IN THE ELECTRONIC INDUSTRY; CASE STUDY: IRAN ARGHAM COMPANY

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Abstract: One of the new industrialize indexes of each country is related to development level of the electronic industry advancement in its country. The electronic industry regarding to its unique properties, is the only industry which is having the 15% growth in the world. This industry in terms of the evolution and innovation has been devoted to itself the greatest progression percentage. The variety of the electronic products, using of the sophisticated marketing techniques, using of the manufactures and products technologies and the other advanced technologies are causing that these products by the large group of the customers can earn a lot of markets. (Safari & Kiai, 1387) In the other side, today the quality and customer- oriented have been proposed as one of the new competitive challenges and sustaining and expanding of the external and internal markets, have entailed the providing of the products and services with quality and reliable through the supplying of the customer's needs in the design and manufacture of the of products or providing of the services. This work has been conducted on the systematic by gnisu of DFQ technique to getting of the customer's demands and the direction (leadership) of these demands within the organization. The main objective of this article is presenting of a model by gnisu of DFQ approach that can explained the best technology transfer methods in the electronic industry based on the customers' demands.

Keywords: Transfer Technology in Electronic Industries, Transfer Technology Indicator, Quality Function Development (QFD)

1. INTRODUCTION

Today the technology and its application have been transformed as the one of the countries' economic-industry development factors, but it seems that in all of the cases, haven't been conducted comprehensive manner to the technology transfer issue and generally the limitations and disadvantages have been followed toward to less- developed countries. The general weakness of the buyer in the field of the technology and information, are causing of the selection limitation among of the probability technology vendors. In such a market that the vendors are using of their unique positions, the value of the technology is expensive and its supply amount would be less than the desirable range. The creating of the technology is required of the investment in the research and development and training of the labor (human powers). At present, many of the economists have been known the main reason of the slowing up the developing countries in the field of the social and economic-industry advancements, due to their utilization in order to develop and or appropriate utilize of technology in the manufacturing activities. To move of the optimizing of the technology transfer and preventing of the capital and time wasting and undermining of the national technology, identifying of the types of the technology transfer procedures, the transfer process and procedures evaluation criteria, the possibility of the model formulation provides the selection of the appropriate method, in order to the technology transfer in the awareness manner and have performed on the basis of the planning in line with of involving of the technology receiver of the maximum scores. (Khajeh Nassiri, 1389)

The winner (success sheet) for many of the modern world organizations have been introduced isn't anything except the accurate and subtly reviewing of the customers' needs in the different aspects and perspectives and planning for their estimate. One of the different areas that recently have been considered the using of the QFD is about of strategic planning.

This approach is not only considered as one systematic tool for strategy formulation, but also have been prioritize the most important strategies and operation regarding to the

organization capabilities that have emphasized on the teamwork and have encouraged the documentary. According to the wide dimension of proposed technologies in Iran electronic industry and the fundamental role of its technological capabilities in the advancing of its objectives, the necessity of applying of the technology management principles in the development process of this industry have apparent (revealing) than before. On the other hand, due to expanding (expansion) of the structure type and technological infrastructure of this industry, the applying of the correct management and purposeful in the process achieving of the technology through the technology transfer, is completely necessary. According to this article, the present article seeks of the presenting a model with QFD approach which can explain the best technology transfer methods in the electronic industry based on the customer demands.

2. LITERATURE REVIEW

2-1. QUALITY FUNCTION DEVELOPMENT (QFD):

The Quality Function Development (QFD) is a mechanism for the translation of the voice of customer into the product / service features in the various stages of planning, engineering and manufacture of a product / service that has been applied widely by (with) the modern enterprises in worldwide. One organization that have implemented, would be able enhances the productivity, quality, and their engineering knowledge and reduces the costs and the time of the product development and their engineering changes. (Akao, 1990).

The Quality Function Development (QFD) is a customer-oriented method for product innovation and is a system for converting (changing) of the customer requirements into many of the necessities on the basis of that level and it also can be useful for design and engineering processes, and as well as it is important for sales and marketing and distribution. The Quality Function Development (QFD) is as one of the most complete methods for the integration goals many of the processes are used and can be conduct them towards customer needs. Therefore, The Quality

Function Development (QFD) is introduced as the product development and quality throughout the world. (Park & et.al, 2012).

2-1-1. HOUSE OF QUALITY (HOQ)

The House of Quality (HOQ) is the main planning tool in Quality Function Development (QFD). (Berkol & Buykozkan, 2011), which the customers' expectations converted into the plethora (set) of the features for product or service, and because of its apparent similarity to the house, is called the House of Quality. The House of Quality (HOQ) is one type of the conceptual plan that provides the procedures for structural planning and communication (Hauser & Clausing, 1988). In fact, The House of Quality (HOQ) is a graphic construct (build up) for recording, organizing and exchanging of the information throughout the product development process. (Locascio & Thurston, 1998).

2-2. TECHNOLOGY TRANSFER

Technology transfer has become as an important activity in any country to increase their economic progresses (advancement). The countries at advancement (progression) different stages, at different levels of industrial advancement (progression) and legislative to this activity are dependent (Tran & et.al, 2011), with regard to the new technologies sites in creating and sustaining of the competitive advantage, so the companies are seeking to achieve through the internal development technology or technology transfer toward the new technologies. (Hemmert, Martin, 2004).

In the recent researches have been identified that in the developing countries to generate only 5 % of global technology, so for these countries the internal (domestic) development technology aren't affordable and practical and thus in the developing countries are following more technology transfer than the other countries. (Cannice, M, 2003)

Technology transfer, in fact is the movement of technology from one place to another. An example (instance), the technology can be transferred from one organization to other organization, from one university to one organization or one country to another country. (Reisman, A, 2005)

Technology transfer can be defined as the transfer of knowledge, products or new approaches from one organization to another organization to increase of the commercial advantage. (Lee & et.al, 2012).

Khalil definition of technology transfer is the process that causes of the formulation of technology flow (process) from the source to the recipient (receiver). The meaning of the source is as the owner or holder of knowledge and also gets to the beneficiary (benefit receivers) such knowledge of the receivers. (Khalil, 1381)

Technology transfer is defined as the technology movement through several channels, from one person or organization to person or another organization. (Sang, 2009)

The term of technology transfer refers to the methods that enable the transfer of initiatives, knowledge, technologies and skills from one environment to another environment (ATTC, 2011).

In a summary, since that the transfer must be performed (paid), it is necessary the

1. There have been one supplier and one recipient of technology.

2. There is a delay in receiver than the supplier in the field of the technical knowledge. In other words, there are differences in the technological level of both sides.

It is necessary at the end should be adapted the technology transfer process to the recipient (receiver). For this purpose it is necessary that all of the capabilities and capacities of the recipient (receiver) to absorb and adapt of the technology to be exist. Technology absorption by the recipient is as a result of the influence of technology in the time dimension (sharif & Haq 1989).

3. RESEARCH METHOD

This research in terms of purpose is the kind of functional researches and in terms of work research, this research is the kind of descriptive research. In this research at first the library survey are conducted in the field of technology transfer and QFD technique, then with gathering of data through the field studies, including of interviews with specialists and experts, completing of the questionnaires and using of the offered (presented) methods in the

articles, was chosen a model of five stages of QFD for this study. In this study, the customers' demands through interviews with professionals and experts of the firm's case study were identified and to determine of the importance of the needs, a questionnaire was prepared and distributed among the members of the statistical society. Also based on the Library studies, the main methods of technology transfer and technology transfer index are determined.

3-1. WORK METHOD

Quality Function Development (QFD) technique is one of the systematic tools and

customer-oriented for products design that the customer needs throughout the lifecycle of the products are considered in terms of their designing, developing and producing.

In this study, by using of a structured methodology, using of Quality Function Development (QFD) for selecting technology transfer methods based on (compliance with) customer requirements, in order to design and produce of the production in Iran Argham company have been proposed . For this reason have been intended (considered) the five -step approach of QFD for problem solving.

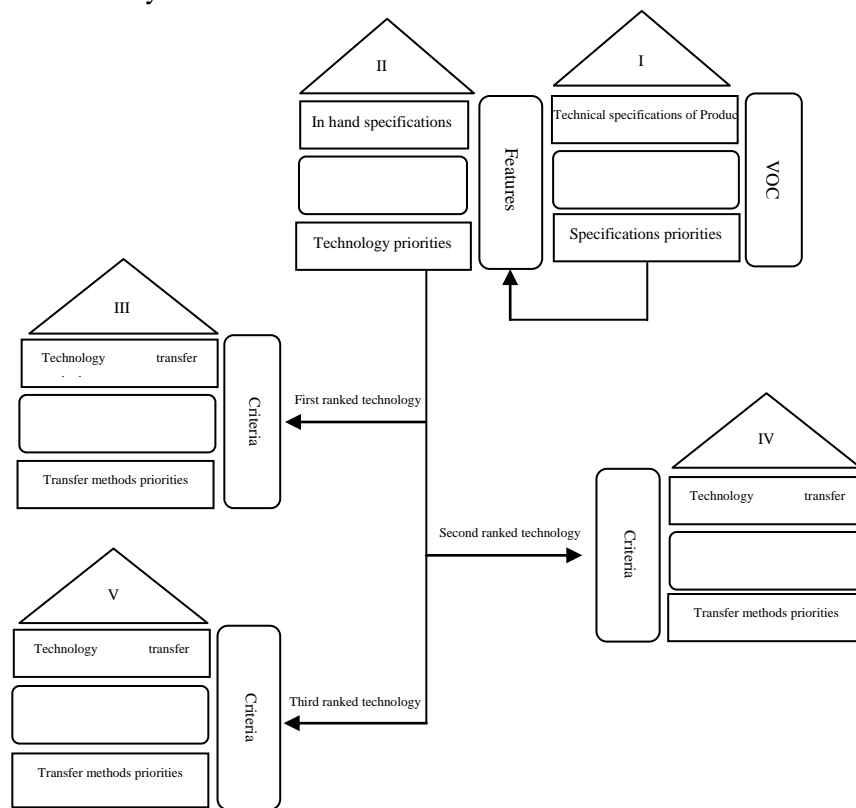


Figure 1. The five step approach of QFD for problem solving

4. THE RESULTS AND RESEARCH FINDINGS

Step One: Identifying of the customer needs and determine of their values

In this study, the customer demands have been exploited through the investigating of the orders and customer complaints and as well as

interviews with experts of QFD members. Then the questioner of Step 1 has designed and were asked the team members to provide (offer) their evaluation in relation to degree of the importance of each of demands based on a questionnaire method. The terms of the scoring to these demands is in this way that according to the very low response 1 point, low response 3 points, medium 5 points, high 7 points and very high 9 points have been obtained.

Customer Demands	Normal value
ATM Security System Upgrade	0.0962
The high speed of systems in transactions and banking operations	0.0962
Capability of recognition bills	0.0758
Performing Banking operation (cash withdrawals, account transfers , bills payments , offering a variety of accounting reports ,loans payments)	0.0991
Mobile recharging	0.0700
Cash received during network outages	0.0758
Cash received from customers, instant payment to favorite customer accounts	0.0962
The integration between inter- banking services to facilitate of the customers	0.1021
Convertibility of currency into the currency of the country	0.0379
Applicability for the Blind and Deaf	0.0466
Read all the cards that need to the money.	0.0670
Back completion card transactions during a power outage	0.0962
Performing of coloring operations	0.0408

Table 1. Customer Demands

4-1. DETERMINATION OF TECHNICAL SPECIFICATIONS AND CALCULATE OF THEIR VALUES:

In this stage, the technical specifications and product engineering (ATM's device) by considering of the customer demands have been determined by the engineers and research team experts (Figure 2).

4-2. IDENTIFICATION OF PARALLEL TECHNOLOGIES WITH CUSTOMER DEMAND AND CALCULATE OF THEIR WEIGHT:

The list of technologies regarding to engineering of research team were determined and have placed on the peak of (at the top of) the house of quality (HOQ) columns. Then the questionnaire of Step 3 has designed and were asked to the team members have provided their evaluation (measurement) in relation to impact amount of each of the technologies in the technical specification of the firm's product based on the scores of 1(low), 3(average) and 9(high). Therefore the scores of the research team responses were derived from the average

and in Matrix2 have performed the quality function development. From the column's total (sum) was calculated the multiplying of each score on the importance (weight) of the technical specification, the absolute weight of each of the obtained technologies and then was calculated the relative weight of the technologies by the software. The following chart shows that the list of technologies with the calculated the absolute and relative weight for each of the technologies, as output of the matrix II of Quality Function Development (QFD) in the software (Figure 3).

According to the matrix II of Quality Function Development (QFD), now(at present) the selection of the technologies are with the highest relative weights and 3 type of the technologies are with the highest relative weights, were selected. The most important these technologies are respectively, Wosa/ Xfs Software with the relative weight (value) of %25.8, Switch ATM Software with the relative weight (value) of %18.6 and YDC Software with the relative weight (value) of %8.9.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	1
ATM Security System Upgrade	9.0	9.0	9.0	9.0		1.5			2.0								0.0962
The high speed of systems in transactions and banking operations					2.3								4.5	5.3			0.0962
Capability of recognition bills													9.0	4.3			0.0758
Performing Banking operation (cash withdrawals, account transfers , bills payments , offering a variety of accounting reports ,loans payments)			1.1		6.8	4.5		6.0	1.5	1.3			6.0	9.0			0.0991
Mobile recharging			1.3				9.0	1.3						4.5			0.0700
Cash received during network outages						9.0									2.3		0.0758
Cash received from customers, instant payment to favorite customer accounts					7.5			4.5	6.0	4.5	9.0			6.8			0.0962
The integration between inter-banking services to facilitate of the customers					9.0									9.0			0.1021
Convertibility of currency into the currency of the country								2.0	4.5	5.3	6.8			5.3			0.0379
Applicability for the Blind and Deaf				4.5								9.0					0.0466
Read all the cards that need to the money		1.8			5.3			9.0						5.3			0.0670
Back completion card transactions during a power outage						2.0										9.0	0.0962
Performing of coloring operations			4.5		1.8			1.5						2.3	9.0		0.0408
ABSOLUTE WEIGHT	1	4.0	0.9														
RELATIVE WEIGHT	2	4.5	1.0														
		6.7	1.2														
		4.9	1.1														
		13.6	3.0														
		6.7	1.5														
		2.9	0.6														
		8.5	1.9														
		5.0	1.1														
		3.5	0.8														
		5.1	1.1														
		1.9	0.4														
		7.8	1.7														
		20.3	4.4														
		1.7	0.4														
		4.0	0.9														

Figure 2. Matrix I QFD

ATM's Technical Specifications	Relative Value (%)	Prioritization
Recording the pictures of the users who have used of the incorrect card or wrong password.	4	11
Preventing of copying of the card information	4.5	10
Input data encryption	5.7	6
The ability customer recognition by scanning palms	4.9	9
The installation of Acceleration switch in the banking transactions control center	13.6	2
Providing of operations related to electronic wallet	6.7	5
The link of the banks switch with supported server of Mobile Phone Company	2.9	13
The capability working with all types of magnetic cards, smart and	8.5	3

Hybrid		
Accurate and rapid identification of banknote	5	8
The identification of bills of exchange and money as the way of mixed	3.5	12
The recipient and intelligent banknote counter	5.1	7
The user's manual for operating instructions with audio and video	1.9	14
The capability reading of the barcodes	7.8	4
Sending of the information to a central switch and sending of the transaction to the cardholder's bank	20.3	1
Accepting and reviewing the authenticity of cheque	1.7	15
The supplying of power sources for powering the device energy	4	11

Table 2. ATM's Technical Specifications

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	1	2	
	APTRA Advanced NDC	Voice technology	Youtong Direct Connect(YDC)	UPS with Auto Restart	OCR	Smart Card	WOSA/XFS	Leiserr reading technology	BNA (Bunch Note Acceptor)	CRM (Cash Recycling)	POS with ability to read and write	ATM	Biometric technology	A keyboard with EPP and coding system (Triple DES, DES)	Anti Skimming Device	Security Camera	ABSOLUTE WEIGHT	RELATIVE WEIGHT	
Recording the pictures of the users who have used of the incorrect card or wrong password	1					4.5										9.0	0.9	4.0	1
Preventing of copying of the card information	2					1.5									9.0		1.0	4.5	2
Input data encryption	3	2.3	4.3									4.5	9.0				1.2	5.7	3
The ability customer recognition by scanning palms	4	3.3	4.5			5.3							9.0				1.1	4.9	4
The installation of Acceleration switch in the banking transactions control center	5					3.8						9.0					3.0	13.6	5
Providing of operations related to electronic wallet	6					6.8	5.3			5.3							1.5	6.7	6
The link of the banks switch with supported server of Mobile Phone Company	7					4.5						6.0					0.6	2.9	7
The capability working with all types of magnetic cards, smart and Hybrid	8	4.5	5.3			6.8	4.5			9.0							1.9	8.5	8
Accurate and rapid identification of banknote	9				2.0	3.8		6.8	9.0								1.1	5.0	9
The identification of bills of exchange and money as the way of mixed	10				1.5				9.0	9.0							0.8	3.5	10
The recipient and intelligent banknote counter	11	4.5	5.3			5.3		9.0	9.0								1.1	5.1	11
The user's manual for operating instructions with audio and video	12	5.3	9.0	6.8			5.3										0.4	1.9	12
The capability reading of the barcodes	13			4.5				6.0	9.0								1.7	7.8	13
Sending of the information to a central switch and sending of the transaction to the cardholder's bank	14							9.0				9.0					4.4	20.3	14
Accepting and reviewing the authenticity of cheque	15					9.0	5.3										0.4	1.7	15
The supplying of power sources for powering the device energy	16				9.0												0.9	4.0	16
ABSOLUTE WEIGHT	1	100.88350																	
RELATIVE WEIGHT	2	5.4	0.9	8.9	1.9	1.6	5.5	25.8	3.8	5.9	6.5	6.0	18.6	2.4	2.7	2.2	1.9		

Figure 3. Matrix II QFD

3-4. EVALUATION OF TECHNOLOGY TRANSFER METHODS TO ACHIEVE THE FIRST TECHNOLOGY (WOSA/ XFS SOFTWARE)

Figure shows the calculated the absolute and relative weight (value) for each of the technology transfer methods as the output of matrix III of Quality Function Development (QFD) in the software.

		Domestic R&D	Jointly Investment	Research Outsourcing	Buying a Franchise	No Aquisition	æÖä
		1	2	3	4	5	1
Speed	1	5.0	5.7	7.0	8.3	7.0	0.20
Cost	2	.20	.29	.24	.12	.12	0.30
Control	3	9.0	7.0	5.0	3.0	1.0	0.15
Core Competency Availability	4	9.0	7.0	2.3	2.3	1.0	0.15
Competency development	5	7.6	8.3	.60	.60	.60	0.10
Availability to handle other organizations	6	.30	8.3	8.3	7.0	5.0	0.10
Absolute Weight	1	4.6	5.0	3.5	3.3	2.3	
Relative Weight	2	24.5	26.9	18.6	17.5	12.4	

Figure 4. Output of matrix III of QFD software.

The obtained values can be drawn in the graphs framework:

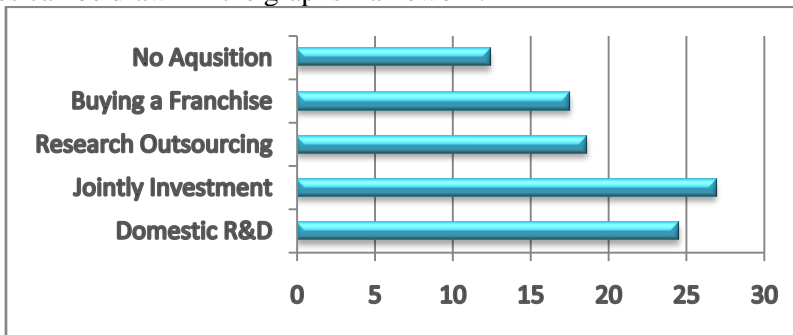


Figure 5. Prioritization of technology transfer methods for Wosa/Xfs software

As it can be seen, the common (joint) venture (investment) with a relative rating is placed in the highest priority 26.9%.

4-4. EVALUATION OF TECHNOLOGY TRANSFER METHODS TO ACHIEVE THE SECOND

TECHNOLOGY (SWITCH ATM SOFTWARE)

8-4 Figure shows the calculated the absolute and relative weight (value) for each of the technology transfer methods as the output of matrix IV of Quality Function Development (QFD) in the software.

	1	2	3	4	5	1		
	Domestic Research & Development	Joint investment	Research Outsourcing	Buying a franchise	No acquisition	æÖä		
Speed	1	7.6	9.0	6.3	9.0	7.6	0.20	1
Cost	2	.30	.20	.18	.14	.11	0.30	2
Control	3	9.0	7.0	6.3	5.0	5.0	0.15	3
Core Competency Availability	4	9.0	7.0	5.0	4.3	2.3	0.15	4
Competency Development	5	9.0	7.0	3.0	3.6	.60	0.10	5
Availability to handle other organizations	6	2.0	5.6	7.0	8.3	7.0	0.10	6
Absolute Weight	1	24.1	23.2	17.8	19.7	15.2		
Relative Weight	2	4.4	4.0	4.4	3.4			

Figure 6. Output of matrix IV of QFD software.

The obtained values can be drawn in the graphs framework:

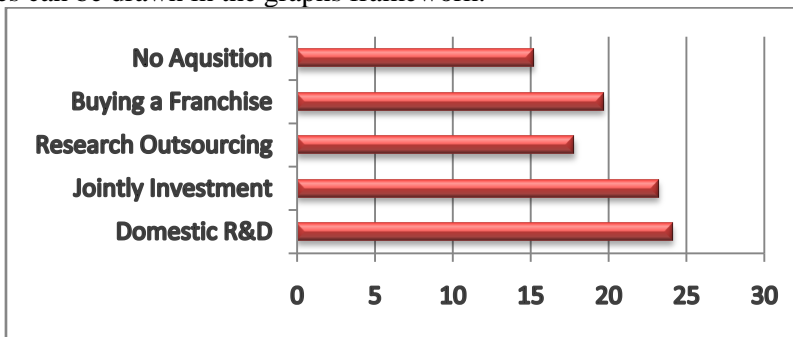


Figure 7. Prioritization of technology transfer methods for Switch ATM Software

As it can be seen, the research method and internal (domestic) development with the relative rating of 24.1% is placed in the highest priority and after that, respectively the joint venture methods with the relative rating of 23.2% the purchasing of the royalty with the relative rating of 19.7% the researches contractual transferred(made over) to out of the organization with the relative rating of 17.8% and non-acquisition(purchase of technology

product) with the relative rating of 15.2% are placed in the following priorities.

4-5. EVALUATION OF TECHNOLOGY TRANSFER METHODS TO ACHIEVE THE THIRD TECHNOLOGY (YDC SOFTWARE)

Figure shows the calculated the absolute and relative weight (value) for each of the technology transfer methods as the output of matrix V of Quality Function Development (QFD) in the software.

		Domestic R&D	Jointly Investment	Research Outsourcing	Buying a Franchise	No Aquisition		
		1	2	3	4	5	1	
Speed	1	3.0	5.0	6.3	7.6	9.0	0.20	1
Cost	2	.14	.20	.18	.14	.12	0.30	2
Control	3	9.0	7.0	5.0	3.0	1.0	0.15	3
Core Competency Availability	4	8.3	8.3	4.3	3.0	.30	0.15	4
Competency development	5	5.0	7.0	2.3	.60	.30	0.10	5
Availability to handle other organizations	6	.30	5.0	8.3	7.6	6.3	0.10	6
Absolute Weight	1	20.9	3.8	20.9	3.8	18.2	3.3	
Relative Weight	2	20.9	4.6	20.9	3.3	14.9	2.7	
		1	2	3	4	5		

Figure 8. Output Matrix V QFD software

Obtained values can be drawn in graphs framework:

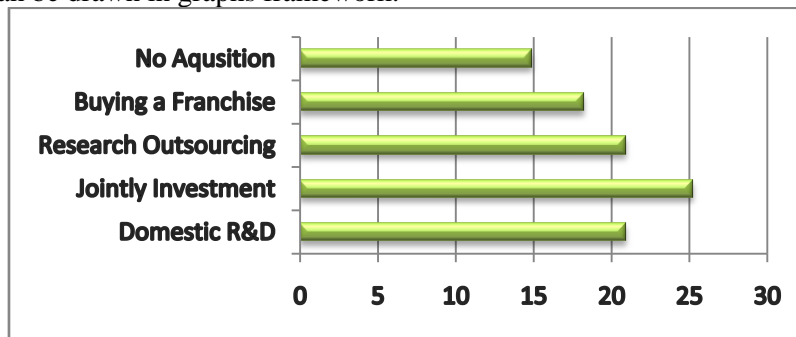


Figure 9. Prioritizing of technology transfer methods for YDC software

6-4. EVALUATION THE VALIDITY OF THE RESULTS:

This section deals with to analysis the sensitivity to customer demands whether with changes in

customer demands, the final outcomes (results) of research will change or not and obtained results, to what extent is similar, predictability and reliable.

Table 3. The obtained results of matrix I QFD as change in customer demands

Change value / Demand No	%50 Increase	%50 Reduction
1	Not change.	Not change.
2	The third and fourth priorities of the technical specification changed.	Not change.
3	The third and fourth priorities of the	Not change.

	technical specification changed.	
4	Not change.	Not change.
5	Not change.	Not change.
6	Not change.	Not change.
7	Not change.	The third and fourth priorities of the technical specification changed.
8	Not change.	Not change.
9	Not change.	Not change.
10	Not change.	Not change.
11	Not change.	The third and fourth priorities of the technical specification changed.
12	Not change.	Not change.
13	Not change.	Not change.

Regarding to this in the four modes, prioritize of the most important of technical specification has been changed, but by studying of the other results of QFD matrices in this model, has not been changed in prioritize of the most important of technologies and as well as in prioritize of technology transfer methods. The robustness is high. Therefore the final answer in terms of the customer demand isn't sensitive and the selective method of the technology transfer is the joint ventures.

5. DISCUSSION AND CONCLUSION

by considering of this, in the output of matrix I and III QFD, the joint venture method are acquired the highest score and also in the output of matrix II QFD, the research method and internal development with the substantial (significant) score rather than the joint venture method are placed in the first priority, regarding to available circumstances, the best method of the technology transfer, are selected the joint venture method in Iran Argham Company.

5-1. SUGGESTIONS:

In general, in a summary (conclusion), can be presented the following recommendations:

5-1-1. regarding to the joint venture method is the most important method in the technology transfer, the selection of the partner is the most important stage in the formation process of the joint venture method. In most

cases, the lack of success of the joint venture method is due to the selection of the inappropriate partner.

5-1-2. In order to avoid (prevent) of the lagging and also deal with the international sanctions, the research method and domestic development, due to the utilization of the maximum of domestic capacity can be a suitable alternative.

5-1-3. Regarding to the necessity of the scientific contact with the all of the phases of technology transfer and complete familiar of the administrators of technology transfer with the ways of achieving to it, it is necessary that the implementation of policies related to technology transfer, are followed up by the professionals in the discussions relation to the technology management.

5-1-4. One of the most important current problems in relation to supply of technology is the internal (domestic) rules and regulations is due to the external investment, which should be minimizing of the troublesome terms, the grounds of the external capital and follow of it ,updating technology to be provided.

5-1-5-In the issues in relation to technology transfer from industrial developed countries, inevitably involving of the partnerships of a foreign company in the form of personnel or investment and in general are involving of the economic interaction, which in these interaction the main goal holder of the

technology firm, is the long-term and short-term of the economics' benefits of such processes.

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