TECHNOLOGY TRANSFER PARTNERSHIPS: STUDY OF BRAZILIAN CASES OF FACTORS THAT LEAD TO SUCCESS OR FAILURE

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ABSTRACT
To build its Defense Industrial and Technological Base, Brazil brings the need to allow to the domestic industry of defense material to achieve independence regarding essential technologies to the defense. Thus, the Brazilian Government is considering the Transfer of Technology (ToT) to make its armed forces more independent of purchases in the international arms market. To do this, the Brazilian State has established several partnerships with foreign companies seeking development of technological capabilities to Brazil. Although the results of these programs are still unknown, there are some factors that experts refer to as essential for the success of a ToT. Thus, this work has two intentions of which the first is to list the main factors (internal and external) that are considered by experts to be essential to the success of a partnership of ToT. The second intention is to check if the factors mentioned above are normally considered by the partners who participate in a ToT, mainly in France-Brazil partnerships. For this, two programs will be analyzed: the PROSUB aimed at the construction of a Brazilian SNA and the H-XBR which aims the development of a Brazilian helicopter.

Keywords: Defense Industrial and Technological Base. Transfer of Technology. PROSUB. H-XBR. Successful partnership. Brazil.

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INTRODUCTION

In 2008, to build the Brazilian Defense Industrial and Technological Base (DITB), the Brazilian National Defense Strategy (NDS) evokes the need to allow the national industry of defense material to achieve autonomy in essential technologies to defense (BRASIL, 2008). Among the proposals listed that might contribute, the following is proposed:

To develop the technological qualification and gradually reduce Brazil dependence of imported services and equipment purchases, partnership agreements will be established with other countries, in a framework of a wider association strategic. Brazil always strengthens its foreign interlocutors that it wants to be a partner and not a simple arms customer, conditioning its purchases of defense equipment for a substantial transfer of technology.

The proposal above shows that the Brazilian Government is considering the Transfer of Technology (ToT) as a way to make its armed forces more independent of purchases of defense equipment in the international arms market.

For this purpose, the National Defense Policy (NDP), in a publication in 2005, evokes that the absorption of modern technologies, from a partnership of ToT with a foreign company, implies an intersectoral cooperation between the several actors involved in Research and Development (R&D).

However, the authors show that a perennial ToT does not only limit itself to the involvement of actors in R&D, since factors that are present even before the partnership is established will influence the future of absorption of a modern technology.

Thus, this work has two intentions:
- List the main factors that are considered by experts to be essential to the success of a partnership. Considering the interest of this study is rather the ToT, the selected factors will be those who will increase the chances of a successful partnership in the field of the ToT; and
- Verify if the factors mentioned above are normally considered by the partners who participate in a ToT, mainly in France-Brazil partnerships.

In this article, the word “partnership” will be understood as a relationship between at least two entities (LAROUSSE, 2016), private or
public, to develop an already existing product or create a new specialty product (KAHN, 2013). Here, the ToT is always implied in the partnerships mentioned, unless explicitly mentioned otherwise.

Another important definition is that of the term “System” formed by the partner companies which means all staff, material and intellectual property located in companies that have formed a partnership to achieve a transfer of technology. If this system assumes a certain technology transfer, so it is implied that the holder of the technology company will transfer it to another company. In this case, according to Figure 1, the first company will be the issuing entity and the second will be the receiving company.

Figure 1 – The consultation of factors and actors who participate in the ToT

In order to improve the understanding of the brief, factors have been classified into two types: those who are in the system of business partners (internal factors) and those who are outside (external factors). Belonging to the partner entities, the primary factors would be under their control. On the other hand, external factors are more unpredictable, demanding a pre-study to reduce their negative impact on the partnership.

Thus, the first part of the work will address the factors (internal and external to the system of the partner entities) that affect the results of a technology transfer.

In the second part, two case studies of France-Brazil technology transfer partnerships will be used to see the consideration of the factors presented in the first part of the work and their effect on the conduct of the ToT.

To get out of the academic study and verify the reality of alliances of ToT, a questionnaire was sent to several people who participated, or is participating, in programs of ToT. These are industrialists, engineers and military personnel who have enriched this work with positive or negative experiences.
More than to show factors that play a key role in the partnerships (mainly in the field of the ToT) and to observe their application in these partnerships, the objective of this work is also the effectiveness of these factors for the success of technology transfer.

Finally, we must also make it clear that this work deals essentially of the Brazilian experience in the field of the ToT.

PART I – POINTS THAT INFLUENCE THE CONDUCT OF TECHNOLOGY TRANSFER

The process by which it accesses a modern technology is called “transfer of technology.” Thus, to better understand the topic of this work, it is necessary to define the term “transfer,” that is the communication of information, materials or equipment from a transmitter (the entity or person that has data or desired materials) to a receiver (the entity or person that gets the data or materials).

The disturbing factors of technology transfer are many among the various authors and various case studies. However, considering the partnership as a unique system, the variables could be classified between those who are in the system and those that are outside.

For examples in the communication, the language used during a dialogue is an internal factor which must be mastered by both sides, otherwise communication will be troubled. In addition, if the noise level of the environment is strong, therefore, certainly, the difficulty in being understood will be increased.

The ToT takes place in the same way. There are some factors in, and out, the system formed by the partner companies that are important for the proper motion of the project. The intervention of the State on the ToT process, for example, is a variable that remains outside of the entrepreneurial system, but that has an effect for the good, or bad, culmination of technology transfer.

The sectors of the economy (construction, digital, financial, steel services, naval, aerospace, textiles, etc.) to which the companies of the partnership belong is also a factor internal to the system formed by the companies. Still in the system, another example is the size of the two companies, being that a partnership between two companies of similar size or a partnership between companies of non-proportional size.
Thus, this part of the work will discuss the factors (internal and external to the system of the partner entities) which affect the results of a technology transfer, mentioned by some authors or found in some case studies.

The first chapter will address factors intrinsic to the partnership and the second chapter will discuss on variables related to the environment, experienced outside of the system formed by the companies.

CHAPTER I.1 – FACTORS INTERNAL TO THE PARTNERSHIP

Considering that the internal factors are in the system of the partner entities, these factors appear more controllable and more predictable for the success of the ToT. In addition, some factors may even be chosen early in the project.

In this way, the factors that will be discussed in this chapter are:

- The development phase of the product (ROXO, 2013): The probability of success of technology transfer will be decreasing with the development phase of a product.
- The size of the companies (DUBIEL; ERNST, 2013): This factor will influence the type of collaboration between the partners in the system.
- Mutual benefits for companies (IKONICOFF, 1974) (PAK, 1996), be that a win-win partnership (LESTIENNE, 2006): Although this factor is the essence of a partnership, the entity supplying the technology may impose some constraints which may make it fail.
- The presence of trained professionals (PAK, 1996): Also, the need for professionals with a training level compatible with the transmitted technology, their previous experience with this type of partnership will positively affect the absorption process.
- The transfer of organizational capacity and other non-technological capabilities (PAK, 1996): Case studies show that the receptor companies of new technologies must also adapt themselves to the structural and organizational changes that often accompany the ToT.
- The economic sectors of companies: A very controversial factor among experts is the influence of the sectorial approach among partners, i.e., is a partnership between competitors a good partnership?
I.1.1 – PHASE OF PRODUCT DEVELOPMENT

The life of a product has normally five phases: Research and development, launch, growth, maturity and decline. Figure 2 shows that, initially, during the first phase (R&D) investments are high (HAINES, 2013). R&D requires still more specific and academic professionals, like researchers and inventors, working with innovation.

As the product advances in its life cycle, professionals related to research and innovation are replaced by administrators, responsible for managing the sales and advertising of the product (ROXO, 2013).

![Figure 2 – The life cycle of a product](source: ROXO, 2013)

Returning about partnerships, technology transfer, normally included in the “Offset” (more about in subchapter I.1.3) of the contract, almost always takes place at the time when new technology comes out of R&D (SPESER, 2006), more precisely from the growth phase, when the product is already developed. A ToT done in this moment will be a transfer of know-how, where the receiving entity will learn how to replicate the process of manufacture of the product.
Thus, to reach a durable transfer, able to innovate (“know what & why”), the receiving entity must be involved in the initial stages of the life cycle of a product, since the likelihood of success of the ToT will be decreasing with the phase of development of a specific product (SPESER, 2006). In these very early stages, the involvement of educational institutions and research is a sine qua non condition for the right motion of the project, aiming the active participation of the communities of R&D, subject that will be discussed in the next chapter.

I.1.2 – SIZE OF THE COMPANIES

Normally, in a strategic partnership with the purpose of developing a new product, if a company is larger than the other, the first one will possibly provide the capital and the needs for development, advertising, manufacturing and capacity of distribution, while the second one will provide creative expertise or specialized technical expertise (KAHN, 2013). On the other hand, when companies have the same size, or almost, the partnership has the tendency to be more collaborative. Thus, this factor will influence the type of collaboration between the partners in the system.

In seeking new markets for their sophisticated products, multinationals increase their participation in emerging markets, such as Brazil, China and India, where there is a growing demand for social classes more open to this kind of product. Thus, the multinationals will establish partnerships with local companies, in order to: facilitate access to emerging markets, speed up links with the supply chain and improve their relationship with the educational institutions (DUBIEL; ERNST, 2013).

I.1.3 – MUTUAL BENEFITS

Although this factor is the essence of a partnership, the entity supplying the technology may impose some constraints which may reduce the benefits of the partner who receives the technology. Some examples of this type of limitations are the ban on sales to third parties, the patent licensing requirement and the obligations for purchase of spare parts. (IKONICOFF, 1974)

Partners must have the exact earnings perception so that
expectations are not destroyed (PAK, 1996). Thus, beyond the good mutual knowledge of the reality of the companies and their entourage, the establishment of an open dialogue is essential so that expectations remain realistic and to ensure that agreements are accomplished.

Another interesting topic that enhances the receiving company’s gains is the artifice of the offset, i.e., bonuses or counterparties which may result in financial compensation in the medium or long term. The offsets are ordered in a direct (related to the negotiated product), semidirect (related to the activity of associated companies) or indirect way.

Thus, to reduce the initial investment, the receiving company could negotiate a factor that may lead to a potential gain in the future, which would make the contract more effective for the contracting party.

Although the offset has its profits, some countries, like France and United States, are more favorable to the use of this device, since the offset partially cancels the profits from the sales.

However, the transmission of knowledge does not mean that the receiving country will be able to absorb it. In order to the purchasing country to benefit fully from the offsets, certain preconditions must have been acquired before, which will allow the absorption of a transfer of technology.

I.1.4 – PRESENCE OF WELL-TRAINED PROFESSIONALS

In addition to the need for professionals of a training level compatible with the transmitted technology, their previous experience with this type of partnership will positively affect the process of absorption (PAK, 1996).

After the fall of the former Soviet Union, this factor has been taken into account when countries of Western Europe have realized several ToT with the former communist countries of Eastern Europe who needed to convert a rather military industry into a civil industry to improve their destroyed economies, entering the international market.

During these ToT, experts found several difficulties affecting the absorption by the former communist countries (PAK, 1996). So, specialists have proposed, as a solution, the presence of well-trained professionals and connoisseurs of the ToT process, capable of managing the process in all its complexity, that had knowledge of practices and the potential of countries and institutions on both sides where technology transfer happened. Their role was to help find
opportunities for cooperation and to establish a network of contact and information (“Networking”).

It is necessary to consider that the absorption of a technology does not naturally happen from one coast to the other. During a symposium on the Brazilian DITB to the Federation of Industries of the State of Sao Paulo (FIESP), in 2017, MECTRON and EMBRAER business speakers referred to the need for employees who can ask the right questions to capture the new technology.

In the survey conducted by this work, the importance of this factor was evident, with most of responses saying that this factor is essential for the success of the ToT.

I.1.5 – TRANSFER OF NONTECHNOLOGICAL CAPABILITIES

The case studies show that receiving companies of modern technologies must adapt themselves to the non-technological changes that often accompany a ToT, receiving administrative, financial, organizational or advertising capabilities (PAK, 1996).

Returning to the case presented in the previous sub-chapter, which dealt with the ToT between the countries of Western Europe and the former communist countries of Europe, some actions have been suggested to improve the ToT:

1- Training in areas such as the marketing of products based on R&D and the combination of training oriented to business with technical education or engineering.

2- Improving communication to provide the technologies that are available to the partner countries of the former Soviet Union, as well as their technical capabilities.

3- Assistance to small and medium-sized businesses which are responsible for a large part of new products and jobs in several industrialized countries.

4- The creation of a common technology transfer center. 5- Assistance to problems of strong currency.

In the list above, the first two paragraphs are transfers of new non-technological capabilities to the receiving companies: improving marketing, organizational restructuring geared to business and improvement of the communication.
I.1.6 – SECTORS OF THE ECONOMY OF COMPANIES

What is the best partnership: one between competing entities or between non-competing? What is the influence of the sectorial approach between partners for the success of a ToT?

Certainly, two companies belonging to the same sector of economy, either two shipbuilding companies, could, instead of fighting over the same customers, expand their market in the case of a partnership. On the other hand, in a situation of competition, an alliance between companies seems to take less profit in the field of the ToT, as the technology used in both sides would have little difference.

However, two companies of different sectors of the economy may not share their customers, they could share their knowledge, without the fear of giving to the opponent their technology.

Thus, this sub-chapter presents a questionable factor, but that literature can help us find clues for this work.

In Europe, due to the reduction of the budget of defense after the fall of the USSR, European governments have encouraged the reconciliation of European naval sector industries as an option as a head-on competition reduced margins from the economical point of view (OLINGO, 2007). In producing and developing products and technologies very alike, these groups reduce their revenues because they are still fighting for customers in the international arms market, resulting in a war without a winner.

Despite then the interest of the European countries to complete this irrational dispute to improve the economic situation of their shipyards, avoiding job losses, the cases of success were little. There are many reasons for such failure: a nationalism exacerbated in some countries, difficulties to reach a common agreement on specifications of projects, sharing the cost of the project, etc.

Probably, these obstacles which exist in partnerships between competitors have influenced the clear majority (83%) of specialists consulted in the questionnaires to assert that this type of partnership does not sufficiently contribute to their success.

Thus, in this work, although a comprehensive study is required, the partnership between non-competitors will be considered as having more chance of success.
CHAPTER I.2 – FACTORS EXTERNAL TO THE PARTNERSHIP

This chapter will address the influences of factors that remain outside the system of the transmitter-receiver entities of new technology. Because of a very strong dependence of third party, these factors are less under the control of the companies than others previously discussed in chapter I.1.

To reduce the uncertainty caused by these variables, it is necessary to conduct a study on partner country compared to the influence of each on the project for the duration of the transfer of technology.

Below are listed the factors that will be discussed in this chapter:

- The intervention of the State (IKONICOFF, 1974) which, in addition to the financial system, the tax system and the economic system (BUGLIARELLO, 1996), also includes the system of protection of intellectual property (SPESER, 2006) (PAK, 1996): This factor is among the most important factors, if not the most important, for the successful partnership in technology transfer.
- The final market and final demand. (IKONICOFF, 1974) (BUGLIARELLO, 1996) (MEYER, 1997): A new technology is a response to a market demand that must exist before.
- The network (“Networking”), through which connect the various actors in the transfer of technology (MEYER, 1997): It is the link to partner companies with the players who are out of the system.
- The active involvement of internal communities of R&D (PAK, 1996) (MEYER, 1997): Technology transfer requires deposits of knowledge. Thus, research and development communities should participate in the process of absorption of new technology.
- Maintaining commitment of policies, including the payment of the contributions granted in the contract: This factor is considerably important for long term partnerships which will probably take place a change of the government.

I.2.1 – INTERVENTION OF THE STATE

Whatever the partnership, it will always be affected by the set of rules developed by the States. In the case of the partnerships formed by companies of different nationalities, the State influence increases since each business will be subject to a proper regulation. This weight of State
intervention increases if the entrepreneurial alliance formed is in a third country.

The intervention of the State (IKONICOFF, 1974) which, in addition to the financial system, the tax system and the economic system (BUGLIARELLO, 1996), still groups the system of protection of intellectual property (SPESER, 2006) (PAK, 1996).

In the social-technical environment presented in Figure 3, the government comes in the first row, followed by several systems that are influenced by all regulations emanating by a sovereign State (BUGLIARELLO, 1996).

As part of the ToT, to the issuing entity ensure that marketed assets will not be used without its authorization, the government must take responsibility for maintaining the security of the environment for the exchange of information. Thus, the State must protect legally (patents, copyright, covered by marketing secrets, etc.), by punishing those who have not respected the contract (SPESER, 2006).

The role of the State is still important for the technology transfer negotiations which the price is estimated by nonquantifiable criteria: desirability, fixation and available alternatives. For example, those responsible by the MCTI (Ministry of Science, Technology and Information) said that Brazil wanted more cooperation inspired mainly by overseas, wishing true cooperation, in a spirit of “win-win” (LESTIENNE, 2006).

In the Brazilian context, NDS enumerates proposals, which the State could intervene, to contribute to the development of the national
defense industry (BRASIL, 2008):
- A legal, regulatory and tax regime to protect the Brazilian defense companies against the ferocity of the international arms market;
- To ensure to the Brazilian DITB manufacturers several purchases of defense equipment to reduce the uncertainty of investments in this sector. To homogenize and to increase purchases, NDS also mentions formulation and execution by the Ministry of Defense of a purchase policy of defense equipment;
- Support by the public sector in the development of cutting-edge technology in cases where private companies are unable to reach or get in a cost-effective manner;
- To increase the scale of production of the DITB-owned industries, the government undertakes to capture a customer base abroad and to develop, with other South American countries, a defense industry;
- Finally, to develop the technological qualification, by gradually reducing Brazil’s dependence of imported services and equipment purchases, partnership agreements will be established with other countries, in a framework of a wider strategic association. Brazil always strengthens its foreign interlocutors that it wants to be a partner and not a simple arms customer, conditioning its purchases of defense equipment for a substantial transfer of technology.

Thus, the list of actions above presents the broad spectrum of government action that allows the intervention of the State in the field of a partnership with technology transfer.

I.2.2 – FINAL MARKET AND FINAL DEMAND

The prior existence of a market is a sine qua non for the development of a new product. All attempts of innovation and development are a response to a request, existing or latent, which must exist before (MEYER, 1997). The opposite, either creating a niche of consumers from the production of a new product, is not sustainable in the long term, since technology is “market-oriented” (SPESER, 2006).

During the 1970s, the countries of the former third-world of the Cold War sought to develop their economy by the method known as “import replacement,” by which productive units of more developed countries settled in least developed countries to reach a new market in these poorer countries.
The concentration of income on a minority of the population limited the dissemination of new models only in the easier social classes, damming an increase in the market. The conclusion is that the development of new products without the prior existence of a market does not change in the pre-existing distribution scheme (IKONICOFF, 1974).

The lack of a market for new products and the purchase of licenses and patents involved widening of the external debt of national companies which, to pay their debts, did the transfer of shares abroad, which made the company less national (IKONICOFF, 1974).

Finally, more specifically in the ToT, the existence in a long-term demand is important to master the technology, guaranteeing the innovative continuity of a company and a community of research. The lack of such market will lead, in the medium or long term, to the failure of the ToT.

Finally, we must also consider that the final market of product of certain alliances in the field of the ToT are out of the countries participating in the partnership.

I.2.3 – NETWORK (“NETWORKING”)

In Figure 2, the network is represented by an arrow that connects the system of partnership with actors in the atmosphere, constituting the favorable situation for innovation (MEYER, 1997). In addition, in different degrees of intensity, interactions connect a technological system with the rest of society (BUGLIARELLO, 1996).

Normally, the kinds of entities among which the transfer takes place are typically industrial, government, and academic.

Several principles have been identified to guide cooperation in transfer of technology between the countries of Western Europe and those from the East after the fall of the Soviet Union. These guidelines included the need to promote “Networking,” that is, to encourage application projects that go beyond institutional boundaries and, in fact, serve as catalysts to fill the gaps that exist between the academics, universities, industrial companies and government (PAK, 1996).

Today, the teams responsible for the innovation of some companies have a branch that seeks to establish the network, either inside the organization or outside. These internal and external collaboration mechanisms highlighted the high performance of these teams in comparison to those who are not experts in the field of the “Networking” (KOEN; BERTELS; KLEINSCHMIDT, 2013).
I.2.4 – ACTIVE INVOLVEMENT OF R&D INTERNAL COMMUNITIES

All transfers of technology require deposits of knowledge which will be in charge for the perpetuity of the transferred object. Thus, research and development communities should participate in the process of absorption of new technology (MEYER, 1997).

R&D communities are usually represented by universities and teaching institutions that will form the future employers of the receiving company. This combination formed by the company and R&D communities will also generate the start-up of several small companies that will benefit from this training.

This model was followed in São José dos Campos, Brazil, where the partnership between EMBRAER and ITA pushes the Brazilian aerospace economy. Since its creation, in 1950, by the Brazilian Air Force, ITA is always involved in ToT agreements so that academics can absorb and maintain new technology. Thus, ITA works as a deposit of professionals specialized in planes to serve as labor to EMBRAER and businesses orbiting around her.

In Brazil, ITA is not the only example as a demonstration of the importance of the involvement of the R&D communities in partnerships of ToT. The model is used in the partnership between Helibras and UNIFEI for the development of helicopters in Brazil.

I.2.5 – MAINTAINING COMMITMENT OF POLICIES

In this work, the focus is rather on the ToT partnerships where public companies play a vital role. In this type of partnership, the government is involved directly in the negotiations for the signing of the contract. The involvement of public bodies leads to political trade-offs dealt in this subchapter.

Since 2007, the Brazilian government shows political will to develop the Brazilian Defense Industrial and Technological Base (DITB). To do this, some official measures have been implemented to encourage investment in the defense sector and to push the growth of Brazilian companies of defense materials (BRASIL, 2012):

- Reduction of taxes on strategic defense industries by implementing the Special Tax Regime for the Defense Industry (RETID).
- The constraint imposed on the Brazilian armed forces to buy

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products of Brazilian Strategic Defense Companies (EED). With this obligation, the government is seeking to protect the national industry and engage them in finding foreign partners to acquire a certain technology through a ToT partnership.

- The establishment of the Secretariat of Defense Products (SEPROD) within the MinDef to run a defense procurement policy and to increase the scale of production industries belonging to DITB, committing the government to capture a customer base abroad and to develop a defense industry with other South American countries.

Thus, to attract investors, the Government of Brazil compromises with defense companies to engage in sustainable development policy of equipment for the Brazilian Armed Forces. This commitment is a formal agreement where mutual trust (government x companies) must exist.

However, in a long-term commitment, the uncertainties increase considerably. Thus, in 2015, the Brazilian economy suffered a setback because of the reduction in prices of raw material in the international market, causing the renegotiation of contracts and slowing current projects, such as the PROSUB\(^3\) program that delayed construction of the Brazilian SNA to 2025\(^4\).

**CHAPTER I.3 – PERSPECTIVE OF EXPERTS ON THE FACTORS**

<table>
<thead>
<tr>
<th>Internal Factors</th>
<th>Is it essential?</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase of production</td>
<td>83% yes</td>
<td>2</td>
</tr>
<tr>
<td>Size of companies</td>
<td>33% yes</td>
<td>4</td>
</tr>
<tr>
<td>Mutual gains</td>
<td>83% yes</td>
<td>1</td>
</tr>
<tr>
<td>Well-trained professionals</td>
<td>83% yes</td>
<td>3</td>
</tr>
<tr>
<td>Organizational capabilities</td>
<td>83%</td>
<td>5</td>
</tr>
<tr>
<td>Economic sectors</td>
<td>83% noncompetitors contribute to success</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>External Factors</th>
<th>Is it essential?</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>State intervention</td>
<td>66% yes</td>
<td>3</td>
</tr>
<tr>
<td>Demand and final market</td>
<td>100% yes</td>
<td>1</td>
</tr>
<tr>
<td>Networking</td>
<td>100% yes</td>
<td>4</td>
</tr>
<tr>
<td>R&amp;D communities</td>
<td>33% yes</td>
<td>5</td>
</tr>
<tr>
<td>Commitments of policies</td>
<td>83% yes</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 1 – Opinion of specialists on the internal and external factors

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During the development of this work, in order to get out of the office and get more into the reality of a ToT, questionnaires were sent to specialists, Brazilians and French, who participate in technology transfer partnerships, in different areas: industrial, government official, employer, etc.

The questionnaire addressed, in a straightforward way, the vision of experts on various (internal and external) factors that affect the result of a ToT. Experts also have placed in order of importance the factors mentioned in this work, that is, from the most important factor, according to them, until the less relevant factor for the success of a partnership.

Table 1 presents in a concise manner the data obtained by the questionnaires, where the third column answers the following question:

“Is this factor essential for the success of a partnership?”

The fourth column (last column) presents the final classification of the factors obtained from the simple arithmetic mean of responses from the questionnaires, where “1” represents the factor considered most important for the success of the partnership.

I.3.1 – INFLUENCES OF INTERNAL FACTORS

The answered questionnaires show a certain unanimity about the importance of the following internal factors for the success of a technology transfer partnership (Graph 1):

- The development phase of the product;
- Mutual gains;
- The need for well-trained professionals. and
- The absorption of non-technological capacity.

Graph 1 – The influence of internal factors
Compared to the difference in size between the companies, 83% of specialists admit participating in a partnership where the difference in size between the companies is high. However, most of the responses agreed that this factor is not essential for the success of a partnership.

As for the importance of the economic sector of the partners, 83% of the questionnaires say that the alliance increases its chances of success in case the companies aren’t competitors.

I.3.2 – L’INFLUENCE DES FACTEURS EXTERNES

As for external factors, the participants are unanimous that the network (Networking) and the final demand are essential factors for the success of a partnership. However, in the ranking of the importance of external factors (Graph 2), these two are separated by a gap, since final demand has been considered as the most important by half of the specialists, the network is only the fourth in the ranking. So, although the network is important for a ToT, there are other factors that must be taken into account before the establishment of a networking.

Also under the classification proposed by the participants in the questionnaire, some of them put at the forefront the factors relevant to the intervention of the State and to maintain the commitment of policies granted during the signing of the contract.
PART II – FRANCE-BRAZIL CASE STUDIES OF TECHNOLOGY TRANSFER PARTNERSHIPS

Considering a defense and development cooperation, the National Defense Strategy (NDS), published in 2008, mentions the need to establish partnerships with other countries to have access to new technologies and to reduce the dependence of Brazil Armed Forces of imported arms. Thus, all foreign purchases of defense equipment for the Brazilian Armed Forces are conditioned to a transfer of technology agreement.

Among the most recent examples of strategic partnership, France signed two major contracts with Brazil: for the construction of a Brazilian nuclear-powered submarine, and the development of a Brazilian helicopter.

The first example is part of an ambitious program of the Brazilian Navy that includes the construction of a new base and shipyard in the city of Itaguaí, located about 100 km from the city of Rio de Janeiro. In addition to the submarine base and the shipyard, the contract includes the manufacturing in Brazil of four Scorpène class submarines and the development of the hull of a nuclear-powered submarine (SNA). For the execution of the works, the company DCNS, winner of the international call for tender, has joined the Brazilian giant ODEBRECHT of the construction sector.

As for the example of the development of the Brazilian helicopter, the helicopter company AIRBUS signed a contract with the Brazilian government aimed at technology transfer to the company HELIBRAS, Brazilian subsidiary of the first company. For this purpose, HELIBRAS has already taken certain actions, such as sending several experts to France and the development of an agreement with the UNIFEI university for the training of professionals specialized in aeronautical engineering.

Thus, in the following chapters, these two examples of partnership with transfer of technology will be used to verify the degree of influence of factors already discussed in the first part of this work.

CHAPTER II.1–PARTNERSHIP BETWEEN ODEBRECHT AND DCNS

The strategic partnership of Brazil for the project of the nuclear submarine, the Programa de Construção de Submarinos (Submarine
Construction Program – PROSUB) included the participation of a Brazilian company in the consortium for the construction of the base and the shipyard.

Thus, after the signing of the contract with the Brazilian government, DCNS, winner of an international tender, has chosen as partner the Brazilian company ODEBRECHT, the largest company in the sector and the seventh largest in Brazil. who already had the experience of the construction of the Naval Base of Mocanguê (Rio de Janeiro) and Angra dos Reis nuclear plant in the State of Rio de Janeiro.

This partnership model is particularly innovative in Brazil, where a foreign company and owner of technology works with a large Brazilian company recognized for its expertise in the field of construction and management of public projects. (AGÊNCIA BRASILEIRA DE DESENVOLVIMENTO INDUSTRIAL, 2010)

According to Itaguaí Construções Navais (Itaguaí Naval Constructions – ICN) website, beyond the production of submarines and the base construction and shipyard, PROSUB also expects the transfer of technology through training and qualification of Brazilians experts, which will make Brazil more independent in the field of the construction of submarines.

This chapter will assess the success factors in the case of the partnership between these two companies of different sectors of economy, shipbuilding (DCNS) and construction (ODEBRECHT), which normally runs with benefits for both sides, although some experts are not sure about the capacity of the Brazilian party to master technology (ABDI, 2010).

II.1.1 – INFLUENCE OF FACTORS IN THE PROSUB PROGRAM

The ToT on which the partnership is based is the know-how of construction of the submarine Scorpène, a France-Spain project from the end of the 1990s for the export market. So, the product was already developed, which make the ToT more complicated, since, during the development of the product, certain needs, such as considering the development of specific

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5 The association formed in 2009 by DCNS and ODEBRECHT is called ICN (Itaguaí Construções Navais), owned 41% by DCNS and 59% by ODEBRECHT. The Brazilian Navy has a “Golden Share” which allows it to participate in the decision-making of the consortium. http://www.icnavais.com/icn.html
documentation, have not been done (JAMMES, 2016).

Although the Scorpène is in production, it should be noted that the Brazilian model (S-BR) has been extended by 11 meters, which makes it 150 Ton heavier than the original version. This change was made by Brazilian engineers with the technical assistance of DCNS. In addition, the purpose of the PROSUB is not only the construction in Brazil of 4 Scorpène submarines, but also the development of a SNA by Brazilian engineers (BRASIL, 2016).

In order to make a comparison between the size of the two companies, the data used will be the number of employers, income and profit of each of these companies between the years 2012 and 2013, presented in table 2, from the information available, obtained on their website.

<table>
<thead>
<tr>
<th>Company</th>
<th>Data</th>
<th>Income (billion euros)</th>
<th>Profit (million euros)</th>
<th>Number of employers</th>
</tr>
</thead>
<tbody>
<tr>
<td>ODEBRECHT*</td>
<td>2012</td>
<td>33,4</td>
<td>38,8</td>
<td>3.234</td>
</tr>
<tr>
<td>DCNS**</td>
<td>2012</td>
<td>2,93</td>
<td>3,36</td>
<td>166</td>
</tr>
</tbody>
</table>

Table 2 – Comparison of data between ODEBRECHT and DCNS

Thus, the information shows that ODEBRECHT is about ten times larger than DCNS, representing a difference in size between the two companies. However, taking into account the answered questionnaires compared to the PROSUB program, the size of the companies was not seen as an unfavorable factor for the conduct of the ToT. Probably, the reason for these answers is the fact that the technology issuing company is DCNS, and not ODEBRECHT, which make the partnership more cooperative, contradicting what is normally acceptable among the experts in the field of ToT.

In addition, the fact that the two companies belong to different sectors of the economy (Naval Construction and Building) is regarded as favorable to the partnership. There are benefits for both sides, since DCNS has met a partner in South America to elaborate contracts in the future and ODEBRECHT discovered the defense equipment sector to increase its range of products. Indeed, ODEBRECHT has created, in 2011, the branch “ODEBRECHT Defense and Technology” after acquiring the firm MECTRON (ODEBRECHT, 2016).

However, in the case of the PROSUB program, the gains achieved by Brazilian companies are limited, either due to the ban on sales to third
parties or due to a partial ToT. According to the former Director of the Brazil submarine export operation of the DGA, ICA Raphael JAMMES, due to the magnitude and the novelty of the ToT of the PROSUB program, a problem not contemplated when the contract was signed was the refusal of some French industries to transfer technology to Brazilian companies, to protect their know-how (JAMMES, 2016).

Intellectual property of Scorpène submarines will remain with DCNS, which will force Brazil to pay royalties for each unit built. However, in the case of the SN-BR (Brazilian nuclear-powered submarine), the authority of the project will be the Brazilian Navy and intellectual property of SN-BR will be Brazilian as well, and DCNS will play the role of technical consultant (BRASIL, 2016).

As part of the contract signed with the Brazilian government, DCNS is responsible for the technical training of engineers and Brazilian technicians who will participate in the development of the SN-BR. Thus, more than 250 professionals of the Brazilian Navy and of the companies NUCLEP and ICN received qualification in France (Cherbourg, Lorient, Toulon, Sophia-Antipolis, Ruelle and Saint-Tropez). Beyond the type “on-the-job training” formations, about thirty Brazilian engineers were trained at the Ecole de conception des sous-marins (School of Design of Submarines), in Lorient, in order to provide to Brazil the necessary assistance for the design of the nonnuclear part of its first SNA. While returning to Brazil, these engineers pass the qualification acquired to other professionals to increase the knowledge.

As for the absorption of new non-technological capabilities, the survey participants agree that have not been sufficiently considered in the context of PROSUB. However, when dealing with a program where security is essential to prevent environmental accidents, French security measures have been integrated by the Brazilian partners.

Having a “Golden Share” in the context of the ICN, the Brazilian Navy plays a key role in the decisions of the consortium. The participation of the State (here represented by the Brazilian Navy) directly in the partnership can be a favorable factor to PROSUB, since it was included in 2013 in the PAC (Growth Acceleration Program) program of the Brazilian government (BRASIL, 2013). By then becoming a political scene, PROSUB guaranteed a steady flow of investment.

On the other hand, there is the other side of the coin, since the economic and political crisis that affects the Brazil since 2015 substantially reduced government expenditure intended for PROSUB, so that the government can invest the budget in other priority programs for the population. Although ODEBRECHT is involved in corruption scandals that began the political crisis, it
is also a victim of the reduction in the budget of the PROSUB, which forced it to cut 38% of the Itaguaí workstations (MOURA, 2016).

Remaining in the problems caused by the crisis in Brazil, the Brazilian Navy was forced to renegotiate the PROSUB funding, by extending its conclusion. Although the surveys conducted during the development of this work show that the fulfillment of commitment of policies is not considered so important to the success of a ToT, an excessive extension of the program could reduce the chance of success of technology transfer.

In addition to the slowdown in the construction of the Naval Base at Itaguaí, the PROSUB program seems to have a lack of market for Brazilian submarines. Within PROSUB, there is no construction of any means after the 4 Scorpènes and SNA is nothing more than a project in development. Thus, considering the factor of the final market, the sustainability of ToT of the PROSUB program is questionable. However, in the years to come, a partnership with France for the development of a new submarine could increase demand.

In another dimension, the PROSUB program has taken into account the factor towards the establishment of a network (networking) and the involvement of the R&D communities. For example, the Brazilian Navy has established a unit (ET-PROSUB) in France where works about ten military personnel to facilitate personal contacts to accompany the program more easily.

As for the involvement of R&D communities, the Brazilian Navy preferred to maintain the knowledge acquired on ToT in the institution (IPqM and CTMSP) and with a limited involvement of universities (UNICAMP and USP) and other educational institutions. This choice of the Navy is not totally inconvenient since the Armed Forces are perennial organizations of a country. Then, the Navy will be a credible deposit for the perpetuity of the ToT.

However, in case the market is low, the lack of demand for a product may affect the continuity of the transmission of knowledge, until the time where workers who participated the PROSUB program arrive at retirement age.

CHAPTER II.2 – TECHNOLOGY TRANSFER OF AIRBUS HELICOPTER TO HELIBRAS

Since its creation, Helibras, Brazilian subsidiary of Airbus Helicopters, has already issued more than 750 helicopters (70% of the type “esquilo”). However, the Brazilian branch remained as a factory for assembly and maintenance service. Thus, to allow the transfer of technology to the manufacture of helicopters to Brazilian companies, the Brazilian Ministry of Defense has signed an agreement
with Airbus Helicopters, in 2008, for the purchase of 50 aircraft of the type EC-725, conditioned to a nationalization rate of 50% of the product.

In this purpose, beyond the construction of a new assembly plant and the creation of 600 new jobs\(^6\), Helibras has also invested in education with the involvement of the institutions of research and partnerships with universities\(^7\). Finally, the first helicopter of the type EC-725, built in Brazil was delivered in 2014, and the forecast of the production of the first helicopter developed in Brazil, the H-XBR project, is 2020.

Although the EC-725 helicopter is already developed and it is in its production phase, the intention is that companies that will absorb the technology are able to innovate, developing the H-XBR (CORRÊA, 2013).

Thus, this chapter will discuss the scope of the effects of the factors already considered in Part I of this paper, to identify those who may be considered responsible for the success of a partnership in technology transfer.

### II.2.1 – INFLUENCE OF FACTORS IN THE H-XBR PROGRAM

Like the submarine Scorpène of PROSUB, the EC-725 helicopter is also a project in the production phase, making the ToT more difficult in the project H-XBR aimed at the construction of 50 EC-725 helicopters to Brazil with a nationalization rate of 50% of the product, considering the added value of parts supplied, and not their weight.

Although the development of a new helicopter is not included in the H-BR program, the Brazilian Armed Forces hope that, at the end of the H-XBR program, the DITB program is ready to design a national project.

To do this, HELIBRAS has already hired more than 600 employers (HELIBRAS, 2014). Also, it has invested heavily in the training of its professionals with training in France of 96 Brazilians who have taken courses from 3 to 18 months in several areas. In addition, 44 engineers of the AIRBUS Helicopters in Brazil guide the employers of HELIBRAS (ROXO, 2013).

As for the involvement of the R&D community, HELIBRAS has partnered with several institutions:

- Creation at the UNIFEI university of the Aeronautical Engineering in Rotating Wings course, in co-operation with the French

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Institute ENSICA (Institute of Aeronautical and Space Engineering);  
- System HUMS (Health and Usage Monitoring System)  
with  
UNIFEI and ITA;  
- Support for the “Science without borders” program at UNIFEI; and  
- Support to the creation of the Center of Technology of Helicopters (CTH).

Although HELIBRAS and Brazilian DITB will obviously have a huge technological advancement, the gains are limited because the intellectual property of the EC-725 will always remain with the French company, and it should allow the manufacturing and marketing of new units by HELIBRAS. However, AIRBUS will have access to the larger market of helicopters of Latin America and the markets where Brazilian products are well accepted.

So, back on the need for an open dialogue between the partners, we see that expectations must be realistic to ensure that agreements are accomplished. In this subject of sincere communication for mutual gain, we must mention the need, during the negotiations of the project H-XBR, to consider an improved multiplier factor in favor of the receiving companies.

Considering that HELIBRAS is a subsidiary of AIRBUS Helicopters, adaptations in the organizational structure are easier to assimilate. For example, HELIBRAS has recently completed a restructuring of the enterprise organization to follow global directives issued by AIRBUS Helicopters aiming the satisfaction of customers and the efficient use of resources.

Thus, although the product is already developed, the two companies belong to the same sector of the economy and the difference in size between the two companies (Airbus Helicopters and Helibras) is high, the program appears to proceed normally, contradicting some experts who talk about lack of cooperation for a ToT in this type of atmosphere.

In July 13, 2014, HELIBRAS issued the 12th EC-725 for the Brazilian Armed Forces, the first completed all the steps of production in Brazil (HELIBRAS, 2014). Until November 24, 2014, 15 EC-725 had already been issued to the Brazilian Armed Forces.

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However, the reduction of Brazilian budget affecting the H-XBR program since May 2015 delayed two years of its conclusion, currently planned for 2019\textsuperscript{9} . Like the PROSUB, the H-XBR program was also included in the government PAC program since 2013 (BRASIL, 2013), in a context of a policy of internationalization of Brazil, where the government was seeking to harmonize the efforts of growth acceleration of the country with needs for National Defense. Thus, the H-XBR also became one of the first victims of the reduction in the budget because of the economic and political crisis.

**CONCLUSION**

In the introduction of this paper, the following objectives have been proposed:

- To list the main factors that are considered by experts to be essential to the success of a partnership;
- To verify if the above factors are normally considered by the partners who participate in a ToT, mainly in France-Brazil partnerships.

Due to many variables that affect a partnership, the factors studied in Part I of this work were those considered by authors as the most important for the success of a partnership of technology transfer.

To facilitate the understanding of the work, the factors were divided into internal and external to the System formed by the partner companies. The first ones to have been studied, internal factors are those that are more easily controlled. On the other hand, external factors are more unpredictable variables.

Thus, the chances of success of a ToT increase inversely to the development phase of the product, i.e., it is necessary that the receiving entity is involved in the initial stages of the life cycle of a product.

The difference in size of companies will influence the type of relationship in the partnership. More similar are the proportions of partners, more cooperative will be the exchanges. However, most of the interviewees do not consider this factor as essential for the success of the ToT.

To establish a business alliance, the starting point is the existence of mutual benefits, a factor which is mentioned as the most important by most of the experts addressed in this work. However, certain constraints may reduce earnings, compromising the sustainability of the ToT.

Beyond the obvious need to have professionals technically prepared

\textsuperscript{9} http://hojeemdia.com.br/corte-no-orcamento-adia-entrega-de-helicopteros-1.305084
to absorb new technology, experts also mention the importance of having professionals with previous experience in the field of ToT.

The receiving company must also accept that the absorption of modern technologies involves the internalization as well of the new nontechnological capabilities in the organization, management, marketing and finance, for example.

Finally, the last internal factor studied, the influence of economic sectors of businesses, shows the effect of competition in the partnership. Although experts are not unanimous, the responses to the survey have reported a subtle preference for the choice of partners who do not belong to the same sector of the economy, being a noncompetitive partnership.

The second purpose of this article – to verify if the aforementioned factors are normally considered by partners involved in ToT, mainly in France-Brazil partnerships – has considered the study of the two most important partnerships signed between Brazil and France: the PROSUB and H-XBR.

Table 3 shows a comparison between the two programs studied, where red cells demonstrate a threat to the success of the ToT, green cells represent the factors affecting positively the ToT and the white cells are factors which, necessarily, do not negatively affect the result of the ToT.

<table>
<thead>
<tr>
<th>Internal factors</th>
<th>PROSUB</th>
<th>H-XBR</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.1) Phase of production</td>
<td>Production</td>
<td>Production</td>
</tr>
<tr>
<td>a.2) Size of companies</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>a.3) Mutual gains</td>
<td>Limited</td>
<td>Limited</td>
</tr>
<tr>
<td>a.4) Well-trained professionals</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>a.5) Organizational capabilities</td>
<td>Partially</td>
<td>Yes</td>
</tr>
<tr>
<td>a.6) Economic sectors</td>
<td>Noncompetitors</td>
<td>Competitors</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>External factors</th>
<th>PROSUB</th>
<th>H-XBR</th>
</tr>
</thead>
<tbody>
<tr>
<td>b.1) State intervention</td>
<td>Very high</td>
<td>High</td>
</tr>
<tr>
<td>b.2) Demand and final market</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>b.3) Networking</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>b.4) R&amp;D communities</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>b.5) Commitment of policies</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Table 3 – Consideration of internal and external factors by PROSUB and H-XBR France-Brazil partnerships.
The next few paragraphs detail the result of this work, which was presented briefly in table 3, showing that the two partnerships are divergent in 4 factors of 11.

a) Internal factors

a.1) Phase of product development

At first glance, the H-XBR project did not consider the factor that deals with the phase of life cycle of the product, since the H-725 helicopter is a product that already exists and is not in the initial stages of development. However, the Brazilian interest in this ToT is first to prepare industries, of professionals and institutions of R&D for the next step: the development of a national helicopter.

In a similar way, despite the construction of 4 submarines Scorpène (a product already developed) in an intermediate step, the PROSUB program aims to also develop a new product, the Brazilian SNA.

a.2) Size of the companies

Although this factor influences in the way the companies will connect themselves, this work did not identify the difference in size that will bring more benefits to the partnership. However, in the two case studies presented, the difference in size between the partners is significantly high (DCNS/ODEBRECHT and AIRBUS Helicopters/HELIBRAS).

Like the existing good cooperation in the case of PROSUB, the relationship between the two companies of H-XBR also seems to lead to satisfactory results, with the involvement of various actors involved in the ToT, such as ITA and UNIFEI, in addition to businesses around the HELIBRAS benefiting also from the project.

a.3) Mutual gains

In both cases (PROSUB and H-XBR), gains obtained by Brazilian companies are limited, either due to the ban on sales to third parties or due to a partial transfer of technology.

According to the former Director of the Brazil submarine export operation of the DGA, ICA Raphael JAMMES, due to the magnitude and the novelty of the ToT of the PROSUB program, a problem not considered at the signing of the contract was the refusal of some French industries to transfer technology to Brazilian companies, to protect their know-how (JAMMES, 2016).

So, back on the need for an open dialogue between the partners, we see that expectations must be realistic to ensure that agreements are accomplished. In this subject of sincere communication, the engineer
Rafael Gonzalez also mentions the need, during the negotiations of the H-XBR project, to consider a better multiplier factor in favor of the receiving companies (GONZALEZ, 2016).

a.4) Presence of trained professionals
In the analyzed case studies, this factor was well respected, in addition to the presence of professionals of a level of training compatible with the technology to be passed, there are also people with previous experience in the field of technology transfer.

a.5) Absorption of nontechnological capabilities
Adaptations to new modifications referred to in this item are more easily assimilated by HELIBRAS since itself is part of AIRBUS, the issuing partner in the H-XBR project. As an example, HELIBRAS has recently completed a restructuring of the company organization to follow global directives issued by AIRBUS Helicopters aiming the satisfaction of customers and the efficient use of resources.

On the other hand, the absorption of new organizational capabilities in PROSUB program is more complicated. However, when dealing with a program in which security is essential to prevent environmental accidents, French security measures have been integrated by the Brazilian partners.

a.6) Sectors of economy of partners
Here, the two studied France-Brazil partnerships have presented completely opposite choices. However, as experts are not unanimous on the influence of this factor for the result of a partnership, this text does not consider that there is a good or bad option as to the economic sector of the selected partner.

Moreover, in dealing with ToT, most of the participants of this work’s survey say that an alliance between noncompetitors contributes more to the success of technology transfer than otherwise. Another important data provided by experts is the fact that this factor is considered the least important for the success of a ToT.

b) External factors
b.1) State intervention
As ToT programs studied involve the participation of the same States (Brazil and France), the intervention level would be expected to be the same. However, this factor seems to have more influence in PROSUB, where the intervention of the Brazilian government is considered very high, possibly due to the “Golden Share” held by the Brazilian Navy,
enabling it to influence the decision-making in the alliance between DCNS and ODEBRECHT.

b.2) The demand and final market

Considered as the most important variable for the success of a partnership, the final market for the product, i.e. the proposed number of customers must always be considered to ensure sustainable technology transfer.

The growth of Brazilian and international demand for helicopters seems to favor the partnership between HELIBRAS and AIRBUS since this will allow the continuity of the development of new products.

However, the market for Brazilian submarines does not seem as favorable as that of helicopters. In fact, in the PROSUB program, there is no plans to build any means after the 4 Scorpénes. And the SNA is nothing more than a project in development. Thus, taking into account the factor of the final market, the sustainability of ToT of the PROSUB program is questionable. However, in the years to come, a partnership with France for the development of a new submarine could increase demand.

b.3) The network (“Networking”) through which connect the various actors of the ToT

It is the link to partner companies with the players who are out of the system. People who responded to the survey of this work consider this factor to influence the result of a transfer of technology.

The PROSUB and H-XBR programs have considered this factor, making exchanges of staff between Brazil and France. For example, the Brazilian Navy established a unit in France where about ten military personnel work to facilitate personal contacts to accompany the program more easily.

b.4) Involvement of R&D communities

So that a transfer of technology is sustainable, it must have deposits of knowledge that will be responsible for the continuous transfer of know-how.

As part of the H-XBR, participation of ITA and UNIFEI allows training of employers who will work at HELIBRAS and the companies participating in its chain of suppliers. Beyond of perpetuating the ToT, these educational entities also allow the updating of professionals in the aeronautics sector.

On the other hand, the Brazilian Navy preferred to maintain the
knowledge acquired in the institution itself with a limited involvement of universities or other educational institutions. This choice of the Navy is not totally inconvenient since the Armed Forces are perennial organizations of a country. Then, the Navy will be a credible deposit for the perpetuity of the ToT.

However, in case the market is low, the lack of demand for a product may affect the continuity of the transmission of knowledge, until the time where workers who participated the PROSUB program arrive at retirement age.

b.5) Maintenance of the commitment of policies

This factor is considerably important for long term partnerships where a change of government is a possibility. However, surveys conducted during the development of this work show that this variable is not considered so important to the success of a ToT.

Here, again, the two programs are affected in the same way and they suffered the effects of the fall of the Brazilian GDP since 2015, which has forced the State to renegotiate the funding for these programs. Although this distancing of payments does not seem to affect the process of ToT in the short term, an excessive extension of the programs can reduce the chances of success of the transfer of technology.
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