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Technological Learning Through Cooperation: Studying Greek Firms

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Abstract

In this paper, we consider technological learning of firms as crucial for their long – term survival and competitiveness. Thinking that a partial answer to the issue of the closure of the technological gap between technologically more advanced and technologically less advanced firms is the transfer of technology from the former to the latter, we consider the opportunities for learning that are present in inter – firm technological cooperation agreements. The study of the factors that have a bearing upon the learning achieved by the technologically less developed firms, through their cooperation with more advanced ones, constitutes the objective of our study. This objective is pursued through 31 cases of technological cooperation agreements between Greek and foreign firms, specifically aimed at technological learning. We test several theoretical hypotheses on factors that seem to have a bearing upon learning achieved. The results seem to indicate that factors related to the quality of the relationship between partners have a major role to play for learning.

Keywords: organizational, learning, cooperation.

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Introduction

Technological learning of firms is crucial for their long – term survival and competitiveness. For firms, the real question is how to learn faster than competitors do. Our research focuses on the ways learning can be achieved through inter – firm cooperation agreements. Successful technological cooperation agreements between Greek and foreign firms, as well as between Greek firms, can perhaps in the long – term partially close the technological gap separating Greece from technologically and industrially more advanced countries. Seen in a broader context, our research question also concerns any technologically and industrially less advanced firm or country.

As technology plays an ever more important role for the production of goods and services, while the speed of technological change is also increasing, technologically less advanced firms and countries find themselves lagging. As technology constitutes the basis for production and the latter creates value, income, as well as the very social fabric and structure of countries, increasing "technological illiteracy" is fast becoming a crucial issue for the survival of firms, countries and people alike.

A question that is beginning to seriously challenge firms of technologically and industrially less developed countries is exactly how much they can afford to be left technologically "behind" and still be an integral part of the international production system.

A partial answer to the issue of the closure of this technological gap is the transfer (or, rather, sale) of technology from technologically more developed to less developed firms (Furtado & de Freitas, 2000; Ernst, 2000; Kim, 1997). In the past, technology transfer was often more the choice of technologically more developed firms, in the sense that they used to select recipient firms in countries with lower production (labour, capital and political) cost. There has been a whole stream of studies on how technologically less developed firms can really transfer and assimilate technology, instead of merely purchasing it. Several of these studies focused on the way restrictions posed by the seller determined the technological future of the recipient. This focus subsequently gave rise to the study of ways to overcome such restrictions, on the part of the recipient firms.

The theoretical focus shifted when it became evident that, on several occasions, transferring firms were not to blame for the lack of technological assimilation on the part of the recipients. Rather, the difficulty was frequently the lack of a certain level of technological capabilities that would enable the recipient to understand and assimilate the technology transferred. As a consequence, the focus shifted once more to the examination of technological capabilities of firms.

Nowadays, international competitive circumstances have driven firms to seek collaborating partners for accomplishing many of their functions. Only a very small number of firms are still fully capable of operating and producing autonomously and vertically. However, while cooperation between firms of roughly the same technological level are just about self – evidently feasible, as long as their technology and goals are complementary, what about cooperative efforts between firms of differing technological capabilities?

The study of the factors that have a bearing upon the learning achieved by the technologically less developed firms, through their cooperation with more advanced ones, constitutes the objective of our study.

Objective and Data Collected

The objective of the study is then the identification of the factors affecting technological learning through inter-firm cooperation agreements. The research project is based on empirical case studies of technological cooperation agreements between Greek firms of the local defence industry and foreign firms. We are interested in studying learning achieved by Greek firms. We put our theoretical views to the test through an econometric study of 19 firms with technological cooperation agreements aimed specifically at learning.

Methodologically, each firm in our sample was asked to describe two cases of technological cooperation it was involved in: the most and the least successful. This made easier the distinction between factors driving technological learning and those hindering it. The criterion distinguishing most from least successful cooperation cases was learning achieved by the Greek firm, as evaluated by the latter. All answers were given at a 1 to 5 Likert scale. It is also important to note that firms were asked to describe cooperation cases of at least two years duration, which had been signed during the last ten years (all cases refer, then, to cooperation agreements that signed between ’91 and ’99). The restriction as to the minimum duration had to do with the fact that a cooperation agreement needs mum duration had to do with the fact that a cooperation agreement needs considerable time before starting to show what can actually be achieved by the partners. The restriction as to the dates the agreements were signed relates to the need to collect data from executives that had personal and relatively recent experience with the cases described.

At present, the Greek defence industry constitutes of about 80 firms, distributed by industrial sector as follows: metal fabricated products and constructions 37%, electrical and electronic equipment 25.9%, transportation means 18.5%, machinery 9.26% and rubber and plastic products 9.26%.

In all, 19 out of a total of 45 firms with cooperation agreements fitting the above restrictions responded and were visited. We collected data concerning totalling 31 cases of cooperation, 19 cases describing a most successful agreement and 12 cases describing a least successful one.

Theoretical Propositions

Our theoretical propositions were measured with the help of composite variables. That is, we created the variables by using several different but related dimensions – criteria. The dimensions – criteria we used for the creation of each variable are presented in Table 1.

Proposition 1: Duration of Cooperation: the greater duration of an agreement should be positively related to technological learning achieved.

Since the relationship continues, it can be assumed that (a) partners have adapted well to each other and know what they can and cannot expect, avoiding misunderstandings and efficiently solving any problems that naturally arise (Wathne et al, 1996), (b) it enables the partners to transfer newer technology and knowledge with less risk and, (c) partners can share new information and/or improvements that either of them may have achieved upon the technology that has been the basis of the cooperation (Lall, 1985). The longevity of an agreement does not necessarily imply a successful relationship, but longevity is certainly a prerequisite for successful learning.

Proposition 2: Cooperative Experience: the greater the cooperative experience of a firm, the more probable it is to achieve technological learning through its cooperation agreements (Anand & Khanna, 2000).

This is because a more experienced firm has a greater capability to search for, locate and contact potential partners with complementary technological capabilities and goals (Cohen and Levinthal, 1990). Second, a more experienced firm has a better understanding of what can be expected from cooperation, as well as of the best ways to extract it. Third, experience helps to overcome the inevitable difficulties characterizing any relationship between firms.

Proposition 3: Cooperative Business Culture: the more a firm's culture is oriented towards cooperation, the easier it is for the firm to develop alliance management capabilities and hence to achieve technological learning and probably competitive advantage (Ireland et al, 2002).

Firms that are flexible, adaptive and open – minded are more suitable for interaction with other firms and for knowledge transfer. Firms with a business culture supportive of trust, directness, openness, honesty, search and experimentation are more probable to better grasp and assimilate benefits related to cooperation agreements, than are firms avoiding cooperation in order to protect proprietary knowledge. A firm with a more cooperative culture will have organizational and administrative structures and procedures that provide more potential for knowledge assimilation, receptivity (Lane et al, 2001), for long-term orientation, for the better understanding of the difficulties caused by the varying perceptions of the partners, etc.

Proposition 4: Cultural Compatibility: the more culturally compatible the partners, the better the results of their cooperation agreement.

Better cultural compatibility between partners will result in fewer and more manageable difficulties, disagreements and arguments, while they will be better able to jointly plan the future of the partnership. The term "cultural fit" refers to the case in which the characteristics of the different cultures of partners can be beneficially combined, or adapted in a way that is mutually acceptable (Child and Faulkner, 1998: 245). Cultural compatibility creates more opportunities for the building of trust. Poor cultural compatibility will breed suspicion and function as a barrier to trust. Personal relations of good faith and trust are important for enhancing cultural compatibility between partners (Von Hippel, 1986, 1988, Eriksson and Hakansson, 1990). For this reason, cultural factors such as a common language, educational background, common ideas and experiences, or even common hobbies, play a very important role in the relations between partners and thus affect what can be learned.

Proposition 5: Communication: the better the communication between partners, the more probable it is to achieve technological learning through cooperation agreements.

It is widely held that in the process of technological accumulation, tacit knowledge is frequently more important than codified specifications, blueprints, manuals, documentation etc (Pavitt, 1986). Since tacit knowledge is quite difficult to communicate, its effective transfer usually depends on the interaction, exchange and movement of personnel (Bresman et al, 1999). Thus, beside each and every formal cooperation agreement there exist several informal networks between employees of the partners. This leads to the crucial issue of effective communication between partners. Organizational and administrative structures: (a) specify the ways in which partners can interact, (b) affect the processing of information and decision making, (c) control the degree to which informal communication is accepted and, finally (d) affect the way in which joint knowledge is created and diffused. Flexible, adaptive and open – minded firms allow wider and deeper levels of interaction and of knowledge transfer.

Proposition 6: Trust: the greater the trust between partners, the more probable it is to achieve technological learning through cooperation agreements. Additionally, greater trust allows partners to reveal some of their "close to core" technological capabilities.

In any cooperation agreement, knowledge and learning do not just happen. Exposure to new information is a necessary but not sufficient prerequisite for learning. There has to exist a minimum level of trust between partners. Firms logically tend to protect their physical and human capital. Without trust, however, exchanges of information and knowledge are contained and partners are less willing to embark on common ventures or undertake joint risks. Trust and commitment are the *sine qua non* of all cooperation agreements. Trust is the belief that the partner will act in a predictable way, will keep true to their promise and will act in ways that will not be harmful for any of the partners. In other words, trust is the willingness of one partner to relate to another, in the belief that the latter's actions will be beneficial, despite the fact that there is no guarantee it will be so (Kramer and Tyler, 1996, Lane and Bachmann, 1998). Trust, then, contains risk because without any risk as to the outcome of the relationship there would be no need for trust.

Proposition 7: Tacit nature of technology and causal ambiguity: the less tacit the nature of the technology involved in the cooperation agreement and the less causal ambiguity there exists, the more probable it is to achieve technological learning through cooperation agreements.

A critical issue that has been identified in the literature concerns whether the degree to which knowledge is tacit and / or ambiguous affects the learning process (Lei, Slocum and Pitts, 1997, Simonin, 1999). The nature of the knowledge contributed by one partner is extremely important for the learning that can be achieved by another. A vital prerequisite for learning through technological cooperation agreements is the degree to which tacit knowledge can be transformed to explicit knowledge that can be communicated between partners.

The dimensions of knowledge have been discussed on the basis of the work of Polanyi (1966) who classified human knowledge as "explicit" and "tacit". The whole meaning of tacit knowledge can be summarised as "*I know more than I can express*". Thus, the more tacit the knowledge (i.e. technology) involved in the cooperation agreement, the more difficult it is for the learning partner to actually understand and assimilate it. Reversely, the more explicit the knowledge, the easier it becomes for the learning partner to assimilate it, and simultaneously the less valuable it is.

Simonin (1999) argues that the starting point for the study of technological learning through cooperation should be the concept of causal ambiguity (Reed & DeFillipi, 1990; Mozakowski, 1997). This ambiguity creates barriers to learning that make it hard for the learning partner to understand the exact knowledge and capabilities that constitute the technology of the foreign partner. In other words, the relations between cause and effect are unknown or unclear. Simonin describes the tacitness, specificity and complexity of knowledge as the main causes for causal ambiguity.

Proposition 8: Specificity of technology: the less specific the technology involved in the cooperation agreement, the more probable it is to achieve technological learning through cooperation agreements.

As far as specificity of technology is concerned, what we seek is to discover the degree to which the partner of the Greek firm had undertaken significant and *ad hoc* investment in physical and human capital, so as to create and accumulate their technology during a significant time period. In cases where the partner's technology is the result of such *ad hoc* high and long-term investment then it should be (a) quite difficult for the Greek partner to assimilate and, (b) even more difficult to reproduce the exact conditions under which the partner use their technology in maximum effect.

Proposition 9: Complexity of technology: the less complex the technology (as well as the knowledge upon which it is based) involved in the cooperation agreement, the more probable it is to achieve technological learning through cooperation agreements.

Proposition 10: Complementarity: the more complementary the technologies used by the partners, the more probable it is to achieve technological learning through cooperation agreements.

The concept of complementarity is an extension of the notion of absorptive capability. Complementarity concerns the achievement of synergies in knowledge used by the partners. These synergies create opportunities that could not be achieved by each partner in isolation (Hitt et al, 2001). Shenkar and Li (1999) argue that the wish to acquire complementary resources might be a main motive for firms to enter into cooperation agreements and may represent one of the most important criteria used to select alliance partners, for technologically strong firms from advanced countries, as well as for firms with weaker technological capabilities coming from less developed countries (Hitt et al, 2000). It seems that firm experience in technological fields close to the technology involved in the cooperation agreement and complementarity in resources both have a positive influence upon the capability of a firm to absorb new information. Thus, previous relative experience and complementarity have a positive impact upon both the transfer of knowledge and the learning process. In addition, even non – technical similarities that have to do with similar structural or administrative characteristics, or even similar compensation practices, can also have a positive impact upon the transfer of knowledge through cooperation (Lane & Lubatkin, 1998). This in turn increases the chances that even firms with vastly different knowledge bases can learn from one another, given they present similarities in their more general characteristics.

Our last variable is technological learning achieved, that is, our dependent variable. The dimensions of technological learning that were used to capture learning actually achieved by Greek firms through the cooperation agreements they described are presented in Table 1. Through criteria (a), (b) and (c), we attempt to determine the degree that our sample firms achieve single loop learning [criterion (a)], double loop learning [criterion (b)] and deutero learning, or learning – to – learn [criterion (c)] (Argyris & Schon, 1978).

Criteria (d) and (h) demonstrate the degree to which the technologies learned through the cooperation are modern, and the time period for which it is estimated that they will remain useful. It is possible that more successful cooperation agreements are related with a comparatively lower technological level of the content of cooperation. Criteria (e) and (g) measure the rate of improvement of the technological capabilities of our sample firms, while criterion (f) is used to investigate the degree to which the technologies involved in the cooperation agreement can be used for purposes beyond those of the agreement. When this is true, technological learning can more easily be diffused to more functional departments of the sample firm.

Table 1. Variables and Dimensions – Criteria Used to Create them
(X1) Duration of Cooperation (one-dimensional)
(X2) Cooperative Experience (α=0,72)
(a) We have in the past engaged in a great number of technological cooperation arrangements
(b) The results of our past technological cooperation arrangements were generally highly successful
(c) We have in the past cooperated with competitors
(d) Independent from the described cooperation, our firm is quite familiar with the skills and technological know – how of our partner
(X3) Business Culture (α=0,74)
(a) Teamwork is very important for our firm
(b) Management considers technological cooperation to be an important strategic tool
(c) Our firm is willing to take the potential risks of a technological cooperation
(d) Our firm has established mechanisms for supporting technological collaboration, such as an alliance or cooperation directorate or office, etc.
(e) Our firm is using specific and explicit partner selection methods
(f) The combination of our resources and skills with those of the partner, will give to the result of our cooperative venture a competitive advantage
(X4) Compatibility of Partners (α=0,82)
(a) Our partner follows a strategy that is compatible to our own (e.g. we are not targeting the same markets, or aiming at the use of similar marketing techniques)
(b) Our partner is unlikely to become a competitor in the foreseeable future
(c) Our combination with the described partner will create value that will pre – empt our competitors (our cooperation actually reduces the options left open to the rest of our competitors)
(d) The partner’s organizational structure is compatible to our own (we can communicate with minimal

bureaucratic or procedural difficulty)

(e) Our partner's national culture is very different from our own

(f) Language difficulties constitute a serious natural barrier in ours' and our partner's efforts for communication and understanding

(g) Our partner's business practices and ways of operation are similar to our own

(h) Our partner's business culture and management style are similar to our own

(X5) Communication between Partners (α=0,82)

(a) Employees (executives, engineers and technical staff) of our firm have very frequent ***in – person*** communication with our partner's staff

(b) Employees (executives, engineers and technical staff) of our firm have very frequent ***indirect*** (i.e. through phone, fax, mail, e-mail) communication with our partner's staff

(c) Employees (executives, engineers and technical staff) from our firm ***and*** our partner's staff have ***jointly*** attended or participated in scientific or technical conferences

(d) Employees (executives, engineers and technical staff) of our firm ***and*** our partner's staff ***jointly*** evaluate the strengths and weaknesses of other competitive firms or firm alliances or constellations

(X6) Trust between Partners (α=0,70)

(a) Our partner is willing to share in – depth information and knowledge with us

(b) In order to share in – depth information and knowledge with us, our partner requires the signing of a formal agreement

(c) Our partner is very cautious about the information and knowledge that they share with us

(d) We often cooperate with our partner informally, beyond the strict clauses of our written agreement

(X7) Tacitness of Technology & Causal Ambiguity (α=0,70)

(a) Employees (executives, engineers and technical staff) of our firm can easily learn and assimilate technologies used by our partner in the described cooperation, by studying a full set of blueprints and other documentation

(b) The training of our firm's employees (executives, engineers and technical staff) on technologies used by our partner in the described cooperation is a relatively quick and easy task

(c) The knowledge that our firm wishes to acquire through the described cooperation can be explicitly formalized in technical manuals, documentation and technical specifications, and can be transferred through systematic training

(d) The causal relations between any action and outcome, or input and output, in the use of the technology used by the partner in the described cooperation are clear and unambiguous

(X8) Specificity of Technology (α=0,75)

(a) In order to develop the technologies, capabilities and skills they use in the described cooperation, our partner has in the past undertaken significant ***investment*** in specialized ***equipment and facilities***

(b) In order to develop the technologies, capabilities and skills they use in the described cooperation, our partner has in the past undertaken significant ***investment*** in the ***development of human capital***

(c) The technologies and technological capabilities of our partner constitute the result of a combination of many interrelated techniques, processes, resources and human capital

(X9) Complexity of Technology (α=0,88)

(a) The described cooperation requires on the part of both (or all) partners investment for the creation

of specialized (tailored to the cooperation) technological, human or production resources
(b) The use of the technologies used in the described cooperation requires complicated production processes and procedures, extensive testing, etc.
(c) The use of the technologies used in the described cooperation requires the involvement of a great number of our firm's employees (executives, engineers and technical staff)
(X10) Complementarity Between Partners (one-dimensional)
(Y)Technological Learning (α=0,86) (a) Through the described cooperation, our firm is learning about specific new techniques, like for example components production or quality control techniques (b) Through the described cooperation, our firm is learning how to introduce new production organization methods and processes, and how to operate these (c) As a result of the described cooperation, our firm has established new criteria for measuring and evaluating firm performance and success, and has determined new factors that are now considered as important for its success (d) The knowledge acquired through the described cooperation is (or was) new in a global level (e) Our technological capabilities improve (or have improved) quite fast, as a result of the described cooperation (f) The knowledge our firm acquires (or has acquired) through the described cooperation can be applied to uses beyond those strictly prescribed in our written agreement (g) The described cooperation enables (or has enabled) our firm to come technologically closer to our partner (h) The technologies and technological capabilities acquired through the described cooperation are up – to – date and will continue to be used by the industry for many years to come
Source: Authors

Econometric Models

The dependent variable of our model is technological learning achieved by Greek firms through the cooperation agreements they described. The 8 composite independent variables are those mentioned earlier and presented in Table 1. The Cronbach Alpha coefficient in all cases exceeds 0.7, thus our variables are internally consistent and coherent. In addition, there are 2 one-dimensional independent variables, duration of cooperation and complementarity between partners.

In order to examine the differences between the rates of technological learning achieved by Greek firms, as well as the factors affecting it, we used the non – parametric Kolmogorov – Smirnov Z test. We grouped the dependent variable in two categories, giving the value of (1) in cases where learning was achieved that was above the average of the total of our sample firms and (0) for cases where learning achieved was below average.

Table 2. Non – Parametric Test Kolmogorov – Smirnov Z							
	Most Extreme Differences			Kolmogorov-Smirnov Z	Asymp. Sig. (2-tailed)	**Exact Sig. (2-tailed)**	Point Probability
	Absolute	Positive	Negative				
X1 Duration	0,420	0,000	-0,420	1,164	0,133	***0,039***	0,017
X2 Experience	0,538	0,059	-0,538	1,490	0,024	***0,009***	0,001
X3 Culture	0,571	0,000	-0,571	1,583	0,013	***0,005***	0,000
X4 Compatibility	0,655	0,000	-0,655	1,816	0,003	***0,001***	0,000
X5 Communication	0,941	0,000	-0,941	2,608	0,000	***0,000***	0,000
X6 Trust	0,693	0,000	-0,693	1,921	0,001	***0,000***	0,000
X9 Complexity	0,311	0,311	-0,063	0,862	0,448	0,280	0,018
X7 Tacitness and Ambiguity	0,739	0,000	-0,739	2,049	0,000	***0,000***	0,000
X8 Specificity	0,315	0,059	-0,315	0,873	0,431	0,271	0,052
Source: Authors							

The results presented in Table 2 show that, apart from variables X8 and X9, all others are significantly important for the interpretation of the differences observed in the rates of technological learning by the Greek firms.

Additionally, in order to study the direction of the relationship between learning and the independent variables, we used the Pearson correlation coefficient. Most of the independent variables are statistically significant, confirming the results of the Kolmogorov – Smirnov Z test.

Moreover, many of the independent variables are positively and statistically significantly correlated to one another. This means that the study of the relative importance of each independent variable for the explanation of learning achieved will be tricky, as there will certainly be multicollinearity. Beyond the problem of multicollinearity, the number of our observations in relation to the number of independent variables is small. Thus, it would be difficult to run regression analysis including all independents.

For these reasons, we chose to use factor analysis, through the method of principal components. This eliminates the problem of multicollinearity and reduces the number of independent variables.

As can be seen from Table 3, the independent variables are grouped in two components. In order to better determine the degree of participation of each independent variable in the two components, the varimax method was used with the criterion Kaiser – Meyer – Olkin.

Table 3. Rotated Component Matrix

	Components	
	1	***2***
X5 Communication	,882	
X3 Business Culture	,808	
X4 Compatibility	,802	
X7 Tacit and Ambiguous Technology	,784	
X6 Trust	,708	
X2 Experience	,705	
X8 Specificity		,863
X9 Complexity		,720
X1 Duration		-,553

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser – Meyer – Olkin Normalization
Source: Authors

The first component comprises of the independent variables: communication, business culture, compatibility, tacit and ambiguous technology, trust and experience. The second component comprises of: specificity, complexity and duration of agreement. The group of variables within the first component is related directly to the characteristics of the relationship that has developed between the partners (that is, the first component reflects the quality of the relationship between firms). The group of independent variables within the second component is more related to the characteristics of the technology that was involved in the cooperation agreement.

Using the factor scores of each observation for each of the two components, we created two new independent variables. The first variable obviously included X2, X3, X4, X5, X6 and X7, while the second included X1, X8 and X9. These two independent variables were then used in regression analysis, with learning remaining, of course, the dependent variable.

However, the second independent that was based on the second component proved to be statistically not significant. By removing this second variable (since the Kolmogorov – Smirnov Z test had shown X8 and X9 to be statistically not significant) and using only one independent variable, we had the results presented in Table 4. The sign of the remaining dependent variable was correct; it was statistically extremely significant and gave an adjusted R^2 of 0.602, which was quite satisfactory given the nature of our research.

Table 4. Regression Analysis (component 1)

	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Adjusted R Square
	B	Std. Error	Beta			***0,602***
(Constant)	22,129	0,896		24,7	0,00	
Component 1	6,203	0,911	0,784	6,81	***0,00***	

Source: Authors

Finally, by introducing the independent one-dimensional variable X10, complementarity between partners (Table 5) we found the sign to be correct, the variable is statistically significant at the 1% level and contributes to the slight increase of adjusted R^2 to 0.627. This second model does not appear to present any multicollinearity problem, since the tolerance of component 1 and of X10 is 0.903.

Table 5. Regression Analysis (component 1 + Complementarity)

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adjusted R Square
	B	Std. Error	Beta			***0,627***
(Constant)	19,183	1,933		9,922	0,00	
Component 1	5,709	0,928	0,722	6,149	***0,00***	
X10 Complementarity	1,234	0,724	0,2	1,705	***0,099***	

Source: Authors

Conclusions

Learning is a difficult to observe and factor. The effect of learning, however, is enormous. The same is true for all factors having an effect on learning: they are soft, not easy to observe and measure. Additionally, as was seen through our empirical research, these factors are interrelated. This means that many conditions have to be simultaneously satisfied for a firm to be able to obtain maximum benefits from a cooperation agreement.

Many firms, especially in technologically less developed countries, either cannot fully grasp the importance of these factors, or are unwilling to place proper emphasis on them. This is because they would mean investment in factors not easily manageable within existing firm structures and, thus, difficult to control and evaluate.

There are indications, however, that this attitude is changing. Some firms are beginning to create structures specifically aimed at the management of cooperation agreements and at the maximization of learning that can be achieved through them. This issue is becoming especially important for firms in technologically less developed countries that face the additional problem of not possessing the resources available to firms in technologically developed countries

As with all research, there are some limitations to the study we present, as well as some questions that may deserve future research. (a) Our research sample was small, as happens with the majority of the studies of this kind. (b) It would be best if empirical research could focus on samples where the independent variable "learning" concerns the same technology or best practice, so as to make comparisons more credible. (c) The issue of the relations between technological cooperation and learning should be studied in an integrated way. One has to study all stages of the cooperation, beginning with the motives, continuing with the partner selection criteria, the dynamics and changing structure of the cooperation, as well as its final outcome.

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