



How Firms Leverage Its Technology Competence and Market Competence for Flat Panel Display: Based on RBT Perspective

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ABSTRACT: *There are two perspectives referring to how firm leverage its competence: technology-orientation and market-orientation. The former, manufacturers need to build “Technology Competence (TC)” and to enter another market. It is consistent with Wernerfelt “Resources-Based Theory (RBT)”. The latter, flat panel display manufacturers choose first respond to market demand for income and then put the technology upgrading. To solve the contradiction between theoretical and practical difference, we extend Danneels “Customer competence” by adding market factors to conceptualize “Market Competence (MC)”. This article found that TC tends to emphasis on learning, innovation, manufacturing, and design. Conversely, MC emphasizes on linking, reputation, service, and communication.*

KEY WORDS: *Technology Competence, Market Competence, Resources-Based Theory Competence Leveraging*

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I. INTRODUCTION

Firms need to continuously renew themselves if they are to survive and prosper in dynamic environments. And that requires a simultaneous thinking of from intra-firm to external-firm (inside-out) and from external-firm to intra-firm (outside-in), that is to say, firm competence leveraging should integration of technology and market, the former bases on technology-oriented market (taking technology to market) and the later focuses on market-oriented technology (transforming technology from market), cannot be understood as one or the other separately. Thus, it is necessary to address the impact of both on firm competence leveraging simultaneously, rather than considering each separately. This renewal challenge is even more pronounced in the current business environment characterized by fast changes in external-firm environments, intra-firm environments, and so on. Therefore, it is necessary to first constitute TC or MC and ‘really new’ competence is crucial to firm survival in the current fast-changing business environment. Particularly in flat panel display industry.

For the firm, resources and competence are two sides of the same coin. Most competence leveraging requires the services of several resources and most resources can be used in several competence building. In sum, it is a central insight that competence leveraging stems from the linkages among resources. The critical point is that different types of resources and linkages among resources constitute firm distinct competence. Specifically, we argue that resources may be useful for building TC and MC. Moreover, by specifying the priority of the firm’s competence building, it is possible to infer the minimum necessary competence leveraging in the allocation and transformation of firm’s resources. Competence leveraging is one of the mechanisms by which firms create, integrate, recombine, and shed resources.

Technology-orientation market

The RBT is a major theoretical framework that addresses the source of inter-firm performance differences (Penrose, 1959; Wernerfelt, 1984; Barney, 1991; Peteraf, 1993; Makadok, 2001; Hoopes, Madsen, and Walker, 2003) and influences competence leveraging differences. RBT clarifies understanding about why some firms continue to outperform others in their industry. Because of firms create competitive advantage and competence upgrade when managers develop resources that are valuable, rare, inimitable, and non-substitutable (VRIN) in a given market (Barney, 1991; Peteraf, 1993) and exploit them in additional markets (Wernerfelt, 1984; Barney, 1986; Amit and Schoemaker, 1993).

Although the general idea is to expand your position in a single strong technology, it is not always

optimal to go full force for diversification in several markets simultaneously (Andrews,1971). Wernerfelt modeled a resource-product matrix as a useful strategic tool for developing the fit between the firm's resources and product. The dynamic entry into new markets relies on the development of new technology competence and then sequential entry other markets, from a position of strength (Wernerfelt, 1984:176). This is technology-orientation market.

Market-oriented technology

Flat panel display manufacturers facing the huge manufacturing cost, in particular, to enter the era of 10-generation panels, manufacturing equipment more greater, more weight, and higher cost, choose the perspective of market-orientation rather than Wernerfelt's technology-orientation so as to first respond to market demand for income, and then to build technology competence, which is market-oriented technology perspective.

The RBT is a major theoretical framework that addresses the source of inter-firm performance differences (Penrose,1959; Wernerfelt, 1984; Barney, 1991; Peteraf,1993; Makadok, 2001; Hoopes et. al., 2003) and especially on developing core resources that are valuable, rare, inimitable, and non-substitutable (VRIN) in a given market (Barney, 1991; Peteraf, 1993) and exploit them in additional markets (Wernerfelt, 1984; Barney, 1986; Amit and Schoemaker, 1993). However, most papers focused on *what* kind resources formation inter-firm performance differences (Grant, 1996), very little on *how* firm to allocation and transformation resources, *how to apply* in the firm competence leveraging of TC and MC.

Whether there is an obvious difference about the strategy thinking of technology-oriented market and market-oriented technology? What's the difference in both competence building? Let us motive to research the path of the two different manufacturers conduct.

The purpose of this paper is to disentangle the differences of technology-oriented market and market-oriented technology, the linking role of competence leveraging, and the decision factors of technology or market competence priority.

II. THEORETICAL BACKGROUND

The priority of firm competence leveraging requires both from intra-firm to have competences relating to technology and external-firm relating to market and each of these competences is constituted by a set of resources. In sum, the firm key resources needed to accomplish them can be classified as technology-related and market- related (e.g., Danneels and Kleinschmidt, 2001; Mitchell, 1992; Moorman and Slotegraaf, 1999). From the RBT perspective, firm competence leveraging depends upon the deployment of resources or combinations of resources that are valuable in the context of a given market, rare, inimitable, and non-substitutable (Barney, 1991).

RBT: neglect of markets

However, the RBT perspective suffers from its neglect of product markets, which in turn explains the absence of any explicit view of the market (Knudsen and Madsen, 2002: 479–480). This is to say, firm must have competences from external-firm relating to market.

Several definitions of resources exist. Some scholars define resources as organizational strengths and weaknesses that are tied to firms (Wernerfelt, 1984). Others define them as all assets, attributes, and knowledge controlled by a firm that help improve efficiency and effectiveness (Barney, 1991) and a firm's resources at a given time could be defined as those tangible and intangible assets which are tied semi-permanently to the firm (Caves,1980). Consistent with these definitions, we define resources as the tangible assets, intangible assets, and organizational processes from which managers can develop value-creating activities. Given this definition, resources include tangible resources such as the fabrication facilities, plant, equipment and the store locations, and intangible resources such as brands, pharmaceutical patents, animation skills, know-how of engine technologies and technical knowledge. They also include organizational processes by which firm allocation, transformation, reconfigure or exit resources such as acquisition process, alliance partnering process, product development process and routes (Bingham and Eisenhardt, 2008:243) .

Necessary for competence building

The term of competence is used to refer to an ability to accomplish something by using a set of material and immaterial resources (Danneels, 2002:1102). My usage is consistent with Grant (1991), who defined a capability as the capacity for a set of individual resources to perform some task or activity: '... the capabilities of a firm are what it can do as a result of teams of resources working together' (Grant, 1991: 120). He uses the term 'capability' interchangeably with 'competence'. We follow the definition of competence formulated by McGrath *et al.* (1995: 254): '... a purposive combination of firm-specific assets which enables it to accomplish a given task.'

By using firm resources to create superior performance is leverage (Prahalad and Hamel, 1990). When core resources are combined with complementary resources, firms can produce products faster, better, and/or more cheaply than the competition (Collis and Montgomery, 1995; 2005). A related point is that the complementary resources that enable value creation from core resources may vary across markets. Thus, leveraging core resources into a new market or adding core resources to an existing market may also require leveraging existing complementary resources or building new complementary ones (Bingham and Eisenhardt, 2008: 245).

This article makes advances in applying RBT to the priority of firm competence leveraging in several ways. First, it explicates which resources are necessary for firm competence building. At this point by upgrading firm competence and escaping from the trap laid by their current competences. Second, the article shows how competence building can serve as a vehicle for the renewal and accumulation of firm competence. The insight into the reciprocity of the resources–competence relation extends RBT by examining not only how competence is used in upgrading, but how they are built as well, and by examining how one competence can be used to build another. The findings of this study show that building and upgrading new competences are activities that can expand the competence base of the firm, which in turn enables further new TC and MC.

The above literature streams are used in this article to develop a framework “Competence Model” that depicts competence leveraging as a vehicle of allocation and transformation among firm resources and upgrading firm competences. After a description of the methodological procedure, the foundation of the framework is laid by describing the reciprocal linkages between firm resources and competences. Drawing on RBT, competence building is depicted as serving to further develop TC and MC. Then the framework developed in this article is evaluated in terms of its theoretical and managerial implications. The article concludes with noting the limitations of the present research, and makes suggestions for further research.

METHODS

My conceptual framework is based on field research and an integration of the scholarly literature regarding leveraging, organizational resources and competences, and RBT. I conducted a field study using interviews, observations, and documents as data sources from two high-tech firms that produce flat panel display manufacturing equipment (Danneels, 2002; 2007). The research sites are briefly described in Table 1. Research sites were selected to achieve a diverse sample that provides many possibilities for comparison, which enables richer theory development (Glaser and Strauss, 1967; Strauss and Corbin, 1990). I intended to contrast firms that were different in terms of their variety of resources and products, competence building and upgrading. Rouse and Daellenbach (1999) called for a rich, detailed investigation of the nature of firm resources through comparative case studies. A multi-site study allows for cross-site comparison and allows the researcher to see idiosyncratic aspects of any one site in perspective (Miles, 1979).

Table1. Research sites

Firm pseudonym	Areas of activity	Age	Size: # employees/annual sales in \$ billion	Number of interviews/ observations conducted
ARET	Automation equipment, micro-drill the entire factory equipment, micro-drill	Since 1982	489/2.25	5 interviews 2 interviewee
MPG	Robot design, Robot application, Automation skill, Moving system, Processing machinery, Clean room equipment design, Pack/unpack system, Control system application	Since 1978	475/3.1	5 interviews 3 interviewee

Triangulation of various types of data collected through different methods can overcome the limitations of one method by counter-balancing the weaknesses of one method with the strengths of another (Jick, 1979). I used various types and sources of data to provide a rich and solid foundation for the theory development. I conducted 15 interviews with organizational members involved in existing resources and competence development to assess their perspectives on and experiences with new resources and competence development. Interviewees were drawn from multiple functional areas (e.g., R&D, marketing, manufacturing, etc.), and from various organizational levels. Data about development processes and projects were compared and integrated across informants. Interviews commonly lasted from 45 minutes to two hours.

I used the extended case method (Burawoy, 1991) as a guide to data analysis. This methodological approach uses empirical data gathered through case study to reconceptualize and extend theory. This study helps to the integration of practical perspectives, concepts and theories by using the extended case method, which aims to integrate, synthesize and stretch existing practical perspectives, concepts and theories. The process involves the interplay of existing concepts, theories and analysis of empirical data. Data analysis points to

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relevant practical perspectives, concepts and theories in the literature, while simultaneously the literature provides conceptual frameworks to aid in the interpretation of the data. This approach is highly similar to that of Rafaeli and Sutton (1991: 757), who developed their insights by ‘an iterative process of traveling back and forth between the data, pertinent literature, and emerging theory.’

To test the credibility of my interpretations of the data, I subjected my analysis to member checks (Hirschman, 1986; Lincoln and Guba, 1985). I checked my emerging insights on an ongoing basis with my informants, asking for their feedback, sometimes in a second interview. In addition, I made presentations of my findings to the participating firms. The member checks served to revise and hone the findings discussed below.

III. COMPETENCE LEVERAGING

To face on dynamic environments, firm competence leveraging must integration intra-firm and external-firm environments, it is a necessary process of linking technology and market. On the demand side, customers’ needs motivate firm to seek certain benefits of products and markets. On the supply side, a firm’s technologies enable it to provide certain benefits through the attributes of its products. Therefore, Firm competence leveraging requires bringing together two competences: TC and MC. This idea is depicted in Figure 1 Competence Leveraging Model. That two types of competence have to come together in firm competence leveraging has implications for the types of new competence the firm pursues. The ready availability of competence relating to some technologies or markets promotes firm prosper and survival in fast change dynamic environments based on those competences, whereas the lack of competence relating to other technologies or markets leads to the decline of firm outputs.

Competence leveraging model is posed of TC and MC and these two forces linked by organizational competence leveraging, analysis as follows:

Whether priority is technology or market, both to build the competence involved in companies resources of the allocation and transformation, directly related to the manufacture and sale of products, the company shall have the manufacturing competence and marketing competence (e.g., Danneels and Kleinschmidt, 2001; Mitchell, 1992; Moorman and Slotegraaf, 1999), until sufficient guidance technology-oriented market, or market-oriented technology, on how to allocation and transformation, which belong to operating within the organizations (Priem and Butler, 2001), that is the role of organization's competence leveraging.

We transform outsourcing manufacturer manpower to companies, ranked in the first line, the company's staff came in second-line in order to cultivate manufacturer (ARET Director).



FIGURE 1. Competence Leveraging Model

IV. TECHNOLOGY COMPETENCE

Wernerfelt (1984) suggests to develop the resource in one market and then to sequential enter another markets from a position of strength, this is technology-oriented market, companies must have relevant TC; Danneels (2007: 520) “De-linking and Re-linking” talked about recognize TC and serve new customers with TC, which will be applied to alternative applications and of characterize TC, the latter to build market-related resources to address new types of customers, and develop products and intellectual property. In this study, extension of the two concepts to build a bigger, broader application of technology competence, trying to infer to other technology-oriented market industries.

From technology-oriented market view, developing new products and extended to the market to do authentication, and gradually improve the shortcomings, the initial yield little stability until after the operation, the output will be gradually expanded. This is the case, the cost of putting in a lot of companies can not wait for mature products in order to obtain large orders, it should allow the currently available professional technology to develop products, or an extension of the existing professional technology to expand into new areas or

applications. For example: ARET company with its existing detection technology development Rally Test-wide machines, and combined with the competence of automation equipment create a automated equipment seized the entire compound.

TC is constituted by tangible and intangible resources (Mitchell, 1992), by the existing technology to exploit new applications and extended to the market or a combination of existing technology and new technology to explore the market. It is known as the TC. Manufacturers should construct what kind of technology-oriented competence to enter other market, citing interviews with the following data analysis:

According to interviews, TC is constituted by such technology-related resources and competence as: Manufacturing and Design, Quality Control, R & D and Innovation, and Integration and Learning, analysis as follows:

Develop new products, prompted to the market to do authentication, and then continuing to improve its operation more stable, so that greater output (MPG Director).

Manufacture and Design

TC gives the firm the competence to manufacture and design a physical product (Danneels, 2002). Flat panel display manufacturing industry is highly customized, manufacturers need to consider customer requirements, design, manufacture related manufacturing facilities, and firms must have manufacturing and design competence, citing interviews with the following information:

It takes 50 seconds to produce a drill, improving to 12 seconds, so that the company's technology upgrading, construction manufacturing competence (ARET Director).

Quality Control

TC is constituted by such technology-related resources and competence as: manufacturing facilities and know-how, and procedures for quality control (Danneels, 2002). In the flat panel display industry, competence for quality control is very important. Because the manufacturing equipment is completed, the actual operation needs to see the status of the operation, if a link error, the loss will be very serious, and then the process requires continuous detection; to avoid the breakdown of the glass panels, resulting in loss of manufacturers, testing end product is also very important. Interview quoted as follows:

There is a loss in manufacturing process, the customer will ask you to make some response in crucial analysis, to prevent these problems, and then firms entered the field of manufacturing equipment detection (ARET Director).

Research and Design, and Innovation

Flat panel displays industry need to continue research and innovation, MPG and ARET attaches great importance to both R & D talent. For examples: ARET continuous innovation and R & D of micro-drill to significantly reduce manufacturing time and cost savings, but also increase revenue. Interview quoted as follows:

MGP betting the cost of innovation, with the turnover will not decrease. The company's R & D manpower has of the total staff number of the 1 / 2 strong (MPG Director).

Integration and Learning

Resource can be leveraged so that a firm is able to apply the capabilities learned and resources earned in one situation to serve a different market (Miller, 2003: 971). It is important for manufacturers the training and cultivation of learning competence, and help also to enhance TC. Quote integration and learning materials are as follows:

The company has done a lot of industries, are also in transition, need for many people, through continuous learning and R & D more products and technology a company in transition momentum (ARET Director).

V. MARKET COMPETENCE

MC gives the firm the competence to serve certain market and to executive certain customer demand that posed by the tangible and intangible resources, and then by the existing market orders to exploit new technology applications or combine with the existing and new orders to explore new technology competence. 'Market' denotes a broader concept, namely the exchanges of goods and services between customers and suppliers, and the effects on these exchanges of environmental factors such as technology, laws, culture, and competition.

MC is constituted by such market-related resources and competences as: Linking with organizations, customers, supply chain and distribution, Communication with intra-firm and external-firm, Reputation of the firm, and Service Innovation.

Flat panel display manufacturers respond to large-size panels demand, build 10-generation manufacturing plants take the production costs of up to 60 billion NT dollars (10-generation sputtering machine as an example), it is difficult for manufacturers to input huge costs in production, due to the costs and risks too high, can only first respond to market demand orders, and then build the technology competence, which is from the perspective of market-oriented technology, firms must priority have MC; Danneels (2002:1102) "Customers competence" talking about the competence serve to customers, the "market factors" did not into consideration, especially the flat panel display manufacturing equipment are large size, heavy weight, and high cost of delivery must be closer to sales network, as well as attention to customer service.

In this study, we extend "Customers competence (Danneels, 2002)" to construct MC a larger scope, wider application, infer to other industries from the perspective of market-oriented technology.

MC derives from the customers identifies with the reputation of manufacturers, competence so that the implementation of orders by the firms, manufacturers choose to first respond to market orders, and then build TC. Citing an interview following data analysis:

MC is constituted by Linking, Reputation, Communication, and Service Innovation, analysis as follows:

Linking

Linking is very important, because the flat-panel display manufacturing equipment industry needs to combine with organizations, customers, manufacturers and distribution systems and then completely finished. Flat panel display manufacturing equipment is larger size, heavy weight, high input costs, to save distribution costs, firm will link the customer side with distribution systems.

It is a high capital-intensive, high tech-intensive industry for the flat panel display, in particular, that must now still largest to cross the threshold, have to link with other manufacturers (ARET Director).

Reputation

Firms select flat panel display manufacturers with intangible knowledge assets: organizational culture, business ethics, and its evaluation. As long as there is no problem with the company's reputation, they provide design drawings, engineers, and together produce with equipment manufacturers, manufacturers will be able to learn professional skills among which, with the company's existing professional technology competence, explore new skills.

Foreign manufacturer technology have patent right protection, customers select your company, basically look at the company's culture, business ethics, and its evaluation on your company, as long as business ethics is well, foreign manufacturer would help company technology upgrading (ARET Director).

Communication

It is very important for firms to communication with internal and external the firms, especially internal between technology personnel and employees need to still discussion and communication with the technology level and problem solving, and also external need to maintain good interactions with customers, which involves intra-organizational and inter-organizational coordination and communication, that has far-reaching and direct impact on the follow-up cooperation.

MPG develops a knowledge management platform to provide professional engineers, staff-sharing, communication, and problem-solving (MPG Director).

Service Innovation

Services will no longer be by telephone, internet to carry out customer service or advice that this kind of "oral to customers " services are no longer appropriate, should be paid "foot to customers" and "hand to customers " services, that is, visit the site to assist customers to solve the problem, and practical operational processes, such as service quality and interactive way to solve customer problems, satisfy customer demands.

Technology staff and operational staff together to serve customers, manufacturers will first inquiry technology staff to solve the problem, which is part of Customer Service (ARET Director)

VI. DISCUSSION

The goal of the paper is to integrate and extend existing theory by employing the empirical and practical data to fill in its gaps, reveal its flaws, elaborate its meaning, and extend its coverage. Moreover, the purpose of this paper is to disentangle the differences of technology-oriented market and market-oriented technology, the linking role of competence leveraging, and the TC or MC building.

Costs and risks

The crucial priority factors in technology or market competence lies in costs and risks. The reason for

manufacturer responds to demand for large-size panels is that flat panel display manufacturing equipment is expensive, large, more weight. For example: 10-generation Sputtering, it needs six billion NT dollars, 40 meters length, 10 meters wide, weighs 200 tons, the cost has not yet been included in hidden costs such as the trial, acceptance, distribution and services, sometimes takes one year to test, during which the costs and risks can not bear for company.

In short, it is a high capital, high-tech, high customization, and high-risk industries for flat panel display that companies must also make any changes to match the requirements of customers tailor-made, and different generations panel have different specifications, size, the process difference. Based on this phenomenon, manufacturers did not obtain orders premise and bears high risk on investing rashly the huge capital, technology, is extremely unlikely. Therefore, firms priority response to market demand orders, and then construct technology. It is worth follow-up tracking that this opinion is the contribution of the study and different from RBT.

Compared with lower-cost equipments such as washing machine, manufacturers produce physical equipment by their own professional technology advantages, and extend to the market of strength, then testing by the market and customers. Manufacturers select technology first, and then extended to the market, consistent with the RBT.

Linking role

The key role of competence leveraging is in response to environmental changes, then coordination, integration, learning, upgrading, and reconstruction of the intra- and external- firm resources, activities and competences, and to apply in TC and MC building. This linking role is to help organizations decision-making of technology first or market first.

Competence hierarchy

TC and MC is component of three hierarchies such as the basis competence, combination competence, and architectural competence (Table 2).

Basic competence refers to enterprise bases on its existing general resources and develops the basic skills; combination competence is an enterprise with its existing resources and skills to develop new skills by learning and linking, and combine both; architectural competence refers to enterprise in response to environmental change and organizational needs, to construct competence through innovative thinking.

Table2. Hierarchy of TC and MC

Component \ Categories	Technology Vompotence	Market Competence
Basic Competences	◆Manufacturing and design ◆Quality control	◆Reputation
Combination Competences	◆Integration and learning ◆R & D	◆Linking ◆Communication
Architectural Competences	◆Innovation	◆Service Innovation

The thinking of technology-oriented market (technology competence priority), manufacturers focus on Manufacturing and Design, Quality Control, Integration and Learning, R & D, and Innovation; market-oriented technology (market competence priority), manufacturers focus on Linking relations with customers, distribution system, and Reputation, Communication, and Service Lnnovation.

The thinking of technology-oriented market gives priority to build tangible competence and then to construct intangible competence. The reasons are that flat panel display manufacturers produce physical equipments with firm's technology, and extend to the market of strength. This is consistent with the opinion of RBT.

The thinking of market-oriented technology gives priority to build intangible competence and then to construct tangible competence. The reason is that flat panel display manufacturing equipment has higher cost, manufacturers respond to market demand orders to reduce the risk of cost, and then customers support manufacturers transforming technology and knowledge. This is consistent with the opinion of Danneels 2002.

VII. THEORETICAL IMPLICATIONS

Flat panel display industry faces major foreign competition, technology-intensive, capital-intensive and other challenges, by the technical capacity to build capacity and the market will help strengthen the manufacturing equipment in place and increase the rate of self-made process equipment, to help manufacturers enter the international, the face of rapidly changing environment and, more importantly, more manufacturers industrial competitiveness and competitive advantage.

Resource-based scholars have started to focus much more on the dynamic nature of competence, asking how competences and resources evolve over time (Helfat, 2000). RBT from intra-firm to external-firm (inside-out) view, the lack of market thinking, this paper to build firm market competence to make up for its shortcomings, and to increase the dynamic learning competence and dynamic interactive competence, will enable firm fast respond to environmental changes.

VIII. MANAGERIAL IMPLICATIONS

Flat panel display manufacturing equipment needs huge manufacturing costs that manufacturers first invests on technology research will have concerns of orders and profitability. Even if the manufacturing technology can support, the lack of orders for commitment will greater burden on manufacturers, to choose first in response to market demand orders, and then to build technology competence is priority considered for enterprise survival.

Manufacturers execute the thinking of market-oriented technology should strengthen dynamic interaction competence to face the changing market, must have the competence of rapid response and communicate with customers, other manufacturers, competitors and distribution mechanisms, and then have competitive advantages of market that can attract customer orders and build new technologies.

Manufacturers execute the thinking of technology-oriented market should strengthen dynamic learning competence to face the changing technology, must have the competence of rapid absorption and learning on manufacturing power, design power, research and development power, and integration power, and then have competitive advantages of technology that can attract customer orders and explore new markets.

IX. FURTHER RESEARCH

In this study, there are two questions for future research. At first, competence leveraging acts as the linking role of TC and MC, the connotation of this process, should be more detailed analysis and discussion, including the past experience of organization, environmental changes and organizational requirements.

Wernerfelt modeled a resource-product matrix as a useful strategic tool for developing the fit between the firm's resources and product. The dynamic entry new markets relies on the development of new TC and then sequential entry other markets, from a position of strength (Wernerfelt, 1984:176). This is the priority of technology-orientation competence.

Second, Flat panel display manufacturing suppliers due to the considerations of cost and risk, manufacturers first choose to respond to market orders, and then construct technology competence. This is the priority of market-oriented competence, and that is obviously different with RBT. It is a worthy deeper research that the cost factors how do interfere with RBT?

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