

Uncertain Supply Chain Management

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A study on how open innovation influences on supply chain behavior

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ABSTRACT

This paper presents a study to investigate the effects of open innovation factors on supply chain behavior in Iranian gas industry. The study uses two questionnaires, one to measure the effects of open innovation factors developed by Chesbrough (2003) [Chesbrough, H. W. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Harvard Business Press.] and the other to measure the effects of supply chain behavior. Using Pearson correlation ratio as well as Stepwise regression model, the study has determined a positive and meaningful relationship between open innovation and supply chain behavior. In our survey, while intellectual property management and networking had no impact on supply chain behavior, three variables of research and development, cooperation and entrepreneurship influence positively on supply chain behavior.

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1. Introduction

Open innovation plays an essential role for development of today's business organizations (Chesbrough, 2003; Helfat & Quinn, 2006; Enkel et al., 2009). According to Mazzocchi (2004), firms with no innovate ideas but meta-innovation have become a center of the business development. Chesbrough and Crowther (2006) identified firms in industries outside 'high technology', which were early adopters of the concept of open innovation. They reported that many open innovation concepts were already in use in a wide range of industries. They documented practices that seemed to assist firms adopting these concepts, and discovered that open innovation was not ipso facto a recipe for outsourcing R&D. They concluded that open innovation had utility as a paradigm for industrial innovation. Lichtenthaler (2011) presented a conceptual framework, which provides the foundation for discussing critical open innovation processes and their use for managing open innovation at the organizational, project, and individual level. They evaluated the multilevel determinants of the make-or-buy, integrate-or-relate, and keep-or-sell decisions in opening up the innovation process. They also

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proposed a research schedule with specific focus on the organizational antecedents and performance consequences of open innovation.

Supply chain management (SCM) is another important component of business development (Cachon & Lariviere, 1999; Simatupang & Sridharan, 2002). Mentzer et al. (2001) investigated the existing literature in an attempt to understand the concept of “supply chain management.” They studied various definitions of SCM and “supply chain”, categorized, and synthesized different characteristics of SCM. They also offered definitions of supporting constructs of SCM and build a framework to establish a consistent means to conceptualize SCM.

2. The proposed study

The proposed study of this paper investigates the effects of open innovation on SCM behavior in Iranian gas industry. The study uses two questionnaires, one to measure the effects of open innovation factors developed by Chesbrough (2003) and the other to measure the effects of supply chain behavior. Open innovation consists of five factors including networking, cooperation, organizational entrepreneurship, open innovation management and research and development. In addition, the SCM questionnaire consists of four factors including customer relationship management, return management, customer services and supplier relationships. The main question of the survey investigates whether open innovation influences on SCM or not. The main question consists of the following five sub-hypotheses,

1. Networking influences on SCM.
2. Cooperation influences on SCM.
3. Research and development influences on SCM.
4. Intellectual property management influences on SCM.
5. Organizational entrepreneurship influences on SCM.

The population of this study consists of managers who work for gas distribution industry in Iran. The sample size is determined as follows,

$$n = \frac{N \times z_{\alpha/2}^2 \times p \times q}{\varepsilon^2 \times (N - 1) + z_{\alpha/2}^2 \times p \times q}, \quad (1)$$

where N is the population size, $p = 1 - q$ represents the yes/no categories, $z_{\alpha/2}$ is CDF of normal distribution and finally ε is the error term. Since we have $p = 0.5$, $z_{\alpha/2} = 1.96$ and $N = 248$, the number of sample size is calculated as $n = 180$. The study distributed 200 questionnaires among the experts and managed to collect 180 filled ones. Cronbach alphas for open innovation and SCM were calculated as 0.94 and 0.92, respectively. Kolmogorov–Smirnov test has confirmed that all components of the survey were normally distributed and we may use Pearson correlation as well as Stepwise regression models to verify various hypotheses of the survey.

3. The results

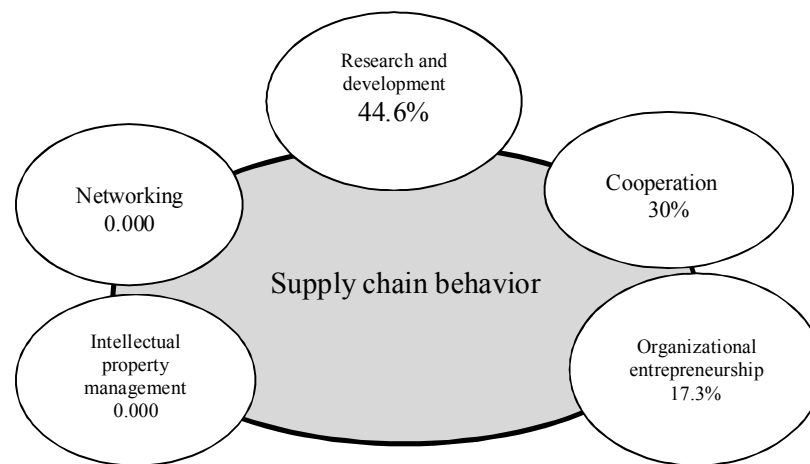
We first present details of Pearson correlation between SCM and open innovation components. In our survey, the highest impact was measured between organizational entrepreneurship and information technology infrastructure in SCM ($r = 0.948$, P-value = 0.000) and the lowest impact was between resources in SCM and open innovation ($r = 0.218$, P-value = 0.000). In our study, two components of open innovation; namely, intellectual property management and networking had no impact on supply chain behavior. We have also performed a stepwise regression technique where SCM is dependent variable and open innovation components are independent variables. Table 1 shows details of the results of our investigation.

Table 1

The summary of Pearson correlation

Open innovation variable	Non-standard β	Standard β	t-value	P-value
Intercept	0.975		7.108	0.00
Research and development	0.370	0.446	6.681	0.00
Cooperation	0.249	0.300	3.685	0.00
Organizational entrepreneurship	0.143	0.173	2.178	0.031

The results of t-value for three components of open innovation are statistically meaningful when the level of significance is five percent. Adjusted R-square is equal to 0.735, which means there independent variables including research and development, cooperation and organizational entrepreneurship approximately describe 74% of the changes on dependent variable. In addition, F-value is equal to 166.889 with P-value = 0.000. This means that there was linear relationship between independent variables and dependent variable. Fig. 1 shows the summary of our findings.

**Fig. 1.** The summary of our findings

Based on the results of Fig. 1, research and development is number one influential factor followed by cooperation and organizational entrepreneurship factors.

4. Conclusion

In this paper, we have presented an empirical investigation to study the effects of open innovation on supply chain behavior. The study has adopted well established questionnaires in the literature to examine five hypotheses of the survey. The results of our investigation have indicated that research and development has been number one influential factor followed by cooperation and organizational entrepreneurship factors. The results of our survey are consistent with findings of other studies (Cachon and Lariviere, 1999; Enkel et al., 2009; Mazzocchi et al., 2004).

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