

Intellectual Capital and New Product Development Performance in Production Firms: A Case Study of Kermanshah Production Firms

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Abstract

Purpose - This survey explores the influence of different elements of intellectual capital (relational, human and structural capitals) on the performance of new product development based on Hui-Hsu and Wenchang-Fang model in foodstuffs firms of Iran.

Design/methodology/approach - This is a descriptive and application survey based on the structural equations model. 131 out of 400 experts of these firms were selected using Cochran formula. Research tool was a questionnaire composed of three parts including: intellectual capital, organizational learning capability and the new product's performance development.

Findings - Path analysis results revealed that there was a positive significance relationship between intellectual capital and new product development performance. On the other hand, the absorptive capability had a negative significant relationship and transformative capability had a positive significant relationship on new product development performance. The structural capital had a negative significant relationship with learning capability and absorptive capability had a positive relationship with transformative capability.

Keywords: Intellectual Capital, Human Capital, Structural Capital, Relational Capital, Learning Capability, New Product Development Performance

Paper type: Research Paper - Case Study

Introduction

It seems that a dynamic environment, in which there are active organizations, includes many new management techniques which encourage the managers to find a way to improve their business performance. Some techniques such as rightsizing of organizations, downsizing and reengineering are regarded as the ways to improve the business performance and their goal is to find the best way to use organizational resources. Today, knowledge has been regarded as the main resource for organizations to compete. Managers prefer to invest on it more than financial capitals and physical resources.

In this regard, firms follow the fulfillment of learning organization, the promotion of team-building and the presentation of self-enabling. Intellectual Capital aims to reach to some knowledge-based advantages for an organization (Bontis, 2001). Intellectual capital is one of the main factors related to the performance and long-term profitability of knowledge-based economy.

Many organizations relate their main liabilities to intangible assets rather than tangible ones (Huu and Fang, 2008). Nonaka and Takuchi believe that the future society is a knowledge-based society whose knowledge-achievement and use is a base for capital growth. In these societies, industry relies not only on the traditional production factors. Besides, industry manages the knowledge and the integrity of various industries plays the main role in the societies. This procedure emphasizes on the importance of organizational learning capability and the way by which the management and the intellectual evaluation have been appeared. Knowledge and knowledge management are some parts of intellectual capital. In short, intellectual capital refers to a set of intangible assets by which the organizational goals are achieved.

Intellectual capital helps the organization to use intangible assets perfectly. On the other hand, the new meanings and technologies enable the organization to create and save knowledge and share it among the shareholders and the clients (Hragreaves, 2001). Basically, product development refers to the fulfillment of the strategies through which the company tries to increase its sale degree by improving available products and services (David, 1999). Usually, product improvement involves much expenses, research and development. Although intellectual capital and organizational learning plays the main role in the development of a company, there are a little research in the field of the relationship between these factors and their influences on the new product development. Due to a research by Griffin, about %34.2 of companies' sale are resulted from the new products market (David, 1999).

New products development is necessary to maintain the competitive advantages of the companies. These variables have been examined by various researchers (Wen-min et al., 2010). It should be mentioned that the organization and its learning capability are regarded as the main affecting factors. Product development of a company is a factor by which the organization is preserved. The needed performance is achieved by innovation of the products. This performance includes the product market performance, financial performance and client-oriented performance which preserves the organization (Huu and Fang, 2008). Through their research about the intellectual capital and its performance in medicine industry, Abdul Aziz and Bontis have confirmed the hypotheses.

Another research by Hui-Hsu et al. revealed that structural capital has a negative effect on performance. Moreover, with regard to the results of the survey it is clear that intellectual capital criterions have presented different and opposite (negative or positive) results in the organizations. Therefore, in this survey the researchers examine the intellectual capital in companies of Kermanshah using Ya-Hui-Hsu and We-chang-Fang model. On the other hand, the relationship between intellectual capitals (including human capital, structural capital and relational capital) and learning capability will be discussed in this research too. Finally the affects of intellectual capital and organizational learning capability on the performance of new product development will be examined by use of suitable statistical techniques.

Research Background and Theoretical Basis

The term 'intellectual capital' has been used in different texts, but its meaning has not been completely customized. Intellectual capital presents new resources through which an organization can compete. Most of discussions related to the intellectual capital are resulted from a financial and accounting process (Bontis, 2001). These research studies follow a way to answer following questions:

- 1) What does promote the values of the companies more than their clerical value?
- 2) What are the intangible assets of a company?

Authorities have differently presented some definitions for intellectual capital, but its dynamic identity has rendered difficult its main definition and the intellectual capital and intangible assets are synonymously used in many definitions. It seems that it is nearly synonym to knowledge

management and organizational learning. Many research studies have revealed that intellectual capital plays a main role in creating a comparative advantage and promoting business values (Bontis, 1996; Bontis, 2001). From the viewpoints of the researchers, intellectual capital is defined as follows:

Intellectual Capital: Viewpoint

The term "Intellectual capital" has been presented for a long time, but it has not been used in the business world. According to the evidences, the traditional financial accounting related to the assets of a company is now unpredictable and managers try to evaluate non-financial assets (Carrell, 2010; Low, 2000). From the view points of the employers, the intellectual capital could be differently defined. They have mentioned several classifications related to the intellectual capital.

Intellectual capital prepares a new tool to perceive the hidden values of an organization. Roos states that the meaning of intellectual capital could not be perceived and she also points to the implied values of an organization (Po-Yang et al., 2006). In 1997, Stewart defined the intellectual capital as a mental capital which had been empowered to make money by creating valuable assets (Abdol Aziz and Bontis, 2010). According to John Kenneth Galberith, intellectual capital refers to the difference between market value and clerical value of an organization (Huu and Fang, 2008). Antonio Karemona states that intellectual capital is referred to a knowledge resource by which an organization achieves its goals and it is related to the ability of innovation in an organization (Carmona et al., 2010; Youdet et al., 2004). Martin Toors believes that intellectual capital is the intangible assets of an organization which has not been recorded in a financial list, but it may create more than %80 values of an organization's market and it includes human capital, structural capital and relational capital (Martinez, 2006). The main part of intellectual capital is evaluation (Muhiuddin et al., 2006).

The importance of intellectual capital is related to its formation. Noonaka believes that learning organization is an organization which trains its staff (Martinez, 2006). For a learning organization, making value is mentioned as the key element related to intellectual capital. It includes intangible assets and created values of an organization. It also refers to the final revenue of an organization which appropriates an accounting title to itself (wen-min et al., 2010). Ahmad Seleim et al. (2006) divide the intellectual capital into three categories: human capital, structural capital and relational capital. Human Capital refers to the staffs and the knowledge of an organization which improves the ability of it to present some procedures on behalf of the personnel. Based on the Bontise's viewpoint, human capital includes a combination of skills, abilities and theoretical knowledge of the staffs.

Therefore, intellectual capital is generally defines as the combination of capabilities, knowledges, strategies, processes, intellectual procedures and relational networks of an organization which causes creating values, comparative advantages and achieving organizational goals(Huu and Fang, 2008).

Most of researchers perform classification of intellectual capital based on their research goals, but all of performed researches follow a special framework presented by Bontise and Johnson. Intellectual capital includes three main categories: human capital, structural capital and relational capital.

Human Capital

Human capital has been known as a resource which could not be replaced by the equipments and machines of an organization. It includes knowledge; preferred ability, motivation and management of an organization (Po-Yang et al., 2006). In fact, human capital is the main part of intellectual capital and one of the most important resources related to the industries such as software development, management consultation and financial services. For example, Mekinsey

believes that the main resource of his company will be human capital composed of the talented, opportunist and clever staff (Ahmed selem et al., 2006). Human resource is a factor which causes the strategic innovation of the organization and includes all characteristics of human resources such as training, knowledge and capabilities relative to the work of the staffs (Bozzolan et al., 2003). People, organizations and different societies believe that organizations require a high degree of skills and experiences. The knowledge achieved by training is used to produce products or services. Today, it is clear that there is a relationship between the elements of intellectual capital and economic development. Although the economic value of intellectual capital could not be ignored, the researchers are worried about the kind and the degree of human resources in order to make a comparative advantage in organizations and companies (Po-Yang et al., 2006; Ahmed selem et al., 2006).

Relational Capital

Relational capital is referred to the relation with the clients and the value of relationship between suppliers, shareholders and clients (Huu and Fang, 2008; Carrell, 2010). Based on the Meritum project, the activities and intangible resources of a company are divided in to three categories named human capital, structural capital and relational capital (Chamined et al., 2003). Recognition of market channels, the relationship between supplier and client and the correct conception of the influence of the relationship with the governmental and industrial institutions are regarded as the main issues of a firm's relational capital (Bontis, 1991; Bozzolan et al., 2003). Relational capital presents the intangible assets of a firm and it could not be easily developed because it differs with the main core of the organization (Bontis, 1991). Some other researchers concluded that firms' ability of innovation is based on the relationship between the staffs, groups and the organizations. The organizational basics include the rules by which all activities of an organization are coordinated and the needed information is collected.

In order to develop their relationships, organizations and industries relay on the ability of data gathering. In these firms, the effective relationship between the shareholders is mentioned as a basic issue. The relational channels will be regarded as the main resources to develop the organization (Bontis, 1991). At all, the client capital which relates the elements of intellectual capital to each other is regarded as a main factor related to the change of intellectual capital, organizational evaluation and improvement of organizational performance (Po-Yang et al., 2006; Chen et al., 2004).

Structural Capital

Structural capital is referred to the shared-knowledge of a company. In fact, the structural capital of a company includes its way of activity, systems, culture and so on. From the legal perspective, some of these factors may belong to a special firm or organization (Chamined et al., 2003). In this regard, Savrio et al believe that internal capital or structural capital of a company includes intellectual capital and infrastructural capital from which the first one is related to the legal aspect of a company, and the second one refers to the intellectual capital created in the company. It also may be achieved from the outside of the company. The culture of a company, the management processes, information system and network systems are regarded as the intellectual capitals of a company (Bozzollan et al., 2003). Suitable technology is mentioned as a basis for creating relational, human and structural capitals in organizations (Nazary et al., 2010).

Structural capital is related to the organizational mechanisms and structures by which the employees could achieve the intellectual capital. Therefore, the value of structural capital is more than the value of business (Bontis, 1991; Roos and Roos, 1997; Nonaka et al., 1995). The organization which uses weak systems and procedures to employ its staffs could not achieve its main potential. On the other hand, an organization which has a powerful structure could help its staffs to achieve their goals using supportive culture (Bontis, 1991).

Organizational Learning Capability

The available literature related to the organizational learning is very confusing. Basically, there are many differences between organizational learning and learning organization on one hand, between academic procedures and normative procedures on the other hand and at last between individual learning and organizational learning (Swee, 2005). The meaning of organizational learning capability emphasizes on the importance of facilitating factors (Alegre and Chiva, 2008). The literature related to this issue helps some factors such as decision-making and creating effective ideas by use of practical researches, systematic improvement, available experiences and joint decisions (Swee, 2005). There are many surveys related to the evaluation of organizational learning capability. Due to his survey, Chiva presents multi aspect factors in order to define the capability of organizational learning. They believe that the organizational learning capability includes some aspects such as experience, correlation with external environment, two-sided decision making and cooperation. In other words, these aspects are regarded as the main aspects of improvement of organizational learning (Alegre and Chiva, 2008). More over, the organizational learning capability is referred to the organizational and management characteristics by which the organizational learning becomes easier (Alegre and Chiva, 2009). Some researchers believe that organizational learning capability is a two-aspect phenomenon. The organizational learning capability is referred to the procedures, attractiveness and transformative capability of an organization. It is referred to the ability of a company in order to achieve the needed knowledge (Alegre and Chiva, 2009; Bontis, 2001). Therefore, by creating a learning organization and developing the organizational learning capability, the leaders aim to prepare internal conditions in order to improve learning. The improving factors of this procedure should be necessarily presented in order to facilitate the organizational learning (Swee, 2005; Alegre and Chiva, 2008)

The performance of new products development procedure in business is a multi-aspect concept which could not be easily measured. It is used to estimate the financial ratios (Isabel et al., 2009). Researchers have presented various definitions about the performance of new products. These definitions are based on the product, producer, consumer and product's expiration time (Bontis, 2001). In fact, the various criteria can be used in order to determine the financial and functional success of a company. But, business performance is expanded and the learning capability has no impact on the performance by financial evaluation. This impact is based on the interaction between learning and organization. These interactions will be suitable when the organizational goals are performed by learning capability. Therefore, the capability of organizational learning should be estimated in order to evaluate the total financial and non-financial performances of the companies. Today, in order to determine the performance of a business, shareholders or companies emphasize mainly on some factors such as clients, staffs and societies (Isabel, 2010). Based on many researches, there are some key factors related to success and improvement of the performance of new product development. These factors are as follows:

- 1) A company should have high performance process to develop products and design new products due to its clients' needs.
- 2) Companies should be able to define strategies of new product development. These strategies include procedures, goals and strategic emphasize.
- 3) Managers should prepare the needed resources in order to develop new products.
- 4) An organization should have an innovative space. On the other hand, cooper et al believes that development of new products could be influenced by human capital, structural capital and organizational learning. In other words, according to the literature, learning capability could be mentioned as an arbitrator and could affect on the organization performance (Bontis, 2001). Therefore, with regard to different divisions, the performance of new products includes market performance, financial performance, clients' performance and product's performance.

Research Methodology

With regard to this issue that the current survey is aimed to determine the relationship between the elements of intellectual capital, learning capability and the performance of new products of foodstuffs production companies, it is a correlative one which uses structural equation modeling and path analysis. Comprehensive statistics are used to examine the relationship between variables and test the hypotheses. The relationship between variables examined using Lisrel software in order to analyze dependent and independent variables regarding each other. Since the relationship between two variables is examined, the path analysis model used to test the hypotheses and the relationship between variables. The population of this research was 400 general managers, production managers and financial managers of 190 companies in Kermanshah province. Using Cochran formula, 131 persons were randomly selected. 140 questionnaires were distributed among the respondents from which 133 ones were collected and analyzed.

Research Goals

This survey is aimed to achieve following goals:

Main Goal: examining the relationship between intellectual capital and performance of new product development based on Hui-Hsu and Wenchang Fang model.

Detailed Goals:

- 1) Examining the relationship between some of the elements of intellectual capital (relational capital and structural capital) and dimensions of organizational learning capability.
- 2) Examining the relationship between dimensions of organizational learning capability and new product development performance.
- 3) Presenting a model about the relation between intellectual capital and new product development performance in examined companies.

Conceptual Model

Regarding performed researches which are mainly based on the viewpoints of Bentiss and Hui-Hsu and Wenchang Fang, Figure 1 illustrates the relationship between the elements of intellectual capital (human, structural and relational capitals), the organizational learning capability and the performance of new products development.

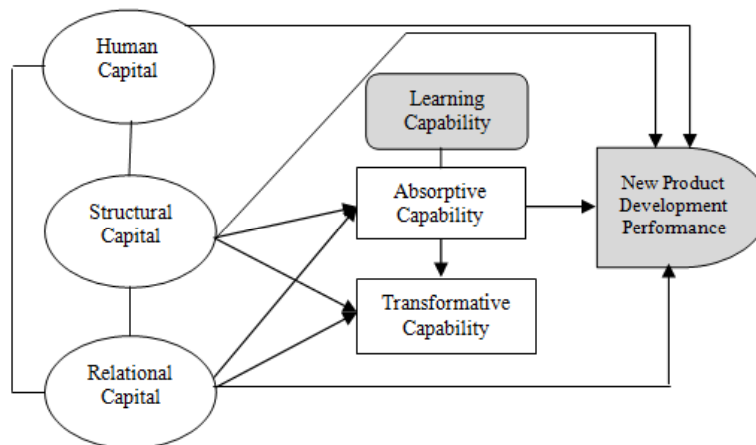


Figure 1: Conceptual Framework

Research Hypotheses

- 1) There is a significant relationship between human capital and New Product Development Performance.
- 2) There is a significant relationship between structural capital and New Product Development Performance.
- 3) There is a significant relationship between relational capital and New Product Development Performance.
- 4) There is a significant relationship between relational capital and absorptive capability.
- 5) There is a significant relationship between structural capital and absorptive capability.
- 6) There is a significant relationship between structural capital and transformative capability.
- 7) There is a significant relationship between absorptive capability and the New Product Development Performance.
- 8) There is a significant relationship between transformative capability and the New Product Development Performance.
- 9) There is a significant relationship between absorptive capability and the transformative capability.

Data Gathering

Data was gathered by library and filed study methods. The tools used in this research included a fiche or index card for collecting suitable information and a questionnaire for collecting field data. The questionnaire was composed of four parts:

- § Part 1: examines the demographic information of the respondents.
- § Part 2: includes 15 questions relative to the intellectual capital variable.
- § Part 3: includes 7 questions relative to the organizational learning capability variable.
- § Part 4: includes 15 questions relative to the performance of new products development.

The variables of this questionnaire are like Bontis' criteria used by Hui-Hsu and wen-chang-Fang. Therefore, this questionnaire is valid because it has been used by other researchers. It has also been confirmed by five managers and experts too. Cronbach's alpha has been used to examine its reliability. The resulted coefficients for intellectual capital, organizational learning and the performance of new products development are respectively 0.862, 0.92 and 0.968. The cronbach's alpha coefficient of total questionnaire is 0.896.

Findings

Before the examination of hypotheses, it needs to examine the reliability of this model. Therefore, we first use path analysis model.

Standard Estimation

In order to compare the effects of available variables by use of Lisrel 8.5 software, the relationship between the variables should be determined as the following model.

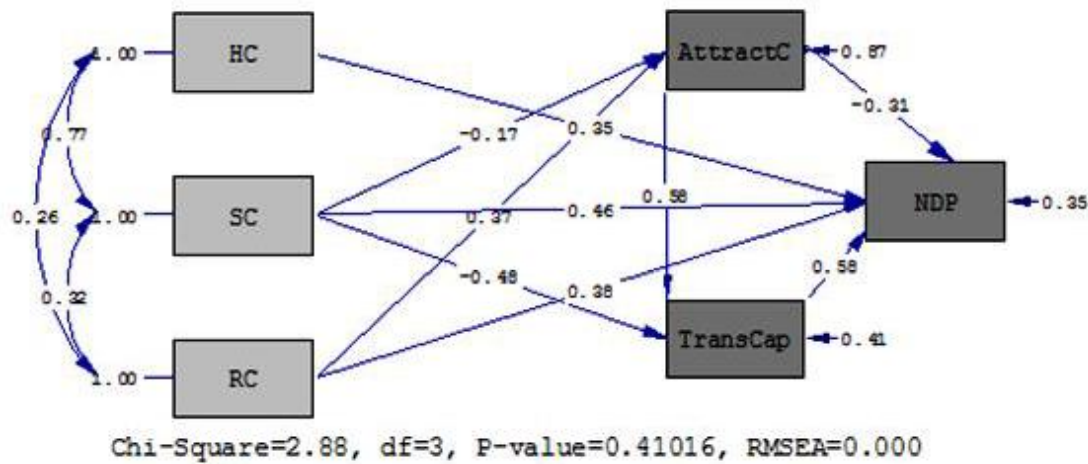


Figure 2: Standardized Model

$\chi^2 = 2.88$, due to the Lisrel software. Results of χ^2 test show the suitability of this model. Based on the criteria presented below (Table.1), this model is a suitable model.

Table 1: Goodnes of Fit Index

| Model-fit measure | Model-fit measure research model | Acceptable Range | Result |
|-------------------|----------------------------------|------------------|--------------------|
| RMSEA | 0.000 | <.09 | Model is confirmed |
| $\chi^2/df < 2$ | 0.96 | <2 | Model is confirmed |
| NNFI | 1 | >0.9 | Model is confirmed |
| IFI | 1 | >0.9 | Model is confirmed |
| NFI | 0.99 | >0.9 | Model is confirmed |
| CFI | 1 | >0.9 | Model is confirmed |
| GFI | 0.99 | >0.9 | Model is confirmed |
| AGFI | 0.96 | >0.9 | Model is confirmed |

Examining the Relationship between Variables

In order to examine the factors affecting on the performance of the new product development, some variables are used. With regard to this issue that the survey examines the variables, the path analysis has been used. Based on the figure below, the needed parameters relative to the suitability of the model were analyzed.

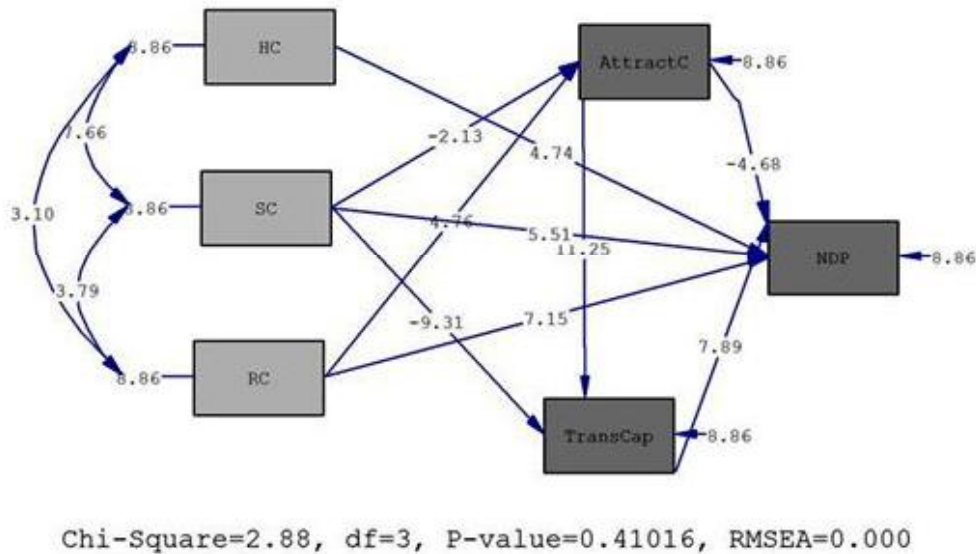


Figure 3: Estimated Model

According to the data resulted from path analysis model, the correlation coefficients are presented in table below.

Table 2: The results of path analysis model

| Path | Non-standardized coefficient | Estimate error | Standardized coefficient | T-value | Hypothesis test result |
|--|------------------------------|----------------|--------------------------|---------|------------------------|
| Human capital -New product development | 0.23 | 0.048 | 0.35 | 4.47 | Supported |
| Structural capital -New product development | 0.4 | 0.072 | 0.46 | 5.51 | Supported |
| Relational capital -New product development | 0.24 | 0.034 | 0.46 | 7.15 | Supported |
| Structural capital -Absorptive capability | -0.13 | 0.062 | -0.17 | -2.31 | Supported |
| Structural capital - Transformative capability | -0.64 | 0.069 | -0.48 | -9.31 | Supported |
| Relational capital- Absorptive capability | 0.22 | 0.046 | 0.37 | 4.76 | Supported |
| Absorptive capability- Transformative capability | 0.99 | 0.088 | 0.58 | 11.25 | Supported |
| Absorptive capability-New product development | -0.34 | 0.072 | -0.31 | -4.65 | Supported |
| Transformative capability- New product development | 0.58 | 0.047 | 0.58 | 7.89 | Supported |

Exogenous (independent) variables affect indirectly on the endogenous (dependent) ones, the direct, indirect and total effects and their relationships are presented in table below.

Table 3: Direct effects, indirect effects and total effect of exogenous variables

| Variables | Direct effect | Indirect effect | Total effect |
|--|---------------|-----------------|--------------|
| Human capital -New product development | 0.35 | 0.0 | 0.35 |
| Structural capital -New product development | 0.46 | -0.28 | 0.18 |
| Relational capital -New product development | 0.38 | 0.01 | 0.39 |
| Structural capital –Attractive capability | -0.17 | 0.0 | -0.17 |
| Structural capital - Transformative capability | -0.48 | -0.10 | -0.57 |
| Relational capital- Attractive capability | 0.37 | 0.0 | 0.37 |
| Relational capital - Transformative capability | 0.0 | 0.22 | 0.22 |

As seen in table 3 relational capital has great positive total effect on new product development (0.39) and the structural capital has a great negative total effect on transformative capability(-0.57).

Table 4: The direct, indirect and total effects of endogenous variables

| Variables | Direct effect | Indirect effect | Total effect |
|---|---------------|-----------------|--------------|
| Attractive capability-transformative capability | 0.58 | 0.0 | 0.58 |
| Attractive capability - New product development | -0.31 | 0.33 | 0.03 |
| transformative capability - New product development | 0.58 | 0.0 | 0.58 |

Due to data presented in table.4, it is clear that transformative process has the most direct affect on the endogenous variable of new products development.

Discussion

Regarding the standardized model, tables, path analysis model and outputs of Lisrel software which show the direct, indirect and total affects, and also with regard to the χ^2 -Test which shows the quantity of T, it could be said that there are some differences between the factors relative to the new products performance development. Based on the T-quantity, there is meaningful relationship between structural capital ($t=5.51$), relational capital ($t=7.15$) and human capital (4.71) and new products performance development. Also, there is a significant relationship between the elements of organizational learning capability (attractive capability = - 4.65 and transformative capability = 7.89) and the new products performance development.

Another hypothesis is the relationship between absorptive capability and transformative capability. Absorptive capability positively affects transformative capability and the results show a high significance. The finding that Absorptive capability positively affects transformative capability is consistent with Isabel's (2009) study. The relationship between learning capability endogenous variable with New Product Development Performance is significant, but absorptive capability negatively ($t= -4.65$) affect New Product Development Performance but transformative capability positively ($t=7.89$) affect New Product Development Performance.

The finding that absorptive capability negatively affects New Product Development Performance is not consistent with Ya-Hui Huu's (2008) study. The negative relationship between absorptive capability and New Product Development Performance may be due to mis-estimation the environment of company, incorrect prediction of knowledge and technology (statement of company managers). Ya-Hui Huu et al (2008) also note that spending too much on information system or R&D expenditures, in turn undermining their financial performance and ignoring their customers, leads to reduced New Product Development Performance.

Structural capital negatively affects absorptive capability ($t= -2.3$) and transformative capability ($t= -9.31$). The finding that structural capital negatively affects absorptive capability and transformative capability is not consistent with Ya-Hui Huu's (2008) study. This result may be

due to mis-recognition or mis-perception of managers about useful investment in information technology infrastructure, applying traditional methods and information systems instead of up-to-date technologies. Finally as shown in table 2, the relational capital positively affects absorptive capability ($t=4.76$). The finding that relational capital significantly affects absorptive capability is consistent with Ya-Hui Hui's (2008) study.

Recommended Practical and Theoretical Implications

Regarding the results of data analysis, the following procedures are suggested in order to improve the performance of new products development in the production companies of Kermanshah province of Iran.

In order to improve the structural capital affecting the new product development performance and absorptive process, (structural capital negatively affects organizational learning capability) we should mention the following cases:

- § Companies must control the amount of financial resources investments on informational infrastructure and suitability and accuracy of information systems.
- § Companies should develop suitable informational infrastructures to reach to the desired business development.

In order to improve the human capital effect on absorptive process and to develop the performance of new products, companies should:

- § design new plans in order to promote the skills of the staffs
- § Create a suitable environment in order to develop the ideas of their staffs and to present other new ideas.
- § make their training structures more suitable

In order to improve the relational capital to affect on absorptive process of the examined companies, they should:

- § Preserve long-time relations with their clients and accept more suppliers
- § Increase their abilities in order to act along with their co-workers.

In order to improve the absorptive process affecting on development of new products, companies should:

- § Pay more attention to getting knowledge from the external and internal resources
- § Predict new perspectives in order to develop the future knowledge of the organization

In order to improve transformative capability affecting the performance of new products development, companies should:

- § Integrate the internal knowledge of the organization and increase the internal ability in order to use this knowledge in new product development process.
- § Increase the ability of grouping existed knowledge in order to use it in future, or on the other hand develop a complete knowledge management system.

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