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An Exploration of Effective Factors in New Product Development (NPD) Project Success

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Abstract
New products are undeniably vital for the viability and success of a firm. Firms need to create and sustain competitive advantages in order to survive in today's highly competitive business environment. This paper's purpose is analyzing the effects of effective factors on new product development (NPD) project success. In this research we have used a questionnaire with 29 questions to study a 134 sample of home appliance managers in Isfahan (Iran). A conceptual model has been designed to show all relationships among all variables which is tested by LISREL software. Empirical results generally support the predictions from the theory. Specifically, the findings of this study show that joint reward system, knowledge sharing, people resource and market research are key factors for NPD project success. Amount of goodness indexes (AGFI= 0.92, GFI= 0.91) shows suitability of the model.

1. Introduction

Firms need to create and maintain sustainable competitive advantages in order to survive in today's highly competitive business environment as market leadership, market share, and sustainable growth are enabled through the process of developing and launching successful new products and services (Barczak and Kahn, 2012). The performance of a firm is based on its sustained competitive advantage and sustained competitive advantage, in turn, is described by idiosyncrasy and immobility of firm resources (Kandemir, Calantone and Garcia, 2006). One major determinant of sustaining competitive advantage is the ability of the firm to develop and launch successful new products, as new products are vital for the viability and success of a firm (Song and Parry, 1997). New products are viewed as a solution to a need. Successful products are those that provide efficient solutions to strong customer needs (Toubia, 2008). Therefore, firms allocate considerable resources in their quest to develop new products offering an advantage over competitors (Slotegraaf and Atuahene-Gima, 2011). However, what should

firms do to launch a new product development successfully? In other words, what are the items essential for a firm to succeed in implementing and maintaining a new product project? Researchers claim that the NPD process can be classified into two main phases including initiation and implementation. The initiation phase focuses on the conceptualization of the product, whereas the implementation phase emphasizes on fulfilling that concept (Nakata and Sivakumar, 1996). On the other hand, based on the literature on new product performance, a successful new product development is affected by process related and organization related factors (Kandemir et al., 2006). Researchers have argued that organization-related factors include resources and skills, whereas the new product development (NPD) process mainly includes technical and marketing activities (Kandemir et al., 2006). In this research, attempting to identify factors affecting a firm's success in new product development process, we have considered a combination of these factors in order to achieve a comprehensive view about antecedents of NPD success. With respect to new product process these factors can be seen in terms of joint reward system and people resource as organization related factors and market research as a marketing activity which altogether make a combination of factors which their influence on NPD success is investigated in this study.

2. Literature Review

2.1 Joint Reward System (JRS) and Knowledge Sharing

Over recent years, organizations have been attempting to sustain efforts to stimulate, facilitate,and utilize organization-wide knowledge in order to gain competitive advantages. Empirical studies have shown that knowledge sharing among individuals strengthens knowledge creation (Shih et al., 2006) and also can facilitate NPD performance (Chang et al., 2006). However, an effective mechanism should be identified to stimulate knowledge sharing among NPD members across different functional areas. Milne (2001) believes that Organizational rewards can be viewed as an effective mechanism. Organizations consist of individual and joint activities. Joint reward system refers to a mechanism designed to reward joint efforts across functions such as R&D and marketing that are jointly responsible for the success or failure of a new product, in the NPD process (Gupta et al., 1986). Researchers argue that rewards based on team performance enhance knowledge sharing within teams and facilitate idea capture schemes for innovation (Bartol and Srivastava, 2002; Chang et al., 2007). On the other hand, it is suggested that NPD project members' commitment and job satisfaction gained by participating in the reward process can lead to a form of sharing knowledge and generating positive job attitudes such as integration and involvement (Chang et al., 2007), and voluntary behavior like providing information to coworkers (LePine et al., 2002). Researchers believe that JRS can be contributive in organization's goal achieving, as it can integrate cross-functional efforts (Sarin and Mahajan, 2001), facilitate interpersonal communication and alleviate conflict levels between human resource and marketing (Chimhanzi, 2004), decrease goal incongruity and conflicting behavior among functional members (Gupta et al., 1986; Xie et al., 2003). Chang, Yeh and Yeh, (2007) identified four features in JRS that are proposed to influence NPD success. These aspects comprise reward procedure view including joint determination of reward allocation and reward contingent on NPD phases, monetary view including risk-free to participants and over-reward incentives. They claim that these aspects are

likely to enhance the degree of knowledge sharing among functional specially R&D, marketing and NPD members.

2.2 Knowledge Sharing and NPD

Shared knowledge is considered as a unique, critical and valuable resources central to gain competitive advantages. Product development is an information- and knowledge-intensive process. Developing highly successful new products is possible through the integration of abilities of both downstream (e.g. manufacturing engineers) and upstream knowledge workers (e.g. design engineers) (Hong et al., 2004). Firms' superior product development capabilities are derived from their ability to create, distribute and utilize knowledge throughout the product development process (Akgu et al., 2002). knowledge creation process however isn't effective without knowledge sharing through the socialization in the knowledge creation process whereby tacit knowledge can be transformed into explicit knowledge that is valuable for organizations (Chang et al., 2007). Scholars believe that knowledge sharing among NPD members can facilitate NPD performance (Chang et al., 2006). Nonaka and Takeuchi (1995), claim that interaction and discussions with others in the knowledge sharing activities enhances market feedback in the NPD via information flow and synergistic coordination. Hansen (2002), suggests that when project teams access to units that contains related knowledge can complete their projects faster, and Chang et al. (2007), believe that a NPD organized by members across functional units may fulfill desired goal more effectively. Slotegraaf and Atuahene-Gima (2011), also have placed knowledge embedded in the cross-functional NPD team at the heart of this process. Generally, there is a strong support backing significant and positive association between knowledge sharing and innovation performance and more specifically, NPD performance (Chang et al., 2006; Song et al., 2000).

2.3 Joint Reward System and New Product Development

As mentioned earlier, JRS is contributive in organization's goal achieving in different ways. A number of studies have highlighted the contributions of JRS in NPD setting in many aspects (Cho and Hahn, 2004; Chimhanzi, 2004; Sarin and Mahajan, 2001; Xie et al., 2003; Chang et al., 2007). In addition to the effect of JRS on NPD through the mediating role of knowledge sharing explained in previous parts, researches have provided sufficient evidence to the fact that JRS affects NPD performance significantly and directly (Griffin and Hauser, 1996; Chang et al., 2007). Cho and Hahn (2004), believe that a joint reward system could bridge existing gaps among sociocultural differences in NPD. Xie et al., (2003) also have proved the contribution of JRS to information exchange, cross-functional harmony relationship and involvement, as well as reducing goal incongruity under NPD context. Furthermore it is found that the most important factor contributing to the cross-functional integration in organizations is how rewards are allocated across different functions (Coombs and Gomez-Mejia, 1991) and JRS is an integrative mechanism employed by firm in order to achieve NPD design-to-market performance (Sarin and Mahajan, 2001). Therefore, as innovation creates added-value and therefore enhances market compatibilities for products, JRS is posited to strengthen NPD performance (Chang et al., 2007).

2.4 People Resources and NPD

People resources is a sort of organizational resource composed of top-management commitment, involvement of a strong champion, use of a multi-disciplinary team, and focus of a dedicated team. According to Kandemir, Calantone and Garcia (2006), these resources in turn can influence NPD success. In a study by these researchers the initiation of the NPD was found to be influenced by top-management commitment and moreover, as firm resources are controlled by the top-management, it can affect the level of resources devoted to the NPD project. On the other hand, the external and internal team communication could be enhanced by project leaders called strong champions. Crawford, 2003 also has found communication among multi-disciplinary teams like R&D, manufacturing and marketing essential to the success of NPD, because as the gap across functions increases, necessary information for product's formation and function might be misunderstood or lost, hence, organizations should decrease function's permeability and instead increase the availability of the information necessary for the NPD project. Finally, the NPD literature points to the importance of dedicated teams to the NPD success. Kandemir et al (2006), argue that employees working in different departments have different "systems of meaning" and understand different aspects of new product development which leads to different interpretations. Therefore, shared interpretations can be developed by the team dedicated to the NPD project via interaction and integration of individuals combined from multi-disciplines. Collectively, these arguments suggest that people resources are important for implementing and maintaining of NPD.

2.5 Market Research and NPD

This part concerns about marketing activities related to new product development that can contribute to the success of this process. It is obvious that searching information about consumers' needs and other characteristics such as price sensitivities, purchasing behaviors and their preferences and competitors' products and actions is critical to the NPD success (Kandemir et al., 2006). The importance of gaining information about existing trends in the market to succeed in developing and launching new products has been highlighted by Barczak and Kahn (2012), as they believe that applying methodologies and techniques to sense, study, and understand customers, competitors, and macro-environmental forces in the marketplace such as focus groups, electronic surveys and ethnographic studies can play a contributive role in firm's ability to gather and use information to drive innovation through NPD projects. Calantone and Benedetto (2010), have identified three aspects of marketing activities specific to the NPD including preliminary market assessment, detailed market research, and sales projections for determining the financial feasibility of the NPD project, and researchers believe that these resources are likely to increase the new product development success (Kandemir et al., 2006). Therefore, according to arguments provided in the literature, following hypothesizes are advanced as:

H1: Joint reward system increases the degree of knowledge sharing among individuals from different departments related to NPD.

H2: Knowledge sharing influences NPD success in a positive way.

H3: Joint reward system has a positive impact on NPD success.

H4: People resources of a firm influence NPD success positively.

H5: Market research influences NPD success in a positive way.

3. Conceptual framework of study

Given the aim of this study to investigate organizational and marketing factors affecting success of new product development (NPD) process, and regarding the literature review, prier studies and proposed hypothesizes, the conceptual framework of the study is proposed. Figure 1 illustrates the conceptual framework of study.

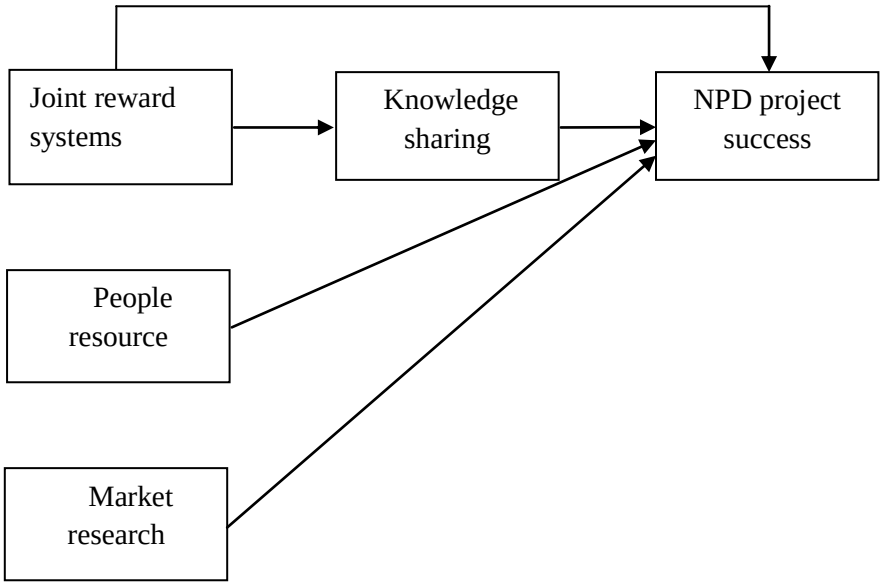

Figure 1. Conceptual framework of study

4. Research methodology

In order to collect the required data for the study, a self-administered survey was used to collect data on Home appliance manager's perceptions of the five constructs: joint reward systems, people resource, market research, knowledge sharing and NDP project success. The questionnaires include 34 items in which 29 items were assigned to five latent variables (joint reward systems, people resource, market research, knowledge sharing and NDP project success), and three items to demographics variables. In this study, Likert's five-point scale has been used to assess the concepts. Measures assessing people resource were adopted from song (2008) by using seven item scale that assesses respondents' perception of the status of people resource offered by the company. Items measuring market research modified from calantone (2003) and by six item scale in order to identify the perception of respondents of the company's operations related to market research performance. To capture respondent' perception of knowledge sharing efforts, five item scale were partly adapted from bartol and srivastava (2002). Joint reward system was measure by using a five item scale that assesses the degree to which the allocation of rewards is determined jointly by all the NPD members. Finally the six items measuring NPD project success were adapted from song (2006). The reliability of

the questionnaire was calculated by means of Cronbach alpha coefficient and estimated to be 0.890.

Table 1.Research Measures and constructs reliability

Construct	Cronbach's Alpha
NPD project successes	0.864
Knowledge sharing	0.902
Joint reward system	0.910
People resource	0.843
Market research	0.927
Total	0.890

4.1 Sample Selection and Date Collection

The research population contains of 155 managers (senior,marketing, manufacturing and R&D) of home appliance manufacturing companies in Esfahan province. Since the population is limited no sampling is necessary thus the whole population is studied. A total of 134 questionnaires out of 155 were returned, demonstrating a response rate of 86 percent. The final analysis was performed based on 134 questionnaires.

5. Results

The validity of the constructs was determined through Confirmatory Factor Analyses. CFA on joint reward system with 5 items (question 1 to 5), people resource with 7 items (question 6 to 12), market research with 6 items (question 13 to 18), knowledge sharing with 5 items (question 19 to 23) and NPD project success with 6 items (question 24 to 29) produced the following results, representing suitability of the measures to be used for further analysis:

Table2. Results of the Confirmatory Factor Analysis

chi-square	250.74
df	124
p-value	0.12
RMSEA	0.005

The research hypotheses were tested by Structural Equation Analyses (SEM) using LISREL software.The structural equation modeling technique enables the simultaneous estimation of multiple regression equations in a single framework. Notably; all direct and indirect relationships in the model are estimated simultaneously, and thus the method allows all the interrelationships among the variables to be assessed in the same decision context. Researchers recommend that a sample size 100 to 200 is appropriate for Structure Equation

Model (SEM) analysis. The sample size in this study was 134, so SEM analysis could be applied. Covariance matrices were analyzed in all cases using LISREL software. The correlation matrix of data is shown in table 5.The result indicates chi-square is 250.74 calculated by LISREL. As degree of freedom is 124, χ^2 / df= 2.021. Other results based on LISREL's output are:

Table 3. Fit indices for the path model

Goodness of Fit Index (GFI)	0.91
Root Mean Square Error of Approximation (RSMEA)	0.005
Comparative Fit Index (CFI)	0.96
Standardized Root Mean Square Residual (SRMR)	0.0045
NFI	0.90

Such results prove that the proposed model exhibits a reasonably good fit to the data. Figure 2 shows the principal model of research and figure 3 illustrates the results of the hypothesis testing. Circumstantial evidence t is used to find out if proposed relationships are significant or not. This circumstantial evidence refers to the proportion of each parameter's coefficient to the standard deviation error of that parameter which will be significant when it is higher than 2 (t ≥2) in t-test and higher than 1.96 (z ≥ 1.96) in z-test. According to what is mentioned, following results can be extracted:

As expected in the first hypothesis, Joint reward system was found to influence knowledge sharing positively (H1: γ_1=0.71, p<0.05) while as predicted in second hypothesis Knowledge sharing has a Positive influence on NPD success (H2: γ_2 = 0.54, p<0.05). The third hypothesis predicted that Joint reward system has a positive impact on NPD success, statistic results confirmed this prediction as well (H3: γ_3=0.69, p<0.05). As proposed by hypothesis 4 People resources was also found to influence NPD project success positively (H4: γ_4=0.62, p<0.05). Finally, in a same way, the significant and positive relation between Market research and NPD success was supported (H5:γ_5=0.57, p<0.05). Generally all of research hypotheses were confirmed statistically. The results are shown in table 5.

Discussion and conclusions

This study is purported to develop and examine the effects of four factors(joint reward system, knowledge sharing, people resource and market research) that leads to NPD project success among managers (senior, marketing, manufacturing and R&D) of home appliance manufacturing companies in Esfahan province. The overall structural equation modeling results produce significant and positive effects for the relationships between joint reward system and knowledge sharing, joint reward system and NPD success, as well as people resource ,market research and NPD success.

Joint reward system yielded consistent significant and positive results in predicting not only knowledge sharing among NPD project members across R&D, marketing, and manufacturing,

but also NPD success. Such findings are highly consistent with recent researches on how reward structure influencing the performance of cross-functional NPD teams (Sarin and Mahajan, 2001) and on the importance of offering reward to invite knowledge sharing without concerning the immediate success or failure to achieve NPD success.

In the development phase of the NPD process, the key organizational activity affecting the success of the NPD project is the detailed market research. These results provide further empirical support to Barczak and Kahn (2012) study, which argues that study, and understand customers, competitors, and macro-environmental forces in the marketplace such as focus groups, electronic surveys and ethnographic studies can play a contributive role in firm's ability to gather and use information to drive innovation through NPD projects that stresses the importance of the detailed, planned, and scientific market research.

Among the people resources, the key factors affecting the NPD project success are the involvement of a strong champion, use of a multi-disciplinary team, and focus of a dedicated team and management commitment. The implication is that the efficient and effective use of individuals that are closely associated with the NPD contributes to the success of the NPD project. top management commitment is necessary for the initiation of the project, its commitment may be directly related to the accomplishment of the NPD project. These results provide further empirical support to Kandemir, Calantone and Garcia (2006) studies.

Limitations

While this study has yielded major findings that possess significant implications for Both theory and practice, several limitations need to be addressed as well:

First, because data for this study were collected from home appliance organizations, it would be helpful for future studies to replicate our findings in other industries to enhance the generalizability of our results in other settings. second, this study ignored the importance of individuals' variance in terms of knowledge, skill, and ability (KSA) for teamwork and knowledge sharing. Future studies may need to incorporate the necessary KSA of NPD members into related studies for further clarification.

Table 4. Sample demographic characteristics

Variable	Type	Frequency	Percent
Gender	Male	118	88
	Female	16	12
Age	21-30	28	20.9
	31-40	70	52.2
	41-50	26	19.5
	More than 50	10	7.4
Educational status	High school	10	7.4
	Diploma	25	18.7
	Bachelors	65	48.5
	Masters and Ph.D	34	25.4

Table 5. Analysis of the results

Path		Hypotheses	Coefficient	T- value	p
join reward system	→knowledge sharing	H1	0.71	6.93	<0.05
Knowledge sharing	→NPD success	H2	0.54	3.83	<0.05
joint reward system	→NPD success	H3	0.69	4.17	<0.05
people resource	→ NPD success	H4	0.62	2.64	<0.05
market research	→NPD success	H5	0.57	8.53	<0.05

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