Impact of Team Learning on Business Model Innovation and Operation Performance

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Abstract. The purpose of this study is to investigate how team learning can influence business model innovation and firm performance. In the conceptual model, team learning is conceptualized as a second-order construct comprising of three complementary first-order dimensions: cross-team, within-team, and market learning. Using a data set from 207 electronics and information industries in China, the structural equation modeling (or SEM) results clearly indicate that team learning can improve business model innovation and firm performance. Moreover,by drawing on empirical evidence from Chinese electronics and information industries, this research study contributes to the current literature on the construct validity of team learning scale.

Introduction

Research Motives.

In recent years, research on organizational learning ability and team learning ability has been widely discussed by many scholars (Bresman, 2010; Hirst et al., 2009). In the past, it was pointed out that team learning is regarded as a key element in organizational learning. In a learning organization, team members are more willing to share knowledge with others and learn from others; therefore, team learning is also seen as a part of organizational learning. Moreover, in recent research, the topics of concern to scholars have gradually shifted from organizational learning to team learning. When organizations increasingly rely on the ability of team learning to assist organizations in making decisions (Tjosvold et al., 2004), strengthen organizational innovation (Chen et al., 2005), and improve company performance (Certo et al., 2006; Malik and Kotabe, 2009; Minichilli et al., 2010), how to make the team to learn knowledge outside the boundaries of the enterprise more effectively is really a big issue for organizations to think about now (Bresman, 2010). On the other hand, from the perspective of resource dependence theory, we can find that the organization is not an independent entity. An organization often needs other organizations or companies to provide the resources and assistance needed by the organization itself. In particular, in order to respond to the fierce competition of global companies, how an organization can obtain external knowledge and skills is very important. Therefore, it can be understood why the organization convert an external technology into internal learning and accumulate the internal learning knowledge and technology as the organization's own capabilities (Lin, 2003). However, the key issue is how an effective team can integrate external and internal knowledge to spread to each level of the organization, and to increase team work efficiency, customer satisfaction, and the company's performance through effective team learning. Therefore, successful team learning not only emphasizes internal learning but also focuses on external learning. Therefore, companies can integrate a variety of different team learning models and organizational innovation models to create and build competitive advantages. Moreover, most of the research of team learning focuses on the behavioral research of team learning (Hirst et al., 2009) or the study of team learning activities (Van Woerkom and Croon, 2009), while a few research focuses on the models of team learning (Lynn, 1998). Although the previous literature has elaborated on complex research topics such as organizational learning, there are still some deficiencies in the discussion of the team learning model. Therefore, this study focuses on the effects of team learning models (including intra-group

learning, cross-group learning, and market learning) on organizational innovation and vendor performance.

Research Purpose.

Discuss how the model of team learning influences the innovation of business model and organizational performance. Looking at the above, the specific purposes of this study are as follows:

(1) Firstly construct the method of team learning by second-order factor analysis, and discuss whether team learning will be reflected in the team's in-team learning, cross-team learning and market learning, which is to be used as the basis for follow-up research and analysis. It also means to construct the validity and measurement of team learning facets, and analyze which is the most important to the team, in-team learning, cross-team learning and market learning.

(2) Explore the impact of corporate team learning model on business model innovation and business performance, and the impact of business model innovation on business performance.

Literature Review

Team Learning.
Significance of Team Learning

Team learning is a management method and a management tool, and its ultimate goal is to implement the team's performance. One of the important roles of team learning is to promote the conversion of tacit knowledge to explicit knowledge. Tacit knowledge is what exists in individuals that is private with special background and depends on the individual's different experiences, intuition and insight. The task of the team is relatively complex and to complicated to be described, so it leads to different tacit knowledge among the members. Also, because the task of the team is relatively complex, it can not be accomplished with only the intelligence and physical energy of the individual sometimes, so team learning is needed.

Team learning refers to the collective learning of a unit. It is the basic unit of learning organization for learning, and facilitates mutual learning among members of the unit, as well as their mutual exchanges, mutual inspiration, and common progress. Team learning is the process of developing group members' overall ability to collaborate and achieve common goals. The team learning theory and its application in organizations are explored through the importance of team learning process on strengthening the growth of personal expertise and enhancing the organization's operating performance. When team learning is applied to an organization, the emphasis is that the members of the organization achieve the purpose of organizational learning through the team learning method under the common vision.

Association of Team Learning and Team Performance

Team learning not only has a direct positive effect on improving team performance, but also has an important mediating effect or absorbing role in some team variables' impact on team performance. When the team is functioning well, teams with heterogeneous members can get multiple perspectives or multiple scenarios that can help improve the quality of decisions, especially when faced with complex and uncertain decision-making problems (Wanous and Youtz, 1986). Naumes (1998) found that: In complex tasks with strong interdependence, the higher the heterogeneity of learning style of team members, the better the performance. By using teamwork as an experimental context, Michaelsen, Watson, and Black (1989) found that: In 97% of the teams, the overall team's ability to solve difficult and complex problems is better than that of the best individual in the team. It shows that in the face of complex and difficult problems, team performance can exceed individual performance through the integration of team operations. Stasser (1988)'s study: The opinions of a few people can help the team to find hidden information that is difficult to see and help improve performance. However, when faced with complexity problems, it is often found that the quality of team decisions is not as expected, because the aforementioned positive effects have not been effectively stimulated (Hackman, 1990); the team's norm generally emphasizes more on reaching consensus, rather than on the presentation and criticism of different views (Hart, 1991). The number of ideas or schemes generated by the team is often lower than the sum of those of individuals (Mullen, Johnson, and Salas, 1991), but the team often has the illusion

of considering itself as a high-performance team (Paulus, Larey, and Ortega, 1995). That is, team members cannot fully share each other's mental models. They can only communicate about some common information and ideas. They can not effectively share the unique insights of team members and learn from each other. Instead, they only enhance each other's opinions or support the original preference plan, and take it for granted that they get a good answer, so how the team can completely share the mental model has become an important issue to improve the effectiveness of team decisions (Orasanu and Salas, 1993). Kolb (1984) pointed out that the learning cycle of this team is mainly composed of four major processes: experience, observation and reflection, conceptization generalization, and active experimentation. The cycle of conference-style team learning emphasizes the integration of organizational experience in the "experience" phase. In the "observation and reflection" phase, the absorption and transformation of knowledge are emphasized, and then new personal experience is formed for the solution of practical work and life problems.
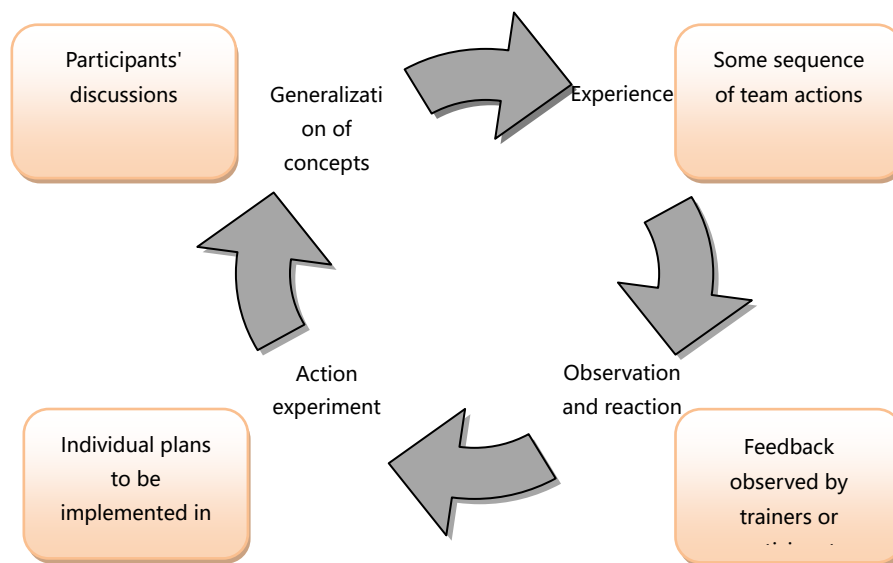
Figure. 1 Team Learning Cycle Source: Kolb (1984)

Business Model Innovation

Because of the rapid changes in the environment today, organizational decisions, procedures, and assumptions about the environment need to be able to keep up with this era of rapid change. This makes the business model of the organization unable to remain the same. Instead, it must consider changes in the overall environment, and continue to think about the impact of the environment on business models and the need to adapt to changes in the surroundings at any time review, and make corresponding improvements. Previous scholars mentioned that business model innovation is like writing a new story. All new stories are often changed from old stories. The direction of change is usually based on people's common life experience at the time. Innovation of the same business model is also produced by changing the value chain of the old business model (Magretta, 2002).

Business model innovation refers to the basic logical change of the value creation of the enterprise, that is, introducing new business models into the social production system and creating value for customers and themselves. To put it simply, business model innovation means that companies make money in new and effective ways. Newly-developed business models may differ from existing business models in terms of constituent elements, and may also differ from existing business models in terms of inter-element relationships or dynamic mechanisms.

Venkatraman and Henderson (2008) divided the framework of business model innovation into two major axes, which are respectively: (1) Method of value creation--deliberate or emergent; (2) The scope of the network relationship - exclusive or inclusive. In the aspect of value creation, it is a good coordination to acquire value creation in a thoughtful way and it is easy to be understood and accepted by organizations in the process of value creation. The emergent approach lacks control.

The organization follows the pace of industrial change and quickly adapts and alternates its business model. In addition, in relation to the scope of the network, exclusionary relationships are usually closely networked, mainly centrally controlled partners or alliances with clear boundaries. The inclusive relationships are based on more loosely controlled and organized ways to expand and collaborate with different partners or alliances.

Figure 2 describes the four aspects of business model innovation. The main axes are the range of value creation methods and network relationships, and the four aspects are (1) design and governance, (2) acquisition and adaptation, and (3) linkage and creation, (4) exploration and development. This architecture guides companies to consider their needs for business model innovation and use forward-looking methods to identify the best ways to challenge and adapt to business models. The distinguishing feature of this architecture is that business model innovation is considered to be network-centric instead of firm-centric.
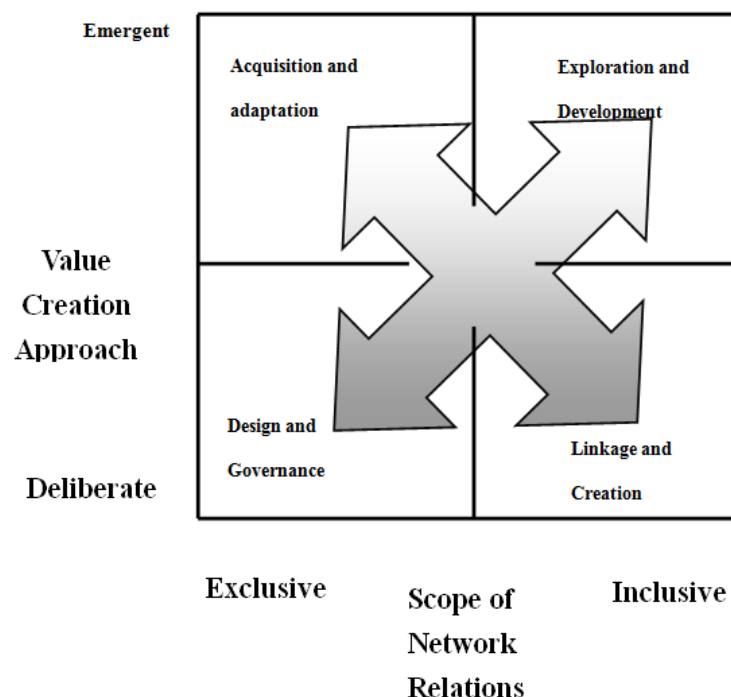

Figure. 2 Four aspects of business model innovationSource: Venkatraman and Henderson (2008)

Johnson et al. (2008) believe that the business model is composed of four interlocking elements that can be combined to create value:

1. Customer Value Proposition: Only successful organizations can find ways to create value for customers. In other words, it is to find ways to help customers do important work. The work mentioned here refers to the fundamental problem that needs to be solved in a certain situation. Many organizations first have product ideas and business models before looking for markets. To be successful, the organization should think about what exactly the customer's real needs are.

2. Profit Formula: While organizations provide value to customers, a blueprint for creating value for themselves includes the following elements:

(1) Income model: Price × quantity.

(2) Cost structure: Direct costs, indirect costs, economies of scale, the cost that mainly depends on the key resources needed for the business model.

(3) Profit rate model: With the expected quantity and cost structure, how much each transaction needs to contribute to achieve the desired profit.

(4) Resource velocity: How fast is the turnover of inventory, fixed assets, and other assets, and overall, how well the resources need to be used to support our anticipated volume and achieve the desired profit.

3. Key resources (or assets): Refers to the people, technology, products, facilities, equipment,

channels and brands needed to create a product that meets the corporate value proposition for the target customer. Emphasis is placed on the key elements of creating value for customers and organizations, and on the way these elements interact with each other(each organization also has general resources, but these resources do not create competition differences).

4. Key process: The operations and management processes of each successful company can repeatedly perform various operations and increase the scale while creating value. These key processes may include normal tasks such as training, development, manufacturing, budgeting, planning, sales, and service, as well as company regulations, measurement standards and guidelines.

Organizational Performance.

Organizational performance is an important topic of management, and its importance is widely concerned. On the one hand, the organization's performance is related to whether the organization can have sustainable operation and development. On the other hand, it involves the formulation and implementation of strategic decision-making of the organization, the performance of policy implementation and other issues. Therefore, to judge whether an organization performs well or whether it has future development, the performance of the organization is often considered as an important consideration in the evaluation.

Chakravarthy (1986): There are four main categories for the classification and measurement of business performance:

(1) Business objectives: It refers to the target level achieved by the company's operating plans, such as annual budget, capital increase, mergers and acquisitions, factory expansion and joint ventures.

(2) Productivity: Refers to the use of the plant and equipment.

(3) Profit: Refers to the proper use of corporate funds, which is reflected in the return on investment and can be calculated from the profit growth rate.

(4) Long-term advantage resources: It refers to what a company relies on to be sustainable and continue to grow.

For the introduction of key performance indicators (KPIs), companies must have a set of standards to measure effectiveness. KPI is used to measure whether the company's competitive strategy has indeed achieved the expected results, and performance management methods are used to promote the practice plan of the company's all-round vision. KPI is a unique concept in the balanced scorecard. Both the way you choose the strategic target to correspond to KPI, and the setting of the target value and weight in KPI will be a new topic and challenge for most companies.

Venkatraman and Ramanujam (1986) believe that organizational performance refers to the extent to which an organization achieves a specific goal. From a process point of view, performance represents the conversion of inputs into outputs to achieve some result, which includes effective cost, realized output, and achieved outcome. Venkatraman and Ramanujam (1986) divided organizational performance into two different definitions, in both narrow and broad senses: Performance in the narrow sense refers to the financial indicators that respond to meet organizational goals; from a broad perspective, organizational performance includes indicators of financial performance (revenue, return on assets, etc.) and operationality (such as product quality, market share, etc.) (Rogers and Wright, 1998).

All the goals of various strategies or activities in an organization are to improve performance. The relationship between strategy and performance is an important research area in strategic management, because performance improvement is the core of strategy management (Venkatraman and Ramanujam (1986). Organizational performance has always been the focus of the organization, but the indicators used in the assessment of organizational performance depend on research areas and research issues. As the research areas and research issues are different, the performance indicators that scholars focus on will be different. Therefore, the organization's choice of measurement indicators for evaluating performance depends on the conditions and circumstances of the assessed unit itself and the goals to be achieved, so that the assessment results can be valued by the appraisers. Regarding the measurement aspect of organizational performance, the measurement standards proposed by many research scholars in the past are not the same, and in principle, they are

based on research topics and objects.

Venkatraman and Ramanujam (1987) proposed a performance conceptual framework for measuring the organizational performance, and emphasized that when adopting multi-faceted metrics simultaneously, the interaction between different facets must be considered and the measurement of organizational performance should be summarized into three categories:

1. Financial performance: Measured by the extent to which the organization's economic goals are achieved, such as sales growth, profitability, earnings per share, etc., which is the most commonly used indicator for the study of traditional strategies.

2. Job performance: In addition to financial performance, it also includes job performance. Job performance refers to the non-financial indicators such as market share, new product launches, product quality and marketing effectiveness.

3. Organizational efficiency: It is the most extensive definition of organizational performance. Apart from including financial performance and job performance, it also includes achieving various types of goals of conflicts of the organization, and reaching the goals of various internal and external parties, such as: employee morale, turnover rate, etc.

Kaplan and Norton (1992) published a balanced scorecard, pointing out that in a knowledge-based, manpower-oriented economic society, traditional accounting and financial indicators cannot be used to fairly evaluate the performance of an organization. They then proposed a concept of balanced scorecards in the hope of adopting a balance between short-term and long-term goals, financial and non-financial measures, backward and leading indicators, and external and internal performance aspects. Therefore, it was proposed, in addition to the traditional financial prospect, the measurement of organizational performance needs to be supplemented by three other perspectives: customer perspective, internal organizational process perspective, learning and growth perspective, and the appropriate performance measurement metrics designed based on these four dimensions to provide the information needed for organizational operations and promote the achievement of organizational strategies and visions, which are described as follows:

1. Financial prospect: including ROI, additional economic value.

2. Customer prospect: usually measured by customer satisfaction or market share.

3. Organizational internal procedures prospect: measured by operational efficiency, such as new product development cycles and specific process costs.

4. Learning and growth perspective: measured by employee satisfaction and availability of information systems.

Zhang (2007) studied the impact of organizational quality management on organizational performance, and divided organizational performance into two types:

1. Strategic indicators: including market share, sales per employee, establishment of new customers, export markets and organizational profitability.

2. Operating indicator: including the four aspects of process, supplier quality management, customer and employee.

Operational performance has always been the focus of the organization. The organization's business performance represents the operating results of its interaction with the external environment. Different organizations often set different performance indicators for their specific goals. There is still no certain standard for measuring performance (Cameron, 1978). In summary, the subjective organizational performance is to use a reasonable review to judge the success of an organization's policy, whether or not it meets its established objectives. Therefore, measuring organizational performance should include assessing whether it meets the conditions set by itself, instead of objective indicators only. Therefore, some scholars believe that when organizations engage in performance evaluation, they should use both subjectivity and objectivity (Choi & Mueller, 1992). Dess and Robinson (1984) pointed out that objective performance measurement involves trade secrets that managers often do not want to disclose. Therefore, it is difficult to obtain information. Subjective measurement methods are suitable for cross-industry comparison. Organizations may be affected by long-term fluctuations or investment recovery, so the results cannot immediately show. As studied the relationship between market orientation and subjective

and objective performance, empirical evidence shows that there is a strong positive correlation between subjective performance and objective performance measurement, that is, the measurement methods of subjective and objective performance should be able to replace each other. Based on the above merits of the subjective performance measurement method, this study adopted a subjective performance measurement method.

Hypothesis Derivation.

Team Learning and Business Model Innovation

From the point of view of organizational learning, so-called learning refers to the process in which an enterprise acquires external technology and accumulates technological capabilities. Its main purpose is to enhance the competitive advantage of the enterprise itself. In addition, from a resource-based perspective, learning ability refers to the ability of a company to develop or acquire new knowledge, basic resources and new technologies, and to provide new products for use (Hull and Covin, 2010). Therefore, team learning is the learning ability of the company, which means that the company will acquire and develop new knowledge and new technologies.

Bresman (2010) believes that team learning activities consist of internal learning and external learning. Through internal learning activities, the team can indeed improve the ability of its members to respond to different situations and improve the quality and efficiency of their work. External learning is to help team members learn the experience of other teams，and find important learning effects and execution procedures in the team to let the team understand how to make the team work more smoothly. Moreover, external learning can enable team members to continue to compete with competitors, and through external learning, teams can develop products with more customer value, and teams do not need to upgrade products through new technologies (Bresman, 2010). Therefore, as mentioned above, business model innovation is one of the types of organizational innovation, and the focus of business model innovation lies in the increase of customer value proposition. Therefore, in order to strengthen business model innovation, the organization team will obtain resources from external and internal technologies. Team learning is a suitable mechanism for strengthening business model innovation. For example, Hull and Covin (2010) believe that the innovation ability of a company is reflected in the learning ability, and it has a close relevance that in turn affects the output of internal innovation. Bierly III et al. (2009) believes that the conversion of knowledge and the application of knowledge come from the development of external sources. The company's knowledge base and access to new ideas can promote the creation of new products and technologies. Effective team learning can therefore facilitate companies' access to technology and knowledge, enhance their ability to innovate, respond to markets, and improve organizational performance (Bresman, 2010; Bunderson and Sutcliffe, 2003; Slater and Narver, 1995). Therefore, inheriting the past research, this study proposed the following hypothesis:

H1: Team learning has a positive impact on business model innovation.

H2: Team learning has a positive impact on vendor performance.

Impact of Business Model Innovation on Vendor Performance.

Business model innovation activities help enterprises establish competitive advantages. The establishment of unique capabilities derived from business model innovation is the most important source of competitive advantage. Because business model innovation can generate new business models that better satisfy customer needs, improve existing product quality or attributes, or reduce product production costs. Boer and During (2001) believe that innovation activities include product innovation, process innovation and operational innovation. The organization needs continuous innovation, development of its new business model, products, procedures and etc. to have continuous competitive advantage. Successful business model innovation drives the company to gain customer support, enhance corporate development and greater corporate profits. It was previously pointed out that business model innovation will have a positive impact on vendor performance. For example, Pohle and Chapman (2006) proposed that business model innovation can reduce costs for enterprises, and to reduce costs can increase corporate profits. They pointed out that business leaders need to adjust their business models in order to remain competitive. Previous

studies have also verified a positive relationship between business model innovation and performance (Chesbrough, 2007; Chesbrough and Rosenbloom, 2002; Johnson et al., 2008; Mitchell and Coles, 2004; Pohle and Chapman, 2006). Therefore, this study proposed the following hypothesis:

   H3: Business model innovation has a positive impact on vendor performance.

Research Method

Conceptual Architecture

Figure 3 is the conceptual architecture of this study. It includes team learning, business model innovation and vendor performance. Previous literature has pointed out that the development of team learning is related to the acquisition of new knowledge and technology, and is also the key to vendor innovation and vendor performance (Bresman, 2010; Bunderson and Sutcliffe, 2003).

   In addition, the previous literature also mentioned that team learning consists of three factors: In-team learning, cross-team learning and market learning (Lynn, 1998). In the conceptual model of this study, team learning is a second-order latent variable, while cross-team learning, in-team learning and market learning are first-order latent variables. Therefore, this study explored the impact of team learning on business model innovation (H1) and vendor performance (H2). Then, it discussed the impact of business model innovation on vendor performance (H3).
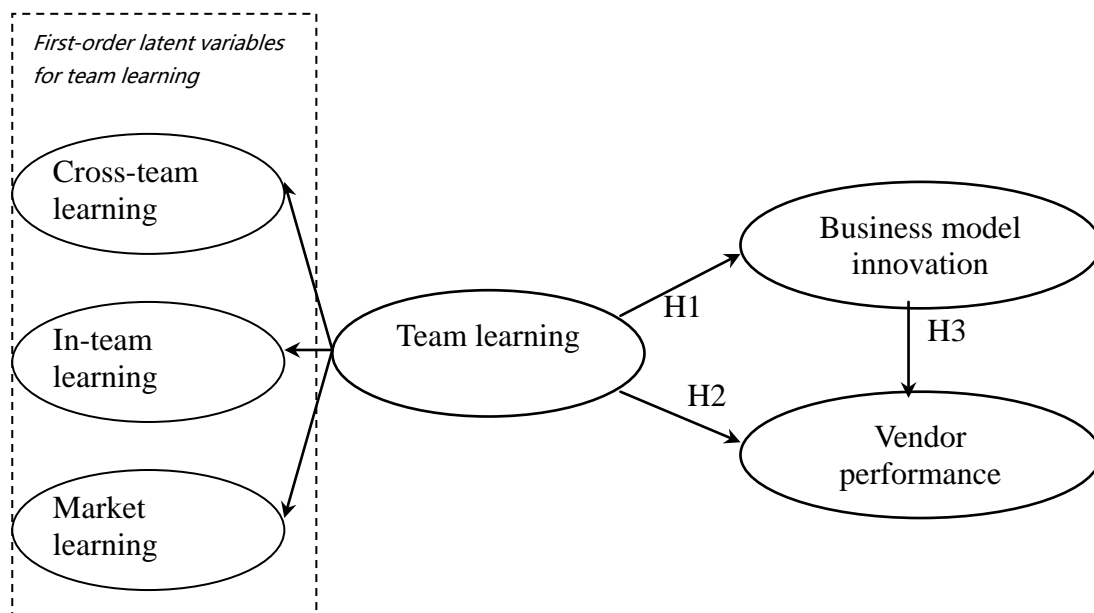

Figure 3 Conceptual Architecture

Data Analysis Methods

1. Outline of Linear Structural Equation Model

   The main purpose of Linear Structure Relationships (LISREL) is to investigate the causality between multivariables or univariates. Since SEM combines multiple regression and factor analysis, it is possible to simultaneously analyze the relationships between many interdependent dependent variables (Hair,Anderson,Tatham,and Black 1995).

   The theoretical framework of a complete linear structure relation model includes two parts, namely:

   (1) Structural equation model, which defines the linear relationship between potential independent variables and potential dependent variables.

   The structural equation model describes many latent variables and the causal relationship among them. The cause and effect in the model are usually are derived on the basis of theories or literature. The "causes" in the model are called potential exogenous variables, and the "effects" are called

potential endogenous variables. The following is the structural model of LISREL:

$$\beta\eta = \Gamma\xi + \zeta$$

Where, ξ is the potential independent variable, η is the potential dependent variable, Γ is the coefficient matrix of the impact of the potential independent variable (ξ) on the potential dependent variable (η), β is the coefficient matrix of the impact of the potential dependent variable (η) on the potential dependent variable (η) and ζ is the residual error.

The structural equation model has several basic assumptions: (1) Each variable is represented by deviation scores (average number is 0); (2) ξ is not related to ζ; (3) The diagonal of β is 0, and I−β is a non-singular matrix.

(2) Measurement model, which defines the linear relationship between potential and manifest variables.

In LISREL's basic theory, it is considered that latent variables cannot be directly measured and must be inferred indirectly through manifest variables. The following formula is used to define the relationship between observed variables and potential variables:

$$x = \Lambda_x\zeta + \delta$$

Where, x is the observed independent variables and Λ_x is the correlation coefficient matrix between x and ζ, and δ is the measurement error of x.

$$y = \Lambda_y\eta + \varepsilon$$

Where, y is the observed dependent variable, Λ_y is the correlation coefficient matrix between y and η, and ε is the measuring error of y.

From the above two lines of the measurement model, there are several basic assumptions: (1) There is no correlation between measurement error and η, ξ or ζ, but there may be correlation between η, ξ and ζ. (2) There is no correlation between residual error (ζ) and measurement error (ε and δ).

According to Chapter 2 Review of Related Literature, this study studied the impact of team learning on business model innovation and vendor performance, using a causal path diagram of linear structural relationships, as shown in Figure 4.
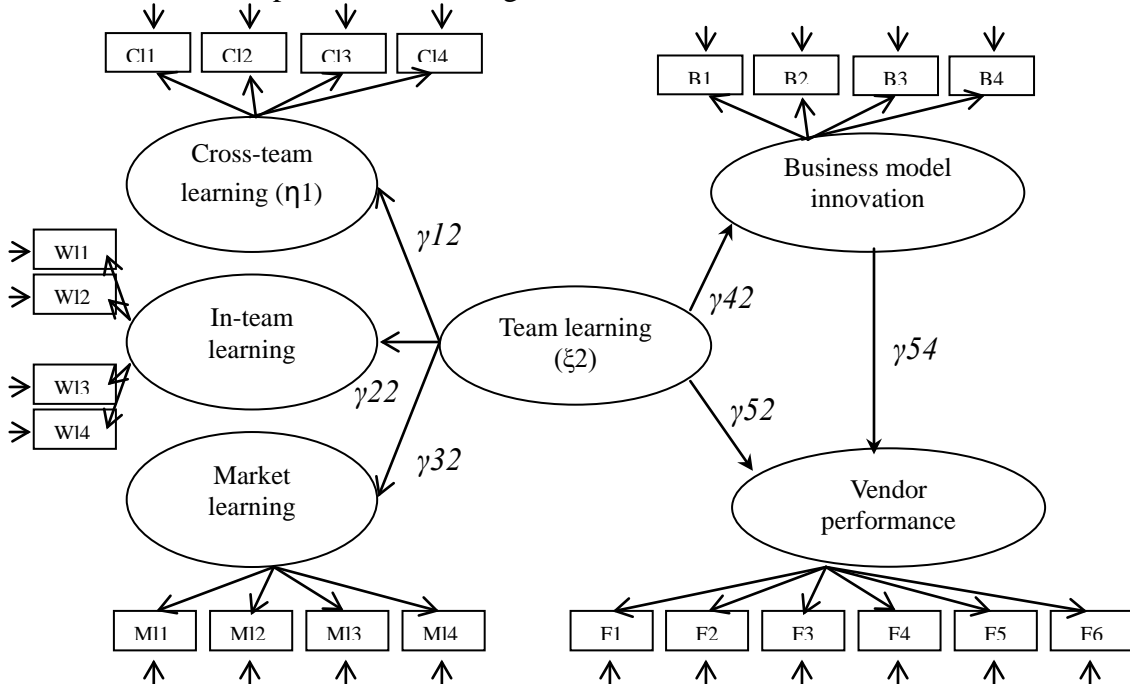

Figure. 4 LISREL Linear Structure Relationship Model

2. Parametric Model Estimation

The purpose of parameter estimation is to minimize the difference between the covariance matrix in sample and in the model. The past linear structure relation model used the ordinary least square method (OLS) and the generalized least squares method (GLS) regression. However, the estimation method used by most scholars at present is the maximum likelihood method (MLE).

3. Model Fitness Assessment

After the parameter estimation was completed, the evaluation and testing of the model was carried out to determine the relationship of variables actually observed in the study and whether it can be assumed to fit the model.

Empirical Analysis

Descriptive Statistics and Correlation Analysis.

This study first described the descriptive statistics and the Pearson correlation, and then analyzed the structural equation model (SEM). Table 1 is the descriptive statistics of various variables and Pearson correlation coefficient of the variables in this study.

Table 1　Descriptive statistics and correlation analysis (N=207)

	(1)	(2)	(3)	(4)	(5)
1. Cross-team learning	(0.90)				
2. In-team learning	.702**	(0.91)			
3. Market learning	.759**	.641**	(0.88)		
4. Business model innovation	.687**	.533**	.749**	(0.92)	
5. Vendor performance	.636**	.614**	.739**	.770**	(0.89)
Average mean	5.38	5.45	5.39	5.51	5.53
Standard deviation	1.12	0.85	1.1	1.11	1.05

Note：*"*"p<0.05　"**"p<0.01*

Figures in parentheses are Cronbach's alphas.

Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis is very important for the development of the scale. The main reason is that the CFA can make a strong test of the theory. This study used the maximum likelihood estimation to perform parameter estimation and verification for each measurement model. In the assessment of measurement models, Bagozzi & Yi (1988) suggested that the reliability of individual items can be used to estimate the significant level of parameters, the compositional reliability, and the average variation extraction amount to perform measurement model estimation to evaluate the intrinsic quality of the patterns .

In this study, the confirmatory factor analysis was used to test the measurement model. As can be seen from Table 2, the individual reliability of the observed variables are between 0.30 and 0.70, and the $\lambda 2$ value across the team between 0.30 and 0.67. The $\lambda 2$ values of the in-team learning range from 0.47 to 0.65, the $\lambda 2$ values of market learning range from 0.62 to 0.70, the $\lambda 2$ values of business model innovation range from 0.60 to 0.64, and the $\lambda 2$ values of vendor performance range from 0.47 to 0.67. These values are all above the threshold of 0.20 proposed by Bentler and Wu (1993). The results show that they meet the requirements of the single variable reliability and indicate that all observed variables have confidence.

In Table 3, all t-test values for all facets to measure project load are higher than the 1.96 significant level, and the value of the factor load (λ) for all observed variables to their individual potential variables are between 0.55 and 0.84. Among them, the λ values for across-team learning are between 0.55 and 0.82, the λ values for in-team learning are between 0.69 and 0.81, the λ values

for market learning are between 0.79 and 0.84, the λ values for business model innovation are from 0.78 to 0.80, the λ values of vendor performance range from 0.69 to 0.82. These values have all reached the threshold of 0.45 or more proposed by Bentler and Wu (1993), indicating that all observed variables are sufficient to reflect the constructed structure, meaning that this study scale has a considerable degree of convergence validity.

Table 2   Factor Loading and Individual Item Reliability

Dimension	Number of questions	Factor loading (λ)	Individual item reliability ($\lambda 2$)
1. Cross-team learning	4	0.55-0.82	0.30-0.67
2. In-team learning	4	0.69-0.81	0.47-0.65
3. Market learning	4	0.79-0.84	0.62-0.70
4. Business model innovation	4	0.78-0.80	0.60-0.64
5. Vendor performance	6	0.69-0.82	0.47-0.67

Table 3   Composite Reliability of Facets and Average Variance Extracted

Dimension	t-value	Composite reliability (CR)	Average variance extracted (AVE)
1. Cross-team learning	5.64-14.38	0.80	0.52
2. In-team learning	11.39-14.19	0.85	0.59
3. Market learning	13.30-14.60	0.88	0.65
4. Business model innovation	12.92-13.50	0.86	0.62
5. Vendor performance	10.93-14.03	0.89	0.59

In this study, a confirmatory factor analysis was first applied to all the items in the team learning facet pattern. According to Lynn (1998) and Hirst et al. (2009) team learning was divided into imaginary mode, single facet, and three-facet mode (hypothesis mode of this study), and the fitness index of each mode and the difference in chi-squared value among various modes were compared respectively. The first mode was the imaginary mode. In the imaginary mode, the path coefficient among all potential variables was set to 0, that is, there was no relationship between different potential variables. According to Hirst et al. (2009) the proposed single facet model was to sum up 12 measurement items in the same facet. Finally, according to the three-facet model proposed by Lynn (1998) team learning was divided into three first-order latent variables: cross-team learning, in-team learning, and market learning. Table 4 compares each mode, including the imaginary mode and the other two comparison modes (single-facet mode and three-facet mode).

Table 4   Results of Analysis of Team Learning Competitive Models

Competitive model	$\chi 2$	df	$\chi 2\chi 2$ / df	$\Delta\chi 2$	GFI	CFI	NFI	NNFI	RMSEA
1.Null model	488.17	54	9.04	--	0.717	0.826	0.814	0.788	0.198
2.One-factor model	240.40	54	4.45	247.77**	0.837	0.955	0.939	0.944	0.129
3.Three-factor model	146.59	51	2.87	341.58**	0.894	0.970	0.955	0.961	0.095

Note: ""$\Delta\chi 2>3.84$; "**"$\Delta\chi 2>6.33$*

The original measurement model (unrestricted model) of this study is χ^2=125.18; df = 51, if the correlation coefficient between the two facets of the cross-team learning and the in-team learning is limited to 1, the χ^2 of this limited mode is 277.54; df = 52, the chi-square difference test was performed between the limited and unrestricted modes, Δdf is 1 and $\Delta\chi^2$ is 152.36, reaching significant difference. The larger the gap, the lower the relevance between cross-team learning and in-team learning and the more the discriminant validity. The discriminant validity analysis results of the various aspects of this study are shown in Table 5. As can be seen from Table 5, the

discriminant validity of each facet of this study has reached a significant level of difference, so we can see that each facet has discriminant validity.

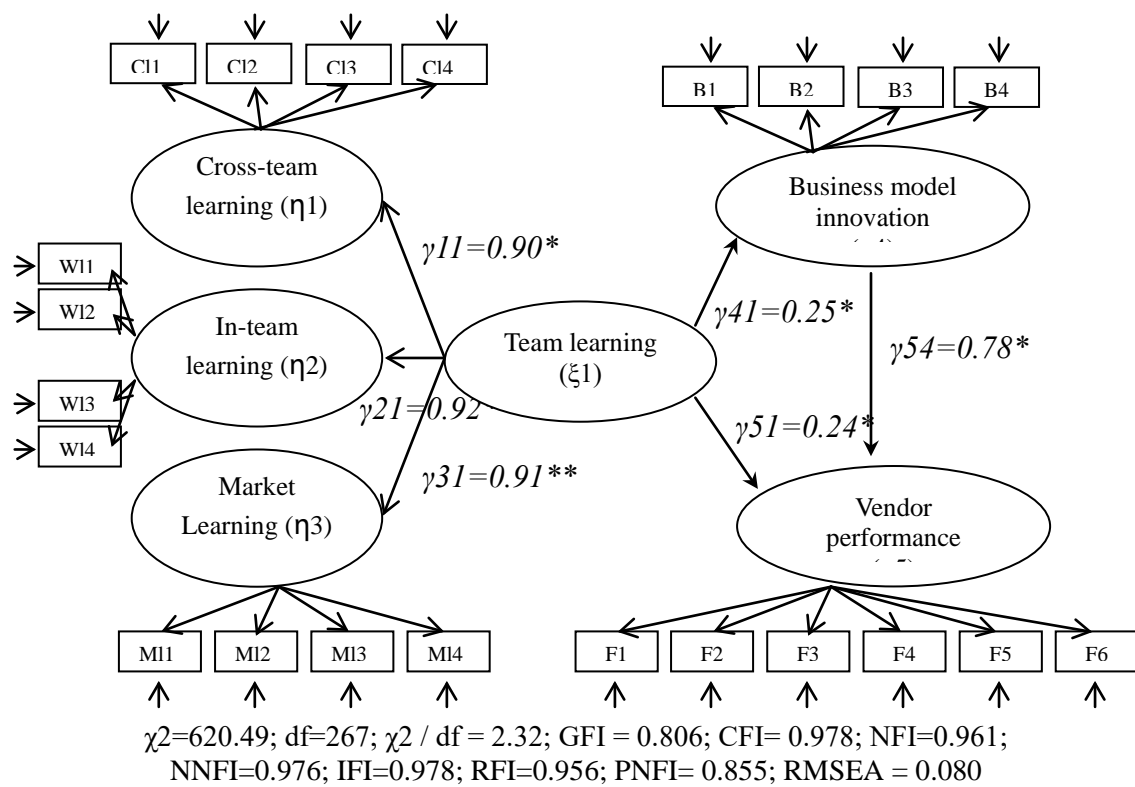Table 5   Discriminant Validity Analysis Results for First-order Latent Variables in Team Learning

Comparison of two facets	Constrained model (ψij=1)		Unconstrained model (ψij=free)		Δχ2	Δdf
	χ2	df	χ2	df		
Cross-team learning v.s. In-team learning	277.54	52	125.18	51	152.36**	1
Cross-team learning v.s. market learning	195.27	52	125.18	51	70.09**	1
In-team learning v.s. market learning	218.61	52	125.18	51	93.43**	1

Note: ""Δχ2>3.84; "**"Δχ2>6.33*

Mode Fitness

This study used the most approximate estimation method (Jöreskog and Sörbom, 1996) to test the structural equation model. Figure 5 illustrates the relationship between exogenous and endogenous variables of the theoretical model and the measurement model. The theoretical model showed the path relationship between team learning, business model innovation and vendor performance. The theoretical model assumed that team learning is a second-order latent variable, which included three first-order latent variables such as cross-team learning, in-team learning and market learning; team learning will also affect business model innovation and vendor performance, and business model innovation will affect vendor performance. Therefore, the theoretical model showed that the Chi-square value reached a significant level (χ^2=620.49; df =267) as an acceptable mode matching degree. Traditionally, χ^2 / df is not more than 3 to test the overall mode matching. Generally, the fitness index of the overall model is tested, including (a) Fitness Index (GFI), (b) Adjusted Fit Index (AGFI), (c) Benchmark Fitness Indicator (NFI), (d) Non-benchmark Fitness Index (NNFI), and (e) Comparison Fit Index (CFI). All fitting indices are greater than 0.9, indicating that the model has an appropriate degree of fit (Bagozzi and Yi, 1988).

The theoretical model of this study (χ^2 / df = 2.32) shows that the model is well-fitted (χ^2/df is less than 3), while the RMSEA is in the acceptable range (RMSEA = 0.080). Specifically, the CFI, NFI, NNFI, IFI, and RFI values above 0.9 are acceptable (0.978, 0.961, 0.976, 0.978, and 0.956). Therefore, the theoretical model of this study has a good fit.

χ2=620.49; df=267; χ2 / df = 2.32; GFI = 0.806; CFI= 0.978; NFI=0.961;
NNFI=0.976; IFI=0.978; RFI=0.956; PNFI= 0.855; RMSEA = 0.080

Note: "*"p<0.05   "**"p<0.01

Figure 5 Path diagram of the theoretical model

Hypothesis Verification

The results of the analysis of the path coefficients of the theoretical model proposed in this study (Figure 5) are shown in Table 6. The path relationships related to this study hypothesis include: (1) Team learning has a positive impact on business model innovation ($\gamma 41$=0.25; p-value<0.01); (2) Team learning has a positive impact on vendor performance ($\gamma 51$=0.24; p-value<0.01); (3) Business model innovation has a positive impact on vendor performance ($\gamma 54$ = 0.78; p-value<0.01); Therefore, H1, H2, H3 are supported.

Table 6   Analysis Results of Path Coefficient of Theoretical Mode

Theoretical model	Coefficient	t- value	Empirical results
path			
H1: Team Learning -> Business Model Innovation (γ41)	0.25**	5.70	Support
H2: Team Learning -> Vendor Performance (γ51)	0.24**	5.21	Support
H3: Business Model Innovation -> Vendor Performance (γ54)	0.78**	7.70	Support

Note: "*"p<0.05   "**"p<0.01

Conclusion and Suggestions

Conclusion.

The innovation of the business model is getting more and more attention in the increasingly

competitive environment. Even if a brand new or quite successful business model will inevitably be simulated and competed by other companies. It is an important issue how an enterprise rethinks the way to make profit in a changing environment, or even thinks about the business model of the enterprise itself.

This study examined the impact of team learning of the information electronics vendors on their business model innovation and vendor performance, and used the SEM model to verify the fitness of the proposed theoretical model and hypothesis verification. First of all, this study used Lisrel second-order factor analysis to construct the way to measure team learning. The analysis results show that: (1) Team learning can be divided into three components: cross-team learning, in-team learning and market learning, among which the most effective is in-team learning, followed by market learning, and finally cross-team learning. (2) All the hypotheses in this study were supported. The results of SEM can clearly show that team learning will positively affect business model innovation and vendor performance. (3) Business model innovation also positively affects vendor performance.

Managerial Implications.

The contribution of this research is to understand the internal and external levels of team learning. Most of the previous research on team learning focused on a single aspect (Bunderson and Sutcliffe, 2003; Ellis et al., 2003; Hirst et al., 2009; Van der Vegt and Bunderson, 2005; Zellmer-Bruhn and Gibson, 2006), and few studies have focused on multilevel research on the facets of team learning (Bresman, 2010; Lynn, 1998). This study used the analysis of potential variables of the second-order level to measure the team learning, and confirmed that team learning should not be regarded as a measure of a single facet.

Second, strengthening business model innovation and improving vendor performance require appropriate in-team learning processes, including interaction and collaboration with other members within the team; proper cross-team learning process, including interaction and cooperation with members of other teams within the company; and the appropriate market learning process, including communication and interaction with competitors, suppliers and customers. From a resource-based perspective, learning is the core competence of vendors (Carayannis and Alexander, 2002). From the point of view of the team learning process, the results of this study show that team learning can effectively enhance business model innovation and vendor performance.

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