



Original Article

Investigating the Role of Overseas Diaspora Experts in Facilitating Knowledge Access and Transfer in Pharmaceutical Industry; a Case Study of Iran

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Human capital is a fundamental feature of determining the country's absorption capacity and its ability to benefit from technology transfer. It is also a key component of the problem of losing technological capabilities through the phenomenon of "brain drain" that has been identified previously. Successful technology transfer can depend on the use of overseas experts who have dual cultures and may "translate" advanced technology to decision maker authorities in developing countries. This study seeks to measure the ability of these individuals to interact as knowledge mediators and reservoirs through each channel of knowledge transfer. In order to collect data, a questionnaire was used in this study. The results reflect the tendency of the target community for technology transfer and the challenges they face in it. The highest tendency was for consulting (89.59%) as a channel of technology transfer, followed by trade (58.7%), licensing (43.5) and foreign direct investment (40.4%). It is necessary to improve infrastructures such as a well-funded system of education and research, and social welfare parameters in order to attract overseas scholars.

Keywords: Knowledge access, knowledge transfer, brain drain, reverse brain drain (RBD), Human resource development (HRD)

1. INTRODUCTION

Technology transfer is defined as a process where the developer of a technology puts his technology at the disposal of a commercial partner to exploit it¹.

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Technology transfer in the pharmaceutical industry can be seen from the perspective of research and development and innovation². Pharmaceutical companies are constantly looking for technologies for the screening and detection of pharmaceutical molecules. Many pharmaceutical companies do not have the capacity to develop and market a molecule until the last stage. So they are interested in transferring their technology to large pharmaceutical companies with financial and human resources. Multinational companies that are deployed in developed countries are leaders in developing and mastering technology in the pharmaceutical sector¹.

Technology can be transmitted through mechanisms, either they are market-based or not. Market-based mechanisms include trading goods and services, foreign direct investment (FDI), licensing, joint ventures, and the movement of personnel from the borders. On the other hand, non-market based mechanisms include imitation, departure of employees (who later join in other companies or start their own business) and exploiting the patents and test data³.

Economic interactions between countries take place through trade, financial flows -including foreign direct investment (FDI) - and the relocation of employees, managers, professionals or academics. These interactions affect the global allocation of resources and serve as a channel for technology transfer. These technology transfer channels can be related to each other, though independent to some degree. Human capital is a fundamental feature of determining the country's absorption capacity and its ability to benefit from technology transfer. It is also a key component of the problem of losing technological capabilities through the phenomenon of "brain drain" that has been identified previously.

It is important that policies be taken to bridge the gap between students from developing countries going abroad for higher education and choosing to stay there, and local human capital pool. Successful technology transfer can also depend on the use of overseas experts who have dual cultures and may "translate" advanced technology to decision maker authorities in developing countries⁴.

Iran is classified as a developing country according to the classification of *World Economic Situation and Prospects(WESP)(2017)report*⁵, and the return of scientists abroad is considered important to it. The target community of this study was Iranians working in foreign pharmaceutical companies and institutions.

The research seeks to measure the ability of these individuals to interact as knowledge mediators and reservoirs through each of the channels of knowledge transfer and to examine the barriers to collaboration through each of these channels.

And finally, by examining the experience of other countries, we will come up with a set of measures to facilitate these people's cooperation.

2. METHODS

It was necessary to examine two issues. First; measuring the **capacity** of the target population; and second, measuring the **ability** of the target population.

Capacity measurement

In this case, the bibliometric method was used. Bibliometrics is a broad term that includes more specific types of research, such as *altmetrics* which uses social websites for analysis and informing scholarship⁶. So, in a more detailed categorization, altmetrics has been used in this research.

First, it was necessary to identify Iranian people abroad in the field of production, development and distribution of drugs. The criteria for extracting these people were as follows:

- 1- Nationality
2. Overseas Activity (Last Experience)
- 3- Field

For each of the above, a keyword had been chosen, which was searched with different permutations each time.

More frequent websites were used:

LinkedIn, Google patents, research gate, PubMed, Google scholar, Justia patents and corporate websites or personal pages on different university websites or on the website of organizations where targets were active.

Through email by individuals themselves. By collecting these data, a database of individuals was obtained. There are potential uses for this database:

1. Web based Publishing of this database and introducing these individuals to domestic institutions and factories
2. Examining migration patterns
3. Government agencies and decision-makers can decide on a national database of incentive schemes for temporary migration and other policies.

Ability measurement

Instrument:

In order to collect data, the questionnaire was used as the main tool. Each questionnaire needs some assumptions of which the components are asked in the form of questions in it. The hypothesis of this study, based on the introduction, were as follows:

Examination of the ability of target community to play the role as advisors for the Iranian pharmaceutical industry

To evaluate the ability of target community and their affiliated institutions to invest directly in Iran's pharmaceutical industry or joint production contracts

Examination of the ability of Iranians abroad to provide pharmaceutical production under license

Examining the abilities of Iranians abroad in the field of bartering

To investigate the tendency of temporary or permanent return of Iranians abroad to Iran and its history of migration as knowledge reservoirs

Pretesting

Validity:

The first method used in evaluating the questionnaires was informal, individually-based expert review. Concurrently, we utilized a “think aloud” methodology, collecting information about the participants’ reason for their responses, by having them verbalizing their thoughts when completing the CHOICES measurements.

Reliability:

In this study, we used the internal consistency method. Coefficient alpha is usually used when a multi response scale (such as Lykert scale) is used. SPSS version 24 of IBM were used for this purpose.

Administration:

In this study, self-administered method was used. The target community of this study was foreign Iranian people studying or working at institutions or factories outside the country. These people were identified at the capacity measurement stage.

The final number of targets was 223. Of these, there were 162 emails available. The first attempt to commute was on December 19, 2016 via email. The request for cooperation and the questionnaire link were sent to individuals. For those whom we did not have their email addresses, the message was sent through LinkedIn messaging system. For synchronization, all subsequent reminders were sent to all targets on December 25, 2016 and March 20, 2017 via LinkedIn messaging system. Finally, 49 Responses were received, of which 48 could be used.

3. RESULTS AND DISCUSSION

By reviewing 48 questionnaires that were obtained and considering the assumptions mentioned in the previous section, results would be inferred.

In the demographic information section, the results were as follows: The largest age group (31.25%) was 35-45 years old. Most of the participants (93.5%) were born in Iran and most people (77.1%) had PhD degrees or equivalent.

Other demographic information is given in the following figure (Fig1):

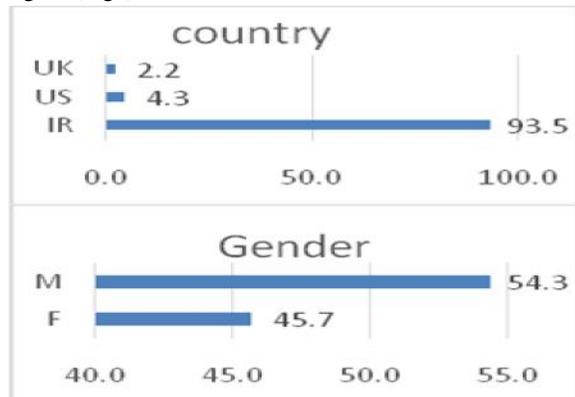


Fig 1: Demographic information

Considering that one of the channels of knowledge transfer is the migration of individuals, in the second part of the

questionnaire we collected information about their current situation and their probability of immigration. The components of this section are the people’s job history, their field of work, the scale of organization, the probability of return, and the type of preferential organization for cooperation. These components can help how to orientate the type of organization for each potential partner and then regulate communication for knowledge transfer.

In case of the position and affiliation of people, “the company or the private institution” (42.4%), and “the university or medical school” (32.2%) got the most points. On the scale of the organization, two options are most selected: “Multinational corporations” (66.6%) and “large-scale companies” (54.4%).

In the next section, people were asked how they would evaluate their possibility of return to Iran. The results showed that individuals tended to return to Iran in the form of a second affiliation, part-time (38.33% of responses) or depending on their job opportunities (16.67% of responses). In the section of preferential organization for cooperation, most respondents have chosen profitable organizations, whether private, public, or semi-private. Percentages of each item could be seen in the following figure (Fig2):

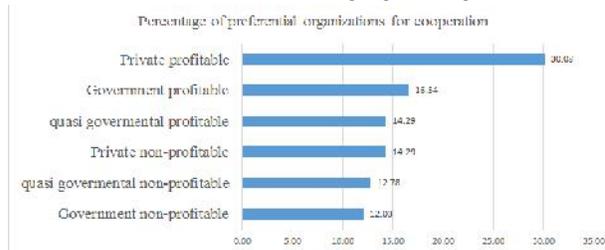


Fig 2: Percentage of preferential organization for cooperation

Transferring from a private company is usually possible only when there is a "business case". Therefore, this transfer is limited to a number of products, and such transfers may not stay constant to promote the development of local pharmaceutical industry.

Although government or non-profit actors may have different reasons for entering technology transfer, but the type of support for these factors is likely to be related to the mission of the organization and may also be related to a specific product⁷.

As previously mentioned, in this research five channels were considered for knowledge transfer. You can see the percentage of target people's interest in each channel (Except movement of personnel) in the table below (Table1).

Table 1: percentage of interest in each channel

channel	Yes(%)	No(%)	Other(%)
consulting	89.59	8.33	2.08
FDI	40.4	51.1	8.5
License	43.5	47.5	8.7
Trade	58.7	34.8	6.5

As you can see, the most willingness of individuals to cooperate has been through consultation(89.59%), after

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 which comes the trade (58.7%), licensing (43.5%) and
 foreign direct investment (40.4%).

In each section (technology transfer channel), after asking
 about the willingness to cooperate, respondents were asked
 to specify their preferred way to cooperate (Fig3).

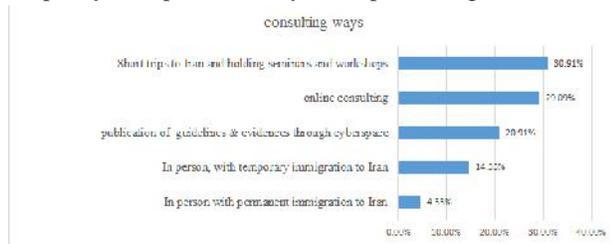


Fig 3: percentage of willingness to cooperation through different way of consulting

Talking about ‘migration’ and ‘mobility’, permanent long-term movements should not be confused with short-term visits. Short-term visits allow scholars to create scientific networks without actually staying in another country. The Internet is making it easier to work on the international scene and the old idea of permanent relocation from one country to another is completely obsolete ⁸.

You will see the preferred ways of technology transfer through other channels in the following figure (Fig 4) :

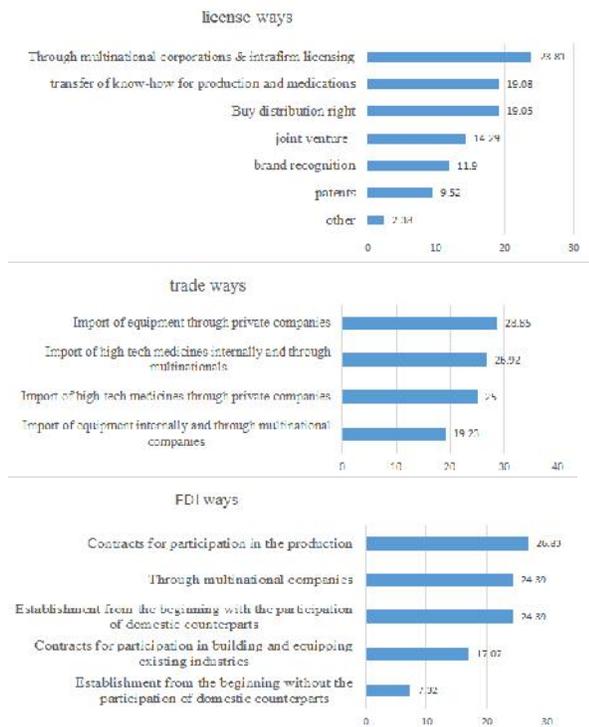


Fig 4 : percentage of preferred ways to transfer technology through each of technology transfer channel

At the end of each section of questionnaire, Barriers to cooperate through each channel were assessed by a 5-point Likert scale. The results are presented in the figure below (Fig 5):

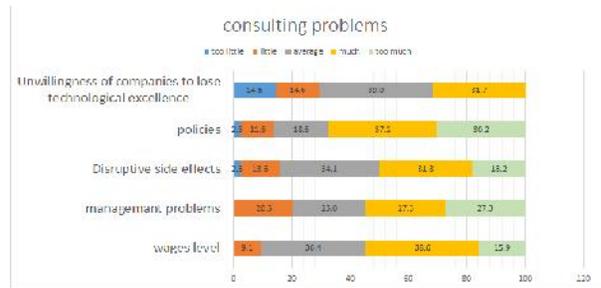


Fig 5: Percentage of score to each one of consulting problems
 Considering the use of the Likert Scale to assess problems, median factor is used to analyze results.

In the median review there have been issued several barriers to consultation: the legal problems related to domestic policies and laws, project management problems, the length of the process, wages and contract conditions. The other “sub problems disrupting the focus on the project” and “the reluctance of the source companies to lose technological excellence” are less important and moderate compared to other factors.

Many economists have pointed out that wealthier a country is, the more scientists tend to stay there. But wealth alone is not enough; a dynamic and flexible, competitive system for budget and development is also vital. Still a well-funded knowledge system seems to surpass the remaining motivations ⁸.

Choosing different technology transfer methods is one of the solutions for profit-making companies to maintain their technological excellence. For example, as long as a technology does not expire, they do not choose ways causing big diffusion of technology ⁹.

There are situations where technology holders do transfer their knowledge to another party, outside of standard market-based transactions, for example multinational corporations use B-generic strategy to transfer license patent rights to supply generic drugs in the local market of a developing country, while simultaneously collect brand A from the market.

On the other hand, some research companies face the problem of “patent cliff” in which many of the profitable products are withdrawn from the patent, with few potential products for replacement; these companies sell Branded-generic drugs in emerging markets, and so it's possible for them to transfer technologies to local branches.

In the end, commercial and social considerations such as freeing up limited production capacity, transferring “know-how” for low-cost products in high-income markets, and providing access to products needed only in developing country markets, could increase motivation in developed countries for technology transfer ⁷.

In the next section, the possible obstacles of investing in Iran were examined. The main obstacle from the perspective of the target community is economic policy. It is followed by the technical rights of the author, and then the status of

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 participation in joint markets and R&D networks, human resource problems ,and investment charges and market size are ranked next (Fig 6).

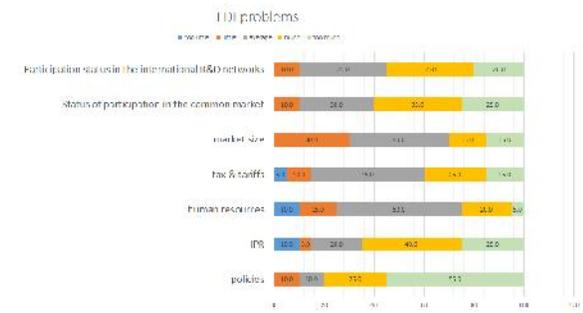


Fig 6: Percentage of scores to each one of FDI problems
 The key issue is how to attract FDI, which explicitly increases the development and other benefits of technology transfer. A series of factors being developed for this purpose are commonly referred to as performance requirements. These can be in the form of constraints imposed on investors, and they are required to meet the specific objectives of their organization in the host country¹⁰. Removing restrictions on FDIs at the world level can be helpful because foreign companies can choose FDI between different ways without any disturbance.

You should be careful that the FDI does not get much encouragement. Financial incentives can cause FDI to be absorbed into false countries - countries whose prices are higher than elsewhere¹¹.

FDI can also depend on the host country's science and technology base. Companies have to invest in research and development abroad to achieve local knowledge, So the target country needs to be well developed and its private and public sectors should have a tendency to R&D, and human resources should have the right and appropriate level of scientific achievement¹².

In the section on barriers to cooperation through Licensing, according to the median, three factors of “the lack of transparency” and “certainty of policy” and “technical rights of the author” are considered important from the perspective of the target community; The size of the market has moderate importance in the process of knowledge transfer through the license (Fig 7).

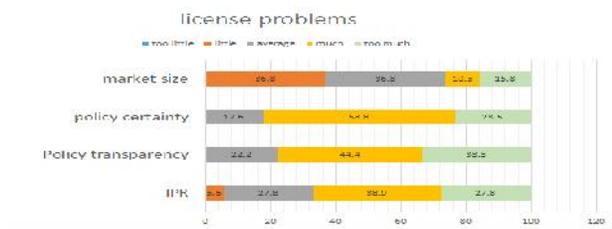


Fig 7: Percentage of scores to each one of licensing problems

Both channels of FDI and licensing respond to factors such as effective infrastructure, transparency, political sustainability and the trade and capital regimes¹³. To attract successful technology import and build preconditions for imported technology, countries need a supportive environment, including protecting the intellectual properties and implementing it. Implementing any kind of intellectual property and regulatory rules will provide transparency and assurance to inventors, recipients and license holders. The rate of technology transfer is highly dependent on the level of intellectual property protection¹⁴. In the review of proposed problems for trade, trade policies are very important, and then the intellectual property rights and the unpredictability of the market are important, and then market size and transportation, has an average importance for the flow of technology transfer through trade (Fig 8).

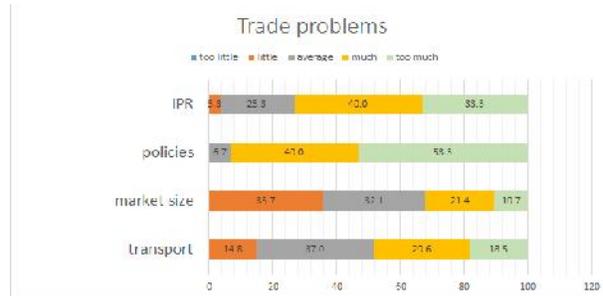


Fig 8: Percentage of score to each one of trade problems
 The documentation suggests that countries pursuing relatively closed trade policies fail to achieve the benefits of technology transfer in the global trade. So everyone agrees on open commerce as a key policy. Companies need capitalequipment and imported inputs that carries foreign knowledge. At the same time, market failures question any unconditional agreement on commercial protection¹³. Here, we first reviewed the political measures that can be taken to facilitate the transfer of technology by host country¹³.

- ✓ Improving the local environment for ITT and its diffusion
- ✓ Attempt to improve infrastructures
- ✓ Transparency and stability in government
- ✓ Cautious effort to create an open trade regime that attracts foreign investment
- ✓ Appropriate environment for research and business that attracts skilled workers back to home from developed countries
- ✓ Investing in at least simple R&D capacity.
- ✓ Adequate supply of engineering and management skills
- ✓ Making domestic education and training policies
- ✓ Reducing the technological distance between local and foreign firms by establishing innovation systems that encourage R&D, transfer knowledge from universities and public laboratories to domestic firms, and promote use of cost-saving technologies.

- ✓ Recognition of the risks involved in adopting foreign technologies
- ✓ A subsidy or similar incentive that could expand innovation and risk taking.

Governments can also tip the scales through immigration policies and travel incentives⁸. By examining the experience of other countries such as China¹⁵,¹⁶, India, Korea, Malaysia, Taiwan¹⁵ Jamaica, Caribbean, Bulgaria, Uruguay, Argentina, Philippines, African countries and Mexico^{16,17}, Pakistan¹⁸, Bangladesh¹⁹ The following policies are suggested for this purpose (Table 3):

Table 2: Strategies to address brain drain

Strategies to address brain drain		
Scientific strategies	Political strategies	Socioeconomic strategies
ü Equipment support	ü Return agreements	ü Temporary visa
ü Journal and Internet access	ü Training for decision-makers in developing countries	ü Letters of future job support
ü Professional networking support	ü Integrating and coordinating the policies and programmes of multiple government ministries	ü Transparent and fair publication of information about investment programs and businesses that transfer knowledge and readily accessible job information
ü Re-entry funding	ü The recognition of diasporas by their home country through special ministry or visible and accessible governmental websites	ü increased accessibility to superior housing and education for their family Financial incentives like increased wages, tax concessions/ breaks foreign currency banking accounts, attractive salary packages with comfortable living standards, and rights to own agricultural land for foreign passport holders ¹⁵ or loan forgiveness programme, like Becas CONACYT in Mexico.
ü Support with writing grant applications	ü Participation in international projects launched in order to use overseas diaspora in the development of developing countries. As: UN Millennium and TOKTEN project.	ü Liberalization of financial markets, improvement of regional cooperation ¹⁷
ü Specific research plans and programs for the participation of Diaspora with universities or public or private sector	ü Elimination of communication barriers, bureaucracy and the inability to absorb and/or apply expatriate and establishing credibility and trust	ü dual citizenship ¹⁶
ü increasing budget for higher education and immigration and education related organizations	ü Allow private sector to enter	

ü S&T development: The availability of both high-quality education and opportunities in research are the keys to retaining and attracting regional talent.	ü Set up a website and centre to assist permanently and temporarily returned overseas scholars.	
ü the policies supporting R&D, including those focusing on the development and expansion of research centres and 'science parks'	ü conferences focusing on building bridges between the diaspora and host country	
ü On-site programmes that involves national talent at home and abroad coupled with creative distance learning strategies could create networks of expatriates thus enabling their countries of origin to gain access to a world-class education in specific disciplines in the developing world.	ü Making diplomatic efforts to create or maintain connections with overseas diaspora by celebrating their accomplishments abroad.	
ü bilateral agreements with countries with strong R & D or S & T systems	ü Strengthening International Profile and Patriotism in overseas scholars.	
ü fund programmes for development projects		

4. CONCLUSION

By reviewing the factors and policies affecting TT, we find that strengthening research and development and creating human capital through the impact on different channels of technology transfer can improve the development and growth of a country.

One way of developing human resources is to focus on overseas scientists and formulate policies and actions that will bring them back. Understanding the failure factors and the success of these policies by analysing the experience of other countries can lead to a successful framework for human resource development and reverse brain drain (RBD) programs.

Here again, the absorptive capacity for technology and positive policy support through an effective national innovation system (NIS) are key determinants.

In this regard, it is necessary to improve infrastructures such as a well-funded system of education and research and social welfare parameters in order to attract overseas scholars.

Also, mechanisms must be considered for identifying these individuals. Then by engaging with international programs or national policies that coordinate ministries and related organizations, or national research initiatives or social or

economic incentive packages, the primary motivation for temporary or even permanent recurrence or cooperation of these individuals provided. Private sector participation should be notable in this context. It is necessary to create a constructive partnership between the NGOs and private institutions with the government.

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