Policy Brief

South-South Technology Transfer: Criteria for the implementation and evaluation of public policies in the BRICS countries

September, 2013

Innovation Systems and Development Governance
BRICS Policy Center / Centro de Estudos e Pesquisa BRICS

Policy Brief

South-South Technology Transfer: Criteria for the implementation and evaluation of public policies in the BRICS countries

September, 2013

Innovation Systems and Development Governance
BRICS Policy Center / Centro de Estudos e Pesquisa BRICS

instituto de relações internacionais
PUC RIO
RIO PREFEITURA

Autores: Luís Fernandes, Ana Garcia (coord.), Paula Cruz (assistente de pesquisa), e Clara Willemsens (estagiária)

Peer Reviewer: Dr. Vinish Kathuria (SJM School of Management, Indian Institute of Technology)

South-South Technology Transfer: Criteria for the implementation and evaluation of public policies in the BRICS countries

Abstract

Analytic review and conceptual parameters for the implementation and evaluation of public policies for South-South technology transfer, focusing primarily on technological cooperation between the BRICS.

Summary

This Policy Brief reviews the existing literature concerned with analytical and conceptual models to evaluate technology transfer (TT) practices in cooperation projects, aiming at contributing to the formulation of effective public policies for the technological development in the BRICS countries. The first section deals with the definition of the concept and the means by which TT may occur. Then it defines the evaluation criteria to the effectiveness of TT processes, highlighting the opportunities and challenges of South-South cooperation. Finally, it provides some recommendations for the elaboration of public policies for TT among the BRICS.

1. Introduction

The ownership and dissemination of technology is a central element of the process of uneven development between countries and regions in the international system. Throughout the post-war period, discussions related to development occupied an important place in international organizations, especially due to the emerging decolonization

processes and the ideological collision during the Cold War. The creation of institutions such as ECLAC (Economic Commission for Latin America and the Caribbean) was a turning point in Latin America's economic thought. Latin American thinkers have adopted the perspective of international division of labor between countries that have the technology, produce and export manufactured goods (the center), and those who are specialized in exporting primary and agricultural products (the periphery). In this context, the discussion concerned with possible catch-up strategies, actors and institutions, which could boost the development processes of the peripheral countries, has gained a lot of importance in the subcontinent. Therefore, notions of these nonlinear processes (such as the "development of underdevelopment" of Gunder Frank, 1966) were formulated and deepened. The promotion of industrialization in countries of the periphery took place through foreign direct investment (FDI), creating industrial metropolis within satellite countries and regions. However, they were linked with and dependent on international production chains. Such dependence has affected their development or specialization process and has pushed them further in periphery. The international debate on technology transfer (TT) thus comes as a possible way to boost development processes in countries of the so-called "third world", articulating its instruments with a broader context of claims for equitable opportunities in the international economic order and differential treatment for developing countries.

This debate is not a new phenomenon, but it has been characterized by profound changes in recent decades. Regarding the BRICS countries, during the Cold War, especially Russia (and later also China) lead the Soviet bloc and were holders of technology in different sectors, while Brazil, India and South Africa were part of the periphery of the world system and were dependents on the technology coming from the central countries. Therefore the predominant model of TT was the North-South, intra-firm model, essentially based on the licensing process between the headquarters of a multinational company and subsidiary company, or producers licensed to operate in the local market (Barton, 2007). Aspects such as the high cost of technology, restrictive contracts that limit the use of technology by the recipient country and the difficulty to access advanced technology were the main concerns of developing countries (Barton, 2007; Correa, 2005; Kathuria, 2011).

Currently, market liberalization and the technological advancement of major emerging economies, such as the BRICS, have imposed changes in the global political economy and complicated the issue of TT in particular . When compared with the 1970s' indicators, countries like Brazil, China and India have shown significant increases in the education of scientists and technicians, as well as advances in industry and scientific research and greater national funding programs (Barton, 2007). Moreover, the diffusion of economies of scale has resulted in increased specialization and trade, both in components and end products, which has created decentralized supply chains, although with a common end goal: the global market. At the same time, with such intensification of international competitiveness, the incentives of TT practices between enterprises of developed and developing countries have been diminishing (Correa, 2005).

Domestic compulsions, on the one hand, and imposition of barriers to products coming from the developing world, on the other, reveal that technological protectionism is increasing, with clear impacts on the flow of technologies from North to South (Barton, 2007; Roffe, 2005). In this new context, the cooperation and technology transfer between countries from the Global South are gaining greater importance as a possible alternative to the North-South joint ventures.

In turn, however, this increased South-South cooperation faces an international regulatory structure that is different than in earlier historical periods. Chang (2002) pointed out that now-developed countries, namely South Korea, Taiwan etc., have been actively using interventionist trade and industrial policies, aiming to protect and promote their nascent industry during periods of catch-up. Nevertheless, the creation of international regimes that promote greater openness of markets made the protection of the domestic market more difficult. Unlike U.S. firms in the early nineteenth century - which benefitted from protectionist measures – today, benefits granted to the nascent industries in developing countries would contradict the principles of the World Trade Organization (WTO) through the most favored nation clause. Similarly, due to the protection of intellectual property established by the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), industries of today's emerging countries cannot make use of the imitation of existing technologies (reverse engineering) toward the evolution of its technological developments, as, for example, did the Japanese companies

of the mid-twentieth century (Barton, 2007; Correa, 2005).

This complex picture we have today indicates that, despite the economic growth registered by BRICS in recent years and the new restrictions in multilateral frameworks, technology transfer remains a key factor for technological catch up strategies adopted by developing countries. In this sense, rather than specific concerns about the costs and characteristics of imported technologies, the focus of the current debate on international TT has included broader issues, which affect the creation and maintenance of technological capabilities in developing countries (Kathuria, 2011).

Thus, how can the BRICS positively integrate the current structure of international production, thwarting competition from developed countries? Is cooperation between developing countries presented as more feasible and promising in this way? What are the advantages and challenges of the South-South TT? To identify possible answers to such questions, first we must recognize the complexity of the study of TT. The multiplicity of definitions and the existence of conflicting views concerned with the analysis of the effectiveness of TT processes are some of the factors that hinder this task (Bozeman, 2000).

This Policy Brief seeks to identify in the current academic production appropriate analytical and conceptual models to promote a qualitative evaluation of the TT processes, in particular, South-South joint-ventures, as well as to contribute to the formulation of effective public policies, primarily focusing on the technological development in the BRICS countries. In the first section, the discussion around the definition of the concept of TT and the means by which it may occur are addressed. Then, it delineates criteria to evaluate the effectiveness of TT's processes, highlighting the opportunities and challenges of South-South cooperation. Finally, it provides some recommendations for the elaboration of public policies concerned with the TT among the BRICS.

2. Definitions and means of technology transfer

The issue of technology transfer is being handled by different fields of knowledge and with different objectives, in addition to being prompted frequently in political discourses and practices. Because of this multiplicity of interlocutors, the term "technology transfer" is often used with different meanings (Bozeman, 2007). Rossner (quoted in Bozeman, 2007, p. 629)

defines technology transfer as the movement of know-how, expertise or technology from one organizational setting to another. However, the author recognizes that this definition covers a surprisingly large amount of organizational and institutional interactions that involve some form of trade-related technology. The term "source" of technology includes, for example, transfers from private companies to government agencies and laboratories, universities, nonprofit organizations, countries etc. On the other hand, included among the "users" are schools, small businesses, laws, cities, states, nations and others.

According to Kathuria (2011), TT has two crucial components: (1) the acquisition of appropriate technology; and (2) its wide diffusion. The difference between transfer and dissemination of technology is one of the points highlighted by Jensen and Scheraga (1998). According to these authors, such distinction is equivalent to the opposition between an orientation focused on supply versus one focused on demand. In other words, although these two components are seen as "two sides of the same coin", while TT is more related to the ability or willingness of the supplier of technology, technology diffusion is related to the ability or willingness to absorb such technology (Jensen and Scheraga, 1998, p. 101).

Nevertheless, according to Kathuria (2011), the search for economic development is not limited to diffusion practices. Beyond this, it is first necessary for the receivers to be able to gradually improve the new technology or process learned, until they finally reach the capacity of creating their own technology. Thus, the author highlights two key points: “a) TT is a process and choosing the appropriate technology in accordance with the allocation of resources is a crucial first step, and (b) the acquisition is only a necessary condition, a sufficient condition is the absorption of technology" (Ibid.). To achieve this, however, there must be some necessary favorable conditions within the States, due to the existence of national companies that have their own agendas and R&D laboratories, research universities with strong foundations, as well as technical capacity and human capital[1] (Hoekman *et al*, 2005, p. 1588).

The identification of actors involved in the TT is fundamental to the distinction between different ways in which the transfer may occur, especially the examination of those who

[1] According to Hoekman *et al*. (2005), these factors reduce the costs of imitation, adaptation and subsequent innovations.

own the technology. According to Kathuria (2011), the most prominent channels are the ones played by multinationals, since they are the largest holders of the modern technologies of the world. It is not a coincidence that international TT has traditionally been given through foreign direct investment (FDI) and licensing. Although multinationals cannot work actively in all channels of TT, they always play a passive or indirect role in such processes (Ibid.). However, it is noteworthy that not all these means are mediated by the market, such as the TT via imitation, scientific exchanges, exhibitions, trade fairs, etc. (Ibid.).

In sum, it is possible to identify three main types of paths through which TT may occur through: (1) marketing of goods and products; (2) foreign direct investment and licensing; and (3) turnover and movements of people. (Hoekman *et al*, 2005; Kathuria, 2011).

TT through the trade of goods and products

According to Hoekman *et al* (2005), trade contributes to the international TT to the extent that new goods and products incorporate new ideas. Thus, international trade acts as a transmitter of knowledge, disseminating new ideas beyond national borders.

However, the access to equipment and machinery does not mean TT per se. The occurrence of such a process is conditioned to the importing country's capability to conduct the technique of reverse engineering, which requires a strong ability to absorb foreign technology and the ability to adapt it to the local circumstances and methods. (Ibid.).

Due to the need of local adaptation, the authors argue that the impact of the TT via trade in goods and products in developing countries is higher when the process occurs with other developing countries, since the proximity of levels of development reduces adaptation costs (Ibid.).

TT through Foreign Direct Investment (FDI) and licensing

Traditionally, FDI is the main channel for international TT, and generally occurs between the headquarters of a multinational company and a subsidiary located in a country with lower relative development (Kathuria, 2011). At the same time, however, it is also the most challenged method due to high possibilities of negative impacts (spillovers) that this type of investment can generate on local economies (Ibid.).

According to Hoekman *et al*. (2005), while subsidiaries that are integrated

into the international supply networks generate a more positive impact in the receiving country, more isolated branches can produce negative outputs on local economies, especially when the multinational undermines the local demand or stimulates skilled workers to leave the country, or furthermore, if it leads to the reduction of internal investments in R&D.

In turn, licensing is seen as an important source of TT for developing countries, which may be essential for the effective acquisition of technology and positive impacts on the local economy (Correa, 2005). According to Correa (2005), without licensing, the transfer does not generate large impacts in the production process of the recipient country and, consequently, the privileged status of companies that hold technology licenses in the international market is maintained. Therefore, it is important to remember that the success of the TT is linked to the effective absorption and application of technologies in the local production processes (Hoekman *et al*., 2005; Roffe, 2005, Kathuria, 2011).

In general, the choice between FDI and licensing depends on the degree of trust in relation to the subsidiary companies, concerned mainly with the leakage of technology in the economy of the recipient country - which can occur through imitation or employee turnover (Kathuria, 2011). The greater the degree of distrust, the lower the probability of multinationals opting for licensing, and then the transfer will be limited to older technologies (Ibid.).

According to Correa (2005), another aspect that complicates licensing is the exorbitant price of royalties charged by the owners of technology, especially due to the high levels of protection of intellectual property rights, as set out in the TRIPS Agreement. Thus, royalties charged by licensing make the process too burdensome for smaller and less industrialized companies. Consequently, it may considerably increase the cost of production in recipient countries, undermining their competitiveness in the global market, discouraging TT processes (Ibid.).

TT through the rotation and mobility of people

The employee turnover and the exchange of people is another potential way of international TT activities, including study or work in foreign countries and exchange of researchers for a certain period of time. According to Kathuria (2011), the capacity to absorb new technologies is favored by the flows of people not only because they emphasize a faster diffusion in the

host country, but because they generate a larger improvement in local productivity. The experience of the software industry in India is often cited as a successful example of the development of a national industrial sector favored by TT via the movement of people (Hoekman *et al*, 2005; Kathuria, 2011).

However, in the case of developing countries facilitating the temporary movement of workers and researchers to foreign countries, guaranteeing their return to the country becomes a major challenge for the formulation of a public policy (Hoekman *et al*., 2005) that encourages TT while at the same time avoiding phenomena such as "brain drain". It is pointed out, however, that the transfer between countries of a similar level of development can mitigate some risks of international TT. Today, there are discussions about the specificities of the process of South-South technology transfer and certain parameters for the evaluation of their effectiveness.

3. Opportunities and challenges of the South-South technology transfer

In North-South relations, economic inequalities in the international system and the political advantages of multinational companies - whose power is a result, *inter alia*, of the possession of intellectual property rights - are traditionally identified as the major difficulties of the international TT. UNCTAD (1994) states that these phenomena would be "market failures" that imply weak bargaining power of recipient countries, resulting in high transaction costs during the acquisition of technologies and, consequently, in the reduction of the rates of transfer. However, there are new questions and concerns that arise out of the relations between countries from the Global South in their pursuits of technological advancement and fostering of innovation, including the difficulty of matching specific needs with appropriate technological solutions.

According to Kathuria (2011), issues such as the reduction of local investments in R&D caused by the importation of foreign technologies and the lack of building capacity at the time of transfer of technology, have been integrated into the TT's agenda. Particularly, new areas with increasing importance, such as nanotechnology, biotechnology and renewable energy, face these kinds of problem. Their main challenges are the prevalence of industrial secrets (institutionalized by the intellectual property rights regime) and the need to involve various industrial branches to act as sources of supply. In this sense, issues such as (a)

the specific needs of developing countries, (b) the requirements of the most appropriate technology to meet such needs, (c) the technical knowledge (expertise) available, and (d) the factors that affect the adoption, assimilation and adaptation of imported technology (Ibid., p. 13) need to be considered.

Following this author, these aspects are particularly relevant when the technology to be transferred comes from countries where labor is scarce, which results in a high level of capital to labor ratio, in contrast to the recipient countries, where the ratio of capital to labor is relatively low (North-South TT). Yet more and more researchers have been arguing that many of these problems are mitigated when the transfer occurs between environments with similar characteristics (South-South TT), including both economic and business environments, as well as the cultural environment.

These factors are precisely the pillars of the conceptual model developed by Jensen and Scheraga (1998) to assess the costs and benefits of TT. For them, any such analysis should include the market structure, government intervention, and cultural differences that may exist between parties (Ibid.; p. 109-110). In the case of South-South technology transfer, the cultural aspect is especially relevant because in this scenario, because the cost of transfer generally depends not on the gap of economic development between the countries, but on their cultural distance (Ibid.).

Similar economic and, in some aspects, cultural experiences between developing countries - as in the case of BRICS - may indeed facilitate the processes of TT among them, resulting in mutual benefits aimed at an internal development of their economies and, in parallel, to their insertion into the international economic system. Another favorable point is the high population density, also as for the BRICS, which may lead to a faster diffusion of the acquired technology (Kathuria, 2011).

However, we must emphasize that technology flows among developing countries are also susceptible to failure and can be unsuccessful in generating the necessary ability to absorb the transferred technology, which emphasizes the importance of keeping in mind the physical and social environment of the recipient country[2] (Ibid.). Therefore, a question arises:

[2]In this sense, Kathuria (2011) cites the TT project in rice production, conducted between China and Liberia. According to the author, due to inability to overcome the administrative and cultural differences between the two countries, the project was not efficient to generate the capabilities needed to the absorption of the technology in the recipient country, compromising the effectiveness of the transfer.

how is it possible to evaluate the effectiveness of the South-South technology transfer, in order to advance the guiding public policies that result in absorption, adaptation and effective diffusion of new technologies in developing countries? In the current literature, some criteria may be identified for evaluating the effectiveness of the South-South technology transfer.

4. Criteria for the Evaluation of the effectiveness of the South-South technology transfer

A major difficulty of studying TT is assessing the effectiveness of their impacts. Often, mere contact between workers is included in business reports as the realization of TT activities. However, many analysts call for the establishment of clearer and more precise criteria to assess the real effectiveness of technology transfer processes and their results (Wicklein, 1998; Bozeman, 2000; Kathuria, 2011).

Although focused on a specific type of technology transfer - between universities and industries in the context of the United States - Bozeman (2000) offers few useful criteria for the evaluation of TT processes as a whole. Adding to it, Wicklein (1998) develops other criteria based on North-South transfer. We use these analysis and criteria as a starting point to develop some evaluation parameters for TT between developing countries. The table below (Table 1) presents a brief description of each, as well as their relevance for the South-South context.

Table 1

Criteria for the Effectiveness of South-South technology transfer

Effectiveness criteria of South-South TT	Description	Relevance focused on Developing Countries
(1) “Out-the-door”	It is concerned with the exit of technology from the host country, without considering its impact on the recipient country.	Since the absorption of technology by the recipient country is fundamental to an effective TT, the negative aspect of this criterion should be considered in the evaluation of the South-South TT. This means that if the evaluation indicates that technology was simply transferred, without having verified the impacts on the recipient country, the transfer should be considered inadequate or unsuccessful. The formulation of public policies should seek ways to ensure the expansion of

		impacts and results, directing a better use of public investments allocated in a TT process.
(2) Market Impact	It focuses on intra-firm TT and evaluates the impacts on trade measured in terms of sales, profits and market share.	By ignoring the transfers coming from the public sector or non-profit transfers, such criteria should be observed carefully by policymakers. Preferably, this type of impact should be accompanied by impacts on regional/national economic or political development, or by improvement on scientific, technological, and human capital.
(3) Economic Development	It analyses effects on regional and national economic development. It is particularly suited to public TT.	Since the regional/national economic development is ultimately the core objective of southern countries, such impacts should be among the most important criteria for evaluating the South-South TT.
(4) Political Impacts	It evaluates if there have been political impacts (such as increased public funding) resulting from the country's participation in the process of TT.	Considering the need to increase public funding for TT in southern countries, the evaluation of such impacts is important in the consolidation of sustainable, long-term public policies, which are essential for processes of TT to make an effective contribution to the development of these countries.

(5) Opportunity Costs	It examines not only the alternative uses of technical and scientific resources acquired in TT, but also any impacts unexpected by actors involved in the enterprises.	Despite the difficulties in measuring this kind of impact, it is especially relevant for the context of South-South TT, considering that the greater the potential for the same technology to generate alternative functions/applications in the recipient country, the more appropriate it will be for the reality of developing countries (see criterion 13).
(6) Scientific, Technological and Human Capital	It considers the impact of TT on improving scientific and technical skills, technically relevant social capital, and infrastructure (networks, user groups etc.), which support scientific and technological work.	By treating TT and technical activity as a long-term process, in which the absorption and generation of capacities in the recipient country are fundamental, such impacts should be among the most relevant criteria in the evaluation of the South-South TT. It is recognized, however, that there is a need for more sophisticated formulation of indicators for the analysis of these results, given the difficulty of equalizing the inputs and outputs of these processes.
(7) Independence between systems	It evaluates not only the importance of a technological device to be transferred, but also materials and auxiliary equipment necessary for its operation, because such support elements are fiscal barriers for the majority of poor people living in developing countries.	In the context of South-South TT, certain technology should be accepted only if the facilities and support devices are already available on site, or if changes and improvements of the existing systems are moderate.

(8) Modernity image	It examines if the technology fulfills a necessity for its users, as well as if it generates the perception of a higher degree of sophistication, which may elevate their social status.	Despite the level of development of a society to which a technology is designated, an adequate technology must incorporate an image of modernity and an appeal to people's dignity and pride, which would meet the expectation of those who can benefit most from it.
(9) Individual *vs.* Collective Technology	It examines the technology's adequacy according to the type of society to which it is designated. In cultures where the commitment to collective processes is predominant, technology should be more dependent on the system, allowing shared responsibility for its operation. In cultures where responsibility and individual accomplishment are predominant, technology must be more independent or planned to be acquired and operated individually.	Appropriate technology must take into account the socio-cultural context in which it will be used, in order to provide the best type of technology for that society.
(10) Technology Costs	It evaluates the cost of the technological apparatus to be transferred, in accordance with the purchasing power of the recipient country. In order for technology to satisfy basic needs, the apparatus' cost should be	Cost reduction should be considered as a high priority in the preparation of technological devices for southern countries.

	affordable for people in developing regions.	
(11) Risk Factors	It evaluates the risks of transferring certain technologies. Two types should be considered: (1) internal risks (adjustment of technology to the local production system), and (2) external risks (support systems necessary to keep the technology working properly).	Some risks provide important challenges to the local economic and production systems. Therefore, in the South-South TT the risk of failure of an appropriate technology should be considered, but not completely removed.
(12) Evolutionary Capacity of Technology	It analyses whether technology has the capacity to expand and be reconfigured to perform a higher volume of work and/or more sophisticated production processes, or if it promotes an increase in the demand.	Technology is expected to grow along with the society it favors, and may also generate opportunities for economic competition at the regional, national and international levels, which should be the ultimate goal of any developing country.
(13) Single Purpose vs. Multiple Purpose Technology	It evaluates if technology permits a variety of applications from a small number of devices or pieces.	Due to the extreme poverty of many people in southern countries, it is desirable that transferred technologies, however specific, have multiple applications, which may benefit those people who cannot afford individual pieces of equipment with only one function.

Elaborated by BRICS Policy Center, based on Bozeman (2000), Wicklein (1998)[3]

These criteria detailed above are suggestions that may serve as a parameter for the formulation of public policies for TT processes involving developing countries, as well as for the evaluation of their results. Thus, although South-South TT can facilitate the acquisition and adaptation of new technologies among these countries, public policies may observe some of the evaluation criteria presented in this work, according to each political conjecture in a given historical context, aiming at improving utilization of the efforts made in the process of TT.

[3] As suggested by Dr. Vinish Kathuria, a further elaborated version of the criteria table would include one more criteria concerning "scale-up and scale-down technology". Since many countries of the South have small-scale production or informal sector, technology needs to have a feature of scaling down and in some cases scaling up. Also, two more columns would be added: column one giving relevance of each of these criteria with 4 point scale, where 4 means extremely relevant, and column two giving example of each of the criteria from a developing country context.

4. Conclusions and Recommendations

We argued here that the possession, diffusion and transfer of technology are central elements of the process of uneven development in the international system, producing the traditional asymmetry between countries: on the one hand, those who generate technology and, on the other, those who receive technology or are excluded from such processes. Although the structure of the international economic and legal system tends to expand the technological gap between these countries, North-South technology transfer is recognized as one of the most effective ways to reduce the technological gap. However, the past decades have demonstrated a tendency to restrict TT. In addition, there has been the occurrence of negative externalities of North-South transfers on local economies of recipient countries - especially when performed through FDI. South-South TT has partially distinct characteristics and can potentially provide an alternative mechanism.

Related to this is the need to formulate and implement public policies that promote TT, taking into account the development level of the countries involved. As we have seen, according to some authors, the benefits of TT will be greater when the level of development of the host country is equal to or slightly above the level of the recipient country, since the similarity of economic, cultural and businesses environments can minimize some of the most frequent problems related to TT, such as the lack of effective absorption of technology by the recipient country.

In this regard, it should be considered that the effectiveness of TT is associated with the achievement of a broader process of transferring, which involves the ability to identify needs, select appropriate technologies, then import, assimilate, adapt and disseminate them, and in the long term, develop its own technologies. Factors such as similarities in economic and business environments, and high population density, may facilitate processes of transferring and disseminating technology among the BRICS countries. On the other hand, cultural aspects may favor the transfer from the BRICS to relatively less developed countries.

In addition to the evaluation criteria mentioned in the previous section, some recommendations may guide the formulation of public policies for the BRICS countries in particular, which policymakers should consider:

- One of the most important factors in the absorption of new technologies is the ability to learn, i.e., the human capital base. This base could be enhanced through policies to promote the flow of students, workers and researchers between the BRICS, with incentives policy to encourage their return to the origin country. The creation of a special type of visa for citizens residing in the BRICS countries would facilitate this flow, serving as a TT channel with great potential, which should be further explored.

- Favorable internal conditions are crucial to the full conclusion of TT processes. Thus, a network between universities, research centers, government agencies and laboratories, nonprofit organizations, etc. should be created within the BRICS. This network would create the registration of institutions and researchers (their demands and technological expertise) and contribute to the elaboration of a database of remote access that would facilitate and encourage the technological cooperation among the BRICS.

One of the greatest barriers to accessing advanced technologies is licensing costs, due to system royalties. In this sense, the creation of a special line of funding in the future BRICS Development Bank directed to the costing of these transactions should be considered. Such policy should be associated with the commitment to transfer the acquired technology to the other BRICS, thus functioning as multipliers of innovation.

References

BARTON, J. H. (2007) "Transferência de Tecnologia: novos rumos", *Pontes*, Jun/2007, pp. 12-14.

BOZEMAN, B. (2000) "Technology transfer and public policy: a review of research and theory", *Research policy*, 29 (2000), pp. 627-655.

CHANG, H.J. (2004). *Chutando a escada: a estratégia de desenvolvimento em perspectiva histórica.* São Paulo: Editora UNESP.

CORREA, C. M. (2005) "Can the TRIPS agreement foster technology transfer to developing countries?" In: MASKUS, K. E.; REICHMAN, J. H. (Eds.), *International public goods and transfer of technology under a globalized intellectual property regime*. Cambridge: Cambridge University Press. pp. 227-256

GUNDER FRANK, A. (1966) "Development of underdevelopment". Monthly Review, September, 1966.

HOEKMAN B. M.; MASKUS, K. E.; SAGGI, K. (2005) "Transfer of

Technology to Developing Countries: Unilateral and Multilateral Policy Options", *World Development*, Vol. 33(10), pp. 1587-1602.

JENSEN O.W.; SCHERAGA, C. A. (1998) "Transferring technology: costs and benefits", *Technology in Society*, Vol. 20(1), pp. 99-112.

KATHURIA, V. (2011) "South-South Technology Transfer: facilitating market mechanisms", *Tech Monitor*, May-Jun/2011, pp. 12-19.

ROFF, P. (2005) "Comment: Technology transfer on the international agenda". In: MASKUS, K. E.; REICHMAN, J. H. (Eds.), *International public goods and transfer of technology under a globalized intellectual property regime*. Cambridge: Cambridge University Press. pp. 257-264.

UNCTAD (1994) *Major issues arising from the transfer of technology*. Geneva: United Nations.

WICKLEIN, R. C. (1998) "Designing for appropriate technology in developing countries", *Technology in Society*, Vol. 20(3), pp. 371-75.