# A Study of the Relationship among Organizational Learning, Knowledge Creation and New Product Development Performance

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**Abstract:** This study aims to understand how organizational learning capability affects the knowledge digestion, absorption and application of the organization. The new product development can be thought as a process of information processing. Both qualitative and quantitative researches are used in researching the relationship among organizational learning, knowledge creation and new product development performance. A survey research from 115 high-tech firms in south China is used to examine the research hypotheses. The results indicate that: (1) organizational learning has a positive impact on knowledge creation, (2) organizational learning does not has a positive impact on new product development performance, and (3) knowledge creation has a positive impact on new product development performance. These understandings benefit the development of organizational learning, knowledge creation and new product development theory and practice.

**Keywords:** organizational learning, knowledge creation, new product development performance

## I. Introduction

In the age of knowledge-based economy, knowledge-intensive industries, characterized by high-tech industries have become a main trend in the development of global industry. With the advancing of technology and the developing of personalized requirements， the market environment becoming volatile and changing quickly. As high-tech product lifecycles become shorter and shorter, the existing products in the market will soon be replaced by the new ones. Without emphasis on development of the new products, a firm will take more risks than others. As a result, in order to find the demands of the market rapidly and develop new products appeal to all consumers in a highly competitive market environment, high-tech enterprises have been committed to enhancing the performance of new product development.

Balasubramaniam & Amrit(1999) argue that knowledge centric activities of developing new products and services are becoming the primary source of sustainable competitive advantage in an era characterized by short product life cycles, dynamic markets and complex processes [3]. Madhavan & Grocer (1998) think that new product development is a high degree of knowledge creation process, and the organizational learning capability will significantly affect the knowledge digestion, absorption and application of the organization [7][13]. Although the previous related studies have shown that there have been some interactions among the organizational learning, knowledge creation and new product development performance, few scholars to address the issue of related concepts above and clarify them, not to mention that in the high-tech industries, empirical research about the issue is lacking. Then how should we understand the relationship among organizational learning, knowledge creation and new product development performance in high-tech industries? This research would have significant meanings in theory and practice. Taking the high-tech firms in the Pearl River Delta (PRD) region as the research samples, this study makes an empirical research on these issues to fill the gap in the researches of whether organizational learning and how it affects organizational knowledge creation and new product development performance.

## II. Literature Review

Organizational learning means the process of improving actions through better knowledge and understanding [6]. Effective learning can enhance an organization's capacity and lead it to make better use of new organizational knowledge. Organizational learning is not equivalent to individual learning, or a collection of it. In addition to the level of individual organizational learning behavior, there are also levels of groups and organizations in organizational learning, and even between organizations. In general, learning takes place mainly at the individual level, but through the individual and the social interaction between individuals, knowledge would be developed, stored up and cumulated in the non-personal (such as groups and organizations) level. It can be explicit or implicit, co-exist on the organizational network, such as cases of rules, capacity, organizational structure, culture and strategies. From the type of organizational learning perspective, McGill (1992) divided it into adaptive learning and generative learning [9]. The former means that the members not only maintain existing skills, but also enhance the organizational problems resolution capacity; the later means that they cultivate the ability to determine issues, to improve the resilience of the organization. These two kinds of learning are also known as the single-loop learning and the double-loop learning, or the low-level learning and the higher-level

learning. March (1991) divided organizational learning into exploitation learning and exploration learning. Exploitation learning makes for the exertion of existing knowledge, capacity and the efficiency of resources [8]. Exploration learning makes for updating their knowledge and ability, and improving the resource utilization. In general, organizational learning must be one of them, which can often be a dilemma. Knowledge creation is an indispensable organization innovation. Pentland(1995) believes that knowledge creation means the replacement or innovation of tacit and explicit knowledge in the organization, he introduced a framework for the analysis of organizations as knowledge systems composed of a collection of knowledge processes: constructing, organizing, storing, distributing, and applying, and it draws heavily on the sociology of knowledge and emphasizes the social nature of each of these constitutive processes [12]. Therefore, knowledge creation is the process of making tacit knowledge explicit. With socialization, externalization, combination and internalization of knowledge, it starts from the individual level, then spreads to the level of interactive groups, organizations and inter-organizational [11]. (1) Socialization means sympathized knowledge: Share experiences to create tacit knowledge (e.g., on-the-job training). (2) Externalization means conceptual knowledge: articulate tacit knowledge explicitly (e.g., metaphors, concepts, hypotheses, models and writing). (3) Combination means systemic knowledge: manipulating explicit knowledge by sorting, adding, combining, etc (e.g., formal education). (4) Internalization means operational knowledge: learning by doing, to develop shared mental models and technical know-how. In order to improve the knowledge creation, Nonaka & Konno (1998) believe that organizations need to establish its ba (a concept comes from Japanese, roughly translates into the English word place) [10]. The so-called ba can be thought of as a shared space for emerging relationships. This place can be physical, virtual, mental or any combination of them. There are four types of ba: (1) originating ba is the world where individuals share feeling, emotions, experiences, and mental models, physical and face to face experience are the key to conversion and transfer of tacit knowledge; (2) interacting ba is the place where tacit knowledge is made explicit, dialogue is key for such conversions; (3) cyber ba is a place of interaction in a virtual world instead of real space and time, the use of on-line networks, group-ware and database enhancing this conversion process; (4) exercising ba facilitate the conversion of explicit knowledge to tacit knowledge, focusing training with senior mentors and colleagues consists primarily of continued exercises.

The new product development can be thought as a process of information processing, the main purpose of engaging in this process is to reduce the uncertainty of new product development. Madhavan & Grocer (1998) believe that new product development can be viewed as a process of knowledge creation through the syndication of diverse streams of knowledge, cross-functional teams, which are increasingly becoming the preferred mode for organizing new product development efforts, are effective because they are ideal vehicles for such synergistic combination of complementary knowledge [7]. The operation of new product development is not only a simple process of social activities, but also a process of cognitive activity and a high degree of mutual integration in knowledge creation. On the whole, new product development is a process of knowledge creation in a team, through the execution of socialization, externalization, combination and internalization, members accomplish the new product development at last. During the process, organizational learning capacity will significantly affect the knowledge digestion, absorption and application in organization [13]. It can learn the relevant professional knowledge and skills directly through routine activities, that promoting the members to collect, analysis, store, diffuse and apply relevant knowledge effectively, thus enhancing the performance of new product development organization. Therefore, Base on the literature review above, we propose the following hypothesis:

**H1.** Organizational learning has a direct positive impact on knowledge creation.
**H2.** Organizational learning has a direct positive impact on new product development performance.
**H3.** Knowledge creation has a direct positive impact on new product development performance.

## III. Methodology

**Research framework**

In the light of previous research, this research designed the research framework as Figure 1, based on the interview and the group discussions in the advanced period. As this study mainly discusses the relationship among organizational learning, knowledge creation and new product development performance, we thereby take organizational learning as the independent variable, knowledge creation as the intermediate variables and new product development performance as dependent variables.

**Variable definition and measurement**

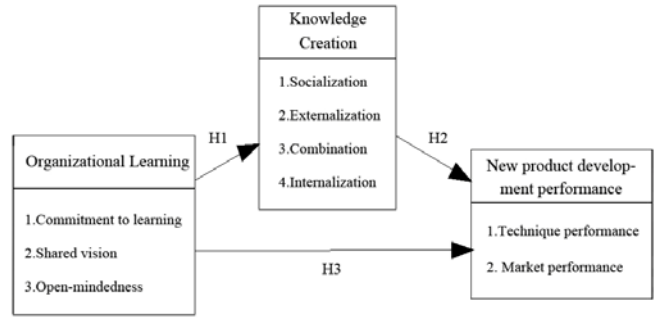


**Fig.1.**The research framework

The measurement scale of organizational learning is mainly according to Baker & Sinkula's (1999) and Xie Hongming & Han zitian's (2005) studies, which is made up of 12 items,

including 3 factors: commitment to learning, shared vision and open-mindedness [2][15]. The measurement scale of knowledge creation is mainly according to Nonaka & Takeuchi's (1995) and Becerra-Fernandez & Sabherwal's (2001) studies, which is made up of 15 items, including 4 factors: socialization, externalization, combination and internalization [11] [4]. The measurement scale of new product development performance is mainly according to Xu tingting's (2003) study, which is made up of 10 items, including technique performance and market performance [16].

**Research sample**

This research takes the companies in southern China as the main sample. According to the Yellow Pages of PRD enterprises, we selected some high-tech companies randomly, after that we got in touch with the companies' senior management by phone to make sure that he or she can finish the survey. In the way of doing face to face interview and mailing, we had sent out 500 questionnaires. In the retrieved 130 questionnaires, 115 are valid, and the return rate is 23%. There were 34 computer hardware companies, 30 software companies, 15 precision mechanism companies, 15 biotechnology companies, 12 opto-electronic companies and 9 info-communication companies involved in the investigation, their products are with a higher degree of knowledge-intensive nature and short product life cycles, so we consider that they belong to high-tech industry.

**The reliability and validity analysis of the sample**

**Tab.1.** Crohbach's α of variables.

| *Factors or variables* | *Cronbach's α Value* |
|---|---|
| Organizational Learning | 0.91 |
| Commitment to Learning | 0.83 |
| Shared Vision | 0.92 |
| Open-Mindedness | 0.87 |
| Knowledge Creation | 0.89 |
| Socialization | 0.69 |
| Externalization | 0.84 |
| Combination | 0.88 |
| Internalization | 0.79 |
| New Product Development Performance | 0.92 |
| Technique Performance | 0.92 |
| Market Performance | 0.90 |

This research uses the coefficient of Cronbach's α to examine the reliability of each factor or variable. As Table1 1 shows, except the socialization, the α of each factor and variable reaches the acceptable level (higher than 0.7), representing the scales have good reliability. On the validity, the items in the questionnaires of this research are all from the literature that have been published, and we also did some modification and improved the expression according to some experts and pre-test to the scholars and entrepreneurs in the related fields. Therefore, these questionnaires have preferable content validity, and could fit the establishment validity requirement. However, taking into account the impact of cross-cultural factors, we use confirmatory factor to validate the construct validity of various scales in this study, as table 2 shows, all factors reach acceptable level generally.

**Tab.2.** Results of variables test.

| | *Organizational learning* | *Knowledge creation* | *New product development performance* |
|---|---|---|---|
| CFI | 0.980 | 0.966 | 0.999 |
| GFI | 0.913 | 0.890 | 0.944 |
| RMR | 0.032 | 0.045 | 0.025 |
| RMSEA | 0.053 | 0.050 | 0.014 |
| $\chi^2$ | $\chi^2$（51）=67.909 | $\chi^2$（86）=111.119 | $\chi^2$（34）=34.736 |

## IV. Analysis and test of the model

The theoretical model of this research is shown in Figure 2, with latent construct showing in ellipses and observed variables showing in rectangles.

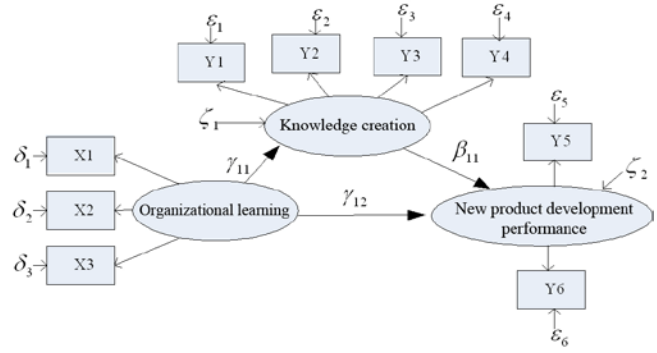


**Fig.2.** The theoretical model

Xie & Han (2005) argued that it should start with the basic fit criterion, fit of internal structure of model, and overall model fit to evaluate whether or not the overall theoretical model is appropriate [18].

(1) Basic fit criterion, which is used to examine the model error, the recognition issues, the input mistakes and so on. It can be assessed by determining if the measurement error of the measurement indicator has a nonnegative value, if the factor loadings are neither too low (less than 0.5) nor too high (more than 0.95) and if all of them have reached a significant level. As shown in Table 3, the factor loadings of each latent construct's measurement indicator ranges from 0.5 to 0.95, which reaches a significant level. As a result, the theoretical model we propose indicates an adequate fit.

(2) Fit of internal structure of model, which is used to evaluate the significance level of the estimated coefficient, the reliability of each indicators and latent construct and so on. It can be assessed by determining whether the individual item reliability is above 0.5, whether the latent construct's composite reliability is above 0.7 and whether the variance extracted of latent construct is above 0.5. As shown in Table 3, the organizational learning, knowledge creation new product development performance is respectively 0.76, 0.77, 0.66, while the variance extracted is respectively 0.67, 0.60, 0.73. Except the composite reliability of the new product development performance (lower than 0.7), other composite

reliability and variance extracted are in the acceptable scopes. Therefore, the overall theoretical model we propose has good reliability and fit of internal structure.

**Tab.3.** The testing analysis of overall theoretical model.

| *Variables* | *Estimated Coefficient of M.E* | | *Combined Reliability* | *Factor Interpreting* |
|---|---|---|---|---|
| | *Factor Loadings (λ)* | *Measurement Error (δ or ε)* | | |
| *Organizational learning* | | | | |
| Commitment to learning | 0.79*** | 0.62 | 0.76 | 0.67 |
| Shared vision | 0.72*** | 0.52 | | |
| Open-mindedness | 0.76*** | 0.57 | | |
| *Knowledge creation* | | | | |
| Socialization | 0.77*** | 0.59 | 0.77 | 0.60 |
| Externalization | 0.59*** | 0.35 | | |
| Combination | 0.63*** | 0.40 | | |
| Internalization | 0.80*** | 0.64 | | |
| *New product development performance* | | | | |
| Technique performance | 0.77*** | 0.60 | | |
| Market performance | 0.64*** | 0.41 | | |

***Note:*** $\chi 2$=34.553, d.f. =21, GFI=0.942, RMR=0.024, RMSEA=0.075, AGFI=0.876, NFI=0.921, CFI=0.966, PNFI=0.537, PGFI=0.564, *P<0.05: **P<0.01: ***P<0.001.

(3) Overall model fit, which is used to examine the overall model and the observed data fit. There are mainly three categories: absolute fit indexes, incremental fit indexes and parsimonious fit indexes. (a) Absolute fit index: $\chi 2$=34.553, d.f.=21, GFI=0.942, RMR=0.024, RMSEA=0.075, clearly, each indicator is acceptable; (b) Incremental fit index: AGFI=0.876, NFI=0.921, CFI=0.966, so, both NFI and CFI are acceptable while the AGFI is lower than the recommended 0.90; (c) Parsimonious fit indexes: PNFI=0.537, PCFI=0.564, exceeding the threshold of 0.05. Therefore, the overall model fit is good.

As a result, we can conclude that the theoretical model fit in this study is good, and the model is appropriate, which can be used to test the relevant hypotheses.

Table 4 presents the path coefficient and hypothesis testing result of the theoretical model. As Table 4 shown, hypothesis 1 and 3 gain the support while hypothesis 2 is rejected. As shown in Figure 3, That is to say organizational learning has a direct positive impact on knowledge creation (P<0.001); knowledge creation has a direct positive impact on new product development performance (P<0.05); organizational learning does not has a direct positive impact on new product development performance (P>0.05). So we can see that organizational learning has indirect positive effects in new product development performance through knowledge creation.

**Tab.4.** The path coefficient and hypotheses testing of the theoretical model.

| *Paths* | *The relationship between variables* | *Path coefficient* | *P* | *Hypothesis* | *Testing results* |
|---|---|---|---|---|---|
| γ11 | Organizational learning → Knowledge creation | 0.90*** | 0.000 | H1 | Supported |
| γ12 | Organizational learning → New product development performance | -0.04 | 0.923 | H2 | Not supported |
| β11 | Knowledge creation → New product development performance | 0.84* | 0.032 | H3 | Supported |

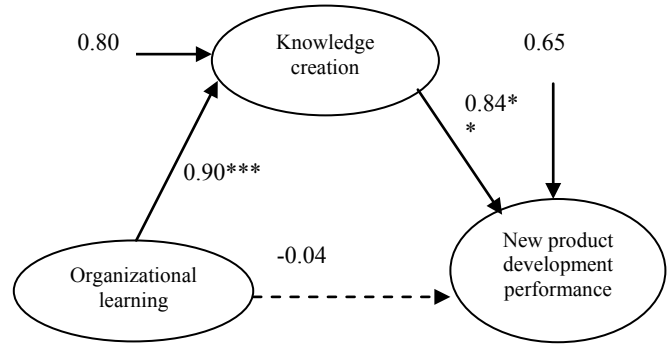


**Fig.3.** The overall theoretical model and relationships between variables

## V. Analysis and test of the model

According to literature review and case interview, this research establishes a research framework, choosing 115 high-tech firms in south China as the research sample, we studies the relationships among organizational learning, knowledge creation and new product development performance. The major findings of this study are summarized as follows: (1) organizational learning has a direct positive impact on knowledge creation; (2) organizational learning does not has a direct positive impact on new product development performance; (3) Knowledge creation has a direct positive impact on new product development performance. The research of this paper has a significant meaning to organizational learning, knowledge creation and new product development performance from theory to practices.

Since 1990s, China's high-tech industries have faced with rapidly changing business environment characterized by accelerating technological progress and market globalization, product life cycles becoming shorter and shorter. In this kind of environment, companies must enhance learning and continuous innovation so that they are able to survive and develop. As the key factor to the survival of high-tech enterprises, new product development is not only an important value-creating activity of enterprises, but also a mean to succeed in maintaining a lasting competitive advantage. This study confirms that the organization

learning does not enhance the new product development performance directly in high-tech industries, but must through the intermediary variable knowledge creation. It tells us that, in the process of new product development, high-tech companies should not only pay full attention the organizational learning activities, but also create a favorable internal environment for knowledge creation, so that the organizational learning and knowledge creation capabilities would be promoted. Therefore, companies can keep the competitive advantage, improve the performance of new products and gain super profit.

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