
Hi-tech small firms in developing countries: An exploratory analysis

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Globalization is a central driving force behind the rapid social, political and economic changes that are reshaping modern society and world order. One of the key elements of globalization is Information Technology (IT). IT plays a central role in helping developing countries (DCs) participate in the global economy. This paper investigates the factors that are essential for the growth of IT in DCs and focuses in particular on the role of local ICT small and medium enterprises. Through internationalization, indigenous entrepreneurs get around domestic market inefficiencies. Moreover, the increasing relevance of their activities is fostering Foreign Direct Investments (FDIs) and forcing local governments to deal effectively with obstacles hindering the growth of IT. In order to highlight these aspects, the paper presents some early results derived from a large research project carried out by the authors and aimed at analyzing the level of ICT diffusion in the North African region. On the basis of some case studies, in this paper we try to draw some implications for further research on hi-tech entrepreneurs in developing countries.

1 Introduction

On the social ground, IT may play a remarkable role for the social development of DC (World Bank 1999, OECD 2001). The modernization of local public administrations through the adoption of the ICT and e-government practices (G2G, G2C, G2E) can remarkably increase both their efficiency and their effectiveness. ICT can also offer a fundamental contribution to the improvement of basic public services such as education and healthcare. Ultimately, ICT capabilities to virtually eliminate distance can help reduce imbalances between local and urban areas.

With regards to economic aspects, globalization is fostering competition and firms operating in DCs can no longer rely on low costs to gain competitive advantages, both domestically and internationally. IT allows these firms to increase their competitiveness, and eventually move up the value added ladder. Furthermore, the adoption of IT is beneficial to traditional manufacturing sectors (e.g. textile, mechanical, oil) and services (tourism), on which developing countries heavily rely on (UNCTAD 2001). Moreover, the growth of the IT in DCs creates value added sectors that eventually attract foreign direct investments (FDIs). Ultimately, it fosters the modernization of DCs, and originates a spill-over effect which is beneficial to traditional sectors.

This paper first focuses on factors essential to foster the growth of ICT in less industrialized countries (§2), stressing the importance of both ICT users and ICT providers (indigenous entrepreneurs, multinational ICT companies). Then, an analysis of those factors through a study carried out by the authors in the North Africa region is presented (§4,5) to describe important characteristics of the local ICT entrepreneurs and companies on the basis of some case studies.

2 Factors influencing IT adoption and development in developing countries

There is a vast literature examining factors that play a key role in the development of IT in DCs. These factors influence structures, strategies and performances of local ICT companies in a remarkable way. Thus, in order to analyze the role of local ICT companies, in particular of small businesses, it is necessary to investigate and describe thoroughly the main factors either hindering or fostering the development of the ICT in DCs.

On the basis of the review of the literature, we classify factors in the following clusters: infrastructure, technology and education, finance, social, market, administrative systems (figure 1).

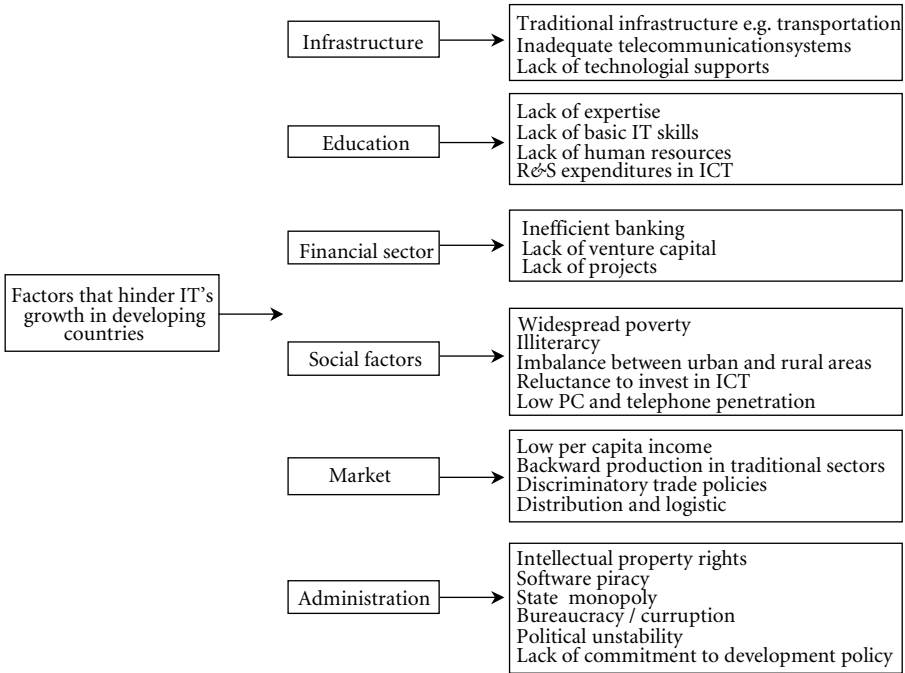


Figure 1: Taxonomy of the factors influencing ICT growth in developing countries

The *communication infrastructure* is crucial for the growth of IT (Davis, Bagozzi, Warsaw 1989), in particular for value added services such as IT outsourcing and electronic commerce (Mann, Eckert, Knight 2000). Instead, as most of IT products are non-tangible and easily transportable, improvements of the infrastructure of distribution and delivery (including the transport and postal infrastructure) are not necessarily related with productivity gains in some IT industries, such as software and IT training. On the contrary, the development of e-commerce requires excellent logistic and distribution capabilities and efficient traditional infrastructures.

Education and technological factors concern essentially the availability of adequate ICT-know-how in the local context. R&S expenditures in the ICT sector are a fundamental indicator of ICT industry capability in a given country (OECD 1998); it goes

without saying that such expenditures are nearly non-existent in many developing and emerging economies, with some exceptions (India, Korea, Malaysia). The availability of sufficient human resources will continue to be an overriding issue in the development of IT. The lack of expertise directly affects the growth of firms operating in this sector. Furthermore, the shortage of both basic IT skills and managerial figures limit the demand of indigenous firms for information systems' implementation (Abdul-Gader, Alangari 1994). It is not accidental that the most successful DCs in the ICT industry, such as India, the Philippines, Malaysia, and China (Harindranath, Dhillon 1994), have become increasingly able to provide a sufficient number of IT technicians. This is due to both demographical reasons and the presence of a good and high selective ICT national educational system.

An efficient and sound *financial structure* is critical for the growth and development of the IT sector in less industrialized countries (Abdul-Gader, Alangari 1996, Hassan, 1998, Lederer, Mendelow 1990). Inadequate regulation framework and the lack of competition among financial institutions, originate shortage of financial resources for IT firms. In the majority of developing countries, the inefficiency of traditional financial institutions is coupled with the absence of alternative resources, such as those provided by private equity funds (Frankel 1998). Furthermore, traditional funding institutions are reluctant in investing in high-tech high-risk activity.

As many research-studies have pointed out, ICT industry could grow and produce benefits in DCs by taking into account *social development* (Burn, Jordan 1997, Janczewski 1992, Hassan 1998, Kahen, Sayers 1994, Lehmann 1994, Lopez, Vilaseca 1996, Mundy 1996, Palvia 1998, Spletstoesser, Towry-Coker 1999). Most of these studies show that a fundamental aspect for creating positive opportunities is represented by the capability to integrate information and communication technologies with general development policies.

Cultural environment is another important element promoting sustainable development of such technologies. Low literacy rates and lack of appropriate skills or managerial abilities determine high failure risks of IT implementation. Language may represent a barrier, especially for the Internet (Fagan 2001, OECD 1998b). Differences among culture play a key role in the development and transfer of IT (Barry, Venkatachalam 1994, Day 1996). They can prevent indigenous population from taking full advantage of IT products (Janczewski 1992) and influence the way local firms design and develop applications. Low participation indicate that there may be cultural resistance to IT (Goodman, Green 1992, Hasan, Hall 1990, Kamel 1996). For example, reluctance in spending money on ICT is due to the incapability to perceive the real benefits of ICT technologies by potential consumers. Furthermore, entrepreneurs operating in traditional sector show diffidence as regards to investing on intangible assets such as software licenses, consultancy and training.

Administrative and legal systems are crucial for market development (Olsen 2000). Besides the negative effects of inefficient public administration (bureaucracy, corruption) and political instability, a critical factor for IT development is the availability of adequate normative IT-specific framework (Damsgaard, Lyytinen 1999). Inefficient commercial law can seriously affect IT activities, such as IT outsourcing, whose imple-

mentation relies on legal contracts. Moreover, restrictions on foreign exchange transactions could limit the possibility for small and medium-sized enterprises (SMEs) to import products such as hardware and software or services such as IT consultancy, which are crucial for start-up firms.

As intangible IT products are expensive to produce but easy to replicate, inefficient intellectual property protection laws can discourage both indigenous and foreign firms from investing in IT activities in developing countries. However, for countries in their early stages of IT dissemination, weak Intellectual Property Rights (IPRs) may represent an advantageous infant industry-strategic-policy (Krugman, Obstfeld 2000). In particular, limiting IPRs may provide inexpensive technological transfer, to the extent that imitative and adaptive capabilities are effective (Maskus 2000). Such policy can also foster the network effect, which is beneficial to the development of the IT sector. But in the long term it can become a major disincentives for foreign investments.

With regards to the Internet, e-commerce requires adequate legal framework for on-line economic transactions and customers protection against electronic frauds. Furthermore, ISPs activities should be regulated through unambiguous laws aimed at encouraging competition and regulating revenues sharing among ISPs and network operators.

In general, deregulation and privatization of telecommunication services is a major issue in fostering ICT growth. Empirical and anecdotal research by the World Bank (Wallsten 1999, Dasgupta, Lall, Wheeler 2001) demonstrates that developing countries' policies are very often inadequate as regards to privatization of telecommunications, introduction of fixed lines as well as wireless competition, and creation of independent telecommunication bodies that significantly improve the telecommunication sector.

The negative interactions among all the considered factors (infrastructure, education, financial, social, administration) can, in the worst cases, prevent any form of ICT development in DCs. Therefore, such interaction could hinder the positive impact of ICT industry on indigenous social and economic development.

3 Sustainable development of IT in developing countries

Notwithstanding these limitations, in many DCs the growth of a local IT industry is a well acknowledged fact. By exploiting opportunities offered by the market globalization, many countries such as India, China, and Malaysia are becoming important ICT producers, especially in the software sector. In this respect, a key role is played by SMEs operating in the IT sector. The positioning of such firms in the global market is helping these countries promote a sustainable development of their own ICT industry.

Most of the researches in this field outline the importance of *sustainability* in order to avoid further external economic "colonization" and assure long term positive effects on general social and economic development (Aladwani 1998, Hassan 1998, Mejias et al. 1999, Mursu et al. 1999, Spletsstoer, Coker 1999). On the basis of the analysis presented in the previous section, it is plausible to state that sustainable local IT development is hindered by two main factors: the scarce inner IT demand and the lack of adequate local technological competencies. More specifically, all factors hindering the IT

development outlined in the previous section affect in a negative way both the capability of producing and using ICT products and services.

Therefore, starting from a structural factor analysis this paper focuses on the key role played by domestic markets and indigenous entrepreneurs in fostering IT growth in developing countries.

In many IT activities, such as IT outsourcing, co-connection (Kapur, Ramamurti 2001) is a good enough alternative to co-location (Porter 1990, 1998). More specifically, co-connection turns out to be the main bridging mechanism that links supply and demand. Nevertheless, domestic markets are crucial at least in the early stages of IT development. According to Hassan (1998), for obtaining export business, the firms need to establish credibility, demonstrate a solid track record of product development, and demonstrate access to financial and managerial resources. But low margins in the local market, the type of work available, and the client's orientation towards investment in IT, makes a software firm's job quite difficult in DCs.

In this respect, the capability of domestic markets to attract Foreign Direct Investments (FDIs) plays a key role in getting around structural obstacles. The benefit related to foreign firms entering domestic markets of developing economies is difficult to be quantified (Manral 2001). Technological transfer and spill-over effects should not be assumed to be an automatic consequence of foreign firms' presence in developing economies (Kathuria 2000). Nevertheless, the presence of such firms is crucial for creating networks ("Keiretsus") which could eventually help indigenous entrepreneurs overcome domestic markets' inefficiencies. According to Lehmann (1994) such Keiretsus (Dunning 1993, Johanson, Vahine 1990) have to be centered around a "hub" from an information technology intensive industry. In DCs, often foreign ICT multinational companies play the role of the hub.

Firms being part of the Keiretsu would perform highly differentiated IT tasks (supply and distribution of software; technical support; supply of hardware and technical supply; development of software; education and training, including management training). For indigenous firms, the Keiretsu turns into a micro market substituting the domestic market. In such a market, actors find their customers across different non-competing industries. The intensive exposure to all aspects of information technology originates a spillover-effect among firms participating in the Keiretsus. However, the fragmentation of local competencies over many business segments could hinder the possibility of know-how sedimentation at the local level.

An alternative model for the development of local IT industries is the so-called "Industrial District" (ID). Some studies focusing on Italian SMEs (Mussati 1990, Marchini 1995), demonstrates that one of the advantages of ID is the availability of companies well established in a network within the same territory. As a consequence, small local companies should aim, at least partially, to a territorial specialization through the identification of specialized areas of know-how. This would eventually create territorial competence centers.

Thus, a possible solution to overcome limitations due to the absence of a solid internal market can be the internationalization of local IT companies through strategic partnership with foreign IT firms. Partnerships can bring mutual advantages to both

local and foreign companies. Local companies can enlarge their market and enjoy considerable increase of their technological competence due to technology transfer. Foreign company can obtain two advantages: a) to have access to local qualified and low wage workforce; b) to enter into strategic and developing markets. If local qualified workforce is available and the local market has good potentialities, DCs can become significant contributors to the outsourcing of IT products and services.

This strategy could be in the short to medium term a way to overcome some structural fragility and can contribute to the consolidation of the fragile local ICT companies. In the long run, the presence of a consolidated local ICT industry can become an important driving force for the development of the local ICT market in three ways:

- a) By providing solutions for local SMEs, local public administration and consumers well suited to their high context-specific needs
- b) By putting pressure through lobbying on local government to invest in IT
- c) By developing local know-how and competencies that contribute to increase indigenous overall degree of competitiveness and foster (indirectly) the number of educated users.

It goes without saying that the success of such strategy rely on the increase in the level of competitiveness of local ICT suppliers and on the presence of some minimal structural requisites. Minimal structural requisites concerns sufficiently efficient TL infrastructures, liberalization of TLC sector, an initial kernel of local entrepreneurial ICT firms and inner country political stability (Aberdeen Group 2001, World Bank 1999).

In the following sections we show the first results obtained through a field research carried out by the Department of Business and Management Engineering of the University of Naples “Federico II”. The aim of the research was to investigate the factors influencing the development and the diffusion of IT within some developing countries located in North Africa. Within this research project we focused our attention on the issue of local ICT entrepreneurship. In this paper we present some case studies. Our aim is to verify, on an empirical basis, which are the characteristics of local ICT entrepreneurs and which role these characteristics may play in fostering the growth of IT within the analyzed DCs.

4 The research methodology

The results presented in this paper were obtained from a field analysis carried out by the authors in three North African countries (Egypt, Morocco, Tunisia) in the middle half of 2001 within a large research project. The research was aimed at drawing an updated picture of the local IT industry in the following respects: size, major trends, local policies, infrastructures, impact of IT development on social and economic growth. The analysis has been implemented at an exploratory level for three main reasons: a) lack of updated data; b) few previous studies available in the literature; c) extremely rapid changes in the sector at the local level due to recent liberalization policies. The research methodology was articulated as follows:

- a) *Field analysis*: after analyzing the literature and secondary sources, a structured questionnaire was implemented and distributed to a large sample of 152 small and me-

dium-sized IT local enterprises based in Egypt, Morocco, Tunisia. However, the answer rate was rather low (15%). In order to collect more data, a sample of firms was contacted for an on-site meeting and an interview. In the end, more than 50 local IT experts have been interviewed in three different countries.

- b) *Data analysis*: On the basis of collected data, the research group decided to focus on the analysis of local IT firms, as explained in §2. The aim of this phase was to investigate more deeply the factors influencing local ICT SMEs' growth.
- c) *Case-studies*: most interesting local companies have been the object of a more detailed analysis through a multiple case-study methodology. The aim of the study was explorative and descriptive.

5 Research results: the IT sector in North Africa

In this section we present a brief overview of the ICT industry in North Africa with respect to the structural factors presented in section 2.

The total population of Algeria, Egypt, Morocco and Tunisia is around 130 million. The inner stability of some countries of the region coupled with their proximity to Europe could play a key role when it comes to compete with firms operating in other developing countries. Moreover, as language skills are crucial in this industry, that French (Morocco, Algeria and Tunisia) and English (Egypt) are spoken in North-Africa represents a further advantage for those countries.

Notwithstanding geographical proximity and basic common aspects, countries involved in the study present sensitive differences as regards to technological, cultural and political factors influencing the diffusion of IT technologies.

Despite good basic TLC infrastructures, access to computers and telecommunication systems is still very scarce and most services are concentrated in the urban areas. The average density of household phones, public telephones, computers and Internet subscribers is much lower than in high-income countries. Very encouraging trends have emerged over the last few years especially in Egypt and Morocco. These are primarily due to the privatization of telecommunications implemented in such countries, that has given rise to an unexpected boom of the mobile communication.

Software development has made relative progress over time. There are many "best practices" cases in various sectors. In general, the average size of companies is very small. The great majority has between five and ten employees and is concentrated in urban areas. As regards to the software development segment, in Egypt and Morocco operate competitive SMEs. As a consequence, high quality of some software packages are produced locally and exported to foreign market, primarily the Gulf States and Europe.

Unfortunately, the growth of this sector suffers from shaky legal foundations. Computer piracy is still a deeply rooted practice. However, governments are stepping up their own efforts to prevent and combat piracy with strict measures. As a result, computer piracy has been reduced over the last few years.

The local electronics industry is still underdeveloped and hardware production is assembly oriented. Computer components and accessories are imported from the US

and the Far East. In Egypt and Morocco, Multinationals Companies (MNCs) are in contact with local distributors across a two-level structure made up of several distributors and retailers. These relationships are often not purely commercial links. In fact, they also involve exchange of know-how and development of solutions compatible with products distributed by leading companies. This phenomenon is generally considered positive and it may lead to outsourcing of high-level services in the middle-long term. Both Morocco and Egypt are candidates to become regional hubs for large MNCs operating in the IT sector, respectively in North West Africa and in the Middle East. In this scenario, indigenous small firms play a crucial role. In fact, not only does the efficiency of a Keiretsu rely on MNCs. Instead, that networks described in § 3 become competitive on a global scale is strongly related to the presence of innovative SMEs. Despite structural factors inadequacy, the attractiveness of such firms could encourage Foreign Direct Investment. India is a case in point.

The total number of Internet subscribers in MENA countries in 2000 was estimated around 300000. However, according to the UN Economic Commission for Africa, each PC with Internet or e-mail connection supports an average of three users. In general, access to the Internet remains limited to only a few privileged. Affordability barriers, PC costs and education levels have kept the Internet beyond the reach of most people. As a result, the level of e-commerce is currently very limited. Forecasts predict that in 2002, e-commerce business in the region should reach only 6500 billion US\$.

Besides common characteristics, there are significant differences in the level of IT development among MENA countries. The results presented in this paragraph are related to four countries: Egypt, Morocco, Algeria and Tunisia. In every country, the IT industry is at different stages of development. In Egypt, Tunisia and Morocco IT has made significant progresses overtime. However, Tunisia still suffers from a strong delay in the privatization of the TLC sector. Moreover, it represents a very small market for IT multinationals. In Algeria, the development of Information Technology is still at an embryonic stage.

Privatization of the Telecommunication sector is almost complete in Morocco, partial in Algeria and Egypt and practically absent in Tunisia. Not only do these countries differ as regards to the velocity of such process. Each country, in fact, has adopted its own procedures. In this respect, Morocco represents a “best practice” example in the region. However, privatization has been on the top of the agenda of every local government as a major tool to promote IT development. Therefore, the common denominator of such policies is the strong commitment of these countries to the growth of IT.

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
<i>Firm's core business</i>	Telecommunication equipment, software for telecommunication management and maintenance	CAD, Information systems for stock and inventory management, GPS systems for cars	ERP, software package integration and customization, e-business, consulting	ERP, DSS, E-business (internet/intranet solutions), software package integration, consulting	Software distribution of important foreign brands	Software package integration and software development for finance assurance, building industry	Software development and integration for Geomatics and GIS
<i>Other activities</i>	Product distribution on local market, subcontracting to local firms (developers)	Consulting	Software Distribution	Training center	Marketing and sale services	Software distribution	Software distribution
<i>Number of employees</i>	240 (120 software developers)	60	180	83	33	22	20
<i>Sales in 2001 (year sales growth rate)</i>	15 MS (NA)	3MS (50%)	8 MS (30%)	7 MS (25%)	15 MS (100%)	0.5 MS (NA)	0.5 MS (80%)
<i>Export as % of sale</i>	NA	50%	8-10%	NA	0%	10%	10%
<i>Organizational structure</i>	Divisional	Based on business area, Marketing department	Structured on business Areas and competence centers	Based on products, HR department	Informal	Based on projects, marketing department	Functional with a R&D team
<i>Merging</i>	Yes	Yes	Yes	Yes	No	No	No
<i>Current market scope</i>	Regional and International	Local and international	Local and regional	Local	Local	Local	Regional and International
<i>Availability of quality certification</i>	Yes	Yes	Yes	Yes	In progress	Yes	Yes
<i>Target country for partnership (or country of origin in case of direct ownership)</i>	France	France, Canada	France	France	Partners as distributors in other countries of the area	France	France, Canada, India
<i>Adopted partnership model</i>	Direct ownership	On-site/off-shore	On-site/off-shore	On-site/off-shore	Commercial partnership	Commercial partnership, looking for partners willing to outsource software development	On-site / Off-shore
<i>Main advantages deriving from partnerships / outsourcing as perceived by the entrepreneurs</i>	Low labor costs, language, availability of good skills, presence on local and regional market	Market enlargement, know-how acquisition	Market enlargement, know-how transfer, HR retention	Market enlargement	Revenues, a certain amount of know-how transfer	Revenues, knowledge transfer, market enlargement	Market enlargement, know-how transfer
<i>Main barriers hindering partnerships as perceived by entrepreneurs</i>	HR turnover, lack of a sufficient number of qualified human resources, scarce incentives to foreign investments	Lack of critical size, lack of adequate know-how, lack of quality certification	ITM Concerns for quality, lack of human resources, scarce incentives to foreign investments	Lack of adequate country image promotion, lack of qualified human resources	Lack of trust by ITM, scarce incentives to foreign investments	ITM concerns for quality and know-how protection, lack of adequate country image promotion	ITM concerns for quality, lack of human resources, inadequate promotion of country image (in any case too focused toward Europe)

Table 1: Case-study description

Needless to say, in many cases goals are not turned into actual policies. Lags are a common feature of policies aimed at promoting e-commerce and intellectual property rights protection as well. As regards to the Internet, the growth of the sector is hindered by firms that benefit from dominant positions, if not monopolies, in the ISP services and fixed telephony.

On the *social side*, all countries suffer from a widespread poverty and high illiteracy rate (except from Tunisia that benefits from a slightly higher GDP per capita and rate of literacy). With regards to the financial sector, all countries present a quite traditional banking sector, scarcity of funding sources for IT start-up and absence of venture capital initiatives. This despite the fact that banks and insurance companies, together with the public administration, are among the largest IT consumers in North African countries.

Seven case-studies were analyzed with respect to the following factors (table 1): entrepreneurs' characteristics, companies core business, other activities, company size, current market scope, export as a percentage of sale, target country for partnership, organizational structure, merging, adopted partnership model, availability of quality certification, main advantages deriving from partnerships as perceived by the entrepreneurs, main barriers hindering partnerships as perceived by entrepreneurs. Table 1 contains a short description of the case studies with respect to these factors.

6 Conclusions

Indigenous entrepreneurs are a driving force behind the development of IT in North Africa. Domestically, the emergence of IT networks (Keiretsus) and Industrial Districts, represents a self-made alternative to inefficient local markets. Moreover, the internationalization of indigenous IT companies through strategic partnerships is helping local actors increase their technological competencies. Such activities are also fostering FDIs, that are beneficial to the balance of payment of the recipient state. Moreover, FDIs play a key role in disseminating IT in developing countries. However, the research's results confirm that the growth of local IT firms is hindered by structural factors. In this respect, local governments are still far from providing indigenous firms with safe and sound pre-conditions for IT development. The call for action involves also local entrepreneurial associations, that should be more active in promoting national industries in foreign markets. On the basis of the first results discussed in this paper we feel that relevant topics for further researches should involve the following issues: a) more detailed studies aimed at describing the characteristics of partnership models; b) which are the most important channels for technology transfer between the supplier and the customer; c) which are the interface competencies that allow supplier and customer managers to effectively build and manage the partnership; d) on which base the customer can evaluate potential suppliers in order to choose those with the best characteristics.

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