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Miguel Angel Bustamante
University of Nebraska at Lincoln, mbustama7@hotmail.com

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Firms in Underdeveloped Countries That Adopt Information Communication Technology (ICT) do not Always Improve Their Competitiveness: An Empirical Investigation

Miguel Angel Bustamante
University of Nebraska Lincoln
mbustama7@hotmail.com

ABSTRACT
This study develops a research model to analyze the outcome of ICT adoption by firms in underdeveloped countries. Based on the theoretical framework of the knowledge based view (KBV) and management information systems literature. This paper proposes a model where a firm’s success when adopting ICT depends mainly on it’s network relationship and assimilation capacity and the characteristics of the particular ICT being adopted. The outcome of the ICT adoption is gauged using the balanced scorecard concept by measuring the firm improvements in: price, products, business processes, and research ability. In the empirical section, this research will use structural equation modeling with data collected from manufacturing firms to conduct tests of the hypotheses developed in the model. The results would have important managerial and policy implications for firms in underdeveloped countries. The model will help managers to adopt ICT with the comprehensive picture of benefits and risks of their choices.

Keywords
Information Communication Technology, underdeveloped countries, path diagram, structural equation modeling.

INTRODUCTION
Information and Communication Technologies (ICT) have well known, but often unrealized, potential to transform businesses and industries (Andal-Ancion, Cartwright and Yip, 2003). As many as half of all companies worldwide are seeking to gain competitive advantage by spending more on ICT yet they find that spending on ICT far outpaces the perceived benefits derived from it (Tippins and Sohi, 2003). This situation is specially true when firms in underdeveloped countries adopt ICT to obtain competitive advantage. A study done in Chile posits that managers need to be proactive to ensure that the ICT being adopted fits within their organization (Grandon and Pearson, 2003).

Objectives of the Paper
The main objective of this paper is to create a model that will include the main factors that managers in underdeveloped countries may need to evaluate when adopting ICT. This study, using as a theoretical base the knowledge-based view (KBV) of the firm, argues that in an underdeveloped country a company’s ability to enhance its competitiveness by adopting ICT is mediated by the firm’s “Network Relationship and Assimilation Capacity” (NRAC). The ability of this factor to properly absorb and process the inputs being fed will determine the outcome of the ICT adoption. The outcome of the ICT adoption will be gauged using the balanced scorecard concept by measuring the firm’s improvements in: price competence, quality of products, quality of business processes, and quality of research ability.

LITERATURE REVIEW AND RESEARCH QUESTION
KBV depicts firms as repositories of knowledge and competencies (Kogut and Zander, 1996). According to this belief, the ‘organizational advantage’ of firms over markets arises from their superior capability in creating and using knowledge. Knowledge creation and innovation result from new combinations of knowledge and other resources (Cohen and Levinthal, 1990). The accumulation of knowledge through learning constitutes a driving force in the development and growth of young firms (Grant, 1996). The development and growth of young technology-based firms are particularly dependent upon innovatively combining their own firm specific knowledge with that of external associates because young firms are resource constrained. A common feature across successful knowledge creation processes is explicit linkage between the local firm...
and the source of knowledge outside the firm (Eisenhardt and Martin, 2000). Knowledge flow from the provider of ICT to the receiver is the most pervasive type of knowledge transfer (Gupta and Govindarajan, 2000).

There are two main views regarding KBV. Some researchers argue that KBV is an outgrowth of the Resource Base View (RBV) thinking where the concept of resources is extended to include intangible assets and, specifically, knowledge based resources (Grant, 1996). Other researchers see KBV as a useful extension of organizational learning to strategy and organization theory, an extension that is capable of informing research and providing new insights into organizational functioning (Kogut and Zander, 1996). This paper merges the two views to develop a framework that can be applied to analyze the adoption of ICT by firms in underdeveloped countries.

**Research Question**

The paper main question is what factors enable a firm in an underdeveloped country to not only obtain ICT from a developed country but also achieve competitive advantage because of the ICT acquisition? In the following sections, this paper develops a research model, and hypotheses that address the question. In the second part of this research, this study will use structural equation modeling to test the hypotheses using sample survey data.

**RESEARCH MODEL**

In the framework presented in Figure 1. “X” (ICT) technology is conceptualized as a higher-order construct consisting of three domains represented by first order factors: “tacitness”, “ambiguity”, and “complexity”. Similarly, NRAC is conceptualized as a higher-order construct composed of four first-order factors representing “compatibility”, “skills”, “knowledge acquisition and learning” and “shared problem solving”.

The KBV as an outgrowth of the RBV and as outgrowth of the organizational learning theory provides theoretical foundation for the model. According to those views the use of new knowledge and the ability to enhance that knowledge through learning will provide “organizational advantage” (Grant, 1996).

When a firm in an underdeveloped country adopts technology it needs to know about the characteristics of the technology being adopted. Furthermore, it needs to know if the firm has the adequate “absorptive capacity” to profit from the adoption. There are studies that actually deal with the characteristics of a particular ICT (Kogut and Zander, 1996; Grant, 1996; Gupta and Govindarajan, 2000). Studies that deal with the absorptive capacity of firms include Cohen and Levinthal, 1990; Simon, 1991; and Szulanski, 1996. Studies that deal with communication issues between a provider of ICT and a receiver include Eisenhardt and Martin, 2000; and Gupta and Govindarajan, 2000. Yet, almost no study has linked those factors to the adoption of ICT by firms in an underdeveloped country, created a model, and empirically tested the model. In the next paragraphs, this study develops the concepts of “X” (ICT) Technology, and NRAC and explains the interaction of those constructs to boost firm competitiveness.

“X” (ICT) Technology

Based on the KBV and management information systems (MIS) literatures, a generic “X” (ICT) Technology being adopted is described by three main traits: First, tacitness as the extent that knowledge related to the particular ICT being adopted is or is not codifiable (Galunic and Rodan, 1998). Second, ambiguity as the extent that a capability that emanates from the particular ICT being adopted is or is not replicable (Szulanski, 1996). And finally, complexity as the extent that the use of a system that emanates from the particular ICT being adopted would be free of effort (Everett, 1983; Davis, 1989).

Network Relationship and Assimilation Capacity (NRAC)

Drawing from literature streams in KBV and MIS this research conceptualizes NRAC as described by four main constructs: First, compatibility as the extent of consistence between the particular ICT being adopted and the existing technology infrastructure, culture, values and preferred work practices of the firm (Grandon and Pearson, 2003). Second, skills as the degree of prior related knowledge of the ICT being adopted that the organization possesses (Szulanski, 1996). Third, knowledge acquisition and learning as the extent that a firm is able to develop organizational capacity by learning (Tippins and Sohi, 2003). And finally, shared problem solving as the degree of communication and collaboration between the ICT provider and the adopter (McEvily and Zaheer, 1999).
HYPOTHESES DEVELOPMENT

The contention of the model is that the adoption of a particular “X” (ICT) technology does not directly effect the firm’s performance. The effect is mediated by a higher order construct: the firm’s NRAC. Accordingly, this research develops three hypotheses:

First, when firms in an underdeveloped country adopt ICT(s) it is likely that a transfer of knowledge will be necessary. Therefore, several individual exchanges may be required to carry on an optimal implementation (Nonaka, 1994). The success of such exchanges will depend on communication and good overall relationships between the provider of the ICT and the recipient (Szulanski, 1996). Furthermore, the ability of a firm to identify the value of new, external information, absorb it and relate it to commercial ends is critical to boost it’s competitive capabilities (Cohen and Levinthal, 1990). Therefore,

H1: The relationship between the “X” (ICT) technology being adopted and firm performance is mediated by the firm’s relationship network collaborative and the firm’s assimilation capacity.
Second, KBV distinguishes between explicit and tacit knowledge. Tacit knowledge is linked to the individual and is very difficult to articulate (Courtney, 2001). Only through observation and action is it possible to learn this type of knowledge. The knowledge-based approach (Kogut and Zander, 1996) identifies tacit knowledge as the most strategic resource of firms. The argument is that, since tacit knowledge is difficult to imitate and relatively immobile, it can constitute the basis of sustained competitive advantage (Grant, 1996). Such a view is shared by Gupta and Govindarajan (2000), who mention that the “causal ambiguity” of knowledge is one of the most widely recognized barriers to its transfer and replication, and by Simonin (1999), who mentions that if most of the knowledge relevant to the ICT(s) being transferred is complex and tacit then the transmission of knowledge between source and receiver is exceptionally difficult. Therefore,

H2: There will be a positive relationship between the “X” (ICT) technology being adopted and the firm’s network relationship and assimilation capacity. The higher the degree of tacitness, ambiguity, and complexity of the ICT the higher the degree of the firm’s network relationship and assimilation capacity that will be necessary for a good incorporation of the ICT into the firm.

Third, data are raw facts, information is data in some framework or with some kind of human understanding (Courtney, 2001). Stockpiles of information are of minute value; only that information which is actively processed in the brain of an individual through learning can be useful (Alavi and Leidner, 2001). The use of new knowledge and the ability to enhance that knowledge through learning will provide ‘organizational advantage’ (Grant, 1996). Therefore,

H3: The firms performance will be positively related to the degree of incorporation of the ICT being adopted by the firm. The higher the degree of incorporation of ICT into the firm, the higher the degree of the firms improvement.

METHODS

This research will develop a survey instrument and will pilot-test it for content verification and validity with managers from manufacturing firms located in underdeveloped countries.

Table 1. Summarizes the main constructs of interest and referred literature.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Measurement (items adapted from the literature)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tacitness</td>
<td>4 items assessing the extent that knowledge related to the particular ICT being adopted is or is not codifiable</td>
<td>(Galunic and Rodan, 1998)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Simonin, 1999)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Szlanski, 1996)</td>
</tr>
<tr>
<td>Ambiguity</td>
<td>4 items assessing the extent that a capability that emanate from the particular ICT being adopted is or is not replicable</td>
<td>(Simonin, 1999)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Szlanski, 1996)</td>
</tr>
<tr>
<td>Complexity</td>
<td>4 items assessing the extent that the use of a system that emanate from the particular ICT being adopted would be free of effort</td>
<td>(Everett, 1983; Davis, 1989)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Grandon and Pearson, 2003)</td>
</tr>
<tr>
<td>Compatibility</td>
<td>4 items assessing the consistence of the particular ICT being adopted with the existing technology infrastructure, culture, values and preferred work practices of the firm</td>
<td>(Grandon and Pearson, 2003)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Kale, Singh, and Perlmutter 2000)</td>
</tr>
<tr>
<td>Skills</td>
<td>4 items assessing the prior related knowledge that the organization possesses</td>
<td>(Szlanski, 1996)</td>
</tr>
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<td></td>
<td></td>
<td>(Tippins and Sohi, 2003)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Simonin, 1999)</td>
</tr>
<tr>
<td>Knowledge acquisition and learning</td>
<td>4 items assessing the ability of the firms to develop organizational capacity by learning</td>
<td>(Kale et al., 2000)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Simonin, 1999)</td>
</tr>
<tr>
<td>Shared problem solving</td>
<td>4 items assessing the degree of communication and collaboration between the ICT provider and the adopter</td>
<td>(McEvily and Zaheer, 1999).</td>
</tr>
<tr>
<td>Firm improvement</td>
<td>4 items measuring the firms improvements in price competence, quality of products, quality of business processes, and quality of research ability</td>
<td>(Kaplan and Norton, 1993)</td>
</tr>
<tr>
<td>Control variables</td>
<td>3 control variables, managerial attributes, regulations, market potential</td>
<td>(Tippins and Sohi, 2003)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Lee, 2003)</td>
</tr>
</tbody>
</table>

Table 1. Main constructs of interest and referred literature
CONCLUSION

This research develops a framework to analyze the outcome of ICT adoption by firms in underdeveloped countries. The study examines factors that determine the acquisition of competitive advantage by the adopters. The results would have important managerial and policy implications for firms in underdeveloped countries. The model will help managers to adopt ICT with the comprehensive picture of benefits and risks of their choices. The parsimonious characterization of both the firm’s internal capacities and the ICT being adopted particular peculiarities may supply a useful conceptual framework for managers to examine their firms’ internal capabilities versus the particular characteristics of the ICT being adopted before making costly irreversible commitments.

REFERENCES