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Value creation in regional innovation systems: The case of Taiwan's machine tool enterprises

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ABSTRACT

Taiwan's machine tool industry is one of the few industries that do not depend on the support of foreign technologies. Nevertheless, it relies on the development of supplier networks among individual enterprises. This study clarifies the customer value creation mode of Taiwan's machine tool enterprises in a regional innovation system (RIS) by understanding the meaning of the value offered by suppliers to their customers and the dynamic development of value creation models across the boundaries of RIS.

In this study, we use as dimensions the customer's perspective of value, the supplier–customer interaction, and particularly the customer involvement to derive the value creation theory. We propose four models of value creation, including a high degree of product standardization with standard recommendations to the customer; product customization with the customer entering into the supplier's process of achieving the customers' preferences; customers and suppliers co-working in a mutual business process to co-create solutions; and the supplier developing a better understanding of customer needs to provide optional solutions. This study demonstrates that four types of value creation have been evidenced in Taiwan's machine tool industry from the viewpoint of the customer, and each type of value creation has its respective environmental and workable conditions. When accompanied by various RIS factors such as customer value creation, this not only develops dynamic growth but also, to a certain degree, affects the growth in competitiveness of the region and its companies.

In a highly customizing, flexible, and demanding environment, enhancing customers' value creation beyond their functional requirements while reducing the interaction costs associated with customization may be a challenge for a single enterprise; however, it may prove to present an opportunity to shift Taiwan's machine tools industry toward global competitiveness.

1. Introduction

Regional innovation system (RIS) theory began with Cooke (1992). After the Nordic region applied this theory and the development of the cluster concept, which is based on Porter's competitive advantage theory (OECD, 2007), the RIS concept has been expanded and RIS insights have progressed in terms of the theory and also in its empirical applications in policy. Since 2000, studies have been conducted on Taiwan's regional industrial clusters or regional networks (Liu and Brookfield, 2000; Hu et al., 2005).

Taiwan has a successful machine tool industry. It relies on domestic technology and is highly supported by an RIS, which is made possible through the industrial clustering that occurs in the mid-Taiwan region. Gartner research data (Jablonowski and Eigel-Miller, 2014) reveal that the production and export of Taiwan's machine tools totaled $5.43 billion and $4.236 billion in 2012, respectively, ranking Taiwan as the world's sixth largest producer and fourth largest exporter of these products.

Machine tool-related industries are clustered in a 60-km region in mid-Taiwan, including suppliers, integrators, and technological support. Nevertheless, they had weak national institutional support. The industry's strong exporting characteristics and long-term sales, through agents around the world, hint that Taiwan's RIS is lacking in immediate customer participation. The weak understanding of users' needs is considered to be a shortcoming of Taiwan's machine tool industry. Therefore, its value-generation ability largely relies on low production costs than on high user value.

Industrial clusters or RISs have the potential to enhance this industry's prosperity in Taiwan. However, with Taiwan's machine tool enterprises establishing their manufacturing bases in China since 2000, they now face challenges from other rising stars that can provide cheaper and more competitive products. Simultaneously, as Taiwan's machine tool enterprises seize an opportunity to sell products directly to end users in Mainland China, they may create new markets and value creation opportunities. Since the actors in the new RIS differ from those of Taiwan's native RIS, the value creation mode may change

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at the same time as more focus is being placed on the role of customer value.

Recently, research and empirical studies indicate that industrial marketing has been gradually shifting focus from product to service. The service-dominant logic (SD logic) concept suggests that the supplier's largest value and source of competitiveness results from providing customers with resources to help them create value in the use of the supplier's products. The product's role is to provide customer service and a value exchange. Only customers can define the value created from vendor's supplies (Vargo and Lusch, 2004).

Machine tool builders must provide differentiated machines according to the needs of different customers and apply the results to a customized production mode. Because of a long product life span and regular maintenance needs during the product life cycle, customers and suppliers regularly interact over the long term. The interactive process between both parties affects each other's operational procedures and enterprise development (Grönroos and Helle, 2010; Gruner and Homburg, 2000; Matthyssens et al., 2009).

If a supplier in an RIS can determine a customer's needs early and provide solutions that create customer value, the supplier will have a chance of becoming a market leader. Many studies reveal that in the business process, incorporating the customer as the co-creator of customer value is important (Gummesson, 1995; Hauser et al., 2006; Khalifa, 2004; Payne and Holt, 2001; Prahalad and Ramaswamy, 2004; Ramaswamy and Gouillart, 2010; Rowley et al., 2007; Sindhav, 2011). Simultaneously, the importance of cooperating with suppliers and customers outside the region to co-create value and knowledge has also been discussed (Asheim and Coenen, 2006; Bathelt et al., 2004). With the pace of globalization, it is argued that the regional innovation process—which is knowledge creation and application—can lead to regional value creation and competitive advantages through the interactions of actors among the RISs.

Entering into a dialog and involving each other's processes seem to have a value-promoting effect. However, how to understand customers' needs, how they assign value to a product, and how a participation model affects the results of co-creation in an RIS still need to be outlined.

This study clarifies the customer value creation mode of Taiwan's machine tool enterprises in its RISs by understanding the meaning of value offered by the suppliers to the customers and participation within the interaction model across the boundaries of RIS. This implies that we should have a clearer understanding of how Taiwan's machine tool enterprises in the RIS generate value creation and also of the business process of the supplier as a major actor in an RIS.

In particular, this study addresses a system that is shifting from a low production cost, i.e., traditional RIS without direct customer interaction, to a new RIS with a high-value product, in which the customer is an important actor.

First, we reviewed the relevant studies on RIS and Taiwan's machine tool industry and recognized the significance of the RIS boundary and the interaction between supplier and customer within the RIS. Second, in the phase of theory construction, an “RIS-related Value Creation Type Theory” was developed. It is based on the findings of the marketing and knowledge-based RIS literatures, the two dimensions of the customer value creation model and supplier–customer relation, and particularly the degree of customer participation. Finally, a case study on the evolution of product development strategies among Taiwan's main tool builders was used to verify the actual customer value creation model in the RIS. Conclusions and implications have been proposed on the basis of the findings of this study.

2. Literature review

Although the history of the development of Taiwan's machine tool industry is novel and exciting, little related research literature exists, both in Taiwan and elsewhere, compared with the literature on other industries in Taiwan. Nevertheless, studies note the following three features of Taiwan's machine tool industry:

First, few foreign theories accurately describe its development. Harvard professor Amsden visited Taiwan twice, in 1974 and 1981, and published two early papers wherein she described this industry. Her findings on the early stage of Taiwan's machine tool industry were not positive. Rather, she noted that it suffered due to the lack of a scale economy, low investment in equipment, limited technological learning from market demand, and a division of labor that did not match the requirements of the industry's later stages of development.

Meanwhile, we also had difficulties in being convinced by the RIS researches on the following arguments that contribute to dominate Taiwan's machine tool industry development: for example, the developmental state model explaining that industrial policies dominated the means of economic development (Onis, 1991; Stubbs, 2009); the importance of national scientific research institutions in the success of industries in Japan, Taiwan, and South Korea (Mazzoleni and Nelson, 2007); and Taiwan's Industrial Technology Research Institute as effectively leading the country to decide on targeted industry development (Amsden and Chu, 2003; Mathews, 2002).

Second, a special mode is involved in learning technology. Foreign technological cooperation did not significantly contribute to the sector's success (Fransman, 1986). Relative to the codification of technical knowledge, Chen (2009) indicated that the technical knowledge transfer that occurred in Taiwan's machine tool industry tended to be tacit; this implies that it was an evolutionary process based on hands-on experience in the technological learning process.

Third, studies have demonstrated the successful factors for the industrial network and modularity in Taiwan's machine tool industry. In fact, the evolutionary profile of the industry indicates that it progressed from a highly in-house integration system to one that was subcontracting with mature suppliers. The theory of the industrial network is recognized as the most important theory when discussing the competitiveness of Taiwan's machine tool industry (Liu and Brookfield, 2000). In the late 1990s, Taiwan's machine tool industry, led by a combination of modular technology trends (Chen and Liu, 2004) and globalization trends, demonstrated a dramatic change in the management structure in both Taiwan and Mainland China (Brookfield and Liu, 2005).

Although the three abovementioned themes can help us understand the context and characteristics of the development of Taiwan's machine tool industry, we endeavored to examine the delicate relation between these outcomes and the RIS theories.

The RIS is an approach to examine the importance of a region from the aspects of economic and technological structures. In this approach, researchers analyze the impact of interactions and collaborations between key actors on the competitiveness of industries and enterprises in the RIS (Asheim et al., 2011; Autio, 1998; Cooke et al., 1997; Doloreux and Parto, 2005; Tödtling and Trippl, 2005).

Autio (1998) noted that regional innovation includes two key factors. One comprises an enterprise-centered system and subsystems based on knowledge application. The elements in this system are enterprises, customers, partners, competitors, and suppliers. The other comprises a system and subsystems that exist for knowledge generation and diffusion. The main actors comprise technological agents, labor agents, governmental research institutes, and educational institutions.

In terms of the globalization of business operations, the discussion also covered interactions with entities located outside the region to achieve the knowledge creation and acquisition that would contribute to local development and enterprise competitiveness (Asheim and Isaksen, 2002; Bathelt et al., 2004; Grabher et al., 2008; Gertler and Wolfe, 2006).

Based on the concept of local buzz and the global pipeline, Bathelt et al. (2004) described knowledge creation within and across clusters. Buzz is the communication between mutual well-understanding actors in a region who can build new relations that may conduct innovations. A pipeline is a communication channel that serves the enterprise in a