Journal of Small Business and Entrepreneurship Development
December 2014, Vol. 2, No. 3 & 4, pp. 47-72
ISSN: 2333-6374(Print), 2333-6382(Online)

Published by American Research Institute for Policy Development
DOI: 10.15640/jsbed.v2n3-4a4
URL: http://dx.doi.org/10.15640/jsbed.v2n3-4a4

Trust and Innovation: Small and Medium Enterprises within Global Value Chains in Northern Mexico

Alejandro Valenzuela[1] & Oscar F. Contreras[2]

Abstract

This paper presents the results of a study conducted in 2011 in Sonora State, Northern Mexico, a regional environment populated by large multinational corporations and where small firms face many difficulties to innovate and participate in global value chains. The relation between trust and technological innovation in SMEs (Small and Medium Enterprises) is analyzed under the assumption that trust reduces uncertainty and transaction costs by replacing the incomplete information in the client-supplier relation. Trust has been classified in three dimensions: normative (based on honesty and good will), technical (based on technical skills) and strategic (based on leadership and prestige). Results indicate that the influence of normative and strategic trust is indirect since both are mediated by learning processes resulting from the client-supplier relation, meanwhile technical trust exerts a direct influence on innovation.

Keywords: Innovation in small companies; trust; technological learning; global value chains

1. Introduction

It is widely known that small companies[1] face many difficulties to innovate and participate in global markets, especially in countries, such as Mexico, with a segmented industrial base and a poor institutional environment for business. During the last decade, however, some studies have pointed out that the insertion of small and medium enterprises (SMEs) into Global Value Chains (GVC) can foster their competitiveness (Ernst and Kim, 2002; Schmitz, 2004: Giuliani, Pietrobello and Rabellotti, 2005).

[1] University of Sonora, Mexico
[2] Research professor, El Colegio de la Frontera Norte, Mexico, Km 18.5 carretera escénica Tijuana – Ensenada, San Antonio del Mar, Tijuana, Baja California, México, C.P. 22560. ocontre@colef.mx, (52 664) 6316300 ext. 3201.

In previous studies we found that interpersonal relations (weather through spin-offs or local socio-professional networks) become an important mechanism to access the supply chains of multinational companies (MNCs) leading SMEs to processes of learning by interaction that eventually allow them to improve their position within the value chain (Contreras, 2008; Contreras and Isiordia, 2010).

In this article we analyze the influence of trust in technological innovation in metal-mechanic (MM) and information technologies (IT) small companies in the state of Sonora, in Northern Mexico. We chose MM and IT firms because, according to previous studies, this activities are the most likely to be linked to the supply networks of MNCs (Contreras 2008; Contreras, Carrillo and Alonso, 2012).

2. Trust and Technological Innovation in SMEs

In the era of globalized markets it is assumed that innovation is a condition for companies to stay in the market (Cohen and Levinthal, 1990; Clegg, et. al., 2002, OCDE, 2010), particularly if they operate in highly competitive markets. To innovate means to create new or improved products or processes (Oslo Manual, 2005).

Innovation in big firms is usually part of their strategic planning, very often managed by a R&D department and eventually through agreements with public or private institutions. Small companies on the other hand, cannot establish R&D facilities and frequently they do not have the capacity to establish agreements with specialized institutions. Innovation is linked to necessity, a good treat of creativity and non-systematic compilation of information that is later transformed into knowledge. Data and knowledge compilation is given, in a high proportion, through relations established with other agents in their environment, mainly in the client-supplier relations.

There are two main approaches about the role of small companies in the economy. According to the first approach, called dynamic, small businesses are considered as the foundation of modern economies, and one of their roles is to introduce advanced products into the economy. Those innovations are possible through new or improved products and processes, sometimes radical, which foster the economy towards the technological frontier (OCDE, 2010). The other approach, the traditional one, considers that small firms impose high costs to the economy due to their few economies of scale

The dynamic approach argues that SMEs (and the entrepreneurial spirit) have played a very important role in the economy. According to this perspective, there are four contributions of this type of firms to the industrial markets: first, they play an important role in the process of technological change. Nelson and Winter (1982) argues that small industrial firms make a significant contribution since they are the source of a considerable amount of innovative activity. Second, the turbulence generated in the markets creates an additional dimension to competition not caught by the static vision of the market structure, but it also generates mechanisms of regeneration serving as agents of change. An important role of small independent enterprises is to become seedbeds of new companies capable of defying the established ones (Beesley and Hamilton, 1984). Third, they promote international competitiveness through the creation of new niche markets (Brok and Evans, 1989). The fourth contribution is their outstanding participation in the creation of employment (Storey, 1994). Menkveld and Thurik (1999), applying a model that measures the relationship between size and growth, found that an industry with low presence of big firms (compared to the same industry in other countries) has behaved better in terms of the product`s growth. Thus, not restructuring the industry (fostering the competence and the elimination of monopolies), has a cost in terms of growth. We can add to the list the fact that small enterprises plays a relevant role in the subcontracting networks through global corporations operates in the local markets, and the fact that this way new processes and better practices are spread in local economies.

Global value chains operate in highly competitive global markets, fostering the need of MNCs to transfer technical and managerial capacities to their local affiliates and suppliers, so that these firms will be able to fulfill the quality standards and lower their production costs. Once the local firms have managed to raise their capability levels, the new standards achieved become an incentive to delegate more sophisticated knowledge and processes to these local suppliers (Ernst, 2000; Gereffi, 1999; Schimtz, 2004; Ernst and Kim, 2002).

In this paper we argue that trust is crucial for small firms since innovation processes depend on their relations with the environment and not as much on their own resources. Since they don't have R&D capabilities, they use their relations with other agents in the environment; they must find a balanced combination of what Nooteboom (2000) calls exploration and exploitation of knowledge.

Exploitation of knowledge means the company's use of the existing knowledge, and exploration means the search for new knowledge and the true basis of innovation.

Innovation has been defined in multiple ways. For Schumpeter (1996), innovation is a powerful process of creative destruction, a dynamic process where new technologies replace old ones. There are five types: the introduction of new products; the introduction of new methods of production; the opening of new markets; the development of new sources of raw material and other inputs, and the creation of new market structures in the industry.

Based in the assumptions of evolutionary economics, Pérez (2001) introduced a useful classification: innovations can be incremental or radical. Incremental innovation is the gradual improvement of products and processes, which happens frequently since the trajectory of each particular technology is characterized by constant increments in technical efficiency, productivity and precision of the processes, as well as gradual changes in the products to get better quality, reduce costs or increment the range of uses. On the other hand, radical innovations consist in the introduction of completely new products or processes. Besides, due to the inertial dynamic of incremental trajectories, it is unusual that radical innovation takes place the improvement of an existent technology.

According to the Oslo Manual (2005), innovation is "…the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations. (…) Innovation activities are all scientific, technological, organizational, financial and commercial steps which actually, or are intended to, lead to the implementation of innovations".

Since its outcomes are in the future, innovation implies a great degree of uncertainty, due not only to the stochastic character of their outcomes, but also because of the participation of several economic agents in the same environment, with incomplete and asymmetrical information. The relationship of a firm with other agents is based in two key factors: vigilance, which most common expression is the contract, and the level of trust developed with their clients, their suppliers and public and private institutions that constitute the environment in which it operates.

2.1 Trust and Uncertainty

Trust is a set of rational positive expectations that are based upon the idea of the comprehension of the other's interests, and upon calculations that evaluate costs and benefits of certain course of action of either one (Gordon, 2005); it is the belief that the others will act in an honest way and with good will; that they will possess the technical knowledge they claim, or that they will exercise a leadership based upon their prestige in certain industrial sector.

The importance of trust in business is crucial. "First, due to the uncertainty that comes with all the activities in the modern world; second, due to the interdependence of enterprise activities; third, due to the risks involved with the technological development; fourth, due to the complexity of technological developments even for highly educated people; fifth, due to the impersonality of many operations, and in general, due to the great amount of options that imply any decision making: not only one side's options, but also the counterpart, for every operation implies at least a bilateral operation" (Sztompka, 1999). In other words, "the economic value of trust rests in the fact that it allows interactions between people and organizations" (Nooteboom, 2002).

Having preeminence over opportunism, "trust is a risky bet" (Luhmann, 2000) that, however, should be assumed because otherwise the agent risk falling into paralysis. It allows practical decisions about clients, suppliers, competitors and associates. Trust is not an innovation "input", at least not in the physical way. It is a characteristic of the environment in which businesses are made; it is a complex attribute that cannot be reduced to a "state" or "mechanism". This reduction would give the false idea that trust is a static concept when in reality it implies a conflictive relationship with time, since trusting means to anticipate the future (Luhmann, 1996).

As a dynamic element in the business environment, trust is not something that one decides to have, or something that is given voluntarily, as an object; one can say that it is constructed in the relationship and that it can chance with time, circumstances and the conditions of the participants; in other words, it is constructed based on *iterated relations* between economic agents. Iteration is the repeated use of a process using in the next use the results of the former. Iterated relations would mean, then, the constant learning as a result of interactions with other companies.

The basis of trust, that lead to the reduction of uncertainty, are: 1) "partial displacement of the problem from the external to the internal", in other words, the strengthening of trust by external conditions; 2) the learning process through which one leans to trust (or not trust); and 3) the detection of symbols in the environment that allow trusting. These three factors contribute to the reduction of the complexity (Luhmann, 1996). Of course, trust is not unconditional, but in order to be useful to foster business relations, it must assign a more relevant role than that of predisposition to opportunism. This means that companies, as individuals, are capable of subordinating short-term profits to accomplish explicit or tacit agreements with their counterparts.

Learning and innovation processes have always been produced in increasingly dubious environments. The sources of this uncertainty are: first, the needs of clients; second, the technological environment that determines the type of learning and which type of innovations are necessary to maintain the visibility of economic unity in the market; third, the competitive environment that sends signals about what is being done by the producers of goods and other services: fourth, the organizational resources, since it is important to know if the company is capable of innovating and relating to other organizations that can contribute with knowledge, help and incentives for innovation (Souder and Moenaert, 2007). And, fifth, the uncertainty that produces the economic environment, in other words, the variability of prices, interest rates and market opportunities.

A process of rapid innovation leads to not foreseen results, about which there are no information, that produce uncertainty and that makes governance, especially if based in contacts, difficult, which increases the preeminence of trust-based collaboration (Nooteboom, 2005a). If information is perfect and sufficient, trust is irrelevant. However, when it comes to the technological innovation of small companies this is not possible. Therefore, if the information is not sufficient to take decisions that involve relations with other agents, there must be alternative mechanisms to proceed. Those alternatives are vigilance or trust, although a combination of both is appropriate because one does not always trust, only in the context of specific exchanges (Hardin, 2003). When trust is established, the uncertainty (or part of it) diminishes and so do operation and transaction costs.

2.2 Trust and Innovation

We can start off from a realistic assumption: small entrepreneurs are more willing to make efforts to innovate when they have positive expectations about the reply of other agents and when they have created the basis for mutual trust. Particularly, small entrepreneurs involve more in innovation processes when they think that their ideas are considered. Since innovation implies risks, it is unlikely their involvement if they don't trust whoever participates in the process (Clegg, et. al. 2002).

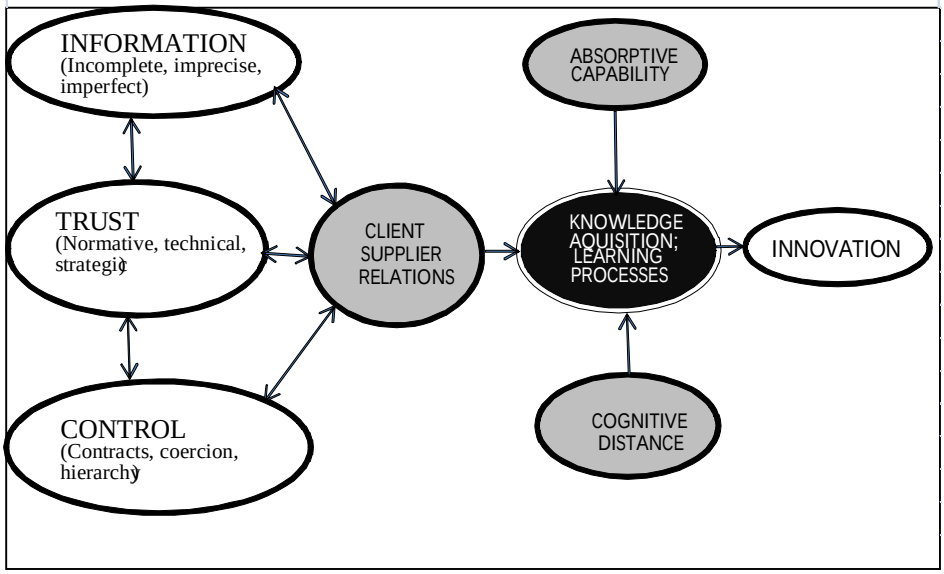
In innovation processes, firms need to be flexible and timely in their decision making in order to adjust to changes in markets and in technologies. This requires collaborative relations with other agents to acquire the knowledge needed (Nooteboom, 2006b). Within this framework, relationship between trust and innovation is indirect since innovation needs knowledge which comes, particularly, from relations with other companies and diverse agents; in those relations trust tends to have an important role as "social lubricant".

A fruitful relation in terms of information exchange that produces knowledge involves absorptive capacity (the ability to recognize the value of new information, to assimilate it and apply it) and maintaining an appropriate "cognitive distance" from the source of knowledge (Nooteboom, 2006a; Cohen and Levinthal, 1990) because it generates diminishing returns. Like cognitive distance, trust has to have an appropriate level because at minimum levels it blocks client-supplier relations and if it is too much it generates rigidity and loss of innovative capacity because it limits competition. These limitations lead to a combination of trust and control. Control has basically two purposes (Nooteboom, 2006b): to reduce the possibilities of opportunism through contracts, coercion and hierarchy; and to provide incentives for a relationship of trust based on respect to reputation, dependence on partners and benefits of the relationship.

Thus, innovation requires three factors: information (always imperfect, imprecise and incomplete); some degree of control over clients and suppliers, and trust in other agents.

In Figure 1 the former ideas are schematized: framing the analysis in the client-supplier relation, we can assert that innovation has its origin in the acquisition of knowledge and in learning processes based in the absorptive capacity and cognitive distance. Learning processes are generated in the context of such relations due to specific combinations of information and knowledge, control and trust, which are also mutually reinforced.

Figure 1. Components and Influences of Innovation



2.3 Dimensions of Trust

Trust can be analyzed in different spheres, but here our focus is on client-supplier relations. In this context three dimensions of trust can be specified: normative, strategic and technical (Luna and Velasco 2005; Gordon, 2005). Luna and Velasco classify trust in *Calculated* (equivalent to *Strategic*), *Normative* and *Cognitive* (equivalent to *Technical*). Meanwhile, Gordon presents a wide revision of different theoretical approaches that sustain the diverse classifications of trust that, according to the author, are not conflicting and can be combined.

The first dimension is related to the disposition to act according to norms and values, particularly honesty and good will. The second has to do with convenience and calculation of the agents (Nooteboom, et. al., 1997) depending on the degree of dependence in a given market structure and the reputation of business organizations.

And the third dimension is related to the expected skills of the suppliers and the intention of doing the activities they assure they will develop (Klein, et. al., 2005).

Table 1. Determinants of trust

DIMENSION	FACTOR	LABEL
INNOVATION	Y1	Innovative activities
	Y2	Product innovations
	Y3	Process innovations
	Y4	Impacts of innovations
LEARNING	A1	Improvement through learning
	A2	Activities to increase knowledge
	A3	Strategies for knowledge sharing
TRUST		
NORMATIVE	CN1	Relation among firms
	CN2	Type of contracts
	CN3	Frecuency of coertion
TECHCNICAL	CT1	External sources of learning
	CT2	Fuentes externas de aprendizaje
	CT3	Agents and influences of learning
	CT4	Absorptive capacity
STRATEGIC	CE1	Market structure
	CE2	Prestige of firms related

Contracts, as expression of instruments of vigilance, require a stage direction because their importance relies on the conception of trust. Some authors postulates a conflictive relationship between trust and contracts (the contract would be the evidence of distrust), but transaction costs economics (Williamson, 1981 and 1989) admits a positive relation between contract and trust, in the sense that trust is part of an institutional environment in which contractual agreements are developed and agreed upon.

For Luhmann (2000) the legal institution of contract contains a technical formulation of the principle of trust in terms of the law that becomes too independent for trust to play a role as a real condition or as a basis for the validity of agreements. In other approaches trust precedes the contract, but in several stages of the relation they can be interchangeable and complementary. According to this point of view, the contract has three functions: it is a mechanism of coordination that allows handling the relation; it acquires the role of safeguard in the face of technical and economic contingencies, and it means the covenant of a commitment that reflects trust between the parts (Klein, et. al., 2005).

For Nooteboom (2005a) and Nooteboom, Berger and Noorderhaven (1997), trust can reduce the need of very specific and more expensive formal contracts. The economic relevance of trust is that it reduces the specification and the monitoring of contracts; it provides material incentives for cooperation and reduces uncertainty. Besides, a contract too formalized, with the capacity of coercion to force the parts to comply, requires a judiciary system that works and one in which agents can trust. Contracts make no sense when there are no legal and judicial appropriate bases (Nooteboom, 2005b).

3. Methodology

The research was conducted during 2010-2011 in Sonora State, Northern Mexico, a regional environment populated by large multinational corporations. We selected metal mechanic (MM) and information technologies (IT) firms, that according to previous studies are the most linked with MNCs supplier networks (Contreras, 2008; Contreras and Isiordia, 2010). For the identification of the companies we used the Mexican Institute of Social Security (IMSS) registries and other public and private data bases. The result was a total of 672 firms, of which 322 are IT and 350 are MM.

From that universe we chose a random sample of 104 firms to which we applied a questionnaire comprising 95 questions that produce 751 variables organized in ten sections (general profile, absorptive capacity, learning and innovation, strategic management, investment, relations with other companies, relations with higher education and government institutions, and relations with business organizations).

This questionnaire is a wide instrument involving several research questions. For this paper we selected those variables related to innovation, learning, normative trust, technical trust and strategic trust; theses dimensions are constructed from a set of factors, and those factors are the outcome of the aggregation of variables. Through standardization and recoding of variables, we calculated indexes for each ones of the five dimensions and their associated factors. The verification of the appropriateness of the organization of variables was based on our experience and the correlation indexes from factorial analysis.

Beyond the structural analysis from the survey data, we developed five case studies that allowed us to explore the dynamics and mechanisms through which trust can be established and evolve in client-supplier relations. Of the 5 selected companies, three are metal-mechanic, one is mixed and the other one is dedicated to software development.

4. The Role of Trust in Innovation: Five Case Studies

The perception of entrepreneurs about the relation trust-innovation is important because it allows capturing the relevance assigned to innovation, as well as the relations with their clients and suppliers, specifically related to such phenomenon. It also makes evident how the treatment with those clients has evolved, from personal relations to technical and professional exchanges. This analysis also shows the perception of businessmen about the MNCs and about the role of the strategic trust in their relation with them.

IRODI is a firm dedicated to metal-mechanics based in Hermosillo which main activity is the design of machines and robotic tools built on specific demand of their clients, among which stand Ford's automotive assembly plant and several companies of the medical devices industry.

DSI is a metal-mechanics firm based in Hermosillo and producing equipment and maintenance services to AC systems for the local industry. Among their clients stand two transnational companies: Norson and Cowi.

PROMAIN is a metal-mechanic company based in Hermosillo, dedicated to structures, metallic pieces and parts for mining industry. Its main clients are the big mining companies established in the region, most of them transnational.

INTERLOGIC is a firm based in Hermosillo and combines metal-mechanics processes with IT products and services Their main activity is the design, manufacture and installation of ATM's, producing the machine as well as the software that makes it work. Among their main clients stand Telmex and CFE.

SIITNE is based in Ciudad Obregon, specialized in solutions based in the development and adaptation of free software; it offers consulting services and implements information systems based in *Open Source* tools. Their main clients are Fertimex and the State Ministry of Education.

The 5 businessmen interviewed are graduated from several engineering schools in the region, and they all had work experience before they started their own company. Such work experiences, mainly in big high technology companies, allowed them to identify market niches (non exempt of competition) linked to very dynamic industries and where innovation is the swivel to stay on the market.

4.1 Dimensions and Meanings of Trust

The main clients of the selected firms are big companies operating with high technological standards and very sensitive to quality; thus, they have high expectations on the technical and professional performance of their suppliers. In other words, buyers (clients) expect acceptable technical standards from sellers (the companies analyzed in this research). The suppliers of these companies (suppliers of the suppliers we analyze) are more and operate in more generic markets, thus they can be substituted with relative ease; therefore, personal contacts maintain a higher importance in client-supplier relations, although as the market develops those relations loose relevance.

Businessmen interviewed have a high appreciation of the principles of honesty and good will, but the normative relation is every time more marginal as the technical abilities become the main axis of the relation. This evolution, however, does not exclude personal relations. In the typical case, personal relations are maintained and complement those based in technical criteria. This is important for the businessmen because judicial mechanisms are very imperfect and their resource leads to more costs than benefits.

In their relations with suppliers, businessmen interviewed operate under the firm of contracts to which they define as “security”, meaning that they see them as a warranty for the fulfillment of the commitments, although trust means that legal safeguards will not be necessary.

The meaning of a contract is different in the case of relations with big clients, being transnational companies or big Mexican companies as the CFE and the mining ones. In those cases businessmen see the contract as reflex of trust that those organizations have in local MM and IT. This means that they practice strategic trust with important companies. In both cases (the relations with suppliers and clients) contracts are important, and although they have a different sense to the virtual absence of conflicts, it can be interpreted as an evidence of the centrality that acquire relationships based on trust.

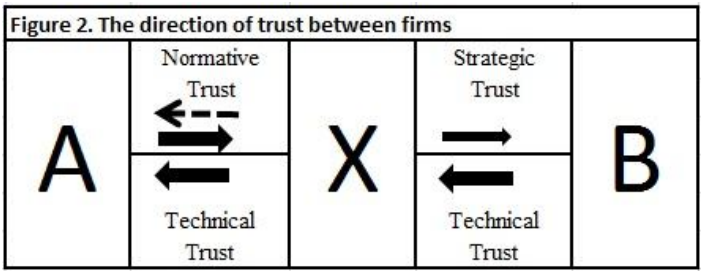
In previous studies (Contreras, 2008; Contreras and Isiordia, 2010) we observed that one of the most frequent mechanisms for the establishment of client-supplier relations between local and transnational companies is the use of "socio-professional networks" in the locality, this is, in interpersonal relations linked to the business environment. What we can add from the interviews is that trust in this context is evolving (in some faster than in others) from the normative to the technical dimension. So, what determines the business relations that make possible the innovation process is the technical trust, which is given to a company that is providing an innovative product, process or service: the client's trust in the supplier's knowledge and abilities to perform the work for which it was hired.

Reputation is important because it means that the client has to trust in firm's trajectory, but most of the jobs that are commissioned, or at least those that matter for the purpose of this study because they mean some level of innovation, are single use machines or devices and thus cannot be mass produced, though each new product or process increases the capacities to solve future problems.

Furthermore, it is observed that the preeminence of technical trust is combined in different ways with the other types of trust. In Figure 2 this phenomenon can be schematized as follows: X, are the small MM and IT companies, relate with A and B that are their providers and clients, respectively. A is, in many cases, a small company that operates in the local or regional market, while A is, in many cases, a big company of national reach, and frequently a transnational company since in the last years global production networks have expanded to local markets (Contreras, 2005; Bracamonte and Contreras, 2008).

When clients trust their suppliers there is an evolution from normative to technical trust, prevailing the value of technical skills over personal relations. Thus, they type of trust that B has in X and that is in A, is technical. On the other hand, trust of suppliers in their clients depends on the market situation. Thus, in general, A trusts in the norms an values of X, but X should trust in B, especially if it is a corporation with prestige or leadership, that is, with more power in decisions inside the chain of value in which the small local company is inserted because that allows her to participate in markets that otherwise would be impossible. Furthermore, trust of X in A transits with time from normative to technical. Theses relations are shown in the following chart, where the arrow means the sense of trust and the pointed arrow means that this type of trust is fading as a main element of the relation.

Figure 2. The direction of trust between firms



4.2 Trust and Innovation

The main reason for a company to be in contact with other organizations is the search of markets for its products, and the subsequent profit making. However, in the more dynamic markets those objectives frequently involve the need to learn and accumulate knowledge to quickly answer to the needs of clients. In other words, the relation with leader companies, of high technological level that participate in highly sensitive markets to quality, imply a certain level of innovation to keep up with those responses.

In most of the cases, the interviewed businessmen describe themselves as "problem solvers" of their clients. This is because the typical relation with their clients consists in that they require solutions to specific problems; the businessman answers quickly and with flexibility giving solutions adjusted to specific needs, and to do this, it demands professionalism and technical dominion. At the same time, suppliers want to put their machines and tools that will contribute to improve the performance.

Throughout the interviews it is clear that businessmen are conscious of the importance of the technical abilities that distinguish them (technical trust), but admit, with different emphases, that honesty and good will (normative trust) are essential and contribute to strengthen their prestige in the environment in which they work. Furthermore, they know that the domain of technology and their experience to introduce innovations strengthen the trust other have in their abilities.

5. The Role of Trust in Innovation: Structural Analysis

This section presents the results of the quantitative analysis that establishes the strength of the relation between factors of trust, learning and innovation.

5.1 Factors and Variables

Based on the results of a questionnaire applied to 104 metal-mechanic and IT companies, we built indexes for five factors: Innovation (Y), learning (A), normative trust (CN), technical trust (CT) and strategic trust (CE). For the construction of indexex the variables were standardized to a comparable scale. This was followed by the selection of variables included in each factor (supporting this process by correlation matrices and discriminant analysis, whenever it was possible) then it was obtained each index by aggregation with a weighting equal for each participant variable. In the end, any given factor (Fi) is the outcome of the sum of variables (Xi) that the factor analysis chose to include.

$$F_i = \sum_{i}^{n} X_i$$

Every chosen variable has the same weighing in the construction of the factor. This is possible due to the recoding of the variables, which reduces them to comparable scales. We preferred the standardization and recoding over normalization because it generates negative values that inhibit tests with logarithmic models.

The method used here is iterative in a certain way because first it was decide intuitively which variables entered in which factors. Once there was an indicator, we ran the correlations that indicated which of the chosen variables confirmed, through the correlation index, their permanence in the factor.

The index of innovation (Y) is constituted by a sequence of implications: the innovative activities (Factor Y1) have to carry the innovations of the product (Y2) and of the process (Y3) and they have to be reflected in the performance of the firm (Factor Y4).

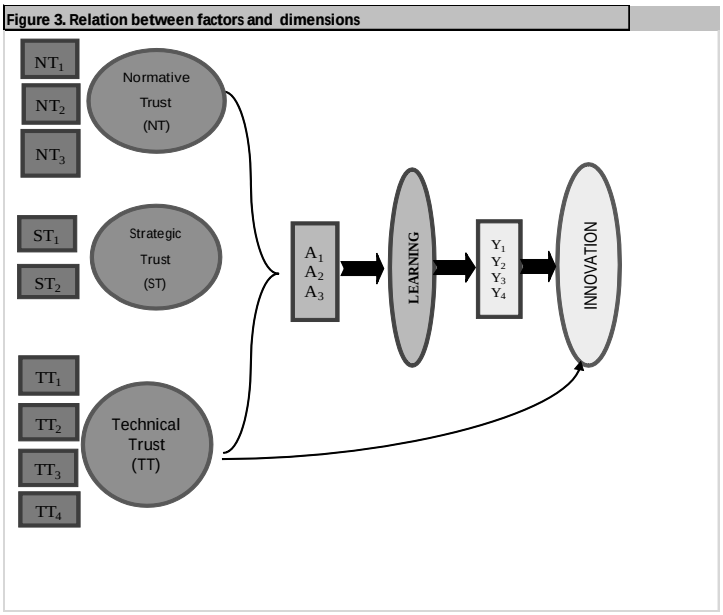
The learning index (A) is built from the detection of specific aspects that are prohibited by the businessman as upgrades from learning (Factor A1); by specific activities to increment knowledge (Factor A2) and the strategies to promote knowledge (Factor A3), e.g., obtaining certifications, machinery renewal and the focus in one product of diversification of products, whichever is more convenient.

The index of normative trust (CN) is built on the relations between companies (Factor CN1), the type of concentration convened with clients and suppliers (Factor CN2) and the frequency with which one has to use coercion to enforce commitments (Factor CN3).

The index of technical trust (CT) is maybe the most sensitive one because one cannot verify objectively the technical abilities and competencies of those agents with which they relate to. Those technical abilities can be verified through existent information (that is never complete and that is expensive to obtain) or leave them to trust. A way to prepare to evaluate the clients and suppliers is reinforcing internal sources of learning (Factor CT1), which will guide them in the search of external sources of knowledge (CT2) and exploit the agents and learning and innovation influences that the market provides (Factor CT3). The absorption capacity (Factor CT4) is based on the level of education of the businessman and workers, the previous experience of the owner, the age of the plant and equipment and the degree of technological advance.

Finally, the strategic trust index (CE), that is, the convenience of trusting a client of supplier, is related with two factors. The first is the market structure (Factor CE1), where transnational clients linked to global chains of production have an important influence. The second factor is the prestige of the related companies (Factor CE2). The variables that conform are about the destination of sales between local, national an foreign markets; the type of sectors that sell (automotive, aerospace and electronics) and the size of the plants.

Figure 3 presents the interrelations between the variables, factors and dimensions constructed.



5.2 Analytical Models

The final target of this research is to prove the hypothesis that technological innovation in small MM and IT companies in Sonora is explained greatly by the trust generated in the client-supplier environment. Furthermore, the hypothesis establishes that the influence wielded by the normative and strategic types of trust in innovation is indirect and is mediated by the learning processes, while technical trust influences both ways, directly and through learning.

Thus, in theory, to test those relations one has to design a set of models of analysis: one that shows the relation between trust and learning; another that shows the relations between learning and innovation and yet another to detect the direct influence of technical trust in innovation. It should be added an additional one that shows that CN and CE have no direct influence.

Regression models, calculated using the method of ordinary least squares, can be linear or logarithmic. In the paper we choose the one that "best fits" the data. When the one that fits best is the logarithmic model, it is empirically showing that the influence of the specific factor has a decreasing marginal influence, which is very possible since, for instance (choosing one of these cases) technical trust cannot have constant rates of influence in innovation.

Models tested and adjusted to the data go as follows[2]

Model 1: Linear model that establishes the relationship between learning and innovation, where the last one is the dependent variable or to explain.

$$Y = b_0 + b_1 A + u_i$$

Model 2: Logarithmic model that establishes that learning is explained by the dimensions of trust (normative, technical and strategic).

$$Ln\ A = Lnb_0 + b_1 LnCN + b_2 LnCT + b_3 LnCE + u_i$$

Model 3: Logarithmic model that demonstrates the direct relationship that technical trust exercises over innovation.

$$Ln\ Y = Lnb_0 + b_1 LnCT + u_i$$

5.3 Results

The following is the hypothesis between the relationship of trust-innovation: Technological innovation in small businesses is the result of the learning process that occurs in the area of customer-supplier relationship, with different levels of degree and meaning, which are supported by trust based on rules, technical abilities and influence and prestige, in other words, on normative, technical and strategic dimensions of trust.

The meaning of coincidence is that learning has a strong degree of explanation on innovation. At the same time, learning is based on specific activities that would increase it not in a formal sense, but through and specific work training, event attendance and relationship with other productive units.

The accumulated knowledge explains only part of innovation because even with all the necessary knowledge, innovation is not possible without the entrepreneurial spirit, without bold and curiousness for events yet to take place, and without the pressure of competition. Of course, reciprocally, all these virtues and attitudes would not lead anywhere without the necessary knowledge.

The specific hypothesis relative to model 1 are, first, that the constant must be greater than zero (because there are systematic factors far from learning that would influence on innovation); secondly, the learning index coefficient is expected to be positive as the innovation grows with knowledge. Lastly, the stochastic error term it's due to a number of random factors that influence the behavior of the dependent variable of this model. This hypothesis is verified on the results of model 1, presented below:

5.4 Results of Model 1

This model fits well the data, as well as the significance levels are lower to 0.005. First, it shows that the learning index explains 35% of the behavior of the innovation index[3]. Secondly, the test F indicates the "quality" of the explanation percentage, and the overall validity of the model[4]. In the model, test F is 56 and therefore it is accepted as a criterion for the overall validity of the model. Thirdly, the results of test t of *Student* indicates that the systematic elements different from learning and reflected by the constant are statistically significant; likewise, by the same test, the learning coefficient is significantly different from zero.

Once the learning influence on innovation has been statistically proven, the next phase would be to demonstrate the influence of trust on learning. If the trust index explain properly (is statistical terms) the learning index, then (based on the results of the previous model) we may conclude that trust has an influence on innovation.

The model that best fits is the logarithmic model (base e) which is actually a type Cobb-Douglas model where the coefficients of the independent variables (which become exponents when the antilogarithms ate taken into account to return to the original variables) represent the elasticity of the dependent variable with respect to changes on the independent variables. Taking the linear expression of that model, its specifications and results are as follows:

5.5 Results of Model 2

The original model results from the application of the antilogarithms:

$$\mathbf{A = 0.0017\ CN^{0.723}\ CT^{1.563}\ CE^{0.495} e^{ui}}$$

This model explains 48 percent of the problem, which is assumed to be a good explanation (Test F), and the coefficients are different from zero and statistically significant (by Test T). The additional interpretations are very simple: for every one percent increase on the trust index (assuming all three simultaneously increase), learning increases 2.78 percent. If we make a comparison with what is happening in the production field, we would say that learning shows increasing performance returns to scale with respect to trust.

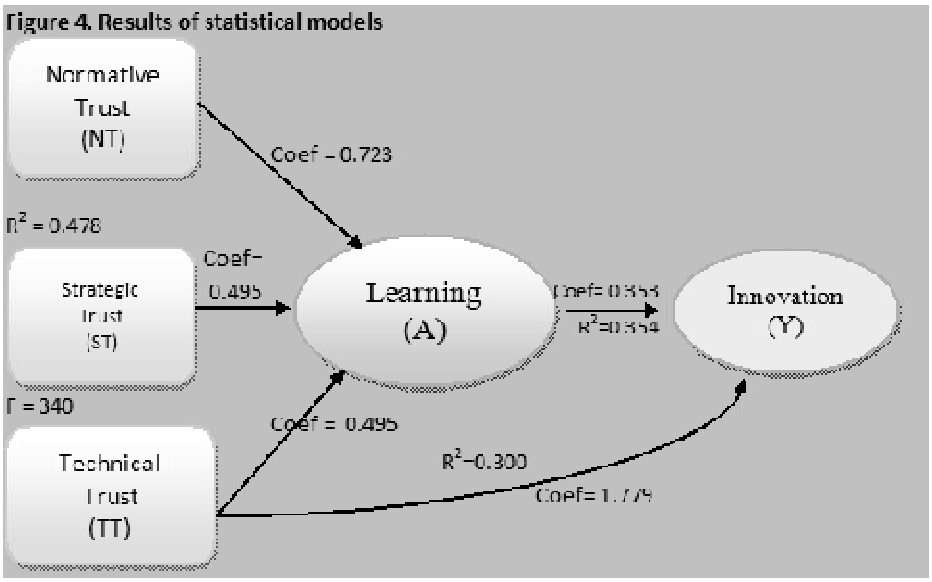
After verifying the influence of trust in innovation through learning, ie, having shown a strong indirect influence of trust in innovation (models 1 and 2), the next task is to check whether there is any direct influence considering separately the three dimensions discussed above. Statistical tests showed that the normative and strategic dimensions of trust have no direct influence (the estimates of the parameters were not statistically significant at a level of significance less than or equal to 0.05). However, these results show that the technique trust does have a clear direct influence on innovation (model 3).

5.6 Results of Model 3

The original model results from the application of the antilogarithms:

$$\mathbf{Y = 0.002326\ CT^{1.779}\ e^{ui}}$$

Model 3 is statistically robust and loses very little explanatory power but instead enhances the influence of technical trust in innovation. What can be concluded from the previous two models is that only technical trust has a direct influence on innovation. The other two (the normative and strategic) have indirect influence through learning. Scheme 4 shows visually the ideas above.



6. Conclusions

The starting point of this study was the previous findings related to the large and persistent difficulties faced by SMEs to innovate and participate in GVC's in Northern Mexico, an environment populated by large MNCs. These studies demonstrated that interpersonal relationships are crucial to access the MNCs supply chains though socio-professional networks, and that this type of links generally leads the SMEs to learning through interaction that will eventually enables them to improve their position in the value chain (Contreras, 2008; Contreras and Isiordia, 2010).

What we found in this study is that technological innovation in small firms is mainly explained by the accumulated knowledge and skills. Learning takes place in the context of the customer-supplier relationship based to some extent on the trust built between the participating agents. Trust influences innovation indirectly through learning, although some of the trust, the technical trust, also has a direct influence on innovation. From the perspective adopted in this study, the notion of trust is more dynamic than static because it is not a product of "a decision", but it is a set of approaches regulated by the attitude, behavior and even the decision. In that sense, trust is an element of the business environment.

Technological innovation is the creation of something new or improved at the plant level. These creations are products or services that are usually demanded by customers, or processes that allow them to more efficiently meet the demands submitted. Most of these innovations are improvements in the methods of production, or products that may be completely new, such as robotic arms, metal parts or software programs for specific applications required by the customer.

Innovation is mainly explained by the accumulation of knowledge. For the company to acquire the information and transforms it into knowledge it is necessary that the plant has a significant absorptive capacity. This is measured by indicators such as education, training and previous job experience of workers and employers (which is above the average of their counterparts in local markets), the type of formal training of the entrepreneur (most of them have bachelor degree in an engineering area), and the age of the machinery and equipment. These indicators are the basis of the technical trust that the firm generates to its customers and it their expectations of their suppliers.

Other variables that measure the learning process are the acquiring strategies used and the activities to increase it (training courses, machinery and equipment adaptation through reverse engineering, production and administrative improvements, certifications and adjustments to the international standards, etc.); also improvements intervene due to learning which gives a better performance in the market.

The propensity to innovate depends on the attitude towards the accumulated knowledge and experience. When the company tries to make the most of the available knowledge, is *exploiting* its stock. When it tries to extend its information basis and looks for new knowledge, is *exploring* new lines to innovate.

There seems to be a consensus in literature, at least among those who start from a dynamic conception, that innovation in those companies does not come mainly from investigation and development, because those businesses are not generally in conditions to deal with the costs or to create the necessary conventions for that. It comes mainly from relations between companies and companies and other agents where information is exchanged and knowledge is created. Besides the absorption capacity, the efficiency in the accumulation of knowledge depends on the cognitive distance. In other words, a receptor of knowledge has to have a distance with the transmitter such that the information received is attractive.

If the distance is too big, the understanding among agents is reduced and the information does not easily flow. If the distance is too small, then both have information and knowledge equivalent and the contact is no longer interesting (does not stimulate innovation). It is required, thus, an optimal distance between agents. This aspect can be confirmed through the interviews and visits to companies, since small companies, besides having an adequate absorption capacity, have clear differences in size and complexity regarding their clients and suppliers. Trust arises from iterated interactions, particularly between clients and suppliers. The trust that facilitates those relationships is a complex concept, dynamic, constructed and that molds the environment in which business are developed.

Trust is an element present in every type of relationship established by firms and in each evolutionary stage of their businesses; it's a factor that facilitates the development of innovations and, in general, the performance of companies. One of the findings of this research is in general that trust evolves from the normative to the technical dimension. The same development of the markets makes less important personal relations to establish and operate businesses. Thus, the accent is focused on the technical and professional abilities of the hired agents. In Mexico the institutional design is still a bad generator of trust in society, however it has evolved and to the extent that it generates rules which violation creates a cost, not in personal terms, but institutionally.

However, innovation processes (which outcomes are in the future and where uncertainty is bigger) it is almost impossible, or very expensive to guarantee the pertinence of the technical abilities of hired agents. Before this impediment, the businessman has to trust that the hired will to do thins according to the agreements. Not everything is trust, of course; there is also information product of the iteration of interactions, and there are diverse ways of control, but there is no full information and there is no contract so detailed that the outcome can depend on control.

In the last decades regional markets have registered a coupling with the global. Many of the national and transnational firms that establish subcontracting networks or that looks for suppliers in local markets are big corporations that impose their conditions to local productive units. Thus the convenience for small units to trust in bigger units, that are powerful and with prestige.

In many cases these relations have been initially established from personal relations (that help big companies to identify potential dependable, and them to identify way to access chains of suppliers of big companies), but the importance of personal relations is diluted rapidly before technical imperatives that allow to sustain the relation between companies in time; thus, for small companies, their trust to big companies resides more in the convenience of staying with their suppliers to stay on the market and expand. It is a strategic trust.

Some of the central findings of our study are:

a) Trust influences innovation indirectly, through learning. Model 1 shows the direct influence of learning, that contributes with 35.4% of the explanation of innovation processes and shows that more learning leads to more innovation;
b) Model 2 shows that all dimensions of trust influences learning. In a logarithmic model it is observed that all three factors of trust are statistically significant, that explains 48% of learning and that this level of explanation is generally acceptable. An additional finding of the model is that learning shows "increasing returns to scale" regarding trust.
c) However, the hypothesis shows that the influence of trust in innovation is direct and indirect. Model 3 was designed to show that normative and strategic dimensions of trust influence indirectly and that technical trust influences directly. In fact, the model throws coefficients that cannot dismiss the hypothesis that they are equal to cero for CN and CE. The coefficient of CT, on the other hand, is statistically significant. The general outcome of this model shows that there are factors of trust (normative and strategic) that do not influence directly in innovation and that technical trust does.
d) To isolate the degree of direct influence of CT in innovation, we tested model 4, that shows statistically acceptable coefficients, complementing the explanation and allowing us to maintain the hypothesis that trust acts directly and indirectly in innovation, and that it does so through learning processes.

References

Beesley, M. E. & Hamilton, R. T. (1984). Small Firms' Seedbed and the Concept of Turbulence. The Journal of Industrial Economics, 33, 2, 217-231.

Bracamonte, A. & Contreras O. (2008). Redes globales de producción y proveedores locales: los empresarios sonorenses frente a la expansión de la industria automotriz. Revista Estudios Fronterizos, 9, 18, 161-194.

Brok, W. A. & Evans, D. S. (1989). Small Business Economics. Small Business Economics, 1, 7-20.

Clegg, C. W., Unsworth, K. L., Epitropaki, O. & Parker G. (2002). Implicating Trust in the Innovation Process. Journal of Occupational and Organizational Psychology, 75, 409-422 .

Cohen, W. & Levinthal, D. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. Administrative Science Quarterly, 35, 128-152.

Contreras, O. (2005). Impacto de la ampliación de Ford Motor Co. en Hermosillo, Sonora. México: Secretaría de Economía, El Colegio de Sonora, FUMEC.

Contreras, O. (2008). Pequeñas empresas globales: un conglomerado automovilístico en México. Comercio Exterior, 58, 9, 617-629.

Contreras, O., Carrillo, C. & Alonso, J. (2012). Local Entrepreneurship Within Global Value Chains: A Case Study in the Mexican Automotive Industry. World Development, 40, 5, 1013-1023.

Contreras, O. & Isiordia, P. (2010). Local Institutions, Local Networks and the Upgrading Challenge. Mobilizing Regional Assets to Supply the Global Auto Industry in Northern Mexico. International Journal of Automotive Technology and Management, 10, 2, 161-179.

Ernst, D. (2000) Inter-Organizational Knowledge Outsourcing: What Permits Small Taiwanese Firms to Compete in the Computer Industry? East-West Center Working Papers, Economics Series, 3, 223-255.

Ernst, D. & Kim, L. (2002). Global Production Networks, Knowledge Diffusion, and Local Capability Formation. Research Policy, 31, 1417-29.

Gereffi, G. (1999). International trade and industrial upgrading in the apparel commodity chain. Journal of International Economics, 48, 37-70.

Giuliani, E., Pietrobelli, C. & Rabellotti, R. (2005). Upgrading In Global Value Chains: Lessons From Latin American Clusters. World Development, 33, 4, 549-573.

Gordon, S. (2005). Confianza, capital social y desempeño de organizaciones. Criterios para su evaluación. Revista Mexicana de Ciencias Políticas y Sociales, 193, 41-55.

Hardin, R. (2003). Social Capital and Trust. New York: New York University.

Klein W., Bas Hillebrand, R. & Nooteboom, B. (2005). Trust, Contract and Relationship Development. Organization Studies, 26, 813-840.

Luhmann, N. (1996). Confianza. México: Universidad Iberoamericana-Anthropos.

Luhmann, N. (2000). Familiarity, confidence, trust: Problems and alternatives. In D. Gambetta (Ed.) Trust: Making and breaking cooperative relations, electronic edition, Department of Sociology, University of Oxford, chapter 6, pp. 94-107, <http://www.sociology.ox.ac.uk/papers/luhmann94-107.pdf>.

Luna, M. & Velasco, J. L. (2005). Confianza y desempeño en las redes sociales. Revista Mexicana de Sociología, 67, 1, 127-162.

Menkveld, A. J. & Thurik, A. R. (1999). Firm Size and Efficiency in Innovation: Reply. Small Business Economics, 12, 97-101.

Nelson, R. R. & Winter, S. G. (1982). An Evolutionary Theory of Economic Change. MA: Harvard UniversityPress.

Nooteboom, B. (2002). Trust, Forms, Foundations, Functions, Failures and Figures. Massachusetts: EE Publishing Inc.

Nooteboom, B. (2000). Learning and Innovation in Organizations and Economies, New York: Oxford University Press.

Nooteboom, B. (2005a). Trust, Institutions and Development. Netherlands: Tilburg University.
Nooteboom, B. (2005b). Embodied Cognition, Organization and Innovation. Tilburg University.
Nooteboom, B. (2006a). Transaction Costs, Innovation and Learning. Contribution to Companion to Neo-schumpeterian Economics. Netherlands: EE Publications.
Nooteboom, B. (2006b). Trust and Innovation. Germany: Dutch Ministry of Economics Affaires.
Nooteboom, B., Berger, H. & Noorderhaven, N. G. (1997). Effects of Trust and Governance on Relational Risk. Academy of management Journal, 40, 2, 308-338.
OCDE (2010). SMEs, Entrepreneurship and Innovation. OCDE Studies on SMEs and Entrepreneurship.
Oslo Manual (2005). Guidelines for Collecting and Interpreting Innovation Data. Third Edition, OCDE and European Commission.
Pérez, C. (2001). Cambio tecnológico y oportunidades de desarrollo como blanco móvil. Revista de la CEPAL, 75, 115-136.
Schmitz, H. (2004). Globalized Localities: Introduction, In Hubert S. (Ed.), Local Enterprises in The Global Economy Issues of Governance and Upgrading. England: Edward Elgar.
Schumpeter, J. (1996). Capitalismo, socialismo y democracia. Barcelona: T.I Ediciones Folio.
Souder, W. & Moenaert, R. (2007). Integrating Marketing and R&D Project Personnel Within Innovation Projects: An Information Uncertainty Model. Journal of Management Studies, 29, 4, 485-512.
Storey D. J. (1994). Understanding the Small Business Sector. United Kingdom: International Thomson Business Press.
Sztompka, P. (1999). Trust. A Sociological Theory. Cambridge: Cambridge University Press.
Williamson, O. (1981). The Economics of Organization: The Transaction Cost Approach. American journal of sociology, 87, 3, 548-577.
Williamson, O. (1989). Las instituciones económicas del capitalismo. México: FCE.

Notes

1. For the purpose of this paper we assume that *small companies* are economic units with 250 or less workers. We use either that term or SMEs.
2. Whenever a particular regression model is chosen from a set of tests should bear in mind, first, a diverse variable inclusion and, secondly, different functional forms. The present model is the one that fits the best.
3. In regression models bases on cross-section data (as opposed to models based on time series) R^2 should not be "large" as an evidence of "good performance" of the model. In this case it is only indicating a percentage of the behavior of the dependent variable explaining the model. It is known in advance that many factors explain innovation, but it is important to know that 35% of this behavior is due to learning.
4. Test F is the relationship between the mean square explained and the mean square residual. This last one (the test denominator) is the variance of the model. The size of Test F indicates how many times the explained part is larger than the not explained part and, if it is sufficiently large (intuitively, large than 4), it concludes that the sums of the parameters is not zero.