Impacts of Knowledge Integration on New Product Development

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ABSTRACT

Although the previous studies of knowledge and new product development are quite quickly spreading in the past few years. In an effort to explore the research gap between knowledge integration (KI) and new product development (NPD), this research takes knowledge-based view to start the literature review, and then carry out an exploratory case study so as to shed light the nature of the KI that really impact continuous NPD at the firm in order to unravel the roots of product development sequencing. The analytical results show that the post-intervention process of KI and NPD was built, such as capturing knowledge, building classification of R&D knowledge, establishing knowledge structure, establishing R&D knowledge base, creating new product’s R&D knowledge management and project management, and establishing maintenance mechanisms (i.e. knowledge integration of R&D and project), company can overcome dilemmas of KI and NPD. Based implications of the research findings, several recommendations are discussed.

INTRODUCTION

In recent years, some management scholars have highlighted the virtues of product development in driving continuous change (Verona and Ravasi, 2003). Product innovation and development speed in the market are often regarded as the keys to survival and success in today’s highly competitive market environment (Sairn and McDermott, 2003). New products have been indicated as the most natural driving force behind change and renewal at the firm (Daneels, 2002). On average, nearly one-half of firm’s annual sales and profits come from products commercialized within the last 5 years (Schmidt and Calantone, 2002); some times companies even bet their survival on key new products. In market economies, new product development (referred to as “NPD,” hereinafter) is a vital business activity. NPD is critical for the renewal, survival, and success of organizations (Brown and Eisenhardt, 1995). For this reason, a growing research of product innovation and development is quite quickly spreading in the past few years. Furthermore, many researchers have been investigated on NPD as a dependent construct from different perspectives. They investigate the antecedents of NPD, such as integrating cross-functional efficiency (e.g., Atualene-Gima and Evangelista, 2000; Keller, 2001; Lovelage, Shapiro, and Weingart, 2001; Sivadas and Dwyer, 2000), establishing organizational commitment (e.g. Schmidt and Calantone, 2002), developing team leader characteristics (e.g. Sarin and Mc Dermott, 2003), establishing reward structure (e.g. Sarin and Mahajan, 2001), establishing collaborative or alliance relationship (e.g., Littler, Leverick, and Bruce, 1995; Young-Ybarra and Wiersema, 1999), developing social relationship (e.g., Kendra and Taplin, 2004; Rindfleisch and Moorman, 2001), and creating market or customer demand (e.g., Karkkainen, Piippo, Puumalainen, and Tuominen, 2001; Troy, Szymanski, and Varadarajan, 2001). Eventually, they have plentiful research to understand what kind of critical antecedents that will impact on NPD.

Besides, as new knowledge provides the basis for organizational renewal and sustainable competitive advantage (Prahalad and Hamel, 1994). The management and processing of organizational knowledge are increasingly being view as critical to organizational success (Inkpen and Dinur, 1998). Some studies have from different perspective of knowledge-based view to investigate how knowledge impacts on NPD (e.g., Aoshima, 2002; Carlile, 2002; Hall and Andriani, 1999; Hargadon and Sutton, 1997; Li and Calantone, 1998; Madhavan and Grover, 1998; Taylor and Lowe, 1991). For instance, Aoshima (2002) examines the effective ways of retaining knowledge in NPD. Carlile (2002) focuses on the relationship between knowledge boundaries and NPD. Karlsen and Gottschalk (2003) investigate on the evaluation of common knowledge transfer mechanisms and their importance for IT project success. Hall and Andrian (1999) emphasize the development of a new technique for sharing knowledge in a NPD project. Hargadon and Sutton (1997) look at the organizational memory of network perspective to gain knowledge of the existing technological
solutions and new product innovation in various industries. Li and Calantone (1998) identify how to create the role of market knowledge competence for enhancing new product advantage. Madhavan and Gover (1998) more argue that the creation of new knowledge can be viewed as the central theme of the NPD process. In additions, Taylor and Lowe (1997) explore through effective ways of retaining knowledge asset grouping to provide significant NPD performance.

As known from the above literature regarding knowledge, the impacts of knowledge on NPD have been investigated from different focuses, such as knowledge creation, knowledge sharing, retaining knowledge, knowledge acquisition, organizational memory, knowledge competence, and knowledge transfer, etc. Yet, it is found that the past studies still seldom have highlighted the relationship between knowledge integration (referred to as “KI,” hereinafter) and NPD from the focus of KI. According to Verona and Ravasi (2003), the increased interaction and exchanges between experts from different professional areas, the establishment of an integrated product development process combined with the absence of physical and structural barriers all stem from a corporate policy that strives to integrate different knowledge and expertise into new product development initiatives. The introduction of new products to the market has been maintained mainly through the product development process, in which organizations perform their critical role of integrating dispersed knowledge in an innovative way, and thus generate effective or new knowledge (Helfat and Rauitschak, 2000). Firms integrate the specialists’ knowledge resident in individuals and turn it into be goods and services (Grant, 1996b); the benefits of specialization in knowledge acquisition, the many types of knowledge required for creation of each product, and the difficulty of integration of these knowledge inputs across markets, suggest that single-product firms will tend to predominate the market. Hence, the integration of knowledge to a collective level is necessary (Okhuysen and Eisenhardt, 2002).

In view of the discussions of the above literature, this research thinks it important to initiate a study of the relationship between KI and NPD. According to the literature related to KI and NPD research (e.g., Helfat and Rauitschak, 2000; Verona and Ravasi, 2003), there should be a certain kind of positive relationship existed linkage between them. But we are not sure right now if the relationship is a positive or a negative one. Perhaps an organization may have involved a lot of manpower, time, efforts and money to conduct NPD activities, but failed to overcome the combination and coordination problems among organizational members in the KI process, thus resulting in low operating efficiency and poor performance. This is a revelation of negative relationship between KI and NPD. Hence, if we can find it out, and build up a linkage between them, we believe that such research will be very contributive. In an effort to link the gap in literature, the aim of this research is to explore the concept of knowledge-based view and help shed light the nature of the KI that really impact continuous NPD at the firm in order to unravel the roots of product development sequencing.

LITERATURE REVIEW

Knowledge Integration

At the heart of knowledge-based view is the idea that the primary role of the firm and the essence of organizational capability is the integration of knowledge (Grant, 1996a). Organizational capability defined as a firm’s ability to perform repeatedly a productive task which relates either directly or indirectly to a firm’s capacity for creating value through effecting the transformation of inputs to outputs. Most organizational capabilities require integrating the specialist knowledge bases of a number of individuals (Grant, 1996b), groups (Okhuysen and Eisenhardt, 2002), or social communities (Kogut and Zander, 1992).

According to Verona and Ravasi (2003), “knowledge integration” refers to the capacity to shape and manage a context that stimulates latent and dispersed knowledge resources, so that they can jointly contribute to developing and launching new product. Hence, how to recognize many characteristic of knowledge to the firm, such as transferability, capacity for aggregation, specialization in knowledge acquisition, and the knowledge requirements of production which have critical implications for management (Grant, 1996b). As Grant’s (1996a) argument, effective KI depends on the extent to which the organization exploits and accesses to individual knowledge, the breadth of specialized knowledge that the organization draws upon, and the extent to which the organization can access to additional knowledge and reconfigure the existing knowledge. In contrast, the integration of knowledge typically takes place in group. The core
concept to the effectiveness of these groups is the KI process, and hence, the work of groups in the knowledge domain becomes central to organizational success (Okhuysen and Eisenhardt, 2002). Therefore, the challenge to create new knowledge (e.g., new product development, solutions to problems) implies that the integration of knowledge from different sources becomes the key capability for a firm’s management to master.

The complexities of knowledge integration, especially when tacit knowledge is involved in firm’s potential for transfer and aggregation, the implications for organizational structure and the location of decision-making authority are profound. The effective management of knowledge integration just likes strategy-making (Mintzberg, 1979) or corporate renewal (Burgelman, 1991) requires a careful balance between deliberate and emergent processes. The benefits of specialization in knowledge acquisition, the many types of knowledge required to produce a product, and the difficult of integration these knowledge inputs across markets, suggest that single-product firms will tend to predominate (Grant, 1996b). Organizing the process of knowledge integration can benefit for structural ambiguity into the configuration of role systems and authority relationships (Ravasi and Verona, 2001).

The particular configuration of knowledge functions is a similar portfolio of platforms on future development such as new product development. A firm’s combative capability builds these platforms to synthesize currently acquired knowledge (De Boer and Van Den Bosch, 1999; Kogut, 1991). According to Kogut and Zander (1992), firms are social communities that permit the cooperation in the creation and replication of partly tacit, partly explicit organizing principles of work; the idea behind the concept of combative capabilities is that it is the KI, rather than the knowledge itself that establishes the basis of a firm’s competitive advantage. Besides, Grant (1996b) argues that the greater the number of location in which that an activity must be replicated; the more complex the activity and the more the KI will rely on combination. The importance of combination is that it reduces the need for further communication among subunits because combination provides a memory for handling routine situation (De Boer and Van Den Bosch, 1999). Hence, combination capability of knowledge integration reflects the degree to which communication, instructions, rules and procedures are laid down in written documents.

In contrast with combative capability, some researchers suggest that the idea behind the concept of coordination capabilities is that it is the KI. For example, Grant (1996b) argued that the firm is conceptualized as an institution for integrating knowledge and firms integrate the specialist knowledge of their member through coordination mechanisms; coordination refers to mechanisms for integrating individuals’ specialized knowledge within the firm. Besides, according to Kogut and Zander (1996), the knowledge of the firm has an economic value over market transactions when identity leads to social knowledge that supports coordination and communication. Cohendet, Kern, Mechanpazir, and Munier (1999) more argue that main problem for the modern, globalised firm is not one primarily of the unequal distributions of information, but rather of the difficulty of mobilising and integrating fragmented forms of localized knowledge. Through integrated coordination of knowledge within the boundaries of a given firm, firm can enrich its integrated networks in competitive market. Moreover, the lateral ways of coordination might be explicitly designed or emerge out of a process of interaction (De Leeuw and Volberda, 1996). In this situation, KI is formed by a specific bundle of relations between members of a group rather than a separate information processing system. De Boer and Van Den Bosch (1999) further suggest that training and job-rotation, natural liaison devices and participation lead to the accumulation of coordination capability within a firm. Therefore, in order to integrate knowledge, the fundamental task of organization is to coordinate the efforts of many specialists in a firm.

In summary above discussions, this research suggests combination capability and coordination capability as two major variables to conceptualize the construct of KI.

New Product Development

New product development (NPD) is widely recognized as a crucial activity for most innovation- oriented companies. Long-term survival is increasingly dependent on the ability of companies to develop and introduce new products on to the marketplace successfully. The development and application based on existing technologies has revolutionizing effects on firm’s capability and knowledge base (Madhavan and Grover, 1998). The concept adopted to identify a ‘new product’ falls into the domain of relativity. A new product does not mean a fundamentally reformed or newly built commodity. In contrast, the newness for a product stems from a comparison for the degree of the deviation
from existing basis. According to Johnson and Jones (1957), these comparisons are embodied from conceptual elements into real-life business things, by specifying the reformulation for existing products, re-merchandising, product improvement, market expansions, etc. As a result, development for new products can be sketched both from content and process views when it is linked to strategic issues. For example, Brown and Eisenhardt (1995) indicate the research of product development can be made explicit by representing three imperatives, including rational plan, communication web, and disciplined problem-solving. In addition, NPD involves both internal and external elements in those contents and processes. For example, sources of knowledge regarding prototype design of basketball shoes come from not merely the R&D members’ idea, but also from the customers’ last feedback for the experience using the last generation product, as well as their expectations on future generation product. This kind of collaborative process, with customers and suppliers contributing complementary knowledge and skills, sets out the drivers by the complexity of new products, shrinking time to market, and capital intensity (Scott, 2000). Thus, this searching for outside aids makes the NPD more externally oriented and dependent, although its core elements needs to be integrate and apply in house.

Since the concept of NPD covers a wide-range and complex set of knowledge, it is very commonly that NPD success is determined by internal/external, as well as objective/subjective evaluations (e.g., Moorman, 1995; Sivadas and Dwyer, 2000) around and across layers of organizational system. In an organizational context, NPD success is basically assessed by three underlying indicators: technological innovation ability, project management ability, and ability of knowledge community development. First, technological innovation ability is a synthesizing the dynamic capability (Eisenhardt and Martin, 2000; Teece, Pisano, and Shuen, 1997) and resource-based view (Barney, 1991), it is not merely that the resource(s) portfolio of a firm makes differences in competitive advantage, but it is more critical of a firm whether it has corresponding capability to use that portfolio well. For NPD, effective integration the knowledge, such as documentation, tacit know-how, and other important sorts of human capital serve as fundamental basis of the innovativeness and embody the consequences of NPD (Verona and Ravasi, 2003). Second, project management ability is specific to the individual members who perform project-related work (Hall and Andriani, 1999; Kendra and Taplin, 2004). These individuals include a project manager and project team members. Project success factors are associated with the social dimensions of organization, and include the micro-social element of project manager skills and competencies, and the macro-social element of project organizational design structures (Kendra and Taplin, 2004). Third, ability of knowledge community development is the flow and accumulation of explicit and tacit knowledge (e.g., inter-unit communications or inter-expertise coordination) that takes the social community for knowledge in a key position for product and technological innovation activities (Kogut and Zander, 1992). Due to products development involves complex knowledge, which constitute the inimitable core of the product and needs to be well managed in a way that both spread the knowledge across borders efficiently and prevent the knowledge spilling over unexpectedly. The expertise-oriented community of knowledge implement better and safer than traditional economic labor divisions in sharing and integrate the knowledge (Brown and Duguid, 2001).

In summary, this research suggests project management ability, technological innovation ability, and ability of knowledge community development as three major variables to conceptualize the construct of NPD.

**METHODS**

Burgelman (1991) argues that exploratory case study has already been successfully adopted in the field of continuous product innovation. Besides, since case study is suitable for responding to the questions of how and why, and it is a thinking process of rationale with useful data being either quantitative or qualitative and data that can be collected through questionnaire survey, interview, files, field studies, and video records, etc. (Yin, 1981, 1994). According to Yin (1994), single case study is more suitable when the case is extreme or unique case. To acquire more substantial research results, this research used single case study to make a more thorough investigation and understanding of the focal company.

**Sample and Procedure**

To explore three research questions of this research, the selection of focal company was based on these criteria: 1) The company is a well-know company in Taiwan with stable profits. 2) The operational management of the company
extremely stressed the product R&D (research and development) of new product, and had achieved certain effects from implementation of the related knowledge management activities, especially in knowledge integration activity. 3) There must be something interesting enough regarding three research questions of this research, which we think no other companies are more suitable than this focal company.

After accumulation of data and search of suitable research targets for some time, the study finds that there are seven famous companies with stocks listed or marketed in the stock market of Taiwan, including Taiwan Semiconductor Manufacturing Company (TSMC), United Microelectronics Corporation (UMC), Applied Material Taiwan (AMT), Advanced Semiconductor Engineering (ASE), China Steel Corporation (CSC), China Motor Corporation (CMC) and Advanced International Multitech Co., Ltd. (Advanced Group), being the companies with outstanding performance for years in the promotion of knowledge management and product research and development (R&D). Besides, the process and achievement sharing of these seven companies’ past promotion of knowledge management and product R&D were successively considered as the exemplary performance in Industrial Knowledge Management Technical Counseling and Promotion Plan implemented by Industrial Development Bureau, Ministry of Economic Office of Taiwan (2003), as well as Knowledge Economic Development Seed Staff Training Plan implemented by Council for Economic Planning and Development, Executive Yuan of Taiwan (2003). Hence, the abovementioned seven companies were preliminarily listed as the samples of this research. However, after analyzing the case data presented by these companies and making interviews with their administration staff, it was found that among the seven companies, only Advanced Group’s past promotion of knowledge management and product R&D was more related to the three research questions of this research. As to the other six companies, although they have remarkable performance in the promotion of knowledge management and product R&D, they laid particular stress on the promotion of knowledge creation, sharing, transfer, acquisition, etc. Therefore, Advanced Group (2005) was selected as the sole target of this research.

In the aspect of the data source, this research had to avoid single source bias (Avolio, Yammarino and Bass, 1991) caused among the constructs of the hypothesized research framework of this study due to common method variance. It refers to the relative inflation among constructs, due to the categoriaization of information, appeared in the answers of participants when filling out the questionnaires. Common method variance not only leads to the relative inflation among constructs which thus forms type I error to the statistical inference; under certain circumstances, it may also cause relative deflation among constructs which thus forms type II error (Williams and Brown, 1994). Therefore, this research was conducted based on three data sources: 1) Initial interviews at the headquarters in Kaohsiung, Taiwan: Interviews in a semi-structured format lasting for five days were conducted with eight supervisors and sixteen staff of each of the eight departments (i.e. from Assistant Manager of Human Resource Management Department, Specialist of Supply Chain Management, Assistant Manager of Knowledge Management Department, Manager of Research and Development Department, Manager of Management Information System Department, Manager of Product Design Center, Vice-President of Marketing Department, and Vice-President of Administration Department) (response rate: 100%). 2) Questionnaires in semi-structured format completed by three main plants in Dongguan of China and one plant in California of USA: Questionnaires were airmailed to each of the eight departmental supervisors and staff (names of posts being the same as those of Taiwan headquarters). These dispatched questionnaires included 360 questionnaires to three main plants in Dongguan of China (120 questionnaires to each plant; response rate: 46.66%), and 80 questionnaires to one plant in California of USA (response rate: 37.50%). Besides, the researchers also sent four questionnaires to the CEOs of four major customers of Advanced Group in North American (response rate: 75%), and three questionnaires to the CEOs of three major customers of Advanced Group in Japan (response rate: 66.66%). Moreover, the researchers also sent 59 questionnaires to every CEO of all the 59 local suppliers of Advanced Group (response rate: 67.79%). Eventually, 243 questionnaires data were collected. 3) Secondary data: The available business reports and internal documents, such as Advanced Group 2004, Letter to Shareholder 2003, Co-Sports Chain Report 2003, were examined. Informal observations were made, and the related data were collected from the headquarters office. Finally, over the observations of knowledge integration and new product development, a three-day discussion was made with eight departmental supervisors and another two-day discussion was made with eight departmental staff in the office of Taiwan headquarters.
Regarding the questions were showed as follow. Questions 1~8 and 14 were designed to examine the construct of new product development. Each of the eight departmental supervisors and staff in Taiwan headquarters, in each of the three main plants in Dongguan of China, the one plant in California of USA and every overseas affiliate of Advance Group had to answer Questions 1~8 and 14. Among these several questions, Question 5 mainly examines the variable of technological innovation ability; Question 6 examines the variable of project management; Question 7 examines the variable of knowledge community development ability; and Question 14 examines the barriers between KI and NPD. As to the CEOs of Advanced Group’s 4 major customers in North America and 3 major customers in Japan, they were required to answer Questions 2 and 4 only. But for the CEOs of all the 59 local suppliers of Advanced Group, they were required to answer Questions 3 and 4 only. Besides, Questions 9~14 were designed to examine the construct of knowledge integration. Each of the eight departmental supervisors and staff in Taiwan headquarters, in each of the three main plants in Dongguan of China, the one plant in California of USA and every overseas affiliate of Advance Group had to answer Questions 9~14. Among these several questions, Questions 10 and 11 mainly examine the variables of coordination capability and combination capability. But the CEOs of Advanced Group’s 4 major customers in North America and 3 major customers in Japan, as well as the CEOs of all the 59 local suppliers of Advanced Group were required to answer Question 11 only.

Analysis

**Case Description.** Advanced Group is a large corporation manufacturing golf club heads, shafts, composite materials, carbon and accessories for bicycles, such as forks, frames, and seat posts. Advanced Group is also the second largest manufacturer of golf club heads in the world. The earnings per share in 2003 are NTD10.22. Ever since its establishment in 1987, Advanced Group has two business units: Golf Business Unit and Composite Business Unit. Both units have their own sales, R&D, and production departments. Advanced Group headquarters is localized in Kaohsiung, Taiwan. There are three main plants in Dong Guan, China and one plant in California, USA. The total annual sales amount is 3.1 billion. Its main export areas include North American (62%), Japan (31%), Europe (2%), and others (5%). There are 59 suppliers chained with Advanced Group. Besides, main customers include the USA’s Taylor Made-Adidas Golf, Cleveland Golf and Mizuno Corporation, and Japan’s Sumitomo Rubber Industries, Maruman Golf Co., Ltd. and Daiwa.

**Data Analysis.** After the 24 interviews, 243 questionnaires and the related secondary data were collected, content analysis was performed to analyze all the above data in semi-structured format in order to explore three research questions in this research. Content analysis is any technique for making inferences by objectively and systematically identifying specified characteristics of messages (Holsti, 1969). Similarly, content analysis is as a tool with systematic and objective analysis of message characteristics (Naccarato and Neuendorf, 1998). The major procedures of content analysis are determination of population, sampling, construction of categories, determination of analytic units, coding and estimation reliability. This study has already explained the procedures of population and sampling in the above section of sample and procedure, and selected the 24 interviews, 243 questionnaires and the related secondary data. As to construction of categories, determination of analytic units, coding and estimation reliability, they are described as follows:

1. **Construction of categories and determination of analytic units:** Since the information collected by means of content analysis were mostly of nominal scale nature, this study mainly focused on the collected 24 interviews, 243 questionnaires and related secondary data, and analyzed their category data, including contents of interviews and questionnaires with The Advanced Group, and the related secondary data. As to determination of analytic units, the contents and semantics of research papers were taken as the analytic units.

2. **Coding and estimation reliability:** Focusing on the collected 24 interviews, 243 questionnaires, and the related secondary data about The Advanced Group, the four coders of this study read carefully the contents of all data and judged their semantics after thorough mutual communication in order to pursue a consistent coding procedure. Having done a certain summarization appropriately, the mutual agreement was 0.82= (0.82+0.83+ 0.76+ 0.85)/4, and the reliability is 0.95= 4*0.82/ (1+3*0.82), reaching the acceptable standard of reliability (Kassarjian, 1977).
In the process of data analysis, we found that The Advanced Group once faced operational dilemmas for several times over the last few years. Specially, in recent years, suffering from quick and changeable challenge factors of customers’ demand for suppliers’ speed and quality, technological complexity of product manufacturing, there are some business dilemmas among NPD with the suppliers, customers, and intra-organization in Advance Group. Eventually, through implementation of the related KI activities for several years, the company underwent great modifications over the promotion of NPD ability and profit earning of the group.

RESULTS

How Advanced Group Overcomes Dilemmas of KI and NPD

Advanced Group overcomes business dilemmas among NPD with the suppliers, customers, and intra-organization, which main solution is through managing KI and creating NPD.

First, to encourage suppliers to participate Supply Chain Management (SCM) system and Product Knowledge Management (PKM) system, Advanced Group has heavily subsidized the network during the early stages of formation, ensuring that main suppliers get substantial benefits from participation. Suppliers are motivated to participate because they quickly understand if they participate in Advanced Group’s SCM and PKM systems which cover the collective knowledge integration processes, they are superior to the isolation from their proprietary knowledge. Advanced Group builds up PKM system. After a period of time, we can see a lot of merits are of great help to the promotion of organizational operation. For example, the existing design knowledge turns explicit and systematized, can be classified for better management, and have research and design database established.

Besides, through the interaction between the existing knowledge and designers, new knowledge can be created; through the management system of production information, the design information can be managed; through the nature of design knowledge, a linkage with Computer Aid Design (CAD) system can be built; and finally, through the continuous coordination with suppliers’ tacit knowledge, a close information exchange and renewal can be established. Indeed the inventory of original supplies can be reduced, the delivery time can be shortened, and the customer satisfaction can be raised. By means of cultivation of suppliers (such as offer of knowledge and training), Advanced Group effectively solidifies the suppliers’ trust in the group. Subsequently, suppliers are willing to sign long-term collaborative agreements with Advanced Group. Stable knowledge integration mechanism is established, and the competitiveness of NPD is promoted.

Second, to solve the customer satisfaction problem, Advanced Group has conducted proper reorganization. Through internet and Business to Business (B2B) platform, single-window service for customer and Customer Relationship Management (CRM) system are established. Meanwhile, PKM system is integrated to let the knowledge of Advanced Group extend from the inside to the outside. By means of information and knowledge integration with the customers’, most precise and latest information, and speediest feedbacks can be provided to customers. As a result, in-depth relationship with customers is built, achieving the strategic goal of satisfactory service for customers and promoting the cooperation credibility of Advanced Group in major foreign customers.

Third, to ensure that intra-organization and network of conglomerate enterprises are efficient for integration of tacit or explicit knowledge and helpful to NPD, Advanced Group has created a highly intra-connected network with a variety of processes that facilitate knowledge integration. In fact it is mainly the linkage between Taiwan headquarters and the subsidiaries overseas, including the three plants in China and one in USA. Advanced Group also efficiently builds up intra-PKM system to create its NPD capability. Conducting knowledge integration of various business units within the Group, PKM system manages and integrates the old product design information in its R&D knowledge management database. Then by using the management modules of product R&D procedures, PKM system improves the working procedures of product development and design so as to control the design information. Knowledge and experience are thus recorded and accumulated, resulting in the mechanisms of information sharing environment, cooperative design and open discussion, etc. These mechanisms shorten the time span for development of product and technique, raise the success rate of professional R&D, increase mutual trust among the personnel of different departments, and share and integrate the product design knowledge. What worthy mentioning is that: through the establishment of knowledge community mechanism in the internal network, Advanced Group can also effectively
integrate the professional information scattered in different departments, and shorten the distance from others’ knowledge which each department was not glad to share originally. Furthermore, due to the operation of knowledge community platform, it raises the organizational members’ willingness to learn, strengthens the staff’s mutual coordination efficiency towards things, effectively integrates the different kinds of professional knowledge, and ultimately promotes the NPD capability.

In summary, there are some problems in the pre-intervention process of KI and NPD of Advanced Group. For example, formal interaction mechanism (i.e. tacit knowledge cannot be converted to explicit knowledge and create coordinative difficulty in each department), professional labor division, difficult integration of NPD procedures, being hard to build immediate interaction with suppliers’ and customers’ professional knowledge, long R&D period, high R&D cost, high non-conformance rate, poor project successful rate, low efficient project management, and low technical innovation of new product. After the post-intervention process of KI and NPD was built, such as capturing knowledge, classification of R&D knowledge, knowledge structure, R&D knowledge base, new product’s R&D knowledge management and project management, and maintenance mechanisms (i.e. knowledge integration of R&D and project), Advanced Group can overcome dilemmas of KI and NPD. We provide the details in Figure 1 which clearly illustrates to compare with pre-intervention process and post-intervention process of KI and NPD.

Figure 1: Evolution of Knowledge Integration and New Product Development

Problems: Advantages:
IMPLICATIONS

From the exploratory case study, we have learned how Advanced Group creates its successful NPD via managing its coordination capability and combination capability of knowledge integration. We clarify the case (Advanced Group) that can be explained by its enhancement of organizational NPD via the mechanism of intra-organizational and inter-organizational knowledge integration. Figure 1 shows a clear understanding for the evolution of KI and NPD process of Advanced Group. The figure also provides a clear picture for academic researchers and managers to understand easily how the evolution of KI and NPD is formed.

This case study of successful business operation by the famous international corporation, Advanced Group, Taiwan, which has rich NPD experience, successfully explains how the company enhances their organizational NPD via the mechanism of intra-organizational and inter-organizational knowledge integration. As known from the above analysis, the concepts of knowledge community for creation of NPD as learned from Advanced Group include: 1) The company builds up a smart PKM system and social ecology that paves the way for good knowledge coordination capability and knowledge combination capability spreading all over the organizations. 2) The company builds up the mechanism of unstructured knowledge sharing and knowledge circulation in the organization since rich transmission channels are required, such as face-to-face communication and transfer of people. As each of the companies establishes a social community within its other plant, everyone knows one another, creating a harmonious atmosphere under trust, open information, communication and interaction. Once Advanced Group builds a smart knowledge integration machine for itself, other companies, suppliers or customers can just transform themselves by following the similar patterns and conducting the same coordination and combination of knowledge creation, acquisition, sharing and integration to an extent as great as possible.

In the case study of Advanced Group, we also have learned some valuable concepts of how to manage knowledge integration for creation of NPD, including: 1) The company is aware of its responsibility to provide excellent products and services to customers and suppliers. 2) The company successfully replaces internal rivalries by coordination and combination, with a common goal in the mind of staff — the objectives of corporation. 3) It provides employees with an environment to grow professionally and intellectually, and gives its shareholders satisfactory returns of their investment. 4) The company values the informal coordination and combination of knowledge integration, instead of formal individual efforts, entrepreneurial practices and independent innovation. 5) The decision-making process and day-to-day operation of the company largely follow the entrepreneurial practices, instead of counterproductive, and sometimes even detrimental bureaucratic practices.

Specifically speaking, the success of the case can be explained by its successful enhancement of organizational NPD via the mechanism of intra-organizational and inter-organizational knowledge integration. After exploratory analysis of the case was made, we believe that the research results not only help us integrate the theoretical implications and management implications, but also can be applied by some organizations on the related issue of strategic construction and development in the future. In summary, these implications help us uncover the potential organizational NPD and challenges in all firms.

CONCLUSION

Although some implications can be derived, there are certain limitations in this research. For instance, first, this research draws one successful case (Advanced Group) with an inductive method to explore the relationship between KI and NPD and help development of propositions. No matter how compact or well-knitted the analytical process of this exploratory case is, it is merely one single successful case study. There must be certain limitations in terms of the replicability and generalizability of the analysis. Therefore, in the next research we should also study another case of failure so as to make a comparative analysis between the successful case and the failed case. By doing so, the replicability and generalizability of the study could be promoted. Second, this research only explores the linkage or relationship between KI (e.g., coordination capability, combination capability) and NPD (e.g., project management ability, technological innovation ability, and ability of knowledge community development). However, under the two
constructs of KI and NPD, we are not sure whether there are some related variables other than the above two major constructs. This is also a direction that future researchers should continue working on.

In summary, within the field of knowledge management, the challenge to theory building is how to create the intangible knowledge asset of organization effectively. The pressure of challenge mainly occurs in several aspects: 1) The knowledge with unique competitive superiority usually belongs to “tacit knowledge,” which cannot be integrated easily, possesses ambiguity, and is embedded in staff or routine work of organization; and 2) There are the main problems of intra-organizational knowledge rigidity (e.g. cognitive barrier and lack of trust) and inter-organizational knowledge exposure prevention (e.g. prohibition of knowledge outspreading from firm and protection of knowledge asset). Thus, researchers have to understand effectively grasp the full integration of the internal and external organization so as to get the major sources of knowledge and strengthen the superiority of NPD. Moreover, what organization has to do is to strengthen the “knowledge base” through managing the coordination and combination capability of knowledge integration, and exert effective leverage in order to increase organizational NPD in the future.

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