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Study the Pattern of "UK Technology Strategy Board" Activities in order to Expand Iran Development Organization's Mission

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Abstract

Development organizations are the main tool of governments to intervene in the market; and interestingly, these organizations are not merely restricted to "undeveloped" or "developing" countries but in all countries, even the "advanced" counties such as the United States, Japan and the UK, the trace of a development organization can be seen. A brief look at the performance of these organizations can help to recognize the important issue that the fields of activity of the development organizations are very diverse: some have undertaken only one or two limited development roles as their activities, while others have taken the responsibility of a wide range of activities, to the extent that they have become the main driving force for the industrial development and innovation in their countries. While the development organizations in Iran, in an effort to redefine their missions, have defined numerous research projects, undoubtedly a short overview of each of these developmental role by the organizations can open new horizons for these organizations. Therefore, the present article attempts to evaluate the pattern of activities of a development organizations in Iran reach new horizons in their missions. The organization is introduced in a short overview:

Technology Strategy Board «TSB»; an organization that is in charge of promoting innovation in the UK and the most important national innovation strategies in the UK are performed by this organization. **KEYWORDS**: Development organizations, Technology strategy board, Collaborative R&D

1. INTRODUCTION

"Technology Strategy Board (TSB) » was established in October 2004 as a consulting organization to the Department of Trade and Industry (DTI) in the UK. The organization's mission was to consult the ministry in three areas to "determine the priorities of technology and innovation in the UK", "doing research in UK's business sector " and "allocation of the budget to these priorities and finding the most appropriate method to support these priorities,"; but after a while, and in November 2006, the Minister of Trade and Industry of England, in a report to the Parliament stated that, in his view, the best way for the success of the organization (as an organization that provides consulting) is the establishment of a 'Technology Strategy Committee "outside the framework of the government and as an Arm Length¹ organization. The report of Minister was agreed upon by the Parliament and thus, on February 2007, "UK Technology Strategy Board (TSB)" as a Non-Departmental Public Body (NDPB)² organization was established. TSB now and after the change of Department of "Trade and Industry of UK" into the Department for "Business, Innovation and Skills of UK (BIS) » receives its main funding source as Grant-in-Aid³ from BIS (TSB Annual Report and Accounts, 2008-09)

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2. MATERIAL AND METHOD

2.1. The objectives and mission of Technology Strategy Board (TSB)

TSB had explained its mission and the area of activities in this way:

«...TSB is an organization that regards business sector as its top priority. The organization (which is financed by the government) tries to encourage and support technological innovation to accelerate the growth of the business ultimately the growth of the UK economy. TSB strives to provide a favorable environment for innovation; reduce the risk of research and development of the firms; improve the transfer of knowledge and cooperation among firms; and create an open innovation platform for them. TSB strives to create a bond between individuals and various organizations that normally would not be able to work together. In fact, the TSB works as an innovation catalyst for the supports and investment which in their absence, innovative of business sector weakens or does not happen. The TSB contribute to accelerating economic growth in the UK by encouraging and supporting innovations in the firms, with its focus on the needs of the institution; that is why the board of directors and staff of TSB all have long and profound experience in the field of innovation and commercialization of technology..."(TSB Annual Report and Accounts 2008-09). In 2011 and for the next four years, TSB defined and published its last strategy which is called "From Concept to Commercialization". For this strategy and in this interval of four years a budget of over 1 billion pounds is dedicated and it is designed in a way that by attracting the participation of partners and the business sector itself an investment equivalent to 2.5 billion pounds take place in the area of innovation in the UK. The budget for the year 2012-2013 was equivalent to 390 million pounds and now, 50% of the budget of these organizations is given to SME. TSB is now working with more than 4,000 large and small firms and 150 research institutions (including 110 universities in the UK) is working.(TSB Delivery Plan Financial year 2012-13).

2.2. Examining performing the mission in (TSB)

We can regard the following 12 programs as the major programs of the organization (to achieve its mission). Therefore firstly each of these programs will be discussed in the following section. Then the way of distribution of TSB budget among these programs are mentioned and finally, the relationship of TSB structure with these programs is described. (TSB Delivery Plan Financial year 2012)



Fig. 1. Twelve major program TSB with their logos

2.2.1 Poles of technology and innovation (Catapults)

"... During the next four years, we will invest more than 200 million pounds on the technology and innovation poles of the UK. The poles will be ideal for research and investigation and very ideal for business and will put the Britain again on the peaks of world's innovation. "These are the statements that David Cameron, the British Prime Minister, made on 22 October 2010 to introduce the poles of technology and innovation; and interestingly the primary responsibility for establishing and monitoring of these sites (known as Catapult brand in England) was given to TSB. From the early 2011, TSB have put the establishment of

the poles on its agenda. The British government and the TSB believe that the poles of technology and innovation will stimulate the economic growth of the country in the future and, in the long run will evolve the Great Britain's innovation capabilities. It is predicted that with the help of private sector investment over the next few years more than one billion pounds will be invested on the poles. (TSB Catapult updates shaping the network of center, 2012) According to studies by TSB, what matters about the poles of technology and innovation is that each pole provide for the firms good access to the "infrastructure", "equipment", "specialized knowledge" and "skilled labor force", focused on a geographical area; resources that the firms (especially small firms) can rarely afford to provide by themselves. On the other hand, the geographical focus of the equipment, knowledge, firms and individuals makes the discovery of work opportunities faster and the speed of commercialization of the ideas increase. Also, since innovation requires long-term investments in equipment and technical knowledge, for a firm's innovation has always been associated with a high risk; but the infrastructure and equipment on a pole can greatly reduce the risk of innovation for the firms (Bis, 2011). According to the predictions of TSB, the poles in a stable condition. receive one third of the funds they need directly from the TSB, one third through other programs of TSB (especially Collaborative R & D Program) and another third through the firms themselves. TSB calls this method for providing funds of technology and innovation as "one-third, one-third, one-third" model. However, after the completion and final development of these poles, TSB strives make each private sector provide 50% of the funding of each pole. For TSB, public investment in the early development of a pole is necessary because it can give confidence to firms that they are facing a stable and guaranteed situation. (TSB Delivery Plan Financial year 2012-13) Meanwhile, to select an area as a pole of technology and innovation (and thus began a long-term investment in it) TSB has some criteria made based on the two reports by Hauser⁴ and Dyson⁵ (who have studied the most successful international clusters). These criteria include:

In the future, will the value of the market this potential pole may achieve raise to several billion pounds a year?

- In this possible pole, does England have a considerable research capability and on a global level?
- Are the UK's firms capable of utilizing the technology developed at the pole to take control of the majority of the supply chain related to the technology within the territory of England?
- Can this possible pole absorb the attention of international firms to establish their knowledge activities within the territory of the United Kingdom?
- Is this possible pole in line with the national strategic priorities? (Hermann Hauser, 2010)

After considering various fields (using the above criteria), TSB has chosen the below three poles as the first poles of technology and innovation in the UK and has begun to establish them:

- 1. High value manufacturing
- 2. Cell Therapy (The use of living cells in pharmaceutical products)
- 3. Offshore Renewable Energy (energy derived from offshore wind, waves and tides)

The pole of "high value manufacturing" began its work formally in October of 2011. In addition to these three poles, TSB has set ten other poles as other possible options in the future:

- Complex systems pole
- Digital media and cultural industries pole
- "future cities" pole
- "Future Internet" pole
- Photonics pole
- "resource efficiency" pole
- Sensors pole
- Smart grids pole
- Aerospace pole
- Transportation systems pole

One of the major issues of technology and innovation poles is the administrative structure and management of these poles. TSB acknowledges that the performance and culture and spirit of any organization is inevitably influenced by a few key individuals, including the executive director, board chairman and other senior members of the organization that must have three characteristics: 1.entrepreneurial spirit 2. Extensive experience in the industry 3. Sufficient academic knowledge. TSB believes that managers of a technology and innovation pole must have these three features. To ensure this, it

regards its involvement in appointing the key people of the pole necessary (although by defining a suitable mechanism). In fact TSB strives to require each pole to appoint an executive board consisting of "expert" individuals in the field of business. Therefore, TSB finances each pole under the following contract:

- TSB defines the management team selection mechanism and scope of activities of each pole.
- TSB incurs to finance the pole at least for five years (according to the "one third", "one third", "one third" formula) and if satisfied by the performance of the pole and considering the government's budget limitations extend the support at least for 10 years.
- Management teams are required to present periodic reports on the pole "performance criteria agreed upon with TSB».
- An agreement must be set between the two sides regarding other topics such as "the possession of property belonging to the pole", " intellectual property rights," "relation with society", "environmental issues", etc.

After signing the contract, the relationship between TSB and each pole mostly is not direct and is done through a committee known as "supervisory committee". The task of the committee in general is exchanging opinions on both sides (TSB and management team of the pole) about the macro issues related to the pole and include the following matters:

- Giving strategic consultation to both sides about the orientation of each pole
- Cooperating with TSB in the definition of "success criteria for each pole"
- Monitoring the progress and performance of each pole
- Providing consultation to both sides on how to invest in the future on each pole
- Establishing a relationship between the pole and the national innovation system of the UK and promoting the "brand" of each pole

Committee members of each "supervisory committee" are composed of very experienced people in the industry, individuals from the UK research institutions (such as the Research Council), and representatives from the Ministry of BIS and TSB itself. President of the committee of "supervisory committee" should also be a person from the industry. (TSB, Catapult updates Shaping the network of centre, 2012)

2.2.2. Collaborative R & D

Collaborative R&D is one of the main programs of the TSB for promoting innovation of the UK's firms. In this program, after definition of a joint cooperation, the firms can benefit from financial incentives of TSB. Through the Collaborative R&D program TSB tries to: (1) Through financing part of the costs of R & D firms reduce the financial risks facing the firms, (2) through encouraging cooperation between firms (possibly between firms and research organizations) increase the knowledge transfer between them; and (3) create new links in the supply chain of these firms. Collaborative R & D (R & D partnership) projects should be defined mainly in the field of applied research. But basis research also should observe some conditions to benefit from the advantages of this program: 1. their orientation must be towards the needs of industry and 2. The purpose of it should not only be doing a basic research, but the only way for the firm to obtain a product. In addition, Collaborative R&D projects must necessarily be cooperative (at least composed of two partners), and must be defined in order to meet the needs of one of the participating firms. Research organizations can also participate as one of the partners in this project but on condition that 70% of the cost of R & D project is realized by the firm. In Collaborative R & D (R & D partnership) projects, small and medium firms can get up to 60 percent of their R & D expenses from TSB. This figure is up to 50% for large firms and for research organizations up to 100% of the costs (depending on the type of research that is done by these organizations) (TSB Delivery Plan Financial year 2011-12).

In Collaborative R&D (R&D partnership) programs, the proposals offered by the firms (for the use of financial incentives of the program) are provided will be evaluated and selected through a "competitive process" by the TSB. In this process, TSB first sends the proposal for evaluation to some independent evaluators. Then on the basis of the scores of these independent evaluators these proposals are ranked and for receiving funds are introduced to the Innovation Programmes (one of the five organizational sectors of TSB). It is worth noting that the TSB, at least in its six other program, has used this "competitive process" (to evaluate and select firms and proposals) are used and has often pointed out the importance of this process in its reports.

According to the estimations of TSB, for every one pound investment of this organization on the Collaborative R & D program, seven pounds of added value has been achieved for the member firms. (TSB, Public and Corporate Economic Consultants, 2011)

2.2.3. Knowledge Transfer Networks (KTNs)

This program is another important program in the TSB trying to establish relationships between government, firms and universities (and other research institutions) in each of the technological fields so that by taking advantage of this network new firms be able to discover new opportunities in each of the areas of technology and ultimately promote technological innovation in each of these areas. TSB technological areas can be seen in the following figure.



Fig. 2. Technological areas intended by TSB

Currently fifteen KTN has been launched by the TSB which include:

- Knowledge Transfer Network "aerospace, aviation, and defence"
- Knowledge Transfer Network "Bio Science"
- Knowledge Transfer Network "Chemical initiatives"
- Knowledge Transfer Network "cultural industries (creative industries)"
- Knowledge Transfer Network, "Electronics, Sensors and Photonics"
- Knowledge Transfer Network "energy supply"
- Knowledge Transfer Network "environmental sustainability"
- Knowledge Transfer Network "Finance services»
- Knowledge Transfer Network "health and medicine"
- Knowledge Transfer Network «ICT»
- Knowledge Transfer Network "Industrial Mathematics"
- Knowledge Transfer Network "material"
- Knowledge Transfer Network "modern built environment"

- Knowledge Transfer Network "nanotechnology"
- Knowledge Transfer Network "transportation"

According to calculations by the TSB, for every pound invested in the "Knowledge Transfer Networks (KTNs) project by TSB, 5 pounds of added value have been created for each firm which is equivalent to 250 million pounds for all of the member firms in the period between the years 2007 to 2010. According to this calculation, more than 50% of member firms have acknowledged that through membership in the knowledge transfer networks have defined new R & D projects or new business connections for themselves, a more than 25 percent of these firms also managed to achieve totally innovative activities.(TSB Delivery Plan Financial year 2012-2013)

For TSB, a firm that joins one of the KTNs can enjoy the following benefits:

Benefit from joint cooperation. Membership in a KTN can help any firm find partners for implementing new projects and for defining new business opportunities for itself.

Benefit from receiving information and news. Membership in a KTN can provide a firm with, free and online access to the published technical reports, news bulletins, webinars and virtual training, virtual conferences and in general information related to each industry and technological field.

Benefit from the knowledge of other supportive activities. With membership in each KTN a firm can be informed of the other support activities of the TSB.

Benefit from "influencing policymakers." Each KTN to provide this opportunity for the member firms to influence the rules and policies adopted by the government and the European Union through forming a coalition. (TSB Knowledge Transfer Networks Contacts, 2011) In addition to these advantages, to clarify the role and importance of KTNs we can mention some of the activities and objectives of a number of these KTNs. For example, the knowledge transfer network of "aerospace, aviation and defence," regards the definition of priorities of "Science, research, technology and innovation" in the area of "Aerospace, Aviation & Defence" and raising the awareness of firms and governments as its main activity. Knowledge Transfer Network of "chemical innovation" refers to 19 professional "interface" in its management team and believes that only the experience and high skill of these people can help KNT identify and resolve problems facing the innovation in the chemical industry. Knowledge Transfer Network of "Finance services" also regards identifying the areas in which doing research would benefit the entire industry Finance of England as its goal. Knowledge Transfer Network of "transportation" refers to cooperation with member firms to identify "common research topics for member firms," and "the introduction of experiences of leading firms to other member firms" as its objectives. In 2010, to improve the performance of its KTNs, TSB launched as a virtual social network called Connect⁶ to enable the firms and individuals share their knowledge more quickly among each other. Therefore, all fifteen KTNs working in TSB have also implements their activities on Connect⁷. (TSB, KTP Achievements and Outcomes 2010-11).

2.2.4 "Knowledge Transfer Partnership" (KTPs) projects

A "Knowledge Transfer Partnership KTP» project helps the firms increase their innovative through the acquisition of "knowledge", "technology" and "skills" available in the knowledge resources of the country (universities, colleges and research organizations in the UK). According to TSB, despite having very high quality universities and colleges in the UK (in an international level), knowledge transfer to the firms in these institutions are often not satisfactory. Therefore, KTP projects have been defined and implemented in the TSB to facilitate the transfer of knowledge from universities (and other research organizations) to the firms. A "group cooperation" is formed in a KTP between a firm, an academic institution and a qualified person (which is called "partner" is called) to transfer part of the academic knowledge to the firm and established the knowledge in the firm. TSB is also committed to pay part of the costs of this collaboration as follows:

- In the case of the SME (less than 250 employees), two-thirds of project costs to be covered by the TSB and the rest by the SME
- In the case of large firms (over 250 employees), half the cost of the project paid by the TSB and the
 remainder to be covered by the firm



Fig. 3. Three constituent member of a KTP

Now, on average, TSB's annually covers 60 thousand pounds of the costs of the KTP. On the other hand, a person should have one of the following conditions to take the role of "partner":

- recently graduated from the university (Bachelor, Master and PhD)
- At least have the NVQ Level 4⁸ certificate or its equivalent

In a KTP, a "partner" 's duty is to play the role of the interface in the process of transferring knowledge from the academic institution to the firm so that not only codified knowledge in academic institutions but tacit knowledge of this institution is transferred to the firm and then institutionalized.

In the TSB, two KTP project can be defined:

- Classic KTPs that take one to three years and are defined in the strategic (long-term) areas
- Short-term KTPs that take between 10 and 40 weeks and are defined in short-term areas

It is also necessary to note that KTP projects are among the projects which are not financed by TSB alone but 15 other UK financial institutions (including Research Council) are also collaborating in the financing with the TSB. The following table shows the contribution of each of these 15 institutions in the financing of KTP. (TSB KTP Achievements and Outcomes 2010-11& Regeneris Consulting, 2010)

Table 1.	The amount	of participation	of UK	's research	funding	institutions	in the he	financing	of KTP
			(20	010-201) pr	ojects				

Sponsor	Budget (£)
Arts and Humanities Research Council (AHRC)	£550k
Biotechnology and Biological Sciences Research Council (BBSRC)	£400k
Department for Environment, Food and Rural Affairs (Defra)	£350k
Department of Health	£300k
Engineering & Physical Sciences Research Council (EPSRC)	£1.933m
Economic and Social Research Council (ESRC)	£1.54m
Invest Northern Ireland	£1.0m
Natural Environment Research Council (NERC)	£300k
South East England Regional Development Agency (SEEDA)	£150k
Scottish Executive Environment & Rural Affairs Department	£10k
Scottish Government	£1.5m
Science & Technology Facilities Council	£250k
South West of England Regional Development Agency (SWRDA)	£150k
Technology Strategy Board	£30m
Welsh Assembly Government	£1.2m
Total	£39.634m

According to its calculations, TSB estimates the benefits of this plan as follows:

- in each active firm in the KTP three new high-quality jobs has been created
- In each active firm in the KTP almost 30 firm workforce have been trained
- This will allow academics to find primary sources of information for their training classes and academic researches (regarding the activities of the English firms) to be able to define new research topics for their future studies.

- "The partner" will also have the chance to improve its professional, leadership and management
 potentials through managing a difficult and challenging project (according to statistics in 63% of
 the cases the firm has offered long-term employment suggestion to the "partner"
- In 2010-2011, for every 1 million pound investment of the government on the KTP projects, about 3.08 million pounds have been added to the annual profits of the firms which are a member of the KTP and about 1.35 million pound added to the investment of these firms on the machinery and equipment. (TSB KTP Achievements and Outcomes 2010-11)

It is also essential to note that in England, each university has a KTP office and advisor providing consult to the academic personnel on how to define a KTP and requirements for the use of the advantages of this program.

2.2.5. Supporting "Small Business Research Initiatives "(SBRI) by government purchases Project

This program tries to accelerate technology development in SME in the country through creating relationship between government institutions (as buyer of technological products) and SME firms in the UK (as a seller of technological products). In this program, the government sector reduces the risk of R & D research and development activities for SME's by taking the role of the buyer. At the beginning a government institution states the challenge (and need) that it confronts to the TSB, then this challenge (and need) is transformed to the SMEs through KTN and technology parks, RDAs⁹ (and other ways) so that these firms offer their proposals to the TSB to the SME information their proposals to the firm (which contains their technological ideas to resolve the stated challenges). Then, through a competitive process (described in the Collaborative R & D Program section) these proposals are examined and the best ones are presented to the government institutions for signing the contract. These contracts in this level are called "first level" contracts. In fact, the "first level" is the feasibility level of the proposal, which usually takes 2 to 6 months and their maximum value does not exceed 100 thousand pounds. Then the successful contracts in this level are entered into the "second level" contracts to create a basic prototype or a primary demonstrator. This level of contracts may take 2 years and reach values up to £ 1 million. After this level, SMEs can start commercialization of the final product and selling it to private or public sectors. In the SBRI program, even companies in the pre-start up stage are also able to attend although SBRI contracts can only be signed with legal institutions. The universities can also take advantage of the program, but with the condition that provide a good perspective on how to perform product commercialization. In the following figure, an example of challenges announcement (and need) by a number of governmental institutions of the UK in the SBRI program are presented. (TSB Accelerating business innovation across the UK, 2010 & SBRI).

But	Inistry of Defence	Low Size, Weight, Power and Cost, intrillgence, Target Acquisition and This Moz 3881 on pattlon is seeing innovative solutions to reduce SWAPC of sensor paylands to ISTAR	Open	05/02/19	16/03/1:
) □	epartment of Health	Improved experience for people at the end of their lives The Department of Health is looking for technologies to help improve the experience of a the illnesses of at head their lines	Open	03/01/13	28/02/1:
ס ס	enatiment of health	Improved superimped for poople with marked health IInesses The Department of Health is looking for booknologies to help Improve the experience of poople with markal health hear or at the end of their loos.	Open	03/01/13	2RJN2/1:
м	linistry of Defence	Strengthening the security of maritime uper attors (his competition seeks proof of concept proposal with the norm proposal with the norm of propriots a concept response to unlawful or heatlife activity at sea.	Open	24/01/13	25/02/11

Fig. 4. Example of definition of need by the governmental institutions of the UK in the SBRI program

2.2.6. Supporting research on the small and medium firms, SMART¹⁰ project

SMART program strives through providing financial incentives for SMEs encourage them to do R & D projects. Of course, unlike R & D Collaborative (R & D partnership) Program, financial incentives in the program are awarded to each of the SMEs separately. SME is defined in the program in accordance with the general definition that has been approved by the European Union.¹¹ In accordance with this definition, SME refers to the firms that their number of employees or turnover or balance sheet is in accordance with the following table:

Type of firm (In terms of size)	employees	Turnover	Overall Financial balance
Medium	< 250	≤€ 50 m	≤€ 43 m
Small	< 50	≤€ 10 m	≤€ 10 m
Micro	< 10	≤€2 m	≤€2 m

Table 2. Classification of firms from the viewpoint of European Union

According to statistics provided by the TSB about 70 percent of the firms that use the financial incentives of the SMART program, micro firms (less than 10 workers) and more than half of the firms last less than five years. Selection of the firms to use financial incentives of SMART, as for the other TSBs, is done through a competitive process (described in the Collaborative R & D Program section). Meanwhile, depending on the type and size of the project, each firm can receive three types of grants:

- Type I: Nine-month grants that cover up to 60% of project costs and their maximum value is 25 thousand pounds.
- Type II: Eighteen-month grant that cover up to 60% of project costs and their maximum value is 100 thousand pounds.
- Type III: 24-month grants that cover up to 35% of project costs for medium firms and up to 45% of
 project costs for small and micro firms and their maximum value is 250 thousand pounds.

After the competitive process and selection of the best TSB proposals, R & D examines the capabilities and available resources in the firm that has offered the proposal. For example, TSB examines the firm's ability to manage cash flow of the project and if a firm fails to finish its R & D project due to the problems that have already been predictable (and manageable) it will refund all of grant awarded to the firm. The TSB also sets a monitoring officer (MO) for each firm (that has presented the proposal). During the project period, the monitoring officer acts as an interface between the firms and TSB and reports the work progress to TSB. Another mission of this person is reassuring the TSB about the availability of all the project management mechanisms at the beginning of each of these projects so that the project can be started in the best condition. (TSB Grant for R & D, 2011).

2.2.7. Project for Supporting the Firms to Utilize "Innovation Vouchers" Specialist

A firm can receive the financial resources necessary to work with a specialist outside the firm (if it's the firm's first collaboration with the specialist) through a Voucher, and use the specialist's knowledge to promote innovation in the firm. This specialist can be an academician, a consultant in the scope of intellectual property rights, a researcher in research organizations, an employee of one of the technical consultation companies, or an individual in one of the poles of technology and innovation (Catapult). The maximum amount that in this program can be given to the firm by the TSB is 5 thousand pounds. Now, in every three-month period, about 100 Voucher is granted to firms by the TSB. The most important prerequisite for granting a Voucher to a firm is the critical importance of the issue that the firm plans to obtain advice about from a specialist outside the firm. Also a Voucher cannot be used for training the personnel or buying the equipment. (Bis Economics Paper No. 15, 2011).

2.2.8 "Missions" project

In this program TSB sends the UK's innovative firms entrepreneurs to another country (more advanced that the UK in terms of innovation) for a short period of time so that these entrepreneurs could find new business relations through meeting the suppliers, customers and potential investors in those countries. For example, in 2012-2013, through the Mission program, entrepreneurs of the active firms in the area of "green energy" and "health" were sent to the United States that had immediate success for the 19 firms, yielded. These firms established new companies (and dependent to the firms) in the United States and found new

investors. Also, these firms could also benefit from the media coverage around the Mission. It is also essential to note that the selection of the companies to use the benefits of the Mission program is done through a competitive process (explained in the Collaborative R & D program section). (TSB Concept to Commercialization, 2011& Annual Report and Accounts 2010-11)

2.2.9. Demonstrators

In a demonstrator, a new technology in a large-scale dimension is tested in reality to identify the obstacles facing the widespread use of it. In this program, all the firms and individuals working in the field of new technology come together and show that to achieve this technology, how should the supply chain of this technology be changed. TSB had held several demonstrators in areas of "low-carbon vehicles", "living place improvement", "digital products" and some other fields. For example, in the «low carbon vehicles" demonstrator (held by eight consortiums including the major automakers in the UK, British universities and small firms throughout the country) 340 low carbon-vehicle were used in the streets experimentally. (TSB Delivery Plan Financial year 2011-12)

2.2.10. The programs associated with the European Union

FP7 (Seventh Framework Programme for Research and Technological Development in the membered countries) is the most important programs of the European Union to encourage R & D in the member countries which is conducted from 2007 to 2013 with about 50.5 billion euros budget. FP7 finances the R & D in the priority areas from the perspective of the European Union which are mainly done through the definition of "big» R & D projects (such as Eurostars project). In the meantime, TSB plays the main role in connecting links between the English firms and this European program. For this purpose, all English firms can simply through a contact number 03003214357, gain all the necessary information on how to use funds of FP7 (especially in the case of administrative procedures and contracting).(TSB Delivery Plan Financial year 2012-13)

2.2.11. Feasibility studies program

"Feasibility studies" is a program in which a grant is awarded to a firm or several firms who are conducting a joint R & D project to investigate the technical feasibility of its innovative idea. Evaluation and selection of the firms to receive grants is done through a competitive process and will be awarded to the firms that have received the highest from the independent evaluators of the TSB (TSB Annual Report and Accounts 2010-11)

2.2.12 Launchpad program (Upgrading the cluster of TechCity)

This program (Launchpad brand) specifically supports the companies that are active in the digital cluster of TechCity in East London. Like most other programs of the TSB, the organization's support of these companies takes place through a competitive process (explained in the Collaborative R & D program section).(TSB Delivery Plan Financial year 2012-13)

2.3. The importance of each of the TSB programs from the organization's perspective

As also can be seen in Figure 5, the largest share the TSB budget is dedicated to the Thematic which is the Collaborative R & D (R & D partnership). In the second place there is the "Center of Technology and Innovation (Catapult)" program which indicates the importance of this program for the TSB. Third place belongs to the KTPs and then next one goes to the administrative and management costs related to the TSB programs.

Nevertheless, perhaps the TSB's prediction of how to allocate the budget for the organizations in the future offer a better knowledge of the importance of these programs in the TSB. In Figure 6 (a prediction published by the TSB on how to allocate funding for the organization in the future) can be seen that in the years 2014 to 2015, the share of Thematic (Collaborative R & D) program budget on the TSB has been reduced and instead the share of technology and innovation poles (Catapult) has been increased in the TSB budget. (TSB Delivery Plan Financial year 2011-12)



Fig. 5. The distribution of TSB budget among different programs of the organization (2011-2012)

Fig. 6. Prediction of TSB budget distribution among different programs of the organization (2014-2015)

2.4. The importance of different areas of technology for the TSB

In addition to the difference of importance each of the TSB programs in the organization, each of technological fields have different priorities for the TSB. In the figure below (which is the prediction of TSB from the distribution of budget among each of the areas of technology in 2014), the priority of each of the areas of technology for the TSB is shown. As indicated in Figure 7, the areas of "energy", "health" and "production with high added value" are the three areas in the next few years which will receive the most amount of the budget (25 million pounds) from the TSB.(TSB Delivery Plan Financial year 2011-12)



Fig. 7. The distribution of TSB budget among the areas of technology considered by this organization

2.5. The importance of the size of the firms for the TSB

Now, after reviewing the different TSB programs, the question is which type of firms is more important for the TSB? The answer varies depending on the type of firms. Figure 8 shows a distribution of budget among firms about some important TSB programs. As the following figure shows, in the Collaborative R&D (R&D partnership) program, among the micro, small, medium, and big firms and academic researchers, the largest share of budget is given to the small and big firms. This situation also exists for the KTP program. Also regarding the FP7 program (especially Eurostars) it can be said that micro, small and medium firms have received all the budget, but regarding the SBRI program and SMART, the budget is mostly given to micro and small firms (the priority given to micro firms). (TSB Delivery Plan Financial year 2012-13)



Fig. 8. The share of micro, small, medium, and big firms and academic researchers in each of the TSB programs

2.6. The structure of TSB

The TSB can be divided into five main sections:

- 1. The "director of Enterprise Communications". Of course, as mentioned, subcategories of this section (because they perform the support and internal activities of TSB) are not shown in the figure.
- 2. The "director of Innovation Programmes. This section is responsible for implementing the «Collaborative R & D» program which regarding the size of the budget, is the most important activity of the TSB. «Collaborative R & D» program finances the R & D partnerships in the following technological fields. In the TSB's organizational structure and in the "director of Innovation Programmes) » a subdivision is considered almost proportional to each of the areas of technology.
- 3. The "director of Knowledge Exchange & Special Projects". This section consists of three subsections. The first subsection is responsible for the KTN and KTP programs. The purpose of both these activities is to promote the exchange of knowledge among the firms (and between firms and research organizations) and due to the exchange of knowledge this section is called "Knowledge Exchange & Special Projects". In the second subsection, matters relating to technology and innovation poles (Catapults) are managed. An important purpose of the technology and innovation poles is "knowledge exchange" among the firms and the research organizations in these poles. The third subsection is a special project that the TSB, in a partnership with the UK Space Agency, has undertaken. That is why this section is called "special projects" ("Knowledge Exchange and Special Projects").
- 4. The "director of Finance & Operations". The main task of this section is the implementation of competitive processes of the TSB such as the competitive processes in Collaborative R & D, SBRI and SMART and monitoring (financial and project management) the projects that have been funded by the TSB.
- 5. The "director of Business Planning". Implementation of SBRI program requires close interaction of TSB with the government agencies TSB (as the buyer of technological products). Management of the interaction and interaction of TSB with other institutions (including European Union, Research Councils and other firms) is done through the subsections of this section.

3. RESULT

This article took a deep study on UK development organization "Technology Strategy Board" that shows even in developed countries, government intervene in the economy sphere and the most important tool for

government intervention are development organizations that Here British government play this role to support the promotion of innovation in enterprises in the UK by «TSB».

Development organization	Ministry respective	The main task
TSBTSB	Department for Business, Innovation &	support the promotion of innovation in
100100	Skill (BIS)	enterprises

This study clearly shows that inevitably, state aid is the main source of financing the activities of development organizations and the fact that some development organizations, have been chosen only one or a limited role for the development activity while the UK Technology Strategy Board has chosen a wide range of activities to some extent that became the main industrial development and innovation propellant in this country.

Development organization	Diversity of activities
TSB	Widespread

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The new generation of innovation policy making¹²**:** This new approach to innovation requires a different policy making (in the area of innovation). In this regard, the study puts forward the significant issues and principles that should be considered in next generation innovation policy making:

- The first principle. Innovation is strongly dependent on the "competition" among the firms and also the "cooperation" and "mutual learning" among the firms. Competition among the firms it is very necessary to inspire innovation in them. At the same time, often there is as a kind of formal and informal cooperation between the successful innovative firms, and that cooperation happens because the innovation includes problem solving and the issues that are faced by the firms are often outside the knowledge and capabilities of the firm. In fact, numerous statistical studies on the firms in different countries show that successful innovative firms are the ones that have cooperation (often long) with other institutions.
- The second principle. Clusters have great importance in innovation and in a way lead to the industrial and technological "specialization" in a region or a country. The firms that are located in the same geographical area will compete with each other and also will work together. In fact, several studies have shown that making a "cluster" is a common feature of many regions and countries that have a competitive advantage.
- The third principle. Innovation in a firm strongly depends on the capabilities of the firm. Each firm to compete with other firms requires quite specific and distinct competencies and capabilities and these competencies and capabilities are not achievable unless through the investment of the firm on its assets (including the firms' kills, knowledge and in general " intellectual assets"); but in the meantime, the process through which these investments should be done is very complex, rarely predictable and with high uncertainty. As a result, there is no one specific and definite path to "success" of the innovation in a firm.
- The fourth Principle. Innovation can be seen in all industries; in other words, innovation is not a phenomenon that only happens in a small group of High-Tech industries or something that is derived by only a few specific technologies. Numerous surveys show that innovation is clearly evident in "all" industries of the developed countries. In other words, even industries that are called "mature" or «Low-Tech» too often have been able to achieve new technological products and processes resulting in their remarkable sale. Similarly, the service industry section too should be regarded highly innovative and this is a very important issue because the service industries are considered the largest industrial sector in developed countries. All explanations indicate that we cannot simply limit innovative policy making to focus on the High-Tech industries.
- The fifth Principle. Innovation is accompanied by several "risks" and "uncertainties" and until now it is rarely possible to predict the path of innovation even when the firms have enough information and knowledgeable and qualified managers often make major mistakes in their predictions, but why? because the prediction of the behavior of industry and society towards new technologies and products is very difficult. Therefore, an important issue for the innovation of the

firms is the issue of "risk"; and the most important matter for a policy maker is to understand how economics can "reduce" the innovation risk for the firms or "share" it among them.

• The sixth principle. "Government sector" should also be considered as part of the innovation system. The government sector can affect the speed and direction of the innovation of the firms through "shaping the firms' environment", through "behavior as a major purchaser of products and services" and through the "innovation in activities related to them" speed and direction of innovation firms under on their impact. Government sector can also make the firms pay attention to the long-term needs of the society (such as climate change, food security, energy and the aging of the population; the needs that the firms normally don't pay attention to).

TSB development activities from the perspective of innovation policy as follows:

- Cooperation among firms
- Reducing the risk faced by the firms
- development of capabilities of firms
- Cluster

4. CONCLUSION & DISCUSSION

In December 2011, the British Ministry of BIS published a document entitled "Innovation and Research Strategy for Growth of the UK" was published in which the priorities are determined for the government of this country to improve the performance of "innovation and research" in Britain. In this document, on numerous cases the role of TSB is mentioned in promoting business innovation in the UK and even some TSB programs (especially "technology and innovation poles, Catapults" program, SMART, SBRI and several other programs in the organization) are directly named in the program as the emphasized programs; but along with this document and on the same day, a backup document was published by the ministry entitled "Innovation and Research Strategy of Growth of the UK: Economic Report" in which the intellectual foundation of the previous document ("Strategy for innovation and research for Growth of the UK" document) was announced; therefore, it seems that the outlook of these two documents on innovation (especially the second document, i.e. the economic report) and their arguments in support of this view, can provide very useful information about the activities of the TSB.

4.1. How does the innovation happen? From the linear model of innovation to more complex models of innovation¹³

Innovation means doing new things in new ways. Innovation improves or changes the technical and functional features of the products (or process). Innovation also alters the organizational structures and business strategies and thus will lead to a permanent change in the economic systems and their productivity growth, but the firm must be trained to do new jobs; therefore, in the study on the "nature and function of innovation", most of the research that has been done in recent years have focused on the "source", "nature" and "features" of the learning and the knowledge that comes with it; but before the advent of this researches, policy-makers for a long time thought that this learning is merely the result of a "scientific (and technological) exploration " (which has happened before the learning), in other words, from the viewpoint of these policy makers, scientific (and technological) discoveries have led to learning in a linear process leading to innovation eventually. This linear approach views the technological changes as "a cycle to cycle sequence" in a way that in this sequence first a "new knowledge" (mainly derived from a scientific research) leads to an "invention" and then this invention becomes an "engineering development" leading to innovation (commercialization of a new product or process). Moreover, in this approach, the "technological development" are usually viewed as a type of "applied science".

However, in recent decades, this linear approach has been rejected by important and numerous studies that are supported by extensive statistical data and conducted on a wide variety of countries and industries. According to these studies, the linear approach greatly overlooks "the mutual relationship between scientific research and innovation" and "elements of the innovation that has nothing to do with scientific research". In fact, these various important studies suggest a more complex model of innovation where the innovation is not regarded as an "isolated and one-sided process," but as a "divided and interactive process"; a process in which, firms in practicing innovation, rely not only on scientific research but also on several different sources. In this process:

- The firms do not have complete information about the opportunities in the market. In fact, they estimate the opportunities available in the market based primarily on speculation and then, based on this estimation perform the "design of products", " growth and development of the firm" and "improving financial, engineering and management capabilities" of the; therefore in this approach "research" is not necessarily the sole initiator of innovation but merely an activity among a complex series of other activities (all of which play a significant role in the innovative of the firms).
- Innovation is not the result of a "simple one way process" but a result of a set of "feedbacks" among different activities, activities that are "continuously" taking place. In other words, innovation is not an "abrupt" and "periodic" activity.
- Innovation is a cumulative (over time) phenomenon, in the sense that part of is dependent on the "past successes" and "experiences gained from the success; in other word, innovative in the firms does not happen only "once and downright" but the innovation (based on past experiences and learning) is like a "flow" (in time).
- Innovation is the result of complex interactions between the firm and its environment. In other words, innovation is not confined within the boundaries of a firm. And the firm for solving the problems facing it should also constantly benefit from the "skills", "information" and "capabilities" available outside its boundaries.

4.2. TSB and innovation policy making

Now, considering the above six principles (which can be considered as the foundation of a new generation of innovation policy making) we have a suitable framework to examine the philosophy of TSB programs (as a governmental policy organization). Therefore, the table below shows the relationships of the TSB programs with the above principles.¹⁴

Principles of new generation of innovation policy making	TSB Programs
second principle (clusters)	(Catapults) Technology and innovation poles
The first Principle (cooperation among firms)	(partnership R&D) Collaborative R&D
The third principle (development of capabilities of firms)	(KTNs) Knowledge transfer network
The third principle (development of capabilities of firms)	(KTPs) Knowledge transfer partnership projects
Sixth principle (the government's role as purchaser)	SBRI
The fifth principle (reducing the risk faced by the firms)	SMART
The third principle (development of capabilities of firms)	Innovation Vouchers
The third principle (development of capabilities of firms)	Missions
The first Principle (cooperation among firms)	Demonstrators
The fifth principle (reducing the risk faced by the firms)	Programs related to the European Union
The fifth principle (reducing the risk faced by the firms)	Feasibility Studies

Table 3. TSB program philosophy from the perspective of innovation policy making principles

On the other hand, the map of technological areas targeted by the TSB (Figure 10) shows that all the industries (High-Tech and Low-Tech) have innovation capabilities from the viewpoint of the organization (The fourth principle: importance of all industries). Also, by having a brief look at the composition of the projects supported by the TSB, there are projects (such as low-carbon vehicles, renewable energy, technology aiding the disabled, etc.) that can clearly lead to the conclusion that the TSB (as a governmental organization) tries to draw the attention of the firms to the long-term needs of society too(The sixth principle: focusing the attention of the firms to the long-term needs of society by the government), and interestingly, attention to these principles can be seen in the description of the TSB itself of his reason for existence.

"... Innovation is coupled with risk and market behavior is never perfect. A firm faces many financial and technical when investing in technology and emerging markets, and the return of this investment is not predictable. Meanwhile, he only concern for small firms is struggling to get financial resources and big firms also prefer to instead of investing in emerging markets, wait until these markets get more recognizable and with lower uncertainties; therefore, the investment of the firms in innovation is delayed and also less than what is often required for a sustainable economic growth (according to the fifth principle). On the other hand, innovation alters the relations between the supply chain of the firms and their business model. In such a situation, many of the firm's partners, suppliers and customers should be simultaneously changed to be able to accept innovations, which is very difficult (according to the first and second principles). On the other hand, in an organic and complex system of innovation, information flow is imperfect, and therefore the firms

need help to access information, identify opportunities and provide an appropriate response to changes that disturb the status quo (according to the third principle). Finally, the government can affect the markets through "its way of behavior as a major purchaser", through the regulator, through the definition of standards and financial incentives (according to the sixth principle). TSB was founded in 2007 and began his career to eliminate such "market failure"... "

Or elsewhere:

"... Our experience shows that regarding the innovation of the firms, there is a (some) key principle. The first principle is that the challenges (both global challenges and the challenges arising from the needs of the market) can encourage innovation. Therefore TSB pays much attention to encouraging challengeoriented innovations (and technologies that lead to new solutions to the challenges) (according to the sixth principle). The second principle is the principle of cooperation. A firm to be able to remove barriers to innovation has to collaborate with other firms in the supply chain, universities, research institutions, government departments, funding sources, and investors (according to the first principle)... in recent years, these principles have helped the TSB in defining its strategic direction ... "

And elsewhere:

"... Since 2007, we have understood the necessity of" association among individuals and organizations "and its immense benefits (according to the first principle). We strive to make our investments and support turn into a "catalyst" for the firms (to develop their new innovative solutions), (according to the fifth principle). We call this approach "providing connection and catalytic support"; the name that has been used for our first strategic program and is a "principle" which we still observe... "

Therefore it can be concluded that the pattern of TSB development activities is the same as the principles governing the new generation of innovation policymaking, and Iran's development organizations can also get inspired by the policies and activities of these organizations in order to take steps toward the improvement and expansion of the mission and development of our beloved country, Iran.

5. Suggestions

This study aims to provide a "development model" of development organizations in order to develop activities rang and redefining the role of these organizations in Iran.

Therefore development organizations including IDRO, IMIDRO can be modeled in the UK Technology Strategy Board to increase their range development activities. There are some development organization like:

- Defense Advanced Research Projects Agency DARPA in United state
- New Energy Development Organization NEDO, in Japan
- Small and Medium Enterprise Development Organization KOSGEB, in Turkey
- National Bank for Economic and Social Development- BNDES, in Brazil
- Malaysian Investment Development Authority MIDA, in Malaysia
- Industrial Development IDC, in South Africa

That can be modeled to accelerate the evolution of these organizations in Iran.

TSB has a wide range activities that are very similar to Iran development organization. some development organization compared to TSB can be seen in the table below:

Development Organization	Ministry respective	Main task
DARPA	United States Department of Defence	Support the frontiers of science and technology
NEDO	The Ministry of Economy, Trade and Industry	National Strategic Research management and research partnerships between industry and academia
TSB	England, Department for Business, Innovation and Skills (BIS)	Support the promotion of innovation in firms
MIDA	Malaysia Ministry of International Trade and Industry & Ministry of Domestic Trade and Consumer Affairs	introduce Investment opportunities and encourage firms to take advantage of these opportunities
KOSGEB	Ministry of Science, Industry and Technology of Turkey	Supporting growth, innovation, and increase the SME exports
IDC	South Africa Ministry of Economic Development	Finance provided for development projects
BNDES	Brazil Department of "Development, Industry and Foreign Trade»	Provide long-term loans for firms

Table 4. Development organization

End Note

⁵ Ingenious Britain: Making the UK the leading high tech exporter in Europe, Sir James Dyson, 2010,

9 Regional Development Agancies

¹¹ EU recommendation 2003/361

¹³ From the document "Strategy for innovation and research for Growth of the UK: Economic Report": 23-32

¹⁴ It is possible that a program has been associated with several principles of the new generation of policymaking. But the table shows the more relevant principles.

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¹ See next note (2)

 $^{^2}$ NDPB is classified as an organization is the organization involved in the implementation of government activities but is not regarded as the subset of the government and works outside the normal rules government. These organizations have been established since 1980 in England and financed by one of the ministries of the government. In fact, the distance of these organizations from the executive body of the government makes them work with more flexibility and enables them to operate with greater freedom in their trade and cooperation with other institutions. However, ultimately there are the ministers who should report on the independence, efficiency and effectiveness of these organizations to the British Parliament. This way of activity of such organizations are also regarded as the socalled «Arm's Length».

³ A kind of budget-providing process in the UK awarded based on the need of the applicant.

⁴ The Role of Technology and Innovation Centres in the UK, Hermann Hauser 2010,

⁶ The address of this social network is http:// connect.innovateuk.org

⁷ In addition to the fifteen KTNs, other groups have been working on connect in the technological areas other than the technological areas of these fifteen KTNs.

⁸ A kind of National Vocational Qualifications in the UK

¹⁰ Smart is the name of the brand of this program not the abbreviation of a specific term

¹² Taken from the document "Innovation and Research Strategy of Growth of the UK: Economic Report", 51-53

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