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A MECHANISM OF TRANSFERRING MANUFACTURING COMPETENCES TO INCREASE MARKET PERFORMANCE

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ABSTRACT

This study uses competence transferring theory to establish a mechanism for transferring competence from the outside of an organization. Data were collected in the US from over 300 manufacturing companies. The mechanism of competence transferring is empirically supported. Also, the transferred competences increase manufacturing process competences including process automation, process integration, and process modularity. Furthermore, the process competences lead to higher market performance of firms.

Key Words: Manufacturing Competence, Market Performance, Automation, Integration, Modularity

1. INTRODUCTION

Market competence is often regarded as a key to survival and success in today's highly competitive market environment. It is firms' capabilities to create value indicated by its market performance, which mainly includes customer retention rate, sales growth, and market share growth (Verhoef, 2003; Batt, 2002; Bharadwaj et al., 2005). The Resource-advantage theory of competition (R-A theory) extends the Resource-based theory and views resources as heterogeneous and imperfectly mobile, which will yield marketplace positions of competitive advantage (Hunt, 1995). Companies should pursue distinct advantages in resources to establish marketplace position. In fact, the lifespan of a marketplace position of competitive advantage is determined by the existence of its associated resources. Studies show that R-A theory can provide fertile ground for applying competence-based approaches to operations and supply chain management (Hunt and Davis, 2008).

Competences are defined as "socially complex, interconnected, combinations of tangible basic resources and intangible basic resources that fit coherently together in a synergistic manner" (Hunt, 2002, pg. 143). As the major function to create added value to the company, how to develop competencies in manufacturing system would appear to be particularly important to increase a company's competitive edge in marketplace. By grounding competence-based view in

the R-A theory, companies can pursue two distinct advantages: advantages in resources leading to competencies and advantages in marketplace position. Through integrating the knowledge-based view (Sanchez et al., 1996), R-A theory explains the dynamic nature of competence and the knowledge driven practices to advance competence.

Although researchers have shown an increased interest in competence transfer as an important strategic tool to develop sustainable competitive edge in marketplace, there is little literature that applies this concept to the development of competence in manufacturing processes. Most studies on competence transferring are case-based. This paper establishes a mechanism within a firm to support the competence transferring from outside of the boundary of a firm. This study is a large scale empirical research using data from 303 manufacturing firms within the US.

Section 2 introduces the research model and the theory of competence transferring which is the foundation of our theoretical framework. Section 3 covers hypothesis development based on the theoretical model. Section 4 discusses research methodology followed by the data analysis and discussions of implications in Section 5. Finally, the conclusions and future research directions are discussedin Section 6.

2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

The theoretical model for the current study is illustrated in Figure 1. We use this model to describe and test firms' internal mechanism for competence transfer and capability development. The mechanism starts at open Communications Climate of a firm; the Communications Climate can affect the communications network and the knowledge base of managers and workers; the communications network and the knowledge base may improve the capability of transferring competence from outside of a firm; and the resulting manufacturing competences will in turn impact the firm's market performance.

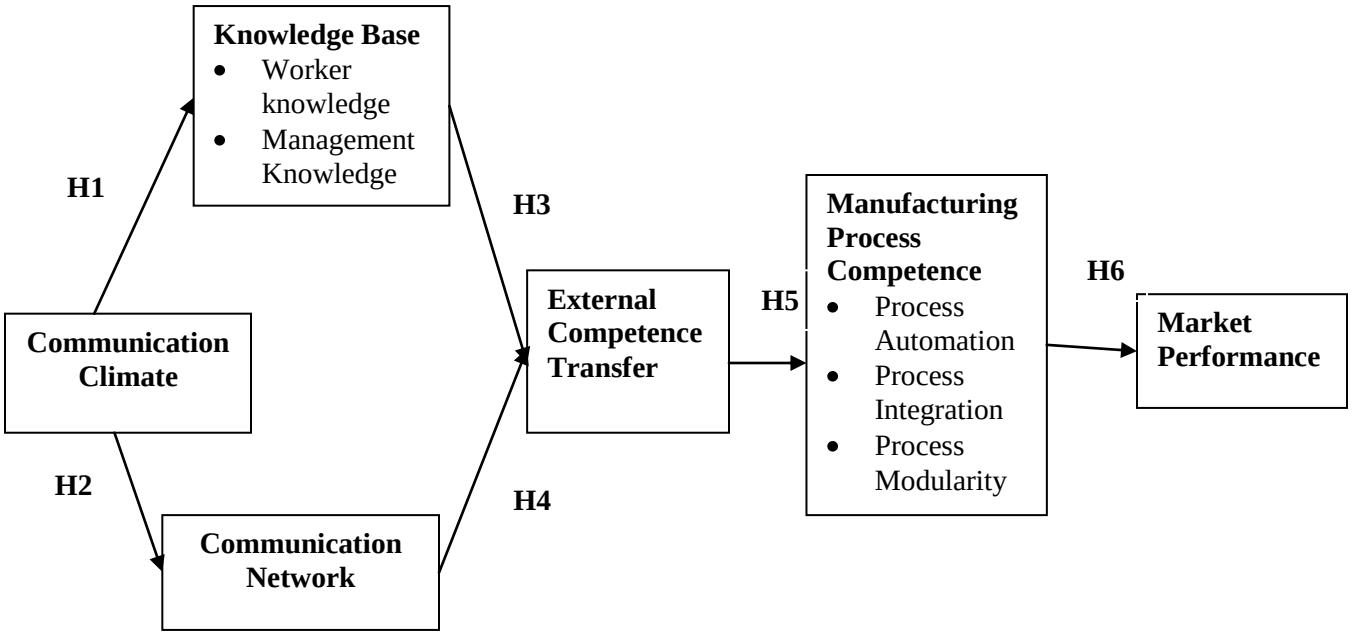

Figure 1: Research Model

Competences

The concept of competencies was first introduced by Hofer and Schendell (1978) as "resource and skill deployments that will help the firm achieve its goals and objectives" (p. 25). Lawler (1994) viewed it as compose of the knowledge, skills and abilities that are associated with high performance on the job at individual level. Competency focuses on how things get done; that is, the relationship between business goals and the competencies individuals must maintain to achieve those goals (Shippman et al., 2000). The concept has been expanded to the firm level as the collective learning to coordinate diverse process or technology competencies. Considering the above elements in competence, this study defines competence as critical manufacturing resources, skills and routines for the value-creation process of the firm.

Competence Transfer

Knowledge has been called the most critical resource embedded in a firm's competence (Grant, 1996) and the ability to exploit this knowledge through competence transfer can be an important source of sustained competitive advantage (Cohen & Levinthal, 1990; Crook, Giunipero, Reus, Handfield, & Williams, 2008). Competency focuses on how things get done; that is, the relationship between business goals and the competencies individuals must maintain to achieve those goals. Previous articles have emphasized the role of competence transfer within the company and across companies (Soderlund, 2008; Prevot and Spencer, 2006; Berghman, Matthyssens, and Vandenbempt, 2006). In this study, competence transfer is defined as mechanism that enables firms to identify and capture relevant internal and/or external knowledge and technology for building up their resources, skills and routines for their goals and objectives.

Internal Competencies

Within a firm, the individual knowledge base and the communication network are critical to improve continuous learning. Koskinen and Pihlanto (2006) argue that individual competence includes both knowledge based competencies and socially based competencies. In our research model, knowledge based competences are at the individual level in the form of employee and manager knowledge base (Knowledge base). The socially based competence is measured by communication network and climate to facilitate information and knowledge exchange and creation of new knowledge (Communicative competence).

External Competence Transfer

External competence transfer is mechanism that enables firms to identify and capture relevant external knowledge and technology for building up their resources, skills and routines for their goals and objectives. Crook, Giunipero, Reus, Handfield, and Williams (2008) conducted interviews with supply chain executives and identified cross-functional teams and meetings with customers and other supply chain participants as effective knowledge sharing mechanisms. The efficiency and effectiveness of knowledge sharing routines determine a firm's ability to learn quickly and adapt to changing market conditions.

Manufacturing Process Competence

Businesses face the competitive challenges resulted from complex business environment and fast

changes in technology and customer demands. In order to meet the competitive challenges, manufacturers have adopted three major manufacturing strategies: automation, integration and modularity. Manufacturing system automation can be defined as substituting labor with automatic facilities and equipment so that the system can operate with fewer labor hours per unit produced (Vonderembse et al. 1997). Manufacturing system integration refers to both the physical connections and information flows among the manufacturing system components. Integration includes physical material flow integration and information flow integration (Frohlich and Westbrook 2001). Manufacturing process modularity refers to the practice of standardizing manufacturing process modules so that the components can be easily re-sequenced or new components can be added in response to changing product requirements (Tu et al., 2004). As a primary advantage, firms are able to decompose a complex system into simpler subsystems by using modularity architecture. This decomposition results in concurrent product designs, concurrent production methods, and easier outsourcing.

Market Performance

In marketing, customer retention rate is a key measurement to maintain the customer base (Verhoef, 2003). Sales growth rate is another key indicate of the success of company's marketing strategy (Batt, 2002). In terms of the competition in the industry, market share growth is a key indicator of overall success of the company (Bharadwaj et al., 2005). This study includes customer retention rate, sales growth and market share growth as market performance measures.

3. HYPOTHESIS DEVELOPMENT

The open environment of communication allows workers and managers to share knowledge freely and thus increase the knowledge base of workers and managers (Foos et al., 2006). The open environment also can also increase the effectiveness of the communication networks between supervisors and works as well as between different departments. Therefore, we hypothesize that:

H1: Higher level of openness in communications environment increases the knowledge bases for workers and managers.

H2: Higher level of openness in communications environment increases the efficiency and effectiveness of communication network within a firm.

Bigger knowledge base of workers and managers increases their capability to transfer competences from competitors, their industry, and other outside resources to their firm. Also, efficient internal communication network increase the capability of knowledge transfer. Ko et al. (2005) identify three antecedents (i.e., communication factors, knowledge factors, and motivation factors) of knowledge transfer from consultants to clients in implementations of ERP. Similarly, other studies have investigated communicability and motivation as key factors to facilitate competence transfer (Koskinen and Pihlanto, 2006; Spencer and Spencer, 1993; Szulanski, 1996). It is the individual who can transfer knowledge from the outside of a firm eventually convert them to the competence of the firm. When individuals are surrounded by rich knowledge sharing networks, they are more active in learning and acquiring new knowledge; therefore an individual's ability to adapt to different operations and business environments can be improved. For innovation, the individual's perception of opportunities to productively change existing routines or resource configurations, their willingness to undertake such change and their

ability to implement these changes determine the success of competence transfer.
Therefore, we have the following hypotheses:
H3: Bigger knowledge base for workers and managers leads to higher level of external competence transfer.
H4: More efficient communications network within a firm leads to higher level of external competence transfer.

Knowledge sharing in the context of supply chain management implies that firms facilitate the development of routine and overlapping knowledge bases that will maximize the benefit of interactions with suppliers. Recently, Huang, Kristal, and Schroeder (2008) applied knowledge theory to the development of mass customization capability. The results suggest that internal and external learning facilitate knowledge creation, which in turn leads to superior capability to quickly produce customized products in large volumes in an efficient and effective manner. Knowledge sharing has also been found to influence the development of exceptional manufacturing flexibility and efficiency (Adler, Goldoftas, & Levine, 1999). In the context of manufacturing management, knowledge sharing with entities outside the boundary of the firm can increase the usage of automation equipments (Choudhury et al., 2006, Tu et al., 2006), system integration (Swink et al., 2007), and process modularity (Busoni et al., 2001).
Therefore, this study proposes the following hypothesis:
H5: Higher level of external competence transfer leads to higher manufacturing process competence.

Modularity in product design and manufacturing has been shown to have a positive effect on mass customization capabilities of firms through empirical studies (Antonio et al., 2007; Tu et al., 2004). Mass customization, which focuses on satisfying the special demand of individual customer as well as maintaining low cost, leads to high customer retention rate, sales growth, and market share growth. In summary, each of manufacturing process competence of automation, integration and modularity leads to high market performance.
Therefore, proposed hypothesizes that:
H6: Higher level of manufacturing process competence leads to higher level of market performance.

4. RESEARCH METHOD

In this section, research methods are described for the instrument development and survey administration. The instrument development process can be roughly divided into four phases: (1) Item generation; (2) Pre-pilot study; (3) Pilot study; and (4) Large-scale data analysis and instrument validation. The research questionnaire was administered through large-scale mailing to over 2,800 manufacturing managers, randomly selected from SME's U.S. membership database. Out of the total of 320 responses received, 303 were complete and usable. The response rate is 10.7%.

The instrument validation processes for the six constructs include the following two steps: (1) Item purification through dimension-level reliability analysis, which checks the corrected item-total correlation (CITC) scores and Cronbach's alpha, to ensure unidimensionality and convergent validity of the instrument dimensions; (2) construct-level exploratory factor analysis

to ensure the discriminant validity of the measurement instrument. All measurements are valid and reliable.

The AMOS algorithm provides several goodness-of-fit statistics to evaluate the hypothesized model and also suggests ways in which the model might be modified given sufficient theoretical justification. As illustrated in Table 1, the structural model fit was very good with all indices meeting the recommended criteria: RMR=0.047, RMSEA=0.072; GFI=0.845, AGFI=0.814 and CFI=0.863. The AMOS path coefficients resemble those derived through multiple regressions. The path coefficients for H1, H2, H3, H5 and H6 are significant at the 0.001 level. The path coefficient for H4 is significant at the 0.005 level.

Hypothesis		Estimate	t-value	P
H1	Communication_Culture --> Knowledge_Base	.883	10.629	***
H2	Communication_Culture --> Communication_Network	.722	10.271	***
H3	Knowledge_Base --> Competance_Transferring	.536	5.170	***
H4	Communication_Network --> Competance_Transferring	.251	2.911	.004
H5	Competance_Transferring --> Manufacturing_Process_Competance	.771	7.081	***
H6	Manufacturing_Process_Competance --> Market Performance	.390	4.783	***
RMR=0.047; RMSEA=0.072; GFI=0.845; AGFI=0.814; CFI=0.863				

Table 1: Model Fit and Hypothesis Test Results

5. IMPLICATIONS AND FUTURE RESEARCH DIRECTIONS

The current study theoretically defined the internal mechanism that initiates the competence transfer from industry competitors, customers, suppliers and other sources, and developed and empirically validated measurement instruments for each construct in the mechanism. Firms should first create a good communications climate of trust, openness, and freedom. Then, two important elements should be promoted in the mechanism: knowledge base for workers and managers regarding management practices and technical know-hows, and communication networks within the firm to allow knowledge to be shared. The knowledge base and communications network can then facilitate the competence transfer from other recourses outside of the firm.

Researchers can now use the definitions and measurement scales to further evaluate other potential competence transfer mechanisms. The relationships of this research framework with other factors in different research scenarios and models can also be studied to further extend our understanding in this important topic area. Practitioners can also benefit from using the instruments to measure their manufacturing system process competences and benchmark with competitors for implementation purposes.

Appendix and References available upon request