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The role of joint actions in the performance of IT clusters in Mexico

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Abstract

Purpose – The purpose of this article is to show the importance of joint actions and institutions for collaboration (IFCs) in the development and performance of information technology (IT) business clusters in the context of Mexico.

Design/methodology/approach – A review of the literature suggests the types of linkages that the clusters must develop to be successful in the context of emerging countries. Two IT clusters in the region of Puebla and Jalisco are compared to highlight the factors that differentiate successful and less successful clusters in this type of environment.

Findings – The presence of an IFC, such as the Jalisco Institute of Information Technology in Jalisco, is a determinant factor of the performance of the IT cluster there, contrary to Puebla. A model of dynamic interactions in clusters is proposed as a result of the analysis of the two cases.

Research limitations/implications – Our analysis included clusters from IT industry in Mexico. It needs to be extended to more clusters, more industries and other emerging countries settings for the sake of comparison and generalization.

Practical implications – In the context of the relative scarcity of formal institutions in emerging country settings, the purposive collaboration of both private and public sectors in IFCs is necessary to ensure a long-standing development and performance of business clusters.

Originality/value – In this article, we show the specific role of institutional arrangements in cluster development and performance in emerging countries, which has seldom been investigated both theoretically and empirically.

Keywords Mexico, Emerging countries, Institutions for collaboration, IT clusters, Joint actions

Paper type Research paper

Introduction

For the past 20 years, national and regional policymakers in emerging countries have been eager to promote business clusters to support their domestic firms and enhance foreign direct investment in their own constituencies (Martin and Sunley, 2003; Tallman *et al.*, 2004). It is particularly difficult to achieve increasing productivity in clusters in those settings because of lack of well-functioning institutions and infrastructure (Altenburg and Meyer-Stamer, 1998; Schmitz and Nadvi, 1999; Khanna *et al.*, 2005) and because of impeding horizontal cooperation necessary to enhance skill accumulation among clusters' members (Schmitz, 1999; Rabellotti, 1999; Breschi and Malerba, 2001; Bengtsson, and Sölvell, 2004; Camisón and Forés, 2011).

This lack of horizontal cooperation in those contexts calls for joint actions (Giuliani *et al.*, 2005) and institutions for collaboration (IFCs) (Andersson *et al.*, 2004; Porter and

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Emmons, 2003). These joint actions and IFCs link the related contextual factors developed in Porter's diamond, such as demand conditions related and supporting industries, firm rivalry and factor input conditions. Joint actions and institutions have been deemed necessary to ensure the sustainability and long-term success of business cluster initiatives and to enhance knowledge externalities, mostly through theoretical perspectives (Storper, 1995; Rabellotti, 1999; Andersson *et al.*, 2004; Giuliani *et al.*, 2005). Several theoretical and empirical studies have been conducted in developed countries, such as the UK, Canada, Sweden and Spain (Waluszewski, 2004; McDonald *et al.*, 2007; Arbuthnott *et al.*, 2010; Chapain and Comunian, 2010; Camisón, and Forés, 2011; Lundberg, 2010; Camisón, and Forés, 2011). However, there is still a gap in the literature regarding the conditions favouring the sustainability and long-term success of business clusters in emerging countries (Perez-Aleman, 2005; Niu *et al.*, 2008; Islam, 2010), which limits international comparisons of cluster efficiency. In this article, we show that emerging countries, and particularly Mexico, require specific joint actions and institutionalization processes in clusters. Therefore, the main question that motivates this article is: How do formal and informal institutions enhance the development and performance of clusters in emerging countries?

Based on a theoretical approach rooted in institutional theory (Oliver, 1992), which suggests that actors develop strategies to legitimize their actions to cope with institutional pressures, and on the results of an empirical study comparing the performance of the emergence and development of two information technology (IT) clusters in two different regions of Mexico, we contend that specific "bridging institutions" stand as essential institutional components to support joint actions between partners within clusters in emerging countries. Examining the case of Mexico yields specific insights about the enablers and obstacles of institutionalizing clusters in such contexts. A model of dynamic interactions in clusters and related propositions derived from the cases under study is presented at the end of the discussion. This model contributes to the knowledge of the processes of institutionalization of clusters.

This article is structured in the following way. First, a review of the literature indicates the types of linkages that the clusters must develop to be successful in the context of emerging countries, and it reveals significant research gaps in this respect. Subsequently, the research methodology is explained. Then, the results of an empirical study comparing the development of two IT clusters in two Mexican cities, Jalisco and Puebla, are presented, looking particularly at outcomes in terms of foreign direct investment and offshoring services. In the discussion, the situation of both clusters is compared to highlight the importance of "bridging institutions" as an important factor to stabilize clusters in an emerging country such as Mexico. The different relationships pertaining to a model of dynamic interactions in clusters are described. Finally, in the conclusion, we include some strategic guidelines for policymakers, as well as the limitations of the study are drawn and future research directions are proposed.

Joint actions in emerging countries' clusters

Clusters are supposed to allow the development of a common stock of organizational knowledge, codes of behaviour, terminology, philosophy and approach to developing human talent and specialized labour, business understanding of the basic competitive dynamics of their industry and approaches to competitive performance measurement (Altenburg and Meyer-Stamer, 1998; Rabellotti, 1999; Simmie and Sennett, 1999; Breschi

and Malerba, 2001; Bresnahan *et al.*, 2001; Camisón, and Forés, 2011). The expected contribution of a cluster also lies in the development of a common sense of identity among all the members of the cluster, enhancing its sustainability and success (Tallman *et al.*, 2004). To produce those outcomes, a series of interactions within and between clusters and their environment are needed (Waluszewski, 2004; Camisón, and Forés, 2011). Porter (1998, 2000) developed the "diamond framework" (Figure 1) to specify the building blocks of clusters and their interrelations. The "diamond" represents a system in which the role of any determinant cannot be viewed in isolation. For example, although home demand may be strong, firms may lack the ability to respond to demanding homebuyers without the presence of appropriate supporting industries.

A cluster should comprise input factors (specialized labour, infrastructure, capital or physical resources), related industries and favourable demand conditions, supporting firms and encouraging investment (Porter, 1998). The existence of strong links between those factors and resulting knowledge "spillovers" also determine the cluster boundaries (Porter, 1998; Tallman *et al.*, 2004; Mesquita, 2007), encompassing "all firms, industries, and institutions with strong linkages", whereas "those with weak and nonexistent linkages can safely be left out" (Porter, 1998).

In another research stream, looking under an institutional lens, cluster formation and maintenance depend on the institutionalization of organizational features and specific actions over time (Oliver, 1992; Perez-Aleman, 2005). Institutionalization refers to the "activities and mechanism by which structures, models, rules and problem-solving routines become established as taken-for-granted part of everyday social reality" (Schneiberg and Soule, 2005). Clusters' failures may be accounted by an opposite process of deinstitutionalization because of political, functional and social pressures that delegitimize processes in place (Oliver, 1992; Nicholson and Sahay, 2009).

Generally, institutions can be defined as a "durable system of established and embedded social rules that structure social interactions" (Hodgson, 2006) or "self-sustaining, salient patterns of social interactions, as represented by meaningful rules that every agent knows and incorporates as shared beliefs about the ways the game is to be played" (Aoki, 2007). Institutions present a mix of formal and informal

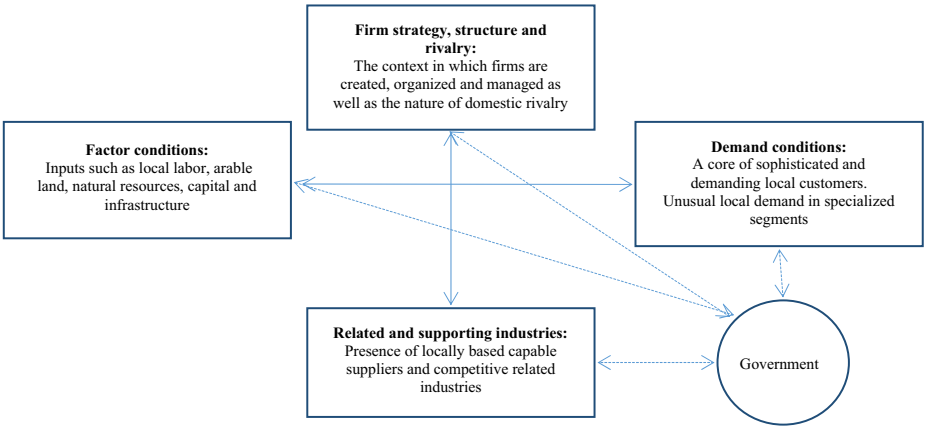

Figure 1.
Porter Diamond

Source: Porter (1998)

features (North, 1994; Hodgson, 2006). Institutions depend on the activities of individuals and constrain and mould them; "through this positive feedback, they have strong self-reinforcing and self-perpetuating characteristics" (Hodgson, 2006).

Cluster formation and growth depend on the interaction of the member firms. Different types of ties, both formal and informal, are supposed to enhance circulation of information. Informal ties occur, for example, through intra-cluster mobility of skilled labour, socialization between individuals or through exchanges with common suppliers (Bresnahan *et al.*, 2001; Tallman *et al.*, 2004; Mesquita, 2007). The presence of interpersonal contacts is seen as necessary to materialize the advantages of co-location and geographic proximity (Bell and Albu, 1999; Martin and Sunley, 2003; Andersson *et al.*, 2004; Jiménez and Junquera, 2010). Interactions within and between clusters and their environment are supposed to be enhanced by specific joint actions. Several authors have already analysed the importance of joint actions to create horizontal, vertical and multilateral linkages between partners of a cluster (Schmitz and Nadvi, 1999; Giuliani *et al.*, 2005; Arbuthnott *et al.*, 2010).

The existence of networks, effective sanctions and trust are all critical factors for joint actions to develop within the clusters (Dwivedi *et al.*, 2003; Niu *et al.*, 2008; Niu *et al.*, 2012; Zettinig and Vincze, 2012). For clusters to survive and produce the expected advantages, those joint actions must find an institutional support. An important vehicle to enhance the efficiency and effectiveness of the clusters is constituted by IFCs (Porter and Emmons, 2003; Andersson *et al.*, 2004; Carpinetti, and Lima, 2013). IFCs can comprise any kind of formal or informal group, including chambers of commerce, professional associations, school networks, university partner groups, religious networks, joint private/public advisory, competitiveness councils, industry associations, specialized professional associations and societies, alumni groups of core cluster companies or incubators playing a horizontal role in facilitating the exchange of information and technology in areas such as procurement, information gathering or international marketing; fostering coordination among firms; creating relationships; building trust; defining common standards; defining and communicating common beliefs and attitudes; and providing mechanisms to develop a common agenda in the functioning of a cluster. Public agencies may help firms learn about the needs of their customers, about key problems related to competitiveness, about lowering transaction costs collectively and about generating the capacity to upgrade continuously (Schmitz and Nadvi, 1999; Nauwelaers, 2003; Mesquita, 2007).

Critical factors in cluster development and enduring success may differ in emerging countries settings. Companies working in such environments do not usually benefit from an easy access to capital or talent because of the lack of specialized intermediaries, weak regulatory systems and contract-enforcing mechanisms (Khanna *et al.*, 2005). Local government institutions, technology institutes, large manufacturers and external buyers working as mediators between partners of the system tend to play an important role in building the required trust (Nadvi, 1995; Schmitz and Nadvi, 1999; Mesquita, 2007).

Regarding the specific role of IFCs in cluster development, Waxell (2009) showed the importance of the complementary role of cluster agents in IFCs, contributing to knowledge spillovers and cluster competitiveness in the Uppsala biotechnology cluster in Sweden. Carpinetti and Lima (2013) proposed a model to outline a series of

performance and change management practices to assist IFCs in the planning, implementation and assessment of joint actions in the context of Brazil.

In spite of those contributions, the specific role of IFCs has not been widely documented, and empirical studies on IFCs in emerging countries remain scarce. Hence, IFCs in clusters in emerging countries deserve further investigations that would look at the organizational underpinnings of joint actions and their consequences in terms of clusters' institutionalization and performance.

Research method

The research reported here is part of a project of which the main objective was to identify key policies to promote the IT industry at the local level in Mexico. In this paper, we report on a project's component that consisted of the analysis of local IT clusters in the country, following a case study approach (Eisenhardt, 1989; Yin, 1994; Stake, 1995). According to Yin (1994), case studies are appropriate to answer "how" and "why" questions. In this way, given that our research explores how IFCs and joint actions work together to promote or hinder cluster development, we chose this methodological approach. Case selection obeyed the criteria of theoretical sampling (Eisenhardt, 1989; Eisenhardt and Graebner, 2007). To better understand the role of IFCs and the effect of such collaboration on the cluster development, we chose one case that involved a well-developed institution for collaboration and one other case with under-developed IFCs, Jalisco's and Puebla's IT clusters, respectively. When selecting the clusters, we considered competitiveness data at the state and cluster levels (Table I). Regarding competitiveness of states, we can see in Table I that the State of Jalisco is positioned better in the rankings than the State of Puebla. Jalisco has also higher investment per employee and gross national product (GNP) per capita compared to Puebla. We also considered a cluster ranking developed by the Federal Ministry of Economy (Table II). Table II shows that the cluster in Jalisco is considered the most advanced cluster in the

State competitiveness index	Jalisco	Puebla
Overall position (total: 32)	13	28
Investment per employee (USD) (mean: $4,197)	$4,333	$2,858
Talent (high-level education, over 25 years old) (mean: 24.94) (%)	26	22
GNP per capita (mean: $81,383)	$78,324	$52,422
State competitiveness sub-index (total:32)		
Reliable and objective legal system	26	31
Sustainable management of the environment	10	8
Inclusive, well-educated and healthy society	10	26
Economy and public finance	20	23
Stable and functional political system	17	14
Factor markets	15	29
World-class supporting industries	6	25
Efficient and effective government	22	29
Linkages with the world	7	13
Innovation ranking	9	15

Table I. State competitiveness index and sub-index

Source: IMCO (2012)

PROSOFT ranking position (total: 22 clusters)	1	15
Competitiveness index (scale: 1-7, mean: 4.75)*	5.22	4.50
Competitiveness level**	National	Regional
Maturity model***	Expansion	Formation

Notes: *The competitiveness index is developed considering factors such as: (1) factorial conditions, (2) demand conditions, (3) supporting and related industries, (4) structure, strategy and rivalries and (5) others; **the competitiveness level is based on its geographic extent impact, it considers four periods: non-competitive, minimum, regional, national and international; ***the maturity model is related with the competitiveness level of the cluster, it is defined in four stages, such as initiaton, formation, expansion and consolidation
Source: Prosoft (2008) and UNAM (2008)

Table II.
IT cluster competitiveness data

country, and the cluster in Puebla is ranked 15 out of 22 (Prosoft, 2008). From Table II, we can also see other differences between these clusters, IT Jalisco cluster has a national impact, and it is considered in expansion, whereas IT Puebla cluster has a regional impact, and it is considered in formation. Thus, the clusters selected were useful for comparing and contrasting interactions among cluster participants and IFCs and their results.

To increase the validity of the study, we used multiple sources of information. Both case studies involved semi-structured interviews as well as secondary data. Interviewees included cluster participants, cluster managers, public managers in local Ministries for Economic Development and representatives from industrial associations. Four key informants participated from the IT cluster in Jalisco and six key informants from the IT cluster in Puebla. The authors of the study conducted interviews during the first semester of 2010. All interviews were tape recorded and transcribed. To increase internal validity, we started by writing a first draft of each case by a member of the research team, which was revised several times by other members looking for missing data and inconsistencies. When needed, additional information was sought and incorporated into the case.

The interview protocol consisted of ten main themes, including the history of the cluster, governance, strategic plans and capabilities, financial and marketing strategies, success factors and the effects of local institutions as well as the market conditions on cluster success. Secondary data included documents from the National Ministry of Economy, the local Ministries for Economic Development, the National Institute for Industrial Competitiveness and the websites of each of the clusters that were included in the analysis. Data analysis included the identification of key themes in the data as well as a process of comparing and contrasting both cases and current theory in an iterative process (Eisenhardt, 1989). Following common practices in qualitative research, data analysis started during the data collection process, allowing us to identify the gaps in the available data, so that they could be addressed in subsequent data collection activities. The validity of constructs used in our analysis comes from their current accepted use in the literature.

A tale of two clusters

The two clusters under study were created as a result of a national programme to promote the IT industry in Mexico: PROSOFT. PROSOFT is a federal government

initiative programme created in Mexico in 2002 to promote the software industry in the country. PROSOFT integrated public and private funding and promoted collaboration among private industries, federal and state governments and institutions of higher education. This programme has been extended to include other services of IT. In 2006, PROSOFT was working with approximately 30 of the 32 Mexican states and 121 universities, and 23 clusters had been developed since the beginning of the programme. The programme has influenced over 4,000 companies, improving more than 20,000 jobs and creating about 22,500 new jobs (Luna-Reyes, 2008). It is important to point out that to have access to PROSOFT grants, it is required that a cluster has a legal status.

Jalisco's IT cluster

Jalisco's IT cluster was created under the leadership of the Jalisco Council for Science and Technology, the main local universities and a well-established IT industry. Although the formal constitution of the cluster was a result of the National PROSOFT programme, the establishment since the 60s and 70s of global corporations or "anchor enterprises" (such as IBM, HP and Intel) in Jalisco has been an important element in the dynamics of the region named the "Mexican Silicon Valley" (*Expansión*, 2009). "Jalisco it's a place where the highest number of PhD registered in all Mexico are currently working" (Collective interview with members of Jalisco's IT cluster, 12th February 2010). Intel, HP and IBM have invested 600 million Mexican pesos to develop Jalisco's IT industry (*Expansión*, 2009).

The core network of the cluster in Jalisco comprises around 30 small-, medium- and large-sized IT companies. Some of the IT services offered by the members of the cluster are: Web and multimedia applications, business applications and IT services, specialized consulting, consulting for quality systems in IT, outsourcing and offshoring software, software testing and testing of embedded systems (collective interview with members of Jalisco's IT cluster, 12th February 2010).

The main clients of the IT cluster are involved in various sectors, such as government, education, food, pharmaceutical, health, agriculture, construction, finance, textile and footwear (Centro del Software, 2012). Nowadays, more than 400 IT professionals from these 30 companies in Jalisco are developing IT applications for clients around the world (*Expansión*, 2009). Interviewees from Jalisco IT cluster observed that:

> […] the transformation of hardware in a commodity and the fact that software is becoming the most important source of value creation is what led Jalisco to move, in the 90s, from the electronics sector to today's IT, software and programming industry.

Changes in industries that were already established in Jalisco also contributed to the development of the IT cluster. Washing machines, TV sets, cell phones and other electronics needed embedded software to work properly. This change was beneficial for the IT industry, as "today, 80 per cent of embedded software (in Mexico) is developed in the State of Jalisco, Mexico" (collective interview with members of Jalisco's IT cluster, 12th February 2010).

For the members of the cluster, the Jalisco Institute of Information Technology (IJALTI) is one of the key elements that enhances the productivity of the IT industry in the state. IJALTI is an institution created as an initiative of the State Council of Science

and Technology in 2002. It is in charge of creating linkages and supporting funding processes. IJALTI, in the words of the interviewees:

> […] is a non-profit civic organization that provides policy guidelines to manage the development of IT, microelectronics and multimedia industry […] Its governing body consists of the Quality Institute of Jalisco, the president of the University of Guadalajara, a representative from the National Chamber for IT Industry (CANIETI)[1], the State Council for Science and Technology, and the Ministry for Economic Development (collective interview with members of Jalisco IT Cluster, 12th February 2010).

In this way, IJALTI works through a group of 12 people coming from different sectors: industry, academia and government. Their different visions are aligned for the sake of finding a social benefit, with a strong commitment of the state and the federal government to the economic development of the region. Performance evaluation in IJALTI is linked to the accomplishment of the proposed annual objectives. For example, to get government funds, new jobs must be generated in the IT sector (*Expansión*, 2009).

IJALTI was funded from three sources: the companies using the main building, Jalisco's state and the federal government (through the PROSOFT programme); the Jalisco IT cluster has been most successful acquiring government funds for projects and cluster growth. In 2006, for example, almost 65 million pesos were invested for the construction of a building for the IT cluster of Jalisco: 9 million pesos from the state government, 22 million from federal funds and the rest from the firms belonging to the cluster. In 2010, Jalisco obtained 50 per cent of the total amount awarded by PROSOFT nationwide (Sánchez, 2011). In 2011, Jalisco requested other 60 million pesos of PROSOFT funds with a matching fund from the state government, as reported by CANIETI in 2012.

IJALTI has been crucial for the creation and the promotion of networks among academia, government and industry. IJALTI, nowadays, manages a physical space in which interactions between 30 IT companies occur (at the beginning they were 25), facilitating the creation and maintenance of internal and external networks. The continuous investments in a shared building came from contributions of cluster's members. The presence of specific staff dedicated to manage the cluster has been an important element of coordination. For interviewees, sharing building strongly promoted communication among members of the clusters. It also led to significant savings because they obtained first-class facilities at very competitive prices. At the same time, physical proximity provided synergies among companies. It has also improved relationships and cohesion among members working on commercial projects. The improved interaction between people resulted in the development of new businesses and joint projects. The shared building also contributed to the creation of a favourable business environment and new contracts with large enterprises:

> […] we had innovative and smart companies in the State. However, the business offices were in the basement of the company owner, which was not the best place to negotiate a contract with companies like Motorola (collective interview with members of Jalisco's IT cluster, 12th February 2010).

Furthermore, this cooperation allowed improved training and certification, and thereby the development of the IT sector in Jalisco.

IJALTI has also played a key role in the active promotion of the cluster. They developed videos in various languages to promote the cluster, emphasizing the closeness to the USA:

> […] one of the things that were done at the beginning when we were building the cluster was to invite opinion leaders from the USA IT industry. They came to Guadalajara one day. They took a city tour in the morning, had a meal, the tequila express tour, and returned at 7 p.m. to the USA. In the end, opinion leaders agreed that Dell investments in Jalisco were positive because Jalisco is a good place to invest, live, work and it is close from home (collective interview with members of Jalisco's IT cluster, 12th February 2010).

In terms of internal management, the cluster has been developed in an organic way since its inception. A significant effort has been made to formulate strategic analysis and strategic planning. It had and still has a constitutive charter, vision and mission. The cluster identified its core competencies and created a strategic growth path. For the interviewees, an industrial sector must first:

> […] identify the ways of approaching the market, its market segments, and where they are going to as an industry to be able to talk to the government […] It is very important to also consider government as a factor to facilitate tasks (collective interview with members of Jalisco's IT cluster, 12th February 2010).

The cluster has a manager and three different committees: a committee to promote the cluster, an infrastructure committee and a communications committee. These committees are advisory and the general managers of the cluster rely heavily on the opinions of these committees to make their final decisions. Furthermore, interviewees stressed that the government should not initiate such initiatives without commitment from firms, because if firms were not committed, they would not work together. Even if a building was constructed, it would only be an empty space. The interviewees also described a rigorous selection process for new firms interested in sharing the space, including not only financial and growth projections, but also the potential to collaborate with other firms in the building. By doing this, they promote that firms belonging to the cluster can agree to work together to satisfy clients' needs, thus leading to mutual growth. Jalisco's IT cluster has a very strong contractual and legal platform for its internal operations. If any member fails to pay the maintenance of the building fee, it could be expelled and/or lose the funds from the government because being part of a cluster facilitates the access to PROSOFT funds.

In terms of external links, the relationship with other business organizations has been of vital importance for the cluster. The interviewees emphasized that the most important factor to maintain the cluster and to achieve growth in the IT sector was "the social element, the interaction among businesses, academia, and government" (collective interview with members of Jalisco's IT cluster, 12th February 2010).

Jalisco's IT cluster has actively promoted its IT services and solutions to the National Chamber of the Tequila Industry, which is a strong industry. It also has close contacts with the chambers of commerce for small businesses to provide IT alternatives accessible to them in the context of low financial capacity. This generates many small sales that may have the same or a greater financial effect in terms of revenues for the IT firms compared to a single large-scale contract with a large firm.

The cluster has long encouraged links with universities: "the academic world must also be considered because of their fundamental role in the transition of university

students to the firms" (collective interview with members of Jalisco's IT cluster, 12th February 2010). The cluster is always seeking internship programmes that add value to both students and businesses. Collaboration schemes with universities where students can take classes in the cluster firms have also been envisaged. Additionally, thanks to the collaboration between industry and universities, the cluster can help universities develop IT products, representing a win–win relationship to both parties.

Jalisco's IT cluster has won national recognition. In 2008, the cluster was ranked number one nationwide based on their maturity and creativity by the Ministry of Economy of Mexico (Prosoft, 2008). For the interviewees, the commitment and the confidence of enterprise members were the key components of the success of the cluster that allowed the software centre to continue running. This cluster currently represents 24 per cent of the national production of an industry, with nearly 200 million pesos and 625,000 jobs nationwide (Sánchez, 2011).

Puebla's IT cluster

The lack of IT global corporations or "anchor enterprises" hamper the development of the IT industry in Puebla. In the early 90s, Motorola established its headquarters and IT development laboratory in Puebla. However, Motorola moved to Jalisco after few years of operations (*Notimex*, 2003). Nowadays, there is only one major private corporation in the IT services sector, T-systems, a company that emerged from the spin-off of Gedas, the former Volkswagen's IT branch (Mendieta, 2004).

Originally, seven executives in the State of Puebla promoted the idea of cluster formation in 2007 under the leadership of the president of the IT section of the National Chamber for the Manufacturing Industry (CANACINTRA) in Puebla. Those businessmen were managers of small-sized IT consulting firms established in Puebla. Their firms offered different services, including software development. Leaders of those firms analysed their own capabilities and resources to offer attractive and competitive products and services to their clients, mostly the larger companies in the region in the sectors of retail distribution, consumer goods, entertainment, catering business, automotive, education and the public sector. They were convinced about the importance of joining efforts to exploit better business opportunities, look for organizational synergies to build capabilities (e.g. training and certification processes), and share resources. One of the interviewees commented:

> […] in order to enhance their core competences and capabilities to approach new client prospects and to maintain their current client portfolio, companies need shared training and commercialization and certification programs.

The fundamental abilities developed by the majority of members were based on software development, particularly in e-commerce and Web applications. These efforts were promoted to achieve goals such as company's growth and collaborative work dynamics to reach new market opportunities (*Fortuna*, 2009a).

The cluster in Puebla has grown in terms of the number of companies, going from the initial seven members to current 52 members. However, the development of the IT industry in the city of Puebla has remained below the expectations of its participants in terms of revenues (interview with a member of Puebla's IT cluster, 4th May 2010).

There has not been any significant financial support from Puebla' state government. The main support was obtained at the federal level from programmes such as

PROSOFT. However, the IT industry in Puebla has not shown any significant development during the past years. As one of the interviewees commented:

> I see neither a long term government plan nor any specific decision from the State government. I believe that the State Governor should make the decision to support the industry in an important way (Interview with a member of Puebla's IT cluster, 4th May 2010).

Today, the demand in IT services from other industrial sectors in Puebla region is limited (Interview with CCEP [Puebla Business Council], 26 August 2010). Although some government officials in charge of promoting the IT industry at the Puebla State level (Secretaria de Economia (SEDECO) [Ministry for Economic Development]) believe that the IT industry in Puebla should have a global reach, limited local demand appears to jeopardize business growth. As one interviewee explained:

> […] it is hard for a small local software company to compete even for projects at Volkswagen (the major IT consumer in the region) given that all decisions are made in Germany, and in order to get a contract, you need to go there and compete globally […] we need to find a way to increase local demand (interview with a member of Puebla's IT cluster, 4th May 2010).

In terms of internal management, a president, who is also president in the industrial branch of IT in CANACINTRA, forms the structure of the cluster. In the case of Puebla, the president of the cluster also runs his own business at the same time that coordinates and promotes the activity of the Puebla IT cluster and the IT section of CANACINTRA. There is no professional staff to help him with this work. The rest of the members (also executives and women in charge of running their own business) have responsibilities as the members of specific committees, such as business solutions for the consumer market, demand analysis, business linkages with academic institutions and governmental entities. Other members are involved with the promotional activities of the cluster. Promotional activities target not only clients, but also government, as they try to find support from the government (interview with a member of Puebla's IT cluster, 4th May 2010).

The level of interaction between business participants in the IT industry in Puebla has been moderate. There is reluctance from some of them to align their corporate interests with governmental requirements. However, the IT cluster in Puebla is often trying to promote and make efforts on behalf of its members to increase market reputation and obtain government recognition.

According to the interviewees, the lack of a long-term vision or state strategy has limited the creation of joint actions for service delivery in Puebla. There is no formal marketing programme for the Puebla IT cluster. The cluster sometimes organizes business fairs to showcase the IT industry in the region and to promote the use of IT in different industries (*Fortuna*, 2009b). Many efforts are taken by individual companies participating at IT exhibitions and supplier expos. The president of the cluster is continuously trying to bring the IT industry into the attention of government officials. The IT cluster in Puebla considers the encouragement and maintenance of linkages with other organizations to be the key factors. Although, collaborative projects with students and professors are of interest to the members in the cluster, these kinds of linkages have not been as successful as desired.

As far as Puebla is concerned, IT companies and organizations do not share a common infrastructure. This constitutes a disadvantage to firms trying to overcome unfavourable market conditions. Actors in the government and the private sector in

Puebla believe that there is a need to find some competitive advantage specific to the region to promote the IT industry, understanding not only the needs of current organizations, but also managing individual interests and commercial opportunities. However, a consensus about the key areas to promote has not been established yet.

Some companies involved in the cluster buy and sell hardware (cables, video monitors and network equipment for example), some develop software and Web applications, while others provide e-learning services, networks and IT consulting (*Fortuna*, 2009a, 2009b). The small companies participating in the cluster have no clear synergetic areas among them. Because of such businesses diversity, it is difficult for members to develop joint efforts, even to buy supplies as a group. In the words of an interviewee: "we do not have common products and supplies purchase. What we have already done is to look for training, commercialization, and certification programmes for members of the cluster" (interview with a member of Puebla's IT cluster, 4th May 2010).

In terms of external relations, in the State of Puebla, there is a lack of consolidated relationships and synergies between related and supporting industries with the IT industry. Particularly, the industry, academia and government have pursued their own initiatives and have shown few intentions to promote collaborative initiatives as a shared goal. In fact, it seems difficult to approach a common vision and strategic planning efforts from major stakeholders in the IT industry in the region. This situation is explained by the existence of different private and public initiatives proclaiming to be the official IT cluster in Puebla.

The president of the private cluster recognizes that academic institutions and the government play a key role in the development and future growth of the IT industry in the region. The former are responsible for the education of human capital with the skills they need, and the latter is the key actor in the promotion and growth of the sector. This is the reason why there exist potential synergies in term of collaboration between the academia and cluster members to promote joint actions. However, it has been difficult to create a dialogue among all key actors.

Although funds from PROSOFT and Fondo pequeñas y medianas empresas (PYMES) are available to all states in Mexico, the access to such funds has been limited to the industry in the State of Puebla. In terms of ranking, the IT cluster in Puebla occupies the 15th position nationally, according to PROSOFT rankings (Prosoft, 2008). Although, the area is recognized regionally for its level of competitiveness, some of the participants in the IT industry are not convinced about the benefits it brings. Some of them did not even know whether their company was a part of the cluster (CANACINTRA meeting, March 2010).

Nowadays, there are few number of group projects in the Puebla IT cluster. Almost all projects have been done through individual initiatives, as a chief executive officer said, "we have not done many projects as a cluster because they are often developed on an individual basis and only with the participation of some of our members" (interview with a member of Puebla's IT cluster, 4th May 2010). An important problem is related to the existence of many uncoordinated groups of small IT companies pushing towards different directions. The first initiative to cluster companies came from the private sector. However, in 2010, the second initiative appeared, this time from the state government. Furthermore, 9 companies and 2 universities in Puebla formed the third initiative (Interview with a member of Puebla's IT cluster, May 4th, 2010). In spite of the attempts to coordinate the IT industry, there is no aligned activity in the sector.

Discussion

Research on the development and performance of business clusters in emerging countries remains scarce (Altenburg and Meyer-Stamer, 1998; Schmitz and Nadvi, 1999; Perez-Aleman, 2005; Niu *et al.*, 2008; Islam, 2010). In our study, we asked: how do formal and informal institutions enhance the development and performance of clusters in emerging countries? We saw the interplay of IFCs and joint actions as the main factor sustaining clusters in emerging countries. In the following discussion, we will compare our findings with the existing literature. This discussion is organized into three sections. In the first section, we present a comparison of the two IT clusters described in the previous section. The second section stresses the role of joint actions and IFCs in both cases. The final section includes the proposal of a model of dynamic interactions within clusters, integrating the influence of institutional factors to extend theoretical views on cluster development.

Comparing the clusters of Puebla and Jalisco

It is probably difficult to disentangle completely the causes of the relative success of Jalisco's cluster over Puebla's cluster. Differences may emerge due to age, size and context in addition to joint actions and institutional processes. In the following paragraphs, we compare and contrast both clusters following the variables included in Porter's diamond (Porter, 1998, 2000).

A strong local and international demand is an important factor contributing to Jalisco IT cluster success. This finding is consistent with the literature (Schmitz, 1999; Schmitz and Nadvi. 1999; Giuliani *et al.*, 2005; Hernández and Von Putlitz, 2009). International dimensions, in particular, played an important role in the dynamics of cluster development in the context of our study. Clearly, international trade integration through the action of multinationals focussing on an export-oriented country such as Mexico has been a detonator in the development of Jalisco's cluster. Volkswagen could have played a more important role in Puebla but failed to become a catalyzer for IT services development, as local companies were not so well positioned to respond to rules set up by the central headquarters in Germany. Concerning the demand, Jalisco had an advantage over Puebla in that the electronics companies and the tequila industry in Jalisco required the development of applications for their different products, and large IT service firms are well equipped and organized to meet that demand. In the case of Puebla, the demand was also sophisticated, but was focussed almost entirely on one company: Volkswagen, and its Web of suppliers sharing the same needs for the sake of compatibility of IT systems. This represented a barrier to small companies, as major decisions are made at the headquarters of Volkswagen and local service providers had to compete with global firms to be awarded IT service contracts for that company and its suppliers.

Complementing our analysis with external sources (Hernández and Von Putlitz, 2009; López and Martin, 2009), Table III illustrates the differences between Jalisco and Puebla's present and future clusters. This confirms that Jalisco's IT cluster is better positioned compared to its counterpart in its present stage and offers a better potential for future growth due to a more diversified industrial base, enhancing demand conditions and eliciting support from complementary industries.

Several studies show the importance of related and supporting industries to enhance the creation and productivity of clusters (Bresnahan *et al.*, 2001; Niu *et al.*, 2008). Our

Industrial clusters stage of development	Jalisco	Puebla
Present cluster	Equipment and electronic components; information technologies, education services	Manufacturing of automobiles, trucks and automotive parts
Emergent cluster	Milk industry and dairy products	Textiles, garments and clothing accessories, education services
Future cluster	Logistics services; health-care and hospital services; car manufacturing and automotive parts	Farming and greenhouse products; health-care and hospital services; tourism services
Recommendations for future development	Attraction of foreign direct investment; infrastructure development	Attraction of national and foreign direct investment
	Experts training; creation of research centers, incubation and laboratories; financial support: regulations to improvement public funding utilization; institutions that generate synergies between cluster's members	

Sources: Hernández and Von Putlitz (2009) and Lopez and Martin (2009)

Table III. Opportunities and recommendations for cluster development in Mexican states

study also confirms this point: Jalisco IT cluster also has advantages with respect to related and supporting industries, that is, the number of IT global corporations that have presence in Jalisco is greater compared to the number of similar companies in Puebla.

In terms of firm rivalry, the Jalisco IT cluster has developed a concept of "co-opetition" (Dei Ottati, 1994; Nalebuff and Brandenburger, 1996) more efficiently than in Puebla. Firms acknowledged the advantages of the cluster, and they were willing to work together to satisfy customers' needs. In Jalisco, the cluster has developed a sense of identity with the embedded software industry, and it is now pushing forward the industry of computer animation.

In the case of the Puebla IT cluster, collaboration among members does not occur on a very frequent basis, and given the fragmentation of the industry, even the level of rivalry among the members of Puebla IT cluster is low. They do not interact between each other. Because they do not share a building and do not address the same market segments, it has been difficult for them to develop a shared identity and to exchange knowledge. The evolution of collaboration is a key to further development, as Schmitz (1999) also showed in the context of Brazil.

Factor input conditions are also different in both cases: although both IT clusters (Jalisco and Puebla) have good local labour conditions, alternatives for capital resources are better in Jalisco. Local labour conditions are good in both places because, in each of them, well-known universities offering IT degrees can be found. Hence, companies are able to recruit new graduates every year continuously. However, capital resources are scarce for the Puebla IT cluster, which depends mainly on its own funds, with occasional access to PROSOFT funds. Meanwhile, Jalisco IT cluster had access not only to funds from PROSOFT, but also to funds from the state government and from the under-ministry for small and medium sized enterprise (SMEs). Access to funding has

also allowed the cluster in Jalisco to hire a group of professional staff. This staff plays a key role in facilitating agreements among cluster members, joint actions with government and research with higher education institutions. Those input factors are deemed as crucial for the take-off and development of clusters in both developed and emerging economies (Bresnahan *et al.*, 2001; Hernández and Von Putlitz, 2009; López and Martin, 2009).

Role of IFCs and joint actions

We concur with the existing literature showing the importance of shared competencies within clusters as distinct from firm-specific, knowledge-based capacities (Camisón, 2004; Tallman *et al.*, 2004; Camisón and Forés, 2011). We also agree that not all firms in a cluster will automatically acquire the knowledge circulating within a cluster, unless they become active players in disseminating collective assets possessed by the local community, reinforcing barriers to imitation at the cluster level (Tallman *et al.*, 2004). Camisón and Forés (2011) acknowledged the role of local institutions in facilitating cooperation and reciprocity, stimulating the wealth of intra-district knowledge flows (Breschi and Malerba, 2001; Camisón and Forés, 2011). In our study, we provide more details about how this can work (or not) in an emerging country setting. IFCs play a specific role in the contexts suffering from a lack of institutional development. Our approach complements the approach of Perez-Aleman (2005) who emphasized the importance of institutions in cluster development in Chile through learning by monitoring processes.

It is certainly true that Jalisco cluster started to be successful because of strong demand. Subsequently, institutional support and joint actions came into place. Joint actions and institutions have contributed to the creation of a more competitive and professional business environment. Puebla never had one or the other. The IT cluster in Jalisco has been more successful compared to the Puebla IT cluster. Particularly, the lack of intensity of joint actions and institutional processes, such as IFCs, differentiates between Puebla and Jalisco's clusters. In this way, establishing IJALTI and providing initial funding to hire professional staff constituted initial joint actions, which led to a series of subsequent joint actions inside the Jalisco cluster. All these joint actions have promoted the growth and consolidation of the Jalisco cluster. On the other hand, Puebla IT cluster's main joint action involved an agreement to create the cluster to become eligible for government funds. However, without the proper IFCs, the effort would not have been successful and the group of companies in the cluster is still looking for their own identity.

Some other joint actions taken by the Puebla IT cluster in this respect are business fairs and collaborative projects with academia. The actions taken by the Jalisco IT cluster have been much more effective than those taken by Puebla IT cluster. In the case of joint actions for inter-actor network creation, having a shared building helped in networking and commercial cooperation among members of the Jalisco IT cluster. The lack of a shared infrastructure complicated communication and cooperation among the members of the Puebla IT cluster. IJALTI, as an IFC, took an active role in the formation of Jalisco IT cluster. They were in charge of promoting the cluster, managing the shared building and helping with networking. IJALTI has been successful in that respect. It has an active promotion programme and clear procedures and politics to manage the building, and it is continually working on networking activities. Puebla IT cluster does

not have an organization that would assume the role of an IFC; hence, the administration and members of the cluster must implement all activities. This has resulted in several problems, such as the development of an informal marketing programme. Table IV summarizes the main differences between Jalisco and Puebla IT clusters, and Table V shows some examples of joint actions and types of linkages within these two IT clusters.

Model and propositions

From the case studies and the ensuing discussion, we propose to build a model (Figure 2) to represent an institutional view of cluster development, contributing to the understanding of the main relationships between contextual factors, joint actions, IFCs and outcomes.

Our model describes institutionalization processes within clusters during the growth stage of a cluster as a part of its life cycle (Menzel and Fornahl, 2010). Our model focusses on the role of joint actions in the stabilization of processes and rules into specific institutions to maintain and improve clusters over time. We developed six propositions to explain the main relationships in this model. The two feedback loops linking joint actions in collaboration with institutions play a central role in this representation. IFCs should have an effect on both the development of joint actions and results, such as the development of a shared identity and vision. In the case of Jalisco, IJALTI enhanced linkages between members who, on their turn, justified, amplified and consolidated the influence of IJALTI. The absence of IFCs in Puebla further debilitated any support to possible joint actions. For instance, domestic reports on the competiveness of clusters in Jalisco and Puebla (Hernández and Von Putlitz, 2009; López and Martin, 2009)

Table IV. Summary of findings

Contextual factors	Jalisco IT cluster	Puebla IT cluster
Demand conditions	Several companies in different sectors (electronics, tequila, domestic appliances)	Limited local demand automotive sector most important (Volkswagen)
Related and supporting industries	IT global companies electronics	One IT global company
Firm strategy and rivalry	"Co-opetition"	Limited competition, fragmented cluster
Factor input Conditions	Good local labour conditions, diversified sources of capital	Good local labour conditions, limited sources of capital

Table V. Examples of joint actions and type of linkages

Category	Jalisco IT cluster	Puebla IT cluster
Joint actions with clients (vertical linkages)	Software center	Business fairs
Joint actions among members (horizontal linkages)	Shared building training and certification programmes	No common infrastructure training and certification programmes
IFCs (enhancing linkages)	IJALTI active promotion existence of a formal management committee	No formal marketing programme collaborative projects with academia lack of formal coordination

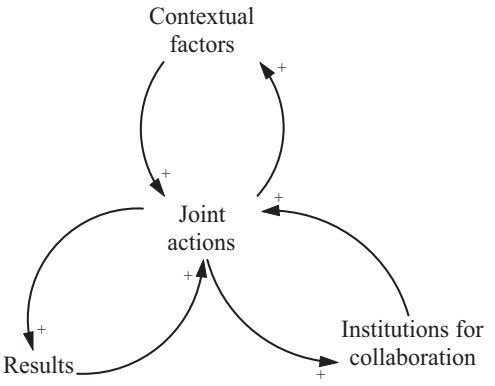

Figure 2.
Main dynamic interactions among clusters

emphasize the importance of sustaining joint initiatives of private entrepreneurs and scientists in public–private alliances and agreements.

Joint actions and IFCs are mutually reinforcing, as joint actions at a certain frequency and degree of intensity (afforded by geographical proximity) coalesce into institutions, and institutions lay the basis for further joint actions to be produced. Therefore, we formulate two propositions describing this reinforcing process:

P1. Institutions for collaboration promote the development of joint actions among cluster members.

P2. Joint actions, in turn, strengthen current institutions for collaboration and promote the development of new ones.

Joint actions, as they gain in importance, should enhance the contextual factors that can be potentially captured and exploited by clusters' members. This should translate into continued government support as well as into better conditions of access to capital. In principle, public infrastructure such as industrial parks or laboratories and public financing through dedicated trust funds, for example, are supposed to support joint actions, and those joint actions should further legitimize the existence of those parks, laboratories or financing schemes to name a few instruments (Hernández and Von Putlitz, 2009; López and Martin, 2009). This is the case, for instance, for Jalisco, where the progressive strengthening of IJALTI and related joint actions in the IT cluster shaped the contextual factor (the distribution of PROSOFT funds). In comparison, in Puebla, only few joint actions (such as business fairs or training and certification programmes) have not sufficiently connected members with related industries and clients or addressed potentially available demands to mobilize human and physical resources. Using government funding without the proper joint actions is most likely to fail and discourage self-sustainability of clusters. Again, joint actions and contextual factors are involved in a second self-reinforcing cycle. Hence, we formulate the following propositions:

P3. Joint actions have a positive effect on contextual factors within a region.

P4. Improvements in contextual factors, in turn, facilitate the development of joint actions.

Joint actions also bring positive results to the cluster in the form of commercial results, and increased social capital, trust or prestige. In turn, capital allows the promotion of new joint actions and improved relationships, creating a virtuous cycle of growth and development, as in Jalisco. On the contrary, this cycle may also work as a trap, making it very difficult for main stakeholders in the cluster to take advantage of joint actions, as it has been the case in Puebla. Many cluster initiatives in different regions tend to start under optimistic perspectives, thanks to initial enthusiasm from public and private partners to enhance regional state competitiveness. However, enthusiasm is not sufficient to sustain joint actions and institutions for collaboration over time. Joint actions and institutions for collaboration need to be supported by positive results of the cluster, as shown in our model. Hence, we formulate the following propositions:

P5. Joint actions have a positive impact on cluster results.

P6. Positive results in a cluster contribute in a positive way on the development of joint actions.

Conclusion

In the previous descriptions of IT cluster development, we showed the importance of clusters' joint actions and their contribution to the success of cluster initiatives, contrasting regions with different factor endowments and different management styles. In both regions, managers recognize the role of external links, but only Jalisco fully acknowledges the importance of institutionalizing joint actions. In a country such as Mexico, this is a rather remarkable accomplishment if we consider the number of initiatives stemming from the governments at different levels (as it is a federal state), which generally do not survive when political leaders change. This is precisely because Jalisco managed to institutionalize its cluster, while Puebla did not. Puebla's case reflects a lack of joint actions and failed attempts to set up "durable systems of established and embedded social rules" or "self-sustaining, salient patterns of social interactions" (Hodgson, 2006).

The data from our cases suggest that in the specific case of the IT industry, local market conditions play more important role compared to other factors, such as input factors, including labour, physical conditions or infrastructure. In Puebla, in particular, it has been very difficult to create a market even though the region did possess other key factors, such as labour and a stable institutional environment. The findings in the cases suggest some basic strategic guidelines to which managers and policymakers should pay special attention:

- *Create legitimate IFCs*: In our study, we concur with Carpinetti and Lima (2013) that the interplay of IFCs and joint actions in IT cluster may improve the capabilities of local companies to enhance productivity inside their clusters, beyond external economies. Companies should be aware that such connections will not operate spontaneously or managed proactively. We believe that collaborating institutions, like IJALTI, are necessary – although not sufficient – conditions for a cluster to succeed. IJALTI has been effective in connecting the government, businesses and universities to pursue common goals and consolidate Jalisco as the leader in Mexico's IT industry. It is also important to stress that IJALTI has had fast results in job creation and businesses improvement, playing an important role in increasing its sustainability. In regions with poorer market

conditions, such as Puebla, policymakers interested in the promotion of the IT industry should consider the creation of an IFC such as IJALTI to attract some key players to promote a local market.

- *Measure performance of IFCs*: SMEs in emerging countries have a crucial need to bridge institutions and develop reliable networks to compensate for an unstable environment from the economic and political perspective. Measuring performance of such joint actions and institutions is a common task necessary to reinforce the confidence of actors in such systems and in their sustainability. IFCs must maintain the interest of participants in being part of the cluster through organizing regular meetings and actively promoting the cluster.
- *Improve the role of public administration*: Public authorities are supposed to provide the basis for the establishment of linkages between firms as facilitators of joint actions, as promoters of a common identity and as brokers to improve access to data and market information. Additionally, public administrators should be able to show the benefits of such joint actions to clusters' participants and they should help break potential barriers created by mistrust between potential competitors within clusters.
- *Understand current capabilities of the industry*: The case of Jalisco shows that understanding the main needs of industrial conglomerates as well as current capabilities in the local industry is the key component of creating a strategic plan to promote cluster development.
- Create alliances and partnerships. As we mentioned before, promoting industrial clusters involves a series of reinforcing processes that constitute virtual traps to managers who attempt to promote them. We believe that no single agency or organization puts enough effort or resources to overcome this initial challenge. In this way, creating alliances and partnerships, like the ones in Jalisco, is a way of breaking the traps.
- *Have a professional staff to manage clusters*: Both IT clusters in Mexico included in this paper represent a form of legally incorporated industrial group, but only Jalisco's cluster has a professional staff for their management. Having professional staff to follow-up key agreements among members represents an effective strategy to promote faster development.
- *Develop a common infrastructure*: Jalisco's cluster has a shared building that enables members of the clusters to know each other and encourages interorganizational collaboration and knowledge sharing. In Puebla, the industry is disseminated and the members of the cluster should examine the establishment of a shared building to take advantage of those benefits.
- *Improve cooperation of clusters' members towards common goals*: In Jalisco, the members develop horizontal linkages, establishing alliances to share the costs of training and certification programmes. Puebla has few horizontal linkages, cluster members work independently, avoiding the advantages of working together.

Our study is limited to 2 of the 23 IT clusters existing in Mexico. For the sake of generalization, we would need to extend our study to even more clusters. Moreover, our

analysis focussed on clusters from IT industry where, for example, institutional arrangements for the circulation of knowledge are different from traditional manufacturing clusters (Rinallo and Golfetto, 2011).

In the study of emerging countries, researchers should pay more attention to regional situations, as regional conditions may differ and national perspectives may eschew those issues. Future research should consider developing more cases in emerging countries while considering the role of cluster management through various IFCs to fill in institutional voids.

Note

1. CANIETI is an autonomous institution of public interest with legal personality and own patrimony, different from each of its affiliates, incorporated under the provisions of the Act of Business Chambers and their Confederations for over 70 years. In CANIETI, individuals or entities are affiliated legally both in Mexico and abroad to engage in activities related to the electronics, telecommunications or information technology. Its mission is to achieve the competitive development of that domestic industry with a sense of solidarity and social responsibility (Canieti, 2012).

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