

Using Strategic Alliances to Gain International Competitiveness: The Case of High-Tech Brazilian Firms

Abstract

The number of interactions between firms in the international market shows a consistent growth in the last years. Networks, fusions, acquisitions, joint-ventures and technological alliances are some of the forms developed to gain competitiveness through inter-firm synergies. This paper analyzes the mechanisms of alliance formation established by newly industrialized countries' companies with firms from developed countries. Firms, when unable to develop advanced technologies, envision alliances as a form to increase their competitive capacity by capturing new knowledge and by upgrading internal capabilities. This work proposes that the effectiveness of an alliance depends on two different dynamics: ex-ante conditions, established by the previous history of the firm to build a capacity to absorb knowledge, and in-progress conditions related to the kind of relationship established between partners. As a result of the study, four profiles are suggested to evaluate the potentiality of a firm to absorb knowledge from an alliance.

Keywords: technological capability, absorptive capacity, learning, strategic alliances, interaction, innovation, knowledge.

Introduction

The number of interactions between firms in the international market shows a consistent growth in the last years. Networks, fusions, acquisitions, joint-ventures and technological alliances are some of the forms developed to gain competitiveness through inter-firm synergies. This paper is intended to analyse the mechanisms of

alliance formation established by newly industrialized countries' companies (NICC) in order to improve their technological capability and to promote knowledge absorption. Alliances are a common form of organizational interaction and many academic studies have been conducted in order to identify types of alliances, governance problems and competence developments, for example (Beamish & Killing, 1997; Inkpen, 1996; Leonard-Barton, 1995; Hamel, 1991; Contractor & Lorange, 1988; Kogut, 1988; Killing, 1980). Although much has been said, there are many questions that remain unanswered. This paper investigates the effects generated by alliances of firms located in a newly industrialized country – Brazil – with more technologically advanced companies located in developed countries. The research question, therefore, is: how do Brazilian companies improve and build their technological capability through alliances with more advanced partners?

Looking at some key aspects in technology transfer via partnerships, we aim at studying the technology transfer process as an important means of leveraging newly industrialized countries' firms' international competitiveness by leveraging their technological capability. In order to do that, we use as a background how alliances are structured, the main characteristics of each process and the main advantages and disadvantages for the local firms. Two elements are vital for our analysis: the technological attribute improved through the learning potential, and the interaction throughout a cooperative strategy.

The history of the Brazilian effort to increase the technological capacity of its firms shows many facets of what is happening in NIC markets in terms of internationalization pressures. The Brazilian government has adopted throughout the years many strategies – from protectionism to open market policies - conceived to

diminish the gap. The period of closed economy, during the 70's and 80's, promoted the creation of high technology firms but, at the same time, condemned these firms to the isolation and transformed them into laggards in the international competition. The country's open market orientation established during the 90's forced Brazilian firms to confront competitive markets without sufficient technological capabilities. This situation provoked the search for a higher technological standard and for more efficient ways of production. One of the alternatives, especially for high technology firms, was to conceive strategic alliances with more developed companies.

The cooperative issue

An international alliance is a strategic alternative in today's highly competitive global environment. In the case of Brazilian companies, they need to upgrade their technologies in the fastest and least expensive way possible. The speed of this adjustment and its cost can be explained by the actual market situation: an open market with strong competition. Companies do not have much time to become competitive nor do they have enough money to get technologically upgraded. As a result, companies need to find a way of getting the high performing technology that they need at a minimum cost. Finding a partner who possesses a competitive technology, and wants to form an alliance, can be a good way of achieving the required competitive level.

Alliances are associations between two or more independent enterprises, which will manage one specific project, with a determined duration, for what they will be together in order to improve their competencies (Garrette & Dussauge, 1995). Despite being easier instruments of transferring a technology, an alliance is something very complex to be managed.

The cooperative strategy does have constraints linked to their implementation. These constraints are controllable but should not be ignored. The main constraints related to the complexity of alliances are the contract formulation (Killing, 1988); the alliance's coordination (Killing, 1980); the risk of sharing proprietary know-how – “appropriability” (Teece, 1992); and, in international alliances, the government policy and fluctuating currencies (Wagner, 1993).

Paper's goal

Everything being observed, one of the major propositions of this work is that the effectiveness of an alliance, for the recipient firm of a NIC, depends on two different dynamics. On one hand, ex-ante conditions established by the previous history of the firm in building a capacity to understand, use and transform knowledge result in a **learning potential**. For the purpose of this paper, learning potential is defined as the combination of firm's absorptive capacity (Cohen & Levinthal, 1990), technological capability (Kharbanda & Jain, 1997) and non-technological elements related to firm's strategy and structure as formulated by Chandler (1962).

In fact, strategy is everything that involves company's plan of action and goals to be achieved. It is *the basic long-term goals and objectives of an enterprise, and the adoption of courses of action and the allocation of resources necessary for carrying out these goals* (Chandler, 1962, p.13.4). Structure represents the administrative heritage presented in the company. It refers to *the design of [the] organization through which the enterprise is administered* (Chandler, 1962, p.13.4), which includes lines of authority and communication between offices and officers as well as the information and data flow.

As a result, if the objective of the alliance, from the point of view of the recipient firm, is technological upgrading to increase competitiveness, it must have developed a certain learning potential – or have achieved pre-conditions before the interaction to allow the knowledge transfer. In other words, the decision to start a cooperative action relies upon the capacity of the firm to effectively absorb technology (Balbinot & Bignetti, 2006).

On the other hand, there is another dynamics that is established while the alliance is in course, during the period of interaction between partners: in-progress conditions refer to the types of relationship established between partners within an alliance. Since technology has a tacit component and cannot always be formally described, socialization of the tacit knowledge sometimes becomes the only way to relay information. In-progress conditions highlight the quality of interaction during the alliance.

In order to make explicit the characteristics of these two dynamics, the next two sections will discuss the theoretical concepts linked to ex-ante and to in progress conditions necessary to achieve an effective technological alliance.

Ex-ante conditions

Ex-ante conditions refer to the creation of the learning potential of the recipient firm that enables it to gain knowledge from a possible alliance. The literature reports many studies conducted to define and understand this potential (Bell, 1984; Hamel, 1991; Kogut, 1991; Lall, 1992; Feinberg & Gupta, 2004). For the purpose of this study, we consider that the learning potential is developed along the existence of the firm and is characterized by the creation and consolidation of a technological capability (Kharbanda

& Jain, 1997) and an absorptive capacity (Cohen & Levinthal, 1990; Zahra & George, 2002; Lane et al., 2001).

Technological capability can be defined as a set of functional abilities that are reflected in a company's performance through various technological activities and whose ultimate purpose is company-level value management by developing difficult-to-copy organizational abilities (Panda & Ramanathan, 1996). In a broader sense, technological capability is the internal capability that helps absorption, adaptation and modification of an external technology involving technological change (Kharbanda & Jain, 1997). In other words, technological capability is the ability to understand and improve a given technology (Kim, 1997) and create new ones.

Absorptive capacity (Cohen & Levinthal, 1990) is considered to be the ability of the firm to recognize new, external information and to apply it to commercial purposes (p. 128). It is not the result exclusively of R&D activities, but the sum of prior related knowledge acquired in each of the firm's functional capabilities, in areas such as marketing, human resources, production, and finance. Although outside sources of knowledge are often critical to the innovation process of the recipient firm in alliances, companies need to have a certain ability to exploit these sources.

We argue that the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends is critical to its innovative capabilities. We label this capability a firm's absorptive capacity and suggest that it is largely a function of the firm's level prior related knowledge (Cohen & Levinthal, 1990, p.128).

Anderson, Farrell, and Sauers (1984 *apud* Cohen & Levinthal, 1990) provide an example of the role of absorptive capacity in a technology transfer process. They

compared two groups of students: one learning LISP as a first programming language, the other learning LISP after having learned Pascal. According to their research, the students that learned Pascal before LISP understood the new language much more effectively than the other group. This is, in part, because they easily understood the semantics of various programming concepts. Absorptive capacity, therefore, refers to a previous organizational knowledge not necessarily related to any particular technology. What is important here is that it is the capacity needed to deal with new knowledge. As stated by Cohen & Levinthal (1990, p.137):

A firm's aspiration level in a technologically progressive environment depends on the firm's absorptive capacity. The greater the organization's expertise and associated absorptive capacity, the more sensitive it is likely to be to emerging technological opportunities and the more likely its aspiration level will be defined in terms of the opportunities present in the technical environment rather than strictly in terms of performance measures.

In comparing the two concepts, technological capability and absorptive capacity, it can be stated that absorptive capacity has a more comprehensive sense and depends upon the organizational ability to incorporate and retain prior related knowledge from all functional areas. Technological capability is related to R&D activities and to the constant technical knowledge incorporated. Furthermore, absorptive capacity is an ability acquired during the entire organization's lifespan and with the participation and knowledge of all functional areas. Technological capability is the ability of a functional area responsible for the company's innovation, like R&D. In this sense, absorptive capacity takes much more time to develop than a technological capability. Furthermore, there can only be one organizational absorptive capacity that grows throughout the

company's life. However, many technological capabilities are possible. Table 1 presents some fundamental differences between absorptive capacity and technological capability.

Table 1: Absorptive capacity versus technological capability

Elements	Absorptive capacity	Technological capability
Quantity	One for each organization	Many
Originated from	All organization	R&D
Development time	Long	Short to medium
Advantage generation	No.	Yes
Innovative role	Passive – Support	Active – Innovation
Connected to	Prior related knowledge	New knowledge*
Needed investments	In all organizational areas through training and development of managerial skills	In technological areas, especially R&D, through technical training, training and equipment acquisition

One of the characteristics of a technology is to be path-dependent. Consequently, it is possible to state that a new knowledge is something always formed from many other experiences or knowledge.

The development of an absorptive capacity and of technological capabilities, therefore, is necessary; to achieve a learning potential that will enable the recipient firm to profit from the alliance. However, we propose that a second dynamics plays an important role for the affectivity of the alliance. Following Killing (1980) and Inkpen (1996), the interaction created through alliances allows for knowledge creation and facilitates technology transfers. Consequently, the quality of the interaction during the period of existence of the alliance is vital in cooperative agreements success. This is the subject of the next section.

In-progress conditions

In-progress conditions refer to the interaction level established between both partners within a given alliance. If ex-ante conditions take into account previous actions taken by both partners separately, in-progress dynamics depend on the interaction during the development of the alliance. The literature refers to four different factors influencing the quality of interaction: the firm strategy concerning the alliance, the communication compatibility, the commitment established within the alliance and the level of socialization (Harrigan, 1988; Nonaka & Takeuchi, 1996; Orlikowisk, 1992).

The strategy motivating a firm to choose a cooperative strategy is a factor that determines the degree of priority established by decision makers concerning the specific alliance and the level of involvement of top executives to the success of the relationship. The value of the alliance for the organization is determined by the strategic priority concealed by decision makers. Evidently, a decisive step to evaluating the attributed strategic value of an agreement is to verify what drove the company toward this decision. The entrepreneurial drive can indicate the importance attributed to the cooperative strategy, whether it was a required strategy or not.

In addition to the strategic importance given to the alliance, which permits the continuous search for a strong relationship surpassing barriers and difficulties, is the level of communication established among partners, that is, the way in which people communicate within the alliance. This refers to the use of both written and spoken language and of technological language to communicate ideas, concepts, mandates and the like. Particularly, alliances between firms of countries of different idioms face the challenge of overpassing language barriers and culture differences. The groups need, evidently, to understand each other and this understanding depends on the language

spoken. There are occasions in which neither of the partners communicates in their native language, but choose a common language to communicate. Also, to cope with idiomatic obstacles, it is even more important that people possess compatible levels of technological capability, since a technical vocabulary may also help them to understand each other. Cultural aspects, reflected on different visions of reality, become critical, especially if language differences are large.

Another factor affecting the relationship within the alliance is the commitment level of participant actors, which is related to the operational actors involved in the alliance. These actors are not decision makers; however, they are vital to the alliance existence and success. People's motivation and enthusiasm to enter a new project is essential to establish a high level of communications to the achievement of results. The commitment of the actor involved in the alliance, of course, depends also on the strategic value attributed by decision makers to the alliance. In addition, trust is an important player. If people in one group do not trust those in the other group the former tend not be open to the process, which makes difficult the task of understanding and accepting the ideas of others. The important building blocks of trust are often laid at the beginning of a new relationship. In other words, the first negotiations and the contract formulation play a significant role in creating trust within an alliance.

The level of socialization of interfering actors is another factor that influences in-progress dynamics. The success of technology transfer also depends on the quality of face-to-face contacts. The level of socialization of each group should also be assessed according to the time people spent together and whether informal groups are created. The more people stay together the better the socialization process. People begin to know one another better and this improves their comprehension of the messages received and

the ones they want to transmit. In this context, non-verbal language begins to be easier to understand, which in turn accelerates transfer. As more people know each other, fewer explanations are needed to communicate an idea. The group increases the willingness of being together, which again improves the understanding of each other's ideas.

With respect to the two dynamics described above, ex-ante and in-progress conditions for technological alliances, two important points must be highlighted. The first one refers to the trajectory or the path-dependency of the process - one important characteristic of a technology (Cantwell, 1991; Nelson & Winter, 1977). Being path-dependent means that a firm has a trajectory that is important and that cannot be avoided. Each step the firm previously took has an impact on the organization's future path. Every new experience accumulated changes or will change the actual knowledge level of the firm. Technological knowledge is enhanced by adding more information, empirical experiences, or learning from external sources. The other point is that interaction is a key element that permits knowledge creation and facilitates technology transfers (Killing, 1980; Nonaka & Takeuchi, 1996; Kim & Lee, 2002). How interaction occurs and what difference it makes in the technological process development is essential for the effectiveness of the alliance. As already discussed, the quality of interaction will dictate the level of knowledge creation and transfer involved in the alliance. If these two points – path dependency and intensity of interaction – should be highlighted, the methodology of research must take into account historical data and in-depth descriptions of the interactions occurred. The next section indicates the strategy of research followed in the study.

Methodology

Our research question is how do Brazilian companies improve and build their technological capability through alliances with more advanced partner? In order to answer the question two important points must be considered. One is the trajectory or the path-dependence of the process - one of the most important characteristics of technology. The other is interaction, which allows for knowledge creation and facilitates technology transfers.

The path-dependency element requires a historical study. How interaction occurs and what difference it makes in the technological process development could be observed only via direct observation in the field. As a result, a method focused on a contemporary phenomenon within some real-life context and showing the ongoing process of interaction, was necessary to analyzing the subject of this study.

To fulfill the objective of contemplating a historical approach to examine the trajectory of Brazilian high technology firms through which they accumulated a learning potential and ex-ante conditions to pursue alliances, and also of describing in-progress interactions among actors, the multiple-case design was considered as the appropriate strategy (Yin, 1994). For the purposes of this study, in order to be object of investigation, a firm should attend different criteria. The criteria limited the spectrum of possibilities, consequently, we have chosen firms from the same sector, that possessed most of the data published, and, finally, those that seemed the most cooperative. The selection criteria were:

1. The firm should have entered an alliance for a minimum of 12 months, with the goal of improving their competencies.

2. The alliance should have begun at least 12 months prior to the data collection period.
3. The firm should be at least 5 years old with a historical background that extends into the *closed economy* period.
4. The firm should have between 5 and 10 people working on each alliance, enabling the observation of each individual involved with the technology transfer.
5. The firm should be from the electrical electronics industry.

Therefore, to perform the research, a multiple-case study was conducted, analyzing five Brazilian firms from the electrical and electronics industry. Among these firms, four of them were solid, established companies: Inepar and Stemac being for 50 years in the market, and Aeroeletronica and Info operating for more than 35 years. The last case is Polonia, a young joint venture formed by the association of a large company called Polonia Group and a small firm, Polonia/Incub, which was totally absorbed by the alliance. It is important to stress that most of the firms crossed different competitive environments in their life span. One of the most characteristic periods was the Brazilian market reserve: during more than a decade the Brazilian market of high technology was closed to imports and to bilateral exchanges. The opening of the Brazilian economy, in the early 90's, forced established companies to face international competition. It was the beginning of a new era, characterized by global competitors and by fierce competition for productivity and quality.

The data was collected from four main types of sources of information: observation, semi-structured interviews with participant decision makers and operational participants, documentation and general data. On the total, 19 people were

interviewed, among CEO's, alliance negotiators and engineers. The detailed description of all the aspects analyzed in this research is beyond the objective of this paper.

In order to guarantee case study's validity, the information was triangulated via different interviews to different people that participated in the same alliance. Another important point was the multi-access data collection used through observation, interviews and documents. Excepting two companies (Info and Polonia) the others have mostly of the information on their alliances published. This fact helped into the data triangulation.

Analysis of the ex-ante conditions

The analysis took into account two key elements: the learning potential level of each firm - what we called the ex-ante conditions - and the quality of the interaction between partners, called the in-progress conditions. The Ex-ante conditions were related to a firm's technological potential for learning new knowledge and the analyzed attributes were the absorptive capacity and the technological capability. In-progress conditions referred to the interaction level established between both partners within each alliance, and considered the firm strategy, the communication compatibility, the commitment established within the alliance and the level of socialization.

Table 2 reports the results obtained by the Brazilian firms in terms of acquisition of technology, side results, profits and goal achievements. As can be seen from the analysis of the table, the alliances brought results of different kinds for each of the Brazilian firms engaged in the process. Considering, for example, Stemac and Polonia/Incub, the two extremes in terms of technological capability, Polonia is much more development-oriented. Consequently, it is imperative for Polonia to have an active

R&D department, which justifies a 10% turnover investment as well as its need for highly qualified labor. This intense development facilitated the company's relationship with its partner. It also gave the company more power to negotiate since Polonia do Brasil became a technology supplier to the Polonia group. This is a significant strategic factor because the owners of Incub lost most of their decision power once they entered the joint venture.

On the other side, Stemac's strategy is much more focused on client satisfaction. This translates into good after-sales assistance that justifies its highly qualified labor. As a result, developing new products is not part of its core strategy. Rather, in order to satisfy the needs of its clients, Stemac managers prefer to upgrade the firm's products through one-way technology transfer. Consequently, Stemac does not need a higher technological capability level to meet its needs. In its market, a medium-to-low technological capability level is enough. It is important to note that Stemac is the Brazilian leader in its industry.

Another interesting comparison is between Aeroeletronica and Info. Both firms had a solid history during the Brazilian market reserve period. Both received major governmental incentives for R&D activities. Nonetheless, each of them followed a different trajectory after the end of the market reserve period. While the government of Brazil's concerns with territorial defense diminished, this obliged Aeroeletronica to look for other markets. At the same time, telecommunications, Info's domain, was experiencing important growth due to the privatization wave.

If Aeroeletronica's technological trajectory is analyzed, it can be said that, when Brazilian market was closed and protected, there was a significant push to R&D development. When the market barriers fell, the company was forced to face a more

competitive environment but its technological capability level did not fall. The company kept following the same pattern that had developed during the market reserve period.

Table 2: Results of the alliances

	INEPAR	AERO - ELETRONICA	INFO	STEMAC	POLONIA
Status	Finished	Finished	Ongoing	Ongoing	Ongoing
Duration	2 years	10 years	From 1999	From 1995	From 1996
Technology acquired	85% of the technology was nationalized. Knowledge in the telecom power generation technology	Both products were totally nationalized.	BROAD's product was totally nationalized.	Stemac's personnel absorbed the know-how they were looking for	Polonia's managers did not intend to learn a certain technology
Side results		Other technologies and proceeding were also incorporated to AE's everyday operations It had a very important enhancement on organization's skills	Info's personnel got in contact with important elements of some technologies they intended to develop	It was absorbed other technological elements to improve other products	It anticipated some technological developments since they mastered and nationalized several technologies
Profit	JV of \$15million dollars annual turnover	It leveraged the company in technological and financial terms	It increased in 142% firm's turnover	It did not cause a major impact. It represents 1% of firm's turnover	It went from a \$300mil to a 5million dollars firm
Goal achievement	Yes	Yes and more	Yes and more	Yes and more	No

Info assimilated the opening of the economy more effectively. After the end of the reserve period, the company began adjusting itself to this new phase. Info's technological capability developed during the reserve period was the turning point to success. It was clear that to fulfill new market needs, Info had to put its R&D department in full speed to develop the products requested by the new clientele.

Inepar focused upon the development of a specific product for the joint venture. The firm was not focused on radical innovations and on independent technological development. The company wanted to provide market solutions through alliances.

The evaluation of the absorptive capacity of the firms is based upon their prior experience, which, in this study, includes especially the experience obtained with alliances. In terms of the accumulation of absorptive capacity, the higher the number of years in the market, the higher should be the expected capacity to recognize and treat information. The market protection period helped firms to develop higher technological capability and greater absorptive capacity. The type of organizational structure, as well, interfered in this capacity – the more informal the structure, and higher the employee's autonomy, the more information will be spread in the organization, thus promoting a higher level of knowledge diffusion. Table 3 presents more details.

Table 3: The Absorptive Capacity Level of Firms

Absorptive Capacity					
	INEPAR	AEROELETRONICA	INFO	STEMAC	POLONIA
Years in the market	Since 1953	Since 1967	Since 1966	Since 1951	Since 1991
History in the market reserve	The market reserve helped to develop its first partnerships because it generated an appeal	It had a huge importance since its development occurred due to this period	It was very important since in this period the Brazilian telecom system standard was developed and adopted	Stemac used this period to improve its internal market and in-house develop, but it was difficult to get information from outside	No history.
Prior experience with alliances	Yes. It believes in partnerships to technological development	No, but its president used to negotiate with multinationals	Yes. It does partnerships with universities	Yes. Also, its president used to negotiate with multinationals	None experience neither with alliances, nor managerial

An analysis of the cases studied indicates that the strategic alliances performed by the Brazilian firms, in general, brought favorable results and increased their learning potential. Table 4 shows that partnerships established helped to increase the technological capability and the absorptive capacity of the Brazilian companies. In the

case of Polonia, for example, it is possible to infer that the firm is technologically ready to absorb technology, but is still managerially immature to form stable strategic alliances. The lack of experience of the managers could have lead to a less desirable outcome: the loss of the decision-making control.

Stemac and Inepar recognize the importance of information as an opportunity for their firms. They identified its value and, sometimes, even convinced their partners that a certain agreement could be of great value to both parties. Nevertheless, Inepar presents a higher technological arsenal than Stemac. As already mentioned, the strategy followed by Stemac is concentrated upon client satisfaction and not on technological leadership.

Table 4: Improvements through Alliances

	INEPAR	AEROELETRONICA	INFO	STEMAC	POLONIA
Goal achievement	Yes	Yes and more	Yes and more	Yes and more	No, but it anticipated some technological developments
Technological capability	Medium	High	Medium to high	Low	High
Absorptive capacity	High	High	High	Medium-to-high	Low
Learning Potential	Medium to high	High	High	Medium	Medium

Aeroeletronica and Info possess important learning potentials. They both are ready to receive technology because they developed consistent technological capabilities. They have the required absorptive capacity to recognize new information and to apply it in order to achieve their goals. They are also in high technology demanding sub-sectors that lead them to continuously develop technology.

Certainly, the analysis above does not imply that the firms studied will have the same learning potential in the future. Conditions change from situation to situation and from one technological base to another. As a result, firms need to continue to work hard in order to maintain and improve technological capabilities, absorptive capacities and learning potentials.

Analysis of the in-progress conditions

In progress conditions refer to the types of interactions established between partners within an alliance. Four attributes were analysed in the alliances: the firm strategy concerning the alliance, the communication compatibility, the commitment established within the alliance and the level of socialization.

The first step to evaluating the attributed strategic value of an agreement is to verify what drove the company toward this decision. Inepar's CEO saw an opportunity to enter the telecom market with an alliance with Lucent. Aside for an interest in a new project, the alliance was not seen as vital to Inepar's survival. For Aeroeletronica, the alliance was a matter of continuing or abandoning the market. At the occasion, Embraer, the Brazilian producer of airplanes, was recruiting companies to enter new development projects and Aeroeletronica needed to be ready to face the challenge. Moreover, it was the president himself who took the decision; as a result, the alliance became a core project for the company.

For different reasons, the establishment of an alliance was crucial to Info, as well. It had anticipated in the development of a product for a future market. Info took the initiative of making an alliance with a company that already had the technology. Consequently, Info's CEO attributed great importance to the cooperative agreement.

Stemac's entrepreneurial drive had a major impact since it was its president that took the decision. However, the alliance was not vital to the company in the same way it was for Aeroeletronica. It was, rather, an opportunity to supply a new market. Its president simply wanted to retain the company's image of being the leading supplier of energy solutions and to demonstrate the firm's ability to supply whatever its clients needed. The same was true for Polonia. According to its president, he saw an opportunity of adding a new investor to the company by developing a joint venture with a French multinational. In contrast to Stemac, it seems that Polonia really needed the investment. In other words, the investment was more important than the alliance per se, since Polonia could not have obtained financial resources by any other means.

The second attribute analyzed was the communication compatibility between partners. The analysis of the Inepar-Lucent alliance indicates that the partners were compatible in terms of communication. The spoken language was Portuguese, since the transferor had a subsidiary in Brazil. As a result, communication flowed in a smooth way. They were also technologically compatible. Despite the fact that Lucent had a higher technological capability level, Inepar's level was sufficient to capture the information Lucent was transferring.

Aeroeletronica had a more difficult time with communication. In the beginning, it did not have the technological capability level required. Aeroeletrônica's personnel had to make an effort to cope with the situation, leveraging its technological capability level to be prepared to understand the technology being transferred. In terms of spoken language, the transferor's language, English, was employed. According to Aeroeletrônica's manager, the idiomatic difference did not pose a problem since in his sector all the technical notes are written in English.

Info and Broad were very similar companies, with very similar beginnings. They had the same technological capability level. Furthermore, an element that helped them to get closer, according to Info's CEO, was the use of a third language in order to communicate. They chose English, which was neither Info nor Broad's native language.

Stemac and Polonia, however, had far more incompatible profiles with their partners. Stemac and Hitech had a considerably different technological capability levels, and the asymmetry caused difficulties in the transfer of information. Also, the actors involved chose to speak English but were not proficient in speaking. As a result, there were communication problems in the beginning. As one of Stemac's engineers explained, they had to cope with awkward situations such as waiting for help in the translation of the documents received before they could get the gist of what they meant. These communication problems were apparently solved later on.

Polonia had communication problems as well. Despite the fact that Polonia and its partner had similar technological capability levels, the partner's use of many languages posed challenges. Another major problem was in terms of the partner's willingness to transfer the technology. A few subsidiaries were not interested in collaborating.

It should be mentioned that the majority of interviewed managers did not see the spoken language as a barrier. According to them, there is a pragmatic aspect in the technology that generates a universal language of communication. As a result, having a compatible technological capability level should have been enough to communicate.

The third attribute considered was the commitment of the participant actors to the alliance, reflected on people's motivation and enthusiasm to enter a new project and on the trust establishes between partners. In the case of the Inepar-Lucent alliance,

people from both sides were very enthusiastic with the project. They knew it represented a significant partnership, bringing together two prestigious firms in the international market. The joint venture generated great publicity for both companies. The contract negotiations only reinforced the motivational atmosphere. Together, these elements fuelled an important feeling of trust within the alliance and the situation, as a result, generated a very high commitment level.

Aeroeletronica did not succeed in getting a high commitment level from its partner. There are two reasons for this: first, the Brazilian market closure legislation imposed to foreign companies, like Sundstrand, the obligation to fully transfer the technology to a local partner in order to gain access to the Brazilian market. Second, contract negotiations were chaotic due to the fact that different entities were involved: the governments of Brazil and Italy and negotiators acting on behalf of both firms. Consequently, building trust was somewhat difficult given these start conditions. However, it should be noted that Aeroeletrônica's own personal commitment to the alliance ultimately helped it to obtain the needed knowledge.

Info, like Inepar, succeeded in creating a perfect atmosphere to get people together and to share ideas. Unlike Inepar, however, the company had to cope with cultural differences. In spite of intense motivation on both sides, Broad took more time to be fully present in the project. Trust was built nonetheless due to initial problems that were solved by the partners together. Over time, Broad fully embraced the alliance. The high learning potential of Info's personnel also helped in developing a two-way relationship through which both partners started exchanging and sharing experiences and knowledge.

Stemac had a very professional, reserved relationship with its partner. There was no enthusiastic outpouring. Contract negotiations were conducted in a very efficient manner. It is difficult to evaluate whether partners presented a high commitment level, since the alliance was not central to their goals. The trust was present, as in other ordinary business relationships, but the extent to which partners shared mutual confidence was difficult to determine.

In the case of Incub, a major deception destroyed the enthusiasm of the participating actors: Incub was dissolved. It seems that, despite the fact that both partners had important motivations to form this alliance, a poorly negotiated contract killed the possibility of a trusting relationship. The inexperience of Incub's managers coupled with their excessive enthusiasm resulted in a disadvantageous contract and Incub's board began to suspect of every action taken by the Polonia Group. As a result of the lack of trust a low level of commitment emerged.

The final attribute analysed during the period of relationship between partners was the level of socialization achieved in the alliance. The success of technology transfer also depends on the quality of the face-to-face contacts. Following Nonaka & Takeuchi's definition of this process, this physical contact is a required element. Consequently, the level of socialization of each group should also be assessed according to the time people spent together and whether informal groups are created.

The more people stay together the better the socialization process. Inepar's CEO believes that their alliance benefited from high quality socialization since the very beginning. Actually, Inepar, with its highly developed communication program succeeded in transferring its communication culture to the joint venture. Inepar had a very open and welcoming culture that facilitated joint venture socialization. The

atmosphere generated was positive. The personnel even had a nickname for venture: “the kindergarten”. A few personal relationships were developed outside the work place, helping the transfer process.

By contrast, Aeroeletrônica’s personnel had to fight hard to contact the staff of its partner’s R&D department due, in part, to a faulty contract that caused many problems during transfer. Ultimately, their communicative problems were resolved because people from both R&D departments were very committed to the project. At the end, Sundstrand’s R&D people proved to be very friendly and cooperative. Although the two groups did not spend much time together, they did succeed in developing some important friendships that lasted long after the end of the project.

Info had to construct a friendly relationship. The emergence of an unexpected technical problem forced the teams to share expertise and facilitated the approximation of the groups. As a consequence, they found themselves working on the same side. Also, coping with the time lag acted as a catalyst for many friendships. Over time, a tight friendship developed. Today, when Broad launches new software, Info is asked to ratify it before sending it to the market.

Stemac’s personnel also succeeded in developing a very good rapport with the employees of Hitech. According executives from Stemac, Hitech is the partner with whom they had the most personal contacts ever. In seven years of partnership, many personal friendships have developed. They also taught each other more than what was agreed in the contract, due to this close relationship. It was the daily conversations and the length of the relationship that improved their socialization within the alliance in the long run.

Polonia did not succeed promoting a high degree of socialization with its partner. However, despite a bad climate concerning the inception of the alliance, Polonia's personnel did develop friendships and informal groups were formed. In some projects a closer relationship was possible.

It is interesting to note that all five Brazilian companies sent their personnel abroad for some time. The decision was considered important for the better understanding of the technology as well as for the approximation of the teams. It facilitated the communication and accelerated the initial transfer of the technology and knowledge. In general, firms chose to send different groups at a time. On average, companies succeeded in transferring the initial technology within 45 days. Subsequent to this process, companies were often involved in completing adjustments and adaptations for the local setting. This adjustment process also required exchanges with the partner. However, at that stage, the bulk of the technology was already mastered.

It can be inferred that Inepar and Info were the two alliances that presented a closer relationship between partners.

Good interaction was clearly not a problem for Inepar. From the beginning, the company had the following important points to its advantage: (1) its partner's willingness to develop a joint-project with them and (2) Inepar's culture of transparency. While Info achieved a similar interaction level, it had to work harder for it. Unlike Inepar, Info's personnel had to prove that they could be trusted. Their competence and high technological level was a surprise and conquered the confidence of its new partner.

Aeroeletronica, Stemac and Polonia achieved only a medium level of interaction. In the case of Aeroeletronica, high quality interaction was ultimately achieved with

Sundstrand's R&D personnel over time. However, the problem with the marketing area remained difficult.

The medium score of Stemac can be accredited to the fact that the case concerns a less relevant project. Stemac was very professional but the venture was not about the firm's core activity. Finally, the medium interaction level of Polonia actually represents an advance in their joint relationship when compared to the beginning of the venture and provide room for optimism during the duration of the alliance.

A closer look at the alliances

The cases illustrated permit a further analysis on the ex-ante conditions to perform an alliance. Although case studies do not permit generalizations, it is possible to tell that the cooperative strategy in the form of technological alliances is not available to every firm. There are some pre-requisites that must be fulfilled before opting for this choice. The learning potential level plays a major role in this choice. Since alliances are a means of acquiring knowledge that demands interaction to be successful, firms must be able to interact. Much more than being together, interaction denotes the ability to understand each other – a condition that is achieved when partners speak the same technological language, which implies that they should have compatible technological levels.

If the learning potential of the recipient partner is confronted with the level of interaction to be achieved in the alliance, four different profiles can be designed that are more suitable for taking advantage of a partnership. These profiles are shown in Table 5 and were built by crossing the learning potential level (Killing, 1980) of each analyzed firm with the degree of maturity of the technology to be transferred (Utterback, 1994).

Firms that could be positioned in the boxes – represented by I, II, III and IV – might take advantage from an alliance strategy to develop their technology more than other firms possessing a different profile. Firms probed to alliances have a medium-to-high learning potential level. The intensity of interaction is decided in relation to the type of technology that is involved and the firm's learning potential. The characteristics of each profile are described below.

BOX I – firms possessing high learning potential, requiring an in-development technology are in this box. Firms in this box do not require a highly interactive activity since they are capable of absorbing and innovating from an acquired technology on their own. In such a case, an alliance can be considered as an optional strategy even if it accelerates the pacing of technology absorption. Polonia was in this situation. It succeeded in learning new technologies without a high level of interaction with its partner. These alliances can thus be termed **optional alliances**.

BOX II – firms placed in box II present medium learning potential and want to transfer an “in-development” technology. In this case, interaction with the personnel of the partner company is essential to improve a firm's technological capability level. Inepar and Stemac can both be placed in this box. In the Inepar case, a totally new technology was transferred. They decided, quite wisely, to pursue a joint venture, since it allows a high interaction with the partner. Without it, the transfer would have not been possible. Stemac, however, is a special case where the company was not interested in mastering the entire technology. Rather it wished to master just a few elements related to product maintenance. Consequently, we believe they could obtain what they wanted with a simple product acquisition. In order to do so, however, they needed to possess a

higher learning potential. Again, the alliance was a necessary choice to achieve this objective. We called this type of partnership a **necessary alliance**.

BOX III – In this box, we placed firms that have a medium learning potential level and need an emerging technology. A firm in this box has to receive some training or some internal technological development before embracing the cooperative strategy in order to be ready to interact effectively (i.e. communication compatibility). This sort of case demands a highly intensive interaction, such as the way Aeroeletronica's transfer occurred. Before beginning the alliance they had to train their personnel and to develop needed machinery. Once it was done, Aeroeletronica had elevated its technological capability level and was ready to join with its partner to receive a highly embedded technology. These are termed **upgrading alliances**.

BOX IV – Finally, firms in box IV present high learning potential and transfer an emerging technology. Interaction might be necessary to accelerate the pace of the transfer. However, interaction is particularly useful for innovating via knowledge sharing. For these firms, the alliance is much more than a means of transferring a certain technology it represents the innovation itself. Info was in this situation. While they were transferring the technology, they also innovated with their partner. We called this partnership a **synergic alliance**.

When the profiles are applied to the cases analysed, it is possible to classify each alliance according to their specific characteristics. Table 5 presents the application of the profiles to the Brazilian alliances studied.

Table 5: Profiles of the alliances

<u>Learning Potential</u>	High	INFO IV SYNERGIC	POLONIA I OPTIONAL
	Medium	AEROELETRÔNICA III UPGRADING	INEPAR/STEMAC II NECESSARY
		Fluid	Transitional
		<u>Technology</u>	

Alliances are complex instruments. They demand experience and expertise from the companies that intend to make use of them. As a result, if an alliance is not necessary, it is better to cope with development using other strategies, such as product acquisition and technology licensing. In essence, this mimics the same logic upheld for the last profile – a low learning potential that requires a specific technology. If a firm can acquire the technology in a kind of turnkey system rather than embarking on the more complex joint venture avenue, it should do so.

Conclusions

This article investigated four alliances between firms of developed countries and firms from New Industrialized Countries (NIC) by describing how Brazilian ventures. Some interesting conclusions can be inferred from the study. First, it should be noted that the cooperative strategy in the form of technological alliances is not a general rule for every firm. There are some requisites that must be fulfilled before performing a contract of technology creation or transfer. The technological potential plays a major role in the decision. There is a trade off that involves the technological asymmetry between partners and the technological capability and absorptive capacity of the recipient firm.

Technological asymmetries and different capabilities might create a knowledge gap difficult to surpass. Conversely, it is possible to infer that companies possessing a higher technological capability level succeeded in nationalizing faster the needed technologies. Since alliances in this case demand close interactions, it is possible to say, on a figurative way, that partners need to speak the same languages: the same idiom and the same technological language.

A second consideration derives from the first. To have a high technological capability or a high absorptive capacity is not a *sine qua non* condition to perform a successful alliance. Mature technologies, for example, present a low-embedded element that can be easily found or replaced by other information from the firm's technological database. This is possible because if the firm's technicians have a high capacity to solve problems, they already had conceived a trouble-shooting routine. As a result, with richer knowledge database, they are capable of combining different information. This happened with Polonia that, even with a very low interaction with partners, succeeded to transfer the technologies it needed.

A third observation, as a consequence, is that a technological alliance involves many more elements than just technology. Managerial experience is vital to its success. Polonia illustrated that the lack of experience in this field can cause serious damage to the project. On the other hand, the huge experience of Inepar's CEO helped it overcome an abrupt joint venture's end. Even if it was unexpected, Inepar nonetheless obtained what it wanted. Contract negotiation proved to be a very tricky part of its alliance. It is also something that can change the entire relationship into any alliance, if it is not well handled. Polonia and Aeroeletronica had problems due to badly formulated contracts. Furthermore, the managers of all five companies showed a high awareness of the fact

that knowledge must be spread throughout the entire organization. Trust was also an important word for them. According to these managers, no alliance is possible without trust.

A fourth aspect to be enhanced is that firms from developed countries choose to make alliances with local companies to enter new markets. Using this strategy, they reduce the risk of failure since they can then depend upon their partner's knowledge of the local environment. Developed country firms seem to search for solid, established partners in order to associate their name to a local one that already has a prestigious reputation. This was certainly the case for Stemac and Inepar. Stemac's partner obtained more than just the benefit of having its name associated to a prestigious company: it also gained access to large developed distribution structure. As a result, the chosen Brazilian companies normally rely on important local assets of different kinds, like solid client base, reputation, knowledge of the market and governmental links, to convince their foreign partners enter an alliance. Polonia and Info both demonstrated impressive technological capability level for local actors, for example.

A fifth and significant consideration concerns the role of the leadership and the experience of some top managers in dealing with alliances. The experience of Inepar's CEO helped the company to attain important results. Even if the alliance had a premature ending, thanks to its CEO, it began and ended under a successful note. On the other hand, the inexperience of Polonia's directors clearly jeopardized the joint venture's future.

A sixth point to consider is the relevance of a structured contract negotiation. The contract gives life to the alliance. A badly conceived contract might put at risk the entire cooperative effort and jeopardise future relationships. For example, Polonia had a

low quality interaction with its partner due to the disastrous beginnings caused by a poorly negotiated contract.

Looking from the host country perspective, these alliances also permit firms from NIC's to receive technology and to catch up with the information divide. As a result, the chosen Brazilian companies normally count on important assets to convince their partners about the advantages of the alliances. Through alliances it is possible to attract foreign investments that help to elevate the technological base of the firm and of the country, to create qualified jobs and to promote economic development.

This study presented a few limitations. First, the external validity of the study is limited, since only five cases were analyzed. Consequently, the findings cannot be generalized. However, it must be said that some of the companies discussed are leaders of their markets. Second, this is a one-sector analysis. In other words, the findings are specific to the electric-electronic sector. Finally, the amount of data collected was extensive, taking more than two years to collect in all. The amount of information employed is also extensive and it was, at times, difficult to analyze. This is a limitation, despite the richness of this qualitative study.

Further researches should take into consideration other sectors in order to test the conclusions of this study in an environment other than high technology. Equally, similar research in other newly industrialized countries may present results to be compared to this work. Finally, a deeper study about the alliance negotiation process should uncover important aspects explaining the success or the failure of a partnership via the contract negotiation and the firm's strategy

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