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The effect of social capital and stakeholder behavior on technology transfer networks: the case of banana agribusiness in Ecuador.

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1. Introduction

Technology transfer is acknowledged for its importance in the sustainability and economic development of regions worldwide (Baron, 1993; Parker & Zilberman 1993; OECD, 2003; AUTM, 2004). Scholars have stressed that transfer of technologies from research organizations to the private sector has played a crucial role in the creation of new businesses, growth of existing businesses, new job creation, the improvement of quality of life, and solutions to problems within societies (Matkin, 1990; Parker & Ziberman 1993; Proctor 1993; Lalkaka, 2001). Although technology transfer has been the subject of ample research in developed countries such as the USA, Germany, Austria, Korea, and others (Meyer-Krahmer & Scmoch, 1998; Carlsoon & Fridh 2002; Schartinger, Rammer, Fischer & Fröhlic; 2002; Lee & Win 2004), this has not been the case in developing countries. Like other countries in Latin America, Ecuador has shown a lack of understanding of technology transfer issues.

Current doctoral research employs network analysis as the overarching theory to explain how social capital in terms of quality relationship has an effect on knowledge transfer network performance through the mediating role of Knowledge transfer variables. It is also of interest to study to what extent stakeholder behavior moderates Knowledge transfer network performance. In this direction I will conduct the study from a network perspective to analyze technology transfer as it facilitates the access, coordination, and transmission of knowledge (Podolny & Lage 1998; Lambooy, 2003; Inkpen & Tsang, 2005). The knowledge transfer network performance will be studied by using different types of inter-organizational networks, which include research cooperation, strategic alliances and supplier-customer linkages. The quality of the relationships will be analyzed through the examination of the three aspects that have been emphasized in the existing literature namely trust, commitment, and reciprocity. Beyond the receiver and the transmitter of knowledge, other stakeholders may be relevant within the process. In this sense, this study will explore behavioural influences in terms of power, legitimacy, and urgency. To do so, this dissertation will look at the network relationships in the banana agribusiness associated to technology transfer by using the case of Sigatoka Negra.

The contribution of the dissertation is threefold: 1) it will provide valuable information regarding of the characteristics of different types of inter-organizational Knowledge transfer networks; 2) having these characteristics, this dissertation will provide insights about the performance of different knowledge transfer networks; 3) it proposes a model to determine the effect of relationship quality on knowledge transfer network performance through the mediating roles of knowledge transfer variables; 4) the proposed model will facilitate understanding of the extent to which other key stakeholders moderate the knowledge transfer network performance.

2. Literature Review

In technology transfer the users and receivers play a decisive role in the exchange of knowledge. However, there are others stakeholders that may influence the process of technology transfer carried out between science and industry.

In this section, I will discuss relevant aspects concerning technology transfer issues and related theories that help explain the network characteristics such as the quality of the relationships among stakeholders and their behaviour.

2.1 Technology transfer (TT)

Technology transfer concept

The term technology transfer is used to describe and analyze a wide range of organizational and institutional interactions involving some forms of technology-related exchange. In this sense, there is a need for a source and a user through which the object of the transfer is exchanged. Sources of technology can be private firms, government agencies, government laboratories, universities, non-profit research organizations, or even entire nations. Users, on the other hand, include schools, small and large business, financers, legislatures, cities, states and nations (Bozeman, 2000; Roessner, in press).

Research organizations and firms define technology transfer as "the process that takes place between R&D organizations, where a technology is developed, and receptor organizations, where the technology is applied such as by commercializing into a product or service that is sold in the market" (Rogers, Carayannis, Kirihara & Allbritton, 1998). Similarly, AUTM (2005) employs the following definition: "technology transfer is the term used to describe a formal transfer of rights to use and commercialize new discoveries and innovations resulting from scientific research to another party". Both definitions are valid, but they only consider technology transfer to be a linear, sequential, formal process where research organizations commercialize their disclosures to the firms. The nature and process of technology transfer is more complex: a set of interactions among research organizations, firms, and other actors takes the form of an interactive and non-linear process. Thus, technology transfer has developed from linear sequential models to a parallel development process between individual units, coordinated by flexible networking mechanisms (Rothwell, 1991; Autio & Laamanen, 1995). Nevertheless, it does not mean that we can point out either the linear or the interactive model as the most important for technology transfer (Göktepe, 2004).

Therefore, the definition of technology transfer as used in this dissertation takes into account the purpose of the research (Bozeman, 2000), which is to analyze the network relationships among the stakeholders involved in the technology transfer process. Accordingly, the dissertation adopts the definition in which technology transfer is conceived as intentional and a goal-oriented interaction between two or more social entities (Autio & Laamanen, 1995), in which one network member is affected by the experience of another (Argote & Ingram, 2000)

Technology transfer process

Harmon et.al. (1997); Göktepe (2004) and Condom & Valls (2005) argued that the types of technology transfer process described in several studies reflect the following perspectives.

The first perspective considers technology transfer to be a linear process between science and firms, where research organizations sell the outcomes of the research and firms buy them (Harmon et.al., 1997; Göktepe, 2004; Condom & Valls, 2005). This process is carried out as a sequential progression of steps that begins with the idea, developed by the inventor, researcher or team faculty, who submits the invention disclosure form to the technology transfer office (TTO). After an exhaustive review of the disclosure, the TTO determines whether intellectual property rights have been obtained or not. Finally, the process ends when the technology is transferred to a company for its commercialization, or results in the creation of a new firm (Harmon et.

al., 1997, Carlsoon & Fridh, 2000; Göktepe, 2004). Thus, this kind of model follows a formal process and generally the technology flows in one direction from university to industry (as examples see Cole 1992; Zhao & Zilberman 1992; Carlsoon & Fridh, 2000).

The second perspective describes technology transfer as the process that begins with a specific problem to be solved by the industry and continues with the university developing the technological solution. This perspective is acknowledged as reverse linear process (Göktepe, 2004), because the transferring of knowledge flows in the opposite way from the perspective shown above.

The third perspective regards technology transfer as an interactive process (Göktepe, 2004) that takes place by establishing networks of relationships (Harmon et.al., 1997; Condom & Valls, 2005). This model is focused on communication and collaboration aspects, and the exchange of information, as well as the patterns and the nature of the relationship that facilitates or impedes the linkage itself. Auster (1990) used network analysis to examine the whole structure of relationships among the transferring organization, transfer agent, and recipients of technology that are involved in the transfer process. This approach enhances the level of analysis from pairs of partners to systems of relations among stakeholders embedded in technology transfer.

Finally, the fourth perspective involves the type of models that are known as hybrid models (Harmon et. al., 1997). Based on this perspective, Padmanabhan & Souder (1994) proposed an analogy between technology transfer and the theory of Brownian motion used to analyze the behavior of the pollen grains when their environment is exposed to changes. However, this analogy has been criticized, because some scholars argue that technology transfer is a purposive and goal-oriented process, different from the random Brownian movement of pollen grains. Other studies that fall into this category are the cases of technology transfer analyzed by Rogers (1995) in his book *Diffusion of Innovation*, and the Triple Helix Model proposed by Leydesdorff & Etzkowitz, (2001). The latter pointed out that under certain circumstances, university, government and industry interchange their roles. The university can take the role of industry, helping to form new firms; the government can take the place of the universities supporting these new developments and industry can take the function of the university in developing, training, and research.

It is recognized that technology transfer does not occur as a process of unplanned generation. It is embedded in a cultural and social environment, where the actions taken by stakeholders take place (Dubini, P., & Aldrich, 1991; Reynolds, 1992; Singh, 2003; Göktepe, 2004). Moreover, some authors suggest doing more research following the interactions perspective (Auster, 1990; Autio & Laamanen, 1995; Göktepe, 2004). For this reason, this study will analyze the technology transfer in terms of the interactive process between different stakeholders involved in the web of relationships. Specifically, I will research technology transfer under the perspective of networks which is recognized as a form to get access and organize information and knowledge (Podolny & Page, 1998; Lambooy, 2003; Inkpen & Tsang, 2005). The transfer of knowledge could take place within the firms, between firms or from universities to firms, taking the form of networks. (Lambooy, 2003; Nooteboom, 2000).

2.2 Forms of relationships among organizations within the Knowledge transfer networks

The existing literature emphasizes three main ways by which organizations can obtain information and resources. Two of these means come from the economists´

point of view. According to the economist perspective, resources are acquired through market mechanisms or through hierarchically arranged firms (Williamson, 1991; Podolny et al., 1998; O´Donell; Gilmore, Cummins & Carson, 2001). The other way, is based on the sociologists point of view, in which the networks allow firms to get access to knowledge, resources, markets or technology (Gulati, Nohria & Zaheer, 2000; Nicolaou & Birley, 2003; Inkpen et al., 2005). The forms of relationships which take place at the transactions have different approaches. In markets, the relations are straightforward and not enduring. When the transfer of goods and resources are done, the relationship finishes immediately (Podolny et al., 1998; O´Donell; et al., 2001; Adler & Kwon, 2002). On the other hand, in a hierarchy form the relations are more permanent, and when disagreements occur among actors, the legitimate authority uses its status to resolve the disputes (Podolny et al., 1998; Adler et al., 2002). Finally, a network form pursues repeated and enduring relations which emerge of the interactions of two or more actors (Podolny et al., 1998; Inkpen et al., 2005).

In the majority of cases, knowledge does not emerge from formal hierarchy structures of the firms or by the market price signal (Powell, 1990). Conversely, networks are viewed as an excellent alternative to get access, coordinate and transmit knowledge, due to the mode in which the relationships are conceived (Podolny et al., 1998; Lambooy, 2003; Inkpen, et alt., 2005).

Hoang & Antoncic (2003), based on a review of literature about network-based research in entrepreneurship, present three main constructs of theoretical and empirical work in this field: Content of network relationship; network governance and network structure. The first construct is the network content of relationships which display two mainstream inter-organisational and personal relationships (O'Donnell et al., 2001; Hoang et al., 2003). Alternatively, the two categories have been called inter-organisational and social networks (Brown & Butler, 1993) or formal and informal networks (Johannisson, 1986). These types of social network relations are employed as a mean for gaining access to resources held by other actors (Hoang et al., 2003). A social network is defined as a set of nodes and connections linked by a set of social relationships of a specified type (Laumann, Galskeiwicz, & Marsen, 1978). In a social sciences context, nodes can be replaced with actors which can be individuals or organizations, and connections can be replaced with social ties or bonds (Davern, 1997; O´Donnell, 2001).The second construct is related to governance mechanisms in relationships which support and coordinate network exchanges. Some of the most important social relational dimensions found in this line of work are: trust (Larson, 1992; Uzzi, 1997; Lorenzoni and Lipparini, 1999; Inkpen et al., 2005); reciprocity (Willianson, 1985; Deyer & Singh; 1998; C.K. Sankat, K.F. Pun, C.B. Motilal; 2005); commitment (Naúde and Buttle, 2000) information sharing and joint problem solving (Uzzi, 1997); feed back mechanisms and interactivity (Sankat et al.,2005). Besides, other scholars pointed out that stakeholders' interest could influence networks through their attributes, such as power, legitimacy and urgency (Mitchell, Agle & Wood, 1997; Rowley & Moldoveanu, 2003). The third construct that researchers have studied is based upon the structural dimensions of network relationships. These studies take into account the systems properties of networks such as size (Auster, 1990; Rowley 1997); density (Auster, 1990; Rowley, 1997; Singh, 2003); centrality (Rowley 1997); diversity (Burt, Minnor & Associates, 1983; Auster, 1990), structure holes (Burt, 1992; Singh, 2003), and weak and strong ties (Granovetter, 1973, 2005).

This doctoral research focuses on the second construct concerning the relational mechanisms employed by the different social actors involved in knowledge transfer networks. Nevertheless, it is important to point out that, depending on the network type, different conditions may affect how the social relational dimensions

influence the knowledge transfer (Inkpen et al., 2005). According to Auster, 1990 and Podolny et al, 1998, inter-organizational networks refer a variety of organizational forms such as strategic alliances, collaborative agreements and supply-customer relationships. The dissertation will study the characteristics of these networks in order to compare the performance of each network will analyze the knowledge transfer performance of these networks and their characteristics.

2.3 Inter-organizational Networks of Knowledge transfer

As mentioned earlier, the content of networks falls into two principal categories: inter-organizational and personal networks. The inter-organizational linkages are recognized as networks of relationships between two or more organizations formed to transfer, exchange, develop or produce technology, raw materials, products and information (Auster, 1990). The content of linkage refers to what is exchanged or transmitted (Homans, 1961; Auster, 1990)

From one side, sociologists and psychologists have used personal networks for analyzing relations such as friendship, acquaintance, work, kinship, and intimacy (Auster, 1990). In another perspective, the economic and managerial literature contains studies on inter-organizational links in terms of buyer-supplier relationships (Auster, 1990; Podolny et al, 1998); joint ventures; (Auster, 1990; Podolny et al.,1998;O'Donnell et.al., 2001); industrial districts (Podolny et al, 1998; O'Donnell et.al., 2001; Inkpen, et al., 2005); franchises (Podolny et al, 1998; Inkpen et al., 2005); strategic alliances (Auster, 1990; Hagedoorn, 1990, 1995; Mowery, Oxley & Silverman, 1996; Kingsley & Klein, 1998; Podolny et al, 1998; Inkpen et al 2005), among others.

The purpose of this study is to analyze the knowledge transfer that takes place within inter-organizational networks in which the main actors through persistent and continuous interactions achieve the goals proposed among the parties. Therefore, short-term contracts or relationships are not considered in this research. Kilduff & Tsai, 2003; and Provan, Fish & Sydow 2007 consider that networks are often formally established and governed and goal directed rather than occurring serendipitously. This point of view is in accordance to the criteria of many scholars who consider knowledge transfer porcess as intentional and goal oriented. Firms can get access and acquire knowledge and technology from external resources that include competing firms, research organizations, government laboratories, industry research associations, and universities (Santoro & Chakrabarti, 2002). As mentioned this research will focus on analyzing strategic alliances among firms, science-industry collaboration and supplier-customer relationships. In the first case the alliance strategic network will be analyze through the knowledge interactions of one large firm and small farmers. The second network type involves the knowledge linkages between one university research center and the small farmers, while the latter embraces the provision of raw material or products from a supplier to small farmers.

The intensity of knowledge that flows from sources of knowledge to firms is assumed to be strongest in the case of interactions that are based on close and recurring face to face contacts (Schartinger, et al.,2002). According to these scholars, this seems to be especially appropriated for the following knowledge interactions: joint research projects, collaborative research; joint publications, mobility of researchers between industry and science and viceversa, contract research and consulting. Furthermore, the intensity of knowledge interactions displays variations among different sectors of economic activity, technology field, orientation of research at the university, and the firm size structure (Meyer-Krahmer et al, 1998; Schartinger et. al, 2002).

From the above discussion, the dissertation will study the knowledge interactions by focusing on the agribusiness sector. According to Binotto, Hamer, Keiko, Azambuja (2004), there is a lack of research in the study of knowledge in agribusiness. Besides, the cooperative networks seem to be the best way for small and medium enterprises (SMEs) to acquire knowledge, due to the scarce resources available for doing research and their limited technology absorption capacity (Albors, Sweeney & Hidalgo, 2005).

2.4 Social capital networks

Even though the concept of social capital has found widespread acceptance, there remains extensive uncertainly about its meanings and effects (Koka & Prescott, 2002). This happens because of the variety of definitions provided by the existing literature (Adler & Know, 2002).

Some authors define social capital in terms of network structure (Burt, 1992, 1997), while others argue that the nature of the relationships between actors within networks is indicative of social capital's potential value (Coleman, 1988). Recently, the scholars have integrated the two dimensions, structural and relational, for enhancing the level of analyses (Nahapiet & Ghoshal 1998; Kostova & Roth, 2003; Inkpen et al., 2005). Kostova et al., (2003) consider both dimensions defining social capital as the potential value arising from certain psychological states, perceptions and behavioural expectations that social actors develop, which is a result of social structures and the nature of their relationship.

Relationship quality

Despite that social structures and the nature of the relationship are important conditions for the transfer of knowledge among actors, it is important to consider the types of knowledge that are transferred. In general terms the knowledge can be classified as explicit and tacit (Nokata & Takeuchi, 1995). Explicit knowledge is easy to codify and transfer. It can be expressed in words and numbers and easily communicated and shared in the form of written and spoken language and hard data, scientific formula and codified procedures. On the other hand, tacit knowledge is difficult to transfer and can be represented in technical dimensions which involve Know-how content and cognitive belief, values, and personal experience (Breesman, 2004).

The structural connections play an important role in facilitating the transfer of explicit knowledge; meanwhile, the quality of relationship is critical for the transfer of tacit knowledge (Collins & Hitt, 2006). Some scholars argue that knowledge transfer is facilitated by effect intensive social interactions of organizational actors (Yli-Renko, Autio & Sapienza, 2000; Inkpen et al., 2005). Therefore, the nature of the relationship between research organizations and farmers will be studied in term of the relationship quality.

Relationship quality is usually measured through several variables that include the development of goodwill (Adler et alt, 2002), trust (Larson, 1992; Uzzi, 1997; Lorenzoni and Lipparini, 1999; Inkpen et al., 2005); reciprocity (Willianson, 1985; Deyer & Singh; 1998; C.K. Sankat, K.F. Pun, C.B. Motilal; 2005); commitment (Naúde and Buttle, 2000) information sharing and joint problem solving (Uzzi, 1997); feed back mechanisms and interactivity (Sankat et al.,2005), and dependency (Morgan and Hunt, 1998). However, the most common variables frequently referred to in the agribusiness

literature are: trust, commitment (Shulze, Wocken & Spiller, 2006) and reciprocity (Sankat et al.,2005).

Stakeholder behaviour

Stakeholder theory has traditionally considered organization interactions with stakeholders in terms of independent interactions, and dyadic relationships. Recent literature has pointed out to the fact that stakeholder phenomena occur in a complex network of influential relationships (Rowley, 1997; Andriof, Waddock, Husted, 2002, 2003).

Stakeholder is defined as any group or individual who can affect or is affected by the activities of the firm (Freeman, 1984) or group of firms (Frooman, 1999). Most of the definitions of stakeholder are defined in term of their interest, on the perspective to enhance or protect their interest and their influence to achieve a specific end state (Rowley & Moldoneanu, 2003).

Research relevant to stakeholder side of the relationship involves two broad topics: stakeholder classifications and stakeholder behaviour (Rowley et al., 2003). Several scholars have proposed classification schemes intended to demarcate stakeholder types take into account a group of factors. Thus, the literature shows different typologys to categorize distinct stakeholder classes such as primary and secondary (Carrol. 1979); voluntary and involuntary (Clarkson, 1995a), or strategic and moral (Goodpaster, 1991), for understanding the nature of different stakeholder-firm relationships (eg., interest, rights, power) and/or firms moral responsibilities with respect to unique stakeholders Langtry, 1994; Clarkson, 1995b; Donaldson & Preston, 1995). Research designed to examine stakeholder behaviour is focused on how stakeholders attempt to influence the focal organization, and how firms respond to these influences depends on the network of stakeholders surrounding their relationship (Rowley, 1997; Rowlet et al., 2003). Michell, Agle & Wood, 1997 argue that stakeholders could influence the focal firms through power, legitimacy and urgency.

This dissertation argues that other stakeholders, through the influence in the cooperative networks, may have a stake in regard to technology transfer issues. This influence could be exerted by their power, legitimacy and urgency in order to achieve a specific end state which, in turn, could benefit or harm the relationship.

2.5 Factors affecting the Knowledge transfer performance

The existing literature indicates that some of the motivations for cooperative relationships between science and firms can be: the improvement of the relationship, the integration of science and industry, the appearance of industry based on technology, the use of science as a means to create firm's competitive advantages as well as the internationalization of technology, and the globalization of the economy (Ahn, 1995; Mora-Valentín, Montoro-Sanchez & Guerras-Martin, 2004).

Previous studies reveal a lack of quantitative and qualitative information about the general nature of the relationships between science and industry (OECD, 1990). Hence, new studies must be carried out to test and evaluate this type of inter-organizational relationships (Mora & Montoro, 2001) and to identify success factors in this kind of relationship (Mora-Valentín, et al., 2004).

The dissertation aims to identify determinant factors that affect the performance of knowledge transfer. Under this perspective, Bao (2007) analyzed some factors such as types of knowledge, organizational learning, reward systems which may affect the knowledge transfer performance. His study found out that the type of knowledge and reward systems do not have an effect on interaction mechanisms of an alliance which affect the process of knowledge transfer. Nevertheless, it is worth mentioning that the sample population of this study included only high tech industries in Taiwan. Due to the fact that this dissertation is focused on the agribusiness sector in Ecuador, in many ways under a different environment to that of Taiwan, our study does not discard that types of knowledge and reward systems may be determinant factors in alliance interaction mechanisms. Moreover, other important research works pointed out the importance of reward systems (Steward & Gibson, 1990; Siegel, Waldman & Link, 2003; Debackere & Veugelers, 2005) and the types of knowledge (Nokata, 1994, Nokata et al, 1995) within the knowledge transfer. Organizational learning ability is considered another important factor which influences the absorptive capacity of firms to acquire external knowledge (Cohen & Levinthal 1990; Bao 2007). The prior related knowledge and the diversity background of the firm determine the capacity to acquire knowledge and consequently the performance of process. In order to broaden the scope of the dissertation, the research takes into account other key factors point out such items as complexity of knowledge (Sorenson, Rivkin & Fleming, 2006); open systems (Fey & Birkinshaw 2005) and types of knowledge transfer interactions (Schartinger et al., 2002; OECD, 2001).

2.6. Knowledge transfer performance

The study will consider the technology adaptation life cycle model based on the innovation behaviour of the receiver (Moore, 1991). This theory suggests that technology transfer acquisition is better explained by the experiences of technology transfer and adoption of the knowledge consumer community. The author classified the consumers of the new technology at the following way: innovator, early adopter, early majority, late majority and laggards. This model was done on the adoption of new strains of seed potatoes among American Farmers. Through this model, the dissertation will analyze de innovation behaviour of the farmers.

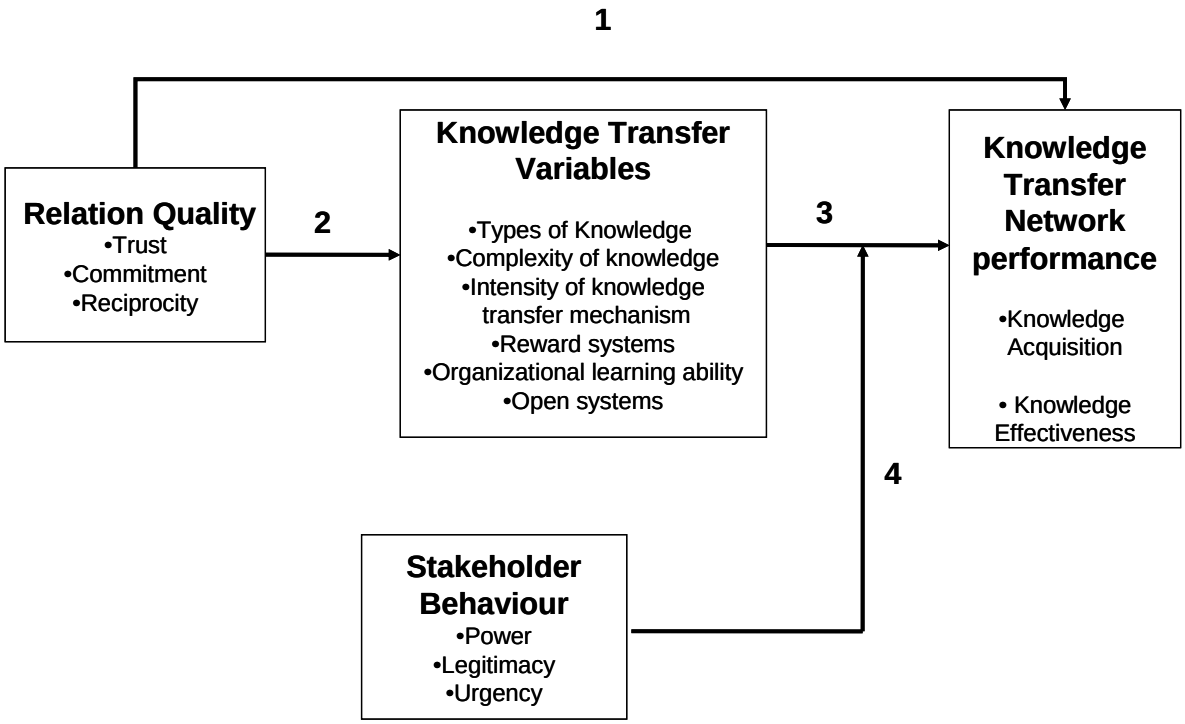
3. Research Framework

The main goal of this research is to analyze the characteristics and performance of knowledge transfer networks. Moreover, the dissertation proposes a model to determine to what extent the relation quality has an effect on the knowledge determinant factors of knowledge transfer which, in turn, influences the knowledge transfer network performance. Furthermore, the dissertation seeks to determine whether the stakeholders' behavior exerts a moderating influence on the knowledge transfer network performance. In sum, this study adopts the definition for technology transfer which is understood as intentional, goal-oriented interaction between two or more social entities (Autio & Laamanen,1995), in which one network actor is affected by the experience of another (Argote & Ingram, 2000). In this line, we will determine the relevant variables concerning relationship quality that take place in different network types, particularly those involved in the agribusiness sector. Moreover, the study also seeks to examine the behavioural variables of key stakeholders which may have an interest in the network performance (see fig.1).

We will choose different types of knowledge transfer networks for analysis in this research, as such is broadly employed in the agribusiness sector (Binotto, et. al., 2004). The types of the most intensity knowledge interactions occurring between

sources of knowledge and farmers will be determined. Key technology transfer stakeholders which have an interest in the knowledge transfer process will be identified, and we will point out the most important factors which play a mediating role between the relation quality and the acquisition of and effectiveness in performance of knowledge transfer. Finally, knowledge transfer performance will be analyzed in terms of knowledge acquisition and knowledge effectiveness. The former will be measured through the Technology Adoption Life Cycle model (Moore, 1991) that is base on the innovation behaviour of the receiver. This model has agrarian roots and for this reason it will be well adapted in the sample due the size of community and different innovations. The latter will be take into account the following measures: reduction on the production cost, increase on the production, sales growth, increase on Knowledge , increase of contact number.

Fig 1 Research Framework



Research questions

1) Do the characteristics of different types of networks such as strategic alliances among firms, science-industry collaboration and supplier-customer relationships differ from one another?

2) To what extent does the quality of relationship influence the performance of a knowledge transfer network?

3) To what extent does the quality of relationships in Knowledge transfer networks have an effect on the factors associated to knowledge transfer?

4) To what extent do knowledge transfer factors influence the performance of a knowledge transfer network?

5) To what extent do behavioural aspects of the key stakeholders have a moderating effect on the performance of a Knowledge transfer network?

4. Research design

Sample frame, sample, data and measurements

The research work is an exploratory study in which technology transfer networks within the banana agribusiness Ecuadorian context will be investigated. To develop this research, we will study how different sources of knowledge such as the biotechnology research organization, the Centro de Investigaciones Biotecnológicas del Ecuador (CIBE), an export banana company, Grupo Wong, and a supplier of agricultural products, AGRIPAC are transferring technology to the agricultural field. In order to analyze the knowledge transfer process, this dissertation takes the case of Sigatoka Negra, that is, the research for control of a fungus disease in which the above mentioned organization is actively involved.

Sample frame

Ecuador is located in the north-west of South America (south of Colombia and north of Peru and Bolivia). It has a population of nearly 12 million people. It is a small economy mainly based upon three export products: oil, bananas and shrimp. During 2001, oil accounted for 37.1% of public earnings, shrimp for 6.0% and banana for 18.2% (BCE, 2002). Since 1952, Ecuador is the major banana export country of the world with a market share 25% of global exports (FAO, 2001). Around $820 millions dollars per year are earned by banana production in Ecuador. Banana production and export provide an income for 12% of the population. Thus, about 1.2 million people depend on banana activities in Ecuador (Chang, 2000).

Sample

The national banana production is concentrated in 10 out of 21 provinces and distributed over five zones of the Country. The most important producing provinces are Los Ríos, Guayas and El Oro, were more than 150,000 has. are cultivated. Unlike other banana exporting countries, where banana production is in the hands of multinational companies, 80% of production in Ecuador is done by national growers in areas smaller than 30 has in average (Fernandez, 1993; Novillo and Romero, 2001). In the three most important producing provinces, more than 5,000 growers are involved. To analyzed the technology transfer networks in the case of Sigatoka Negra, the dissertation will study the relationships that take place between sources of knowledge and the farmers of Los Rios, Guayas and El Oro.

Primary and secondary Data

Secondary data will be obtained through the accessible information of national and local sources, such as population of the province, current state of agricultural issues in the study zone, the number of association and farmer by province, etc.

A survey will be developed for acquiring qualitative and quantitative data. Based on the existing literature, a list of proxies will be included in order to measure the variables proposed in this research work. The questionnaire will be administered following a face-to-face interview and filled in by trained interviewers. This approach is followed since the mail and telephone system in the Ecuadorian rural zones are not completely available.

Measurements

- Relational quality
  - Trust (Larson, 1992; Uzzi, 1997; Lorenzoni et al, 1999; Inkpen et al., 2005)
  - Commitment (Naúde et al., 2000; Shulze, Wocken & Spiller, 2006)
  - Reciprocity (Willianson, 1985; Deyer et al, 1998; Sankat, et al, 2005)
- Stakeholder Behaviour (Mitchell, et al, 1997)
  - Power
  - Legitimacy
  - Urgency
- Knowledge transfer factors
  - Types of knowledge (Bao, 2007)
  - Organizational learning (Bao, 2007)
  - Reward system (Bao, 2007)
  - Open system (Fey et al., 2005)
  - Types of knowledge interactions (Schartinger et al., 2002; OECD, 2001)
  - Complexity of knowledge (Sorenson, Rivkin & Fleming, 2006)
- Knowledge Transfer Performance
  - Acquisition (Moore,1991)
  - Effectiveness

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