

UNDERSTANDING IT PROFESSIONALS' ATTITUDES IN OPEN INNOVATION PROCESSES: AN EMPIRICAL STUDY

Completed Research Paper

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Abstract

Recently, an innovation paradigm is shifting from a closed to an open innovation model, characterized by the use of purposive inflows and outflows of knowledge not only to accelerate internal innovation but also to expand the markets for external use of innovation. However, the Not-Invented-Here (NIH), and Not-Sold-Here (NSH) or Only-Use-Here (OUH) syndromes are the most commonly faced problems in open innovation processes. Therefore, the aim of this study is not only to identify the factors that influence NIH and NSH/OUH attitudes in open innovation processes based on motivation theory with perceived organizational fairness and commitment, but also to investigate their impacts on NIH and NSH/OUH attitudes through an empirical research. The research model was analyzed with Visual PLS using survey data collected from IT professionals in Korea. The findings indicated that IT professionals' perceived organizational fairness is negatively affected to NIH attitudes in open innovation process.

Keywords: Open Innovation, Not-Invented-Here (NIH), Not-Sold-Here (NSH), Only-Use-Here (OUH)

Introduction

As the business environment rapidly changes, product or service life cycles get shorter. Also, R&D investment performance has declined because of increasing technology development costs and the shortening of product life. In other words, for several reasons (e.g., stronger global competition, increased technological complexity, and greater availability and mobility of highly skilled R&D personnel), the “do-it-yourself” principle of closed innovation is not sustainable in many industries these days. In response, many companies and researchers are doing a variety of efforts to help come up with answers to this phenomenon. They have realized that valuable ideas and technologies do not need to originate within one’s own firm, and that presenting them to the market does not have to rely on the firm’s own activities. To generate radical innovations or build new businesses, firms often depend on external knowledge sources (Amesse and Cohendet 2001; Dyer and Singh 1998; Lichtenthaler and Ernst 2006). Integrating external R&D sources is a pressing need that has prompted many firms to shift from using a closed innovation model to an open innovation model, which uses external ideas and knowledge (or technologies) in conjunction with internal R&D to achieve and sustain innovation (Chesbrough 2003b).

On the one hand, open innovation uses external and internal knowledge sources to accelerate internal innovation. On the other hand, it also uses external paths to markets for internal knowledge (Chesbrough et al. 2006). That is, open innovation is a holistic approach to innovation management. It is “systematically encouraging and exploring a wide range of internal and external sources for innovation opportunities, consciously integrating that exploration with firm capabilities and resources, and broadly exploiting those opportunities through multiple channels” (West and Gallagher 2006) (p. 320).

Chesbrough (2003b) described an innovation paradigm shift from a closed to an open innovation model, characterized by the use of purposive inflows and outflows of knowledge to both accelerate internal innovation and expand the markets for external use of innovation. Recently, numerous companies, such as IBM, Intel, and P&G, have started to adopt the concept of open innovation. However, despite the success of these firms, most companies still hesitate to adopt open innovation because they want to avoid problems that might hinder its successful execution in their organizations. Especially, employees from well-reputed, knowledge intensive organizations demonstrate blind faith in their own ability to generate the highest quality knowledge. Such attitudes can severely limit the infusion of new ideas into the organization and shortchange it with respect to innovation and the serendipitous success that open knowledge sharing organizations rely on for their competitive edge (O’Neill and Adya 2007). Actually, there are many barriers in companies’ attempts at executing the open innovation process, such as employees’ perceptions and attitudes toward knowledge transactions (i.e., inflows and outflows of knowledge), which are the most common problems. The Not-Invented-Here (NIH), and Not-Sold-Here (NSH) or Only-Use-Here (OUH) syndromes are the most commonly faced problems in open innovation processes (Chesbrough 2006). The **NIH syndrome** is defined as “an attitude to the external acquisition of knowledge that is more negative than an ideal economic attitude would be” (Lichtenthaler and Ernst 2006) (p. 375) or which had led researchers to reject any externally originated idea (Katz and Allen 1982). Whereas the **NSH** or the **OUH syndrome** is defined as “an attitude to the external exploitation of knowledge that is more negative than an ideal economic attitude would be” (Lichtenthaler and Ernst 2006) (p. 377). As Katz and Allen (1982) found that when research and development staff is inflicted with the NIH syndrome, performance suffers from insularity and failure to keep up with advances in wider scientific and industrial communities (Landau and Drori 2008).

In recent years, many researchers have studied about open innovation. However, most of them only understood its basic concepts (e.g., its characteristics, best practices, managerial challenges based on case studies) and the difference between closed and open innovations. Only a few studies try to understand what factors affect the NIH and the NSH/OUH attitudes (Lichtenthaler and Ernst 2006; Lichtenthaler et al. 2010). Furthermore, a few studies investigated those factors, but only tried to understand them in the organizational level. Although various research streams have contributed to research on open innovation and some of the different levels of analysis have been addressed in previous studies, the evolving debate is missing a key element, the people side of the equation (Herzog 2011). That is, with regard to the different levels of analysis related to open innovation, many have focused on the firm level. It means that the first level (i.e., the level of individuals) has not received much attention in previous studies on open innovation (Herzog 2011). However, the NIH and the NSH/OUH syndromes originate from the level of employees (individuals). Therefore, there is a need for a deeper understanding of the influencing factors in the individual level. In addition, according to behavioral studies, employees’ perceived fairness in an organization is an important factor which can affect their attitudes and behaviors, especially toward organizational changes.

Therefore, understanding the factors that influence NIH and NSH/OUH attitudes in an open innovation process based on employees' perceived fairness perspective is important.

Also, as previously mentioned, the business environment is rapidly changing especially in the Information Technology (IT) area, which is one of the most dynamic fields. As such, in this paper, we have focused on the NIH and the NSH/OUH attitudes and their influencing factors especially from the standpoint of IT professionals. IT professionals' NIH and NSH/OUH attitudes toward the open innovation processes can be mainly affected by their motivation in their organizations. Thus, ultimately, their attitudes may be the important key to the success of open innovation in their organizations.

Therefore, the objective of this study is not only to identify the factors that influence NIH and NSH/OUH attitudes in open innovation processes based on motivation theory, but also to investigate their impacts on NIH and NSH/OUH attitudes through an empirical research. The specific research questions are the following:

- **Research Question 1:** What are the factors that influence NIH and NSH/OUH attitudes in open innovation processes?
- **Research Question 2:** What are the relationships between the factors?

This paper is organized as follows. In the next section, we provide a literature review and a theoretical background on open innovation. Based on the literature review, we identify key factors to develop our research model and hypotheses. Then, we describe the research model and its hypotheses based on the previous section. After that, we describe the research methodology, including the measured items of each construct and the data collection methods. Using the collected data, we conduct an analysis and provide its results. Finally, we discuss the conclusion, contributions, and limitations of this research.

Theoretical Background

Open Innovation

Traditionally, industrial companies develop new technologies by themselves for their own products and/or services (Ahlstrom 2010; March 1991). Thus, most companies mainly pursue closed innovation strategies, meaning limited interactions with the outside environment or sources. In recent decades, these strategies have begun to change as firms across industries have increasingly acquired external technologies to complement their internal knowledge bases (e.g., by means of strategic alliances or in-licensing, which involves acquiring the right to use external knowledge) (Beamish and Lupton 2009; Cassiman and Veugelers 2006; Teece 1986; Von Hippel and Von Hippel 1988). A similar development has been observed recently in the areas of knowledge exploration and exploitation. Firms across industries have started to actively commercialize their technological knowledge, either exclusively or in addition to using it internally for their own products through out-licensing or strategic alliances, where firms allow external partners to use some of their own technology. On this basis, firms may achieve monetary benefits (e.g., licensing revenues) and non-monetary benefits (e.g., access to external technology through cross-licensing) (Gassmann 2006; Grindley and Teece 1997).

Henry Chesbrough used the term "open innovation" (Chesbrough 2003b) to describe innovation processes in which firms interact extensively with their environment, leading to a significant amount of external knowledge exploration and exploitation (Chesbrough 2003b; Van De Vrande et al. 2006). According to Chesbrough et al. (2006), open innovation is defined as "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively" (p.1). That is, open innovation emphasizes that companies should use more external ideas, technologies, and knowledge in their own businesses while letting their unused ideas to be used by other companies. This requires each company to open up its business model to let more internal knowledge flow to the outside. Open innovation offers the prospect of lower costs for innovation, faster time in going to the market, and the chance to share risks with others (Chesbrough 2006). Effectively bringing ideas from the "outside in" taps into tremendous potentials for identifying and creating new values. Likewise, companies that move ideas from the "inside out", enabling others to use unused ideas, realize a new way of capturing more values and sustaining themselves in these times of increasing global market competition (Chesbrough 2006). The

underlying assumption of the closed innovation model is that “successful innovation requires control” (Chesbrough 2003b), while the basic assumption of the open innovation is the complementarity between internal and external knowledge (Chesbrough 2003a; Herzog 2011). The contrasting principles of closed and open innovations are summarized in Table 1 (Chesbrough 2003a; Chesbrough 2003b).

Table 1. Closed Innovation vs. Open Innovation (Chesbrough 2003a) (p. 38)	
Closed Innovation Principles	Open Innovation Principles
<ul style="list-style-type: none"> • The smart people in our field work for us. • To profit from R&D, we must discover, develop, and ship it. External R&D can create significant values. We need to keep internal R&D to ourselves. • If we discover it ourselves, we will get it to the market first. • If we are the first to commercialize an innovation, we will win. • If we create the most and the best ideas in the industry, we will win. • We should control our intellectual properties (IPs) so that our competitors do not profit from our ideas. 	<ul style="list-style-type: none"> • Not all of the smart people work for us so we must find and tap into the knowledge and the expertise of bright individuals outside our company. • External R&D can create significant values. Internal R&D is needed to claim some portion of those values. • We do not have to originate the research in order to profit from it. • Building a better business model is better than getting to the market first. • If we make the best use of internal and external ideas, we will win. • We should profit from others’ use of our IP, and we should buy others’ IP whenever it advances our own business model.

NIH and NSH/OUH in Open Innovation

Companies increasingly maintain knowledge outside their organizational boundaries over time, and this dynamic perspective points to inter-organizational relationships as an extension of firms’ internal knowledge bases (Grant and Baden Fuller 2004). Despite its growing importance, many companies still experience severe challenges in actively managing the processes of open innovation (Lichtenthaler 2008; Van de Vrande et al. 2009). That is, open innovation has its dark side as well. Yet, even successful firms have to overcome major challenges at the beginning of their open innovation initiatives (Laursen and Salter 2006), and there are major inter-firm differences on how open innovation is successfully managed. Embracing an open business model is not easy. There are significant barriers and costs that an open business model is likely to encounter in most companies. Behaviors, like the NIH syndrome, inhibit a company’s ability to search for external sources of ideas that could advance the business model. The NSH or the OUH syndrome keeps potentially valuable internal ideas bottled up inside a firm. Building and growing a strong innovation system requires overcoming this barrier (Chesbrough 2006). Table 2 summarizes the possible antecedents and the potential consequences of the NIH and the NSH/OUH syndromes.

Identifying Key Factors of NIH and NSH/OUH

Based on the in-depth literature review summarized in Table 2, we identified the important role of motivation theory that mainly used to explain human attitudes and behaviors (i.e., NIH and NSH/OUH in this paper) in prior studies. Most prior research mentioned that inadequate incentive systems and employees’ interactions with other people are important possible antecedents of NIH and NSH/OUH attitudes. According to behavioral literature in organizations including human resource management and psychology, the main reason of human’s attitudes and behaviors can be traced back to their motivation. Also, many prior studies which adopted the motivation theory showed that employees’ perceived commitment and their perceived fairness are important factors that can affect their attitudes and behaviors, especially regarding resistance or evasion in organizational changes.

All in all, based on the motivation theory and its related literature, we identified five major factors that can be used to answer our research questions - perceived organizational fairness (including four types of fairness: distributive, procedural, interpersonal, and informational fairness), motivation (including two types of motivation: intrinsic and extrinsic motivation), perceived organizational commitment (including three types of commitment: affective, continuance, and normative), NIH, and NSH/OUH.

Table 2. Possible Antecedents and Consequences of NIH and OUH Syndromes

Syndrome	Definition	Possible antecedents	Potential consequences	Key Theories
Not-Invented-Here (NIH)	The NIH syndrome is defined as an attitude toward the external acquisition of knowledge that is more negative than an ideal economic attitude would be. (Lichtenthaler and Ernst 2006)	<ul style="list-style-type: none"> • Inadequate incentive systems • Influence of social environment • Aim to reduce insecurity (Katz and Allen 1982) 	<ul style="list-style-type: none"> • No or suboptimal use of external technology, resulting in inflexibility and preventing the realization of a firm's potentials • Failure to implement external technologies • Failures or delays in the innovation process (Katz and Allen 1982) • Inappropriate evaluations of external technology • Failure to identify new business ideas, which may result from a combination of internal and external knowledge. 	<ul style="list-style-type: none"> • Resource based view (Herzog 2011) • Motivation theory (Herzog 2011)
Not-Sold-Here (NSH)/ Only-Use-Here (OUH)	The NSH/OUH syndrome is defined as an attitude toward the external exploitation of knowledge that is more negative than an ideal economic attitude would be. (Lichtenthaler and Ernst 2006)	<ul style="list-style-type: none"> • Overemphasis on strengthening • Competitors and negatively affecting core competencies • Supposed legal and organizational difficulties of commercializing disembodied knowledge • Traditional focus on internal knowledge exploitation • No or little experience in external knowledge commercialization • Inadequate incentive systems • Influence of social environment 	<ul style="list-style-type: none"> • Underutilization of monetary and strategic potentials inherent to external knowledge commercialization • Underutilization of the intellectual property portfolio • Failure to establish own technologies as industry standards • Difficulties in gaining access to external knowledge (bi-directional knowledge transfers) 	<ul style="list-style-type: none"> • Resource based view (Herzog 2011) • Dynamic capability (Lichtenthaler et al. 2010) • Motivation theory (Herzog 2011)

Research Model and Hypotheses

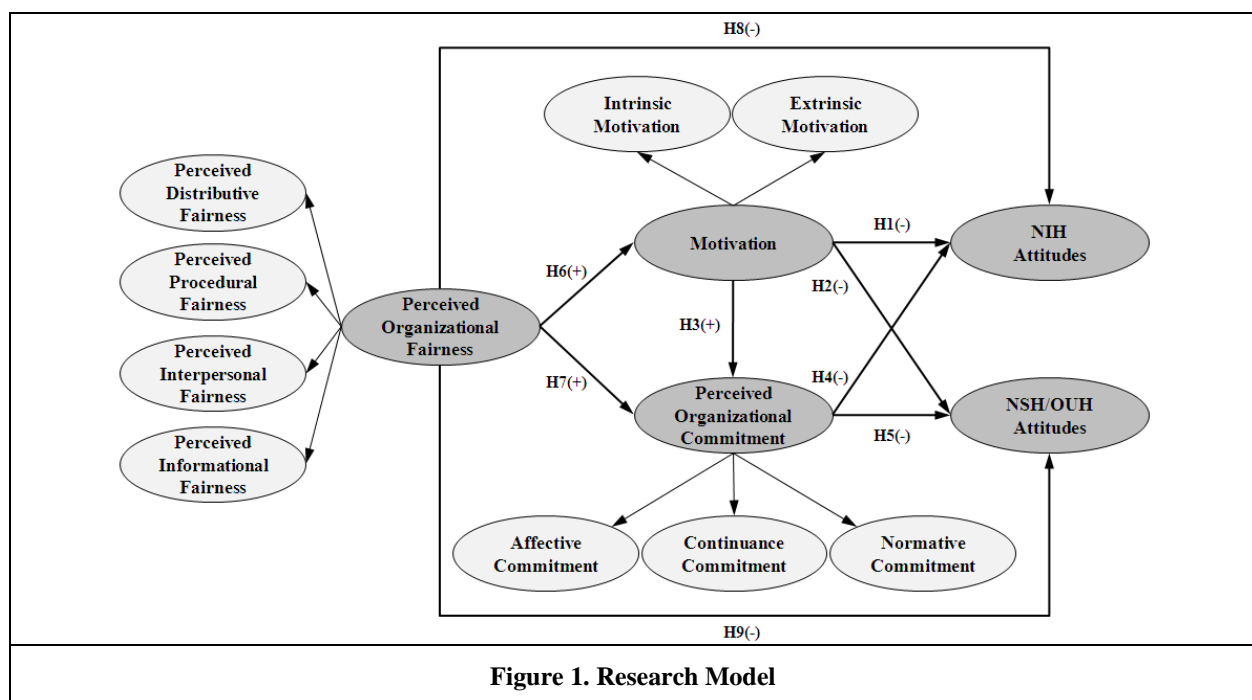
In this study, as discussed in the previous section, the organizational justice theory, the motivation theory, and the organizational commitment theory are applied to identify the factors that influence NIH and NSH/OUH attitudes in the open innovation process in the IT industry. As depicted in Figure 1, the research model is designed to study the relationships between the influencing factors and their impacts on NIH/OUH attitudes.

Motivation of Employees

In many companies, people lead or push innovations. Thus, companies often provide incentives or rewards to encourage their employees to be innovative. Regarding these, both *intrinsic* and *extrinsic* motivations have to be taken into account (Angle 1989). Intrinsic motivation can be defined as “the motivation to work on something because it is interesting, involving, exciting, satisfying, or personally challenging” (Amabile 1997) (p. 39). As such, intrinsic motivation drives self-initiated activities. Thus, high levels of intrinsic motivation are assumed to result in

high levels of spontaneous, innovative behaviors from innovation team members. Whereas intrinsic motivation has been demonstrated to play a crucial role in enhancing creativity and in innovative behavior, the role of extrinsic motivation has been discussed controversially. Extrinsic motivation is “the motivation to work primarily in response to something apart from the work itself” (Amabile et al. 1994) (p. 950). Goals outside specific work tasks are, for example, are meant to achieve a promised reward or position, or meet a deadline. Studies made by Amabile et al. (1996) showed that extrinsic motivators can undermine intrinsic motivation and, therefore, result in lower creativity. Extrinsic motivators have a detrimental effect on intrinsic motivation, wherein employees no longer work because of interest in the work, but to get a reward or recognition. This effect occurs primarily when work performed by employees is challenging and when they perceive that they do not have a choice on how to behave (Eisenberg 1999). Other scholars have argued that extrinsic motivators enhance any behavior when administered properly. However, Angle (1989) noted that providing powerful extrinsic incentives and rewards to trigger innovative behavior is not straightforward. The challenge is, on the one hand, to provide these incentives and rewards in a systematic and timely manner. On the other hand, these incentives and rewards must be valued by each individual employee. In here, this value can be interpreted as the employees’ perceived fairness by receiving incentives and rewards. Therefore, based on the harmony of intrinsic and extrinsic motivations, employees have a more positive attitude toward outside technology or knowledge sourcing. Thus, we hypothesize that

- H1: Employees’ motivation is negatively related to NIH attitudes (reduce NIH attitudes).*
H2: Employees’ motivation is negatively related to NSH/OUH attitudes (reduce NSH/OUH attitudes).
H3: Employees’ motivation is positively related to perceived organizational commitment.



Organizational Commitment

Organizational commitment has been considered crucial in explaining employees’ attitudes and behaviors in organizations (Meyer and Allen 1991). According to Meyer and Allen (1991), organizational commitment is the degree of employees’ affective attachment to an organization. Based on past literature, they conceptualized commitment in three approaches and suggested a three-component framework on organizational commitment, namely, *affective*, *continuance*, and *normative commitment*. “Affective commitment refers to the employee’s emotional attachment to, identification with, and involvement in the organization. Continuance commitment refers to an awareness of the costs associated with leaving the organization. Normative commitment reflects a feeling of obligation to continue employment” (Meyer and Allen 1991, p.67). These organizational commitments can affect

employees' attitudes and behaviors, and have an interaction with employees' motivation. According to prior studies, organizational commitment affects the level of internal resistance or avoidance from innovation. Also, employees' strong attachment to an organization leads to attitudes that are centered on the organization, which might lead to a greater degree of NIH and NSH/OUH. Thus, we hypothesize that

H4: Perceived organizational commitment is negatively related to NIH attitudes (reduce NIH attitudes).

H5: Perceived organizational commitment is negatively related to NSH/OUH attitudes (reduce NSH/OUH attitudes).

Organizational Fairness

Studies on the organizational justice theory started with Adams(1963)'s Equity Theory (Cohen-Charash and Spector 2001). After the Equity Theory came out, researchers tried to expand its application, applying the same to help understand employees' attitudes toward and behaviors in organizations. As a result, studies, called "organizational justice", were conducted (Greenberg 1987). Basically, there are three types of justice in an organization. The first is *distributive justice*. Based on Adams's Equity Theory (Adams 1963) in the early 1960s, which focuses on perceived fairness in outcome distribution in an organization. According to Greenberg (1990), distributive justice involves employee assessments of fairness of rewards and inducements received in exchange for contributions at work. Prior research and theory on social exchange and distributive justice suggest that when employees receive inducements that are commensurate with their knowledge, skills, and abilities, they are more likely to think that their outcomes, such as pay, benefits, and terms of work, are fair and just. In contrast, if employees feel that outcomes are not congruent with their human capital, they will make lower distributive justice judgments (Ang et al. 2003). The second is *procedural justice*, which was introduced in the 1970s. It focuses on perceived fairness in procedure and in related institutional systems for output distribution in an organization. Procedural justice involves employee assessments of the extent to which decisions are based on fair methods and guidelines. In other words, employees evaluate the extent to which they feel processes used to make decisions that influence them are just (Niehoff and Moorman 1993). Prior research and theory on social exchange and procedural justice suggest that when organizational decision-making is consistent and meets the bias suppression rule, employees have positive assessments of procedural justice. In contrast, when decision-making processes apply differently to employees, procedural justice judgments of those affected are lower (Ang et al. 2003). The last is *interactional justice*, which was introduced in the 1980s. It focuses on perceived fairness in interaction in the procedure and in related institutional systems in an organization. Some researchers emphasize that interactional justice should be divided in two perspectives, namely, *interpersonal justice* and *informational justice* (Colquitt 2001). *Interpersonal justice* focuses on how treatment is considered fair in interpersonal relationships, especially in the execution of decisions, while *informational justice* focuses on how a decision maker provides correct and adequate information about the decision-making process and its results. In this research, we applied distributive justice, procedural justice, interpersonal justice, and informational justice as elements (or constructs) of employees' perceived fairness in organizations to understand the NIH and the NSH/OUH attitudes in an open innovation process.

The context in which an open innovation approach is presented within a company affects the level of internal resistance. Firms can adopt a more externally oriented technology strategy after an internally oriented strategy is widely considered as a failure. For this failure to be perceived, a significant downsizing of R&D staff is usually required (Chesbrough 2006). Also, according to behavioral research, employees' perceived fairness in an organization is an important factor, which can affect their attitudes and behaviors, especially toward organizational changes. Therefore, understanding the influencing factors to NIH and OUH attitudes in an open innovation process from the organizational justice perspective is important. Thus, we hypothesize that

H6: Perceived organizational fairness is positively related to employees' motivation.

H7: Perceived organizational fairness is positively related to perceived organizational commitment.

H8: Perceived organizational fairness negatively related to NIH attitudes (reduce NIH attitudes).

H9: Perceived organizational fairness negatively related to NSH/OUH attitudes (reduce NSH/OUH attitudes).

Research Methodology

Measures

In this paper, the following constructs are involved: perceived organizational fairness (perceived distributive fairness, perceived procedural fairness, perceived interpersonal fairness, and perceived informational fairness), motivation (intrinsic motivation and extrinsic motivation), perceived organizational commitment (affective commitment, continuance commitment, and normative commitment), NIH attitude, and NSH/OUH attitude. The measurement items of each construct were developed using relevant literature. However, we modified or added some items to make them more appropriate for this study. For NIH and NSH/OUH attitudes, we developed measures by converting the definitions of constructs. Perceived organizational fairness, motivation, and perceived organizational commitment were considered as second-order factors. All measures used, including operational definitions and related references, are summarized in Appendix. All items are measured on a seven-point Likert scale, ranging from strongly disagree (1) to strongly agree (7).

Data Collection

This study used a field survey to test our proposed hypotheses. The unit of analysis is individual company employees. Empirical data for this study were collected via an online survey of IT professionals in Korea who have experience in IT services or IT related projects. In Total, 72 responses were received. There were no missing data and outliers, so all responses were used in the final analysis. The demographic characteristics of the respondents are summarized in Table 3.

Table 3. Demographic Characteristics		
Characteristic	Frequency	Percentage (%)
Gender: Male / Female	59 / 13	81.9 / 18.1
Position		
- Executive	1	1.4
- General manager	2	2.8
- Deputy general manager	8	11.1
- Manager	16	22.2
- Assistant manager	24	33.3
- Senior staff	3	4.2
- Staff/Clerk	18	25.0
Working experience (year)	N/A	Average 6.4
Industry		
- IT/Information system	52	72.2
- Telecom (e.g., SK, KT, LGT)	6	8.3
- Electronics	4	5.6
- Public affairs/Public corporation	4	5.6
- Distribution	2	2.8
- Broadcast/Press/Media	1	1.4
- Bank/Finance	1	1.4
- Shipbuilding/Automobile	1	1.4
- Others	1	1.4

Data Analysis and Results

Analysis Method

Two-stage structural equation modeling was applied to examine our proposed models and hypotheses, as recommended by Anderson and Gerbing (Anderson and Gerbing 1988). In the first step, the measurement model

was examined to ensure the reliability and the validity of the measures taken. The second step tested the structural relationships among latent constructs.

Measurement Model

Confirmatory Factor Analysis (CFA) was applied to assess construct validity with Visual PLS not only because we had a small sample size to analyze (i.e., we did not have enough sample size to enable the use of covariance-based analysis tools, such as LISREL) but also because our model included three second-order factors (i.e., perceived organizational fairness, motivation, and perceived organizational commitment).

To validate the measurement model, three types of validity were assessed, namely, content validity, convergent validity, and discriminant validity of the instrument. The instrument's content validity was first established to ensure that the measurement items were consistent with reports in literature. Convergent validity was then assessed by looking at the Composite Reliability (CR) and the Average Variance Extracted (AVE) from the measures (Hair et al. 2009). Convergent validity of the scales was verified using three criteria suggested by Fornell and Larcker (1981), that is, (1) all indicator loadings should be significant and should exceed 0.7, (2) construct reliabilities (i.e., CR of the constructs) should exceed 0.7, and (3) AVE of each construct should exceed the variance because of the measurement error for that construct (i.e., AVE should exceed 0.5). In the current model, all loadings were above the 0.7 threshold in Table 4. During the process, NI4 and NI5 (i.e., items for NIH attitudes) were removed because of cross-loadings. Also, CC (i.e. continuance commitment for perceived organizational commitment) was removed because of low loading values. As shown in Table 5, the CR of the constructs ranged between 0.830 and 0.913, while AVE ranged between 0.604 and 0.779. Hence, all three conditions for convergent validity were met.

Table 4. Factor Structure Matrix of Loadings and Cross-Loadings

	MT	OF	NIH	NSH	OC
IM	0.925	0.495	0.186	0.067	0.547
EM	0.755	0.354	0.113	0.024	0.252
DF	0.374	0.685	-0.056	0.153	0.486
PF	0.346	0.823	-0.155	-0.119	0.287
AF	0.373	0.713	0.014	0.073	0.419
IF	0.475	0.873	-0.266	0.021	0.378
NI1	0.102	-0.275	0.920	0.030	0.020
NI2	0.211	-0.094	0.935	0.199	0.226
NI3	0.202	0.038	0.784	0.063	0.165
NS1	0.146	0.085	0.124	0.732	0.211
NS2	0.038	0.013	0.076	0.862	0.231
NS3	-0.010	0.046	0.096	0.861	0.225
AC	0.582	0.531	0.122	0.206	0.924
NC	0.224	0.323	0.138	0.283	0.792

*MT=motivation; OF=perceived organizational fairness; NIH=NIH attitudes; NSH=NSH/OUH attitudes; OC=perceived organizational commitment; IM=intrinsic motivation; EM=extrinsic motivation; DF=perceived distributive fairness; PF=perceived procedural fairness; AF=perceived interpersonal fairness; IF=perceived informational fairness; NI=NIH attitudes; NS=NSH/OUH attitudes; AC=affective commitment; NC=normative commitment

Table 5. Reliability and AVE

Construct	CR	AVE	Cronbach Alpha
MT	0.830	0.712	0.619
OF	0.858	0.604	0.777
NIH	0.913	0.779	0.861
NSH	0.860	0.674	0.759
OC	0.850	0.740	0.664

*CR=composite reliability; AVE=average variance extracted; MT=motivation; OF=perceived organizational fairness; NIH=NIH attitudes; NSH=NSH/OUH attitudes; OC=perceived organizational commitment

Finally, discriminant validity of the instrument was assessed by comparing the square root of AVE of the construct and the correlation shared between the construct and the other constructs in the model (Fornell and Larcker 1981).

Table 6 lists the correlations among the latent variables, with the square root of the AVE on the diagonal. Results revealed that the square root of AVE for each construct was greater than the correlations between each construct and all the other constructs. Multicollinearity for all variables was examined using the Variance Inflation Factor (VIF). According to Myers (1990), when the VIF is greater than 10, the model built is considered to have a multicollinearity problem. Our results showed acceptable values of VIF, which were all under 3.0. Hence, results of the inter-construct correlations confirmed that each construct shared a larger variance with its own measures than with other measures. These results suggest that the measurement models fit the data well and merit further analysis.

Table 6. Correlation of Latent Variables					
	MT	OF	NIH	NSH	OC
MT	0.844				
OF	0.514	0.777			
NIH	0.185	-0.154	0.883		
NSH	0.060	0.053	0.116	0.821	
OC	0.508	0.516	0.147	0.270	0.860

* The shaded numbers on the diagonal are the square roots of the AVE

Structural Model

The structural model reflecting the causal relationships among the constructs was tested using data collected from the validated measures. Figure 2 displays the results of the proposed model. Based on the results of the data analysis, we found that IT professionals' perceived organizational fairness is the key factor which can reduce NIH attitudes (i.e., negative attitudes toward technology- and knowledge- or idea- sourcing from the outside).

As shown in Figure 2, the effect of motivation on perceived organizational commitment was significant, which supports H3. The effect of perceived organizational fairness on motivation and perceived organizational commitment was statistically significant, providing support for H6 and H7. Also, perceived organizational fairness explains 26.4% of variance in motivation, and perceived organizational fairness and motivation together explain 34.6% of variance in perceived organizational commitment. We found that perceived organizational fairness was significantly related to NIH attitudes. Thus, the result supports H8.

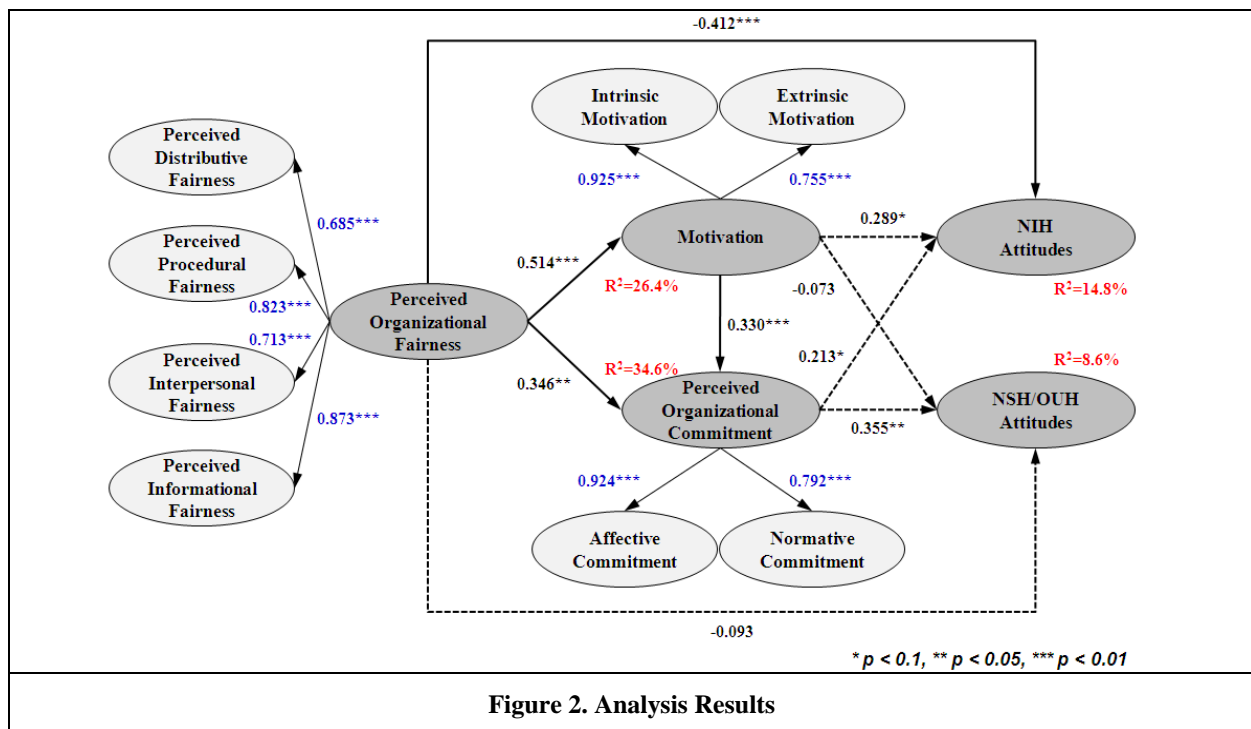


Figure 2. Analysis Results

Although the effect of motivation on NIH attitudes was statistically significant, the result shows positive effect; thus H1 was not supported. Also, motivation was not significantly related to NSH/OUH attitudes, indicating the lack of support for H2. In addition, the effect of perceived organizational commitment on NIH attitudes and NSH/OUH attitudes was statistically significant, however the results show positive effect, contradicting H4 and H5. Perceived organizational fairness had no effect on NSH/OUH attitudes, so H9 is not supported. However, three factors including opposite direction effects (i.e., perceived organizational fairness, motivation, and perceived organizational commitment) explain 14.8% of variation of NIH attitudes. Although perceived organizational commitment had a positive effect on NSH/OUH, it explains 8.6% of variation in NSH/OUH attitudes.

Since the results show that perceived organizational fairness of IT professionals in open innovation processes is negatively related to NIH attitudes, we conducted an additional model analysis to see the effects of perceived distributive fairness, perceived procedural fairness, perceived interpersonal fairness, and perceived informational fairness on NIH and NSH/OUH. We found that perceived informational fairness is the key factor which can reduce NIH attitudes. That is, perceived informational fairness of IT professionals in organizations is negatively related to NIH attitudes. If IT professionals perceive that they have enough information regarding their work, they are more generous toward technology- and knowledge- (or idea-) sourcing from the outside. Also, the results show that perceived procedural fairness of IT professionals in organizations is the factor which can reduce NSH/OUH attitudes (i.e., negative attitudes toward technology and knowledge or idea exploitation). If IT professionals perceive that they have enough rights appropriate procedures in their work, they are more generous toward technology- and knowledge- (or idea-) exploitation.

Discussion and Conclusion

A summary of the findings is shown in Table 7. Based on the results and analysis interpretation, for open innovation to succeed, executives in organizations who make decisions concerning open innovation should first consider IT professionals' perceived fairness in an organization. Especially in open innovation processes, executives have to provide enough information and appropriate processes or procedures for IT professionals to be able to do their jobs properly.

Table 7. Summary of Results	
Hypotheses	Results
H1: Employees' motivation is negatively related to NIH attitudes (reduce NIH attitudes).	Not Supported
H2: Employees' motivation is negatively related to NSH/OUH attitudes (reduce NSH/OUH attitudes).	Not Supported
H3: Employees' motivation is positively related to perceived organizational commitment.	Supported
H4: Perceived organizational commitment is negatively related to NIH attitudes (reduce NIH attitudes).	Not Supported
H5: Perceived organizational commitment is negatively related to NSH/OUH attitudes (reduce NSH/OUH attitudes).	Not Supported
H6: Perceived organizational fairness is positively related to employees' motivation.	Supported
H7: Perceived organizational fairness is positively related to perceived organizational commitment.	Supported
H8: Perceived organizational fairness negatively related to NIH attitudes (reduce NIH attitudes).	Supported
H9: Perceived organizational fairness negatively related to NSH/OUH attitudes (reduce NSH/OUH attitudes).	Not Supported

This study makes the following contributions to both IT research and practice. For IT research, this study suggests possible ways for successful open innovation by understanding the factors that influence NIH and OUH syndromes. In addition, this study is an empirical research; thus, it has more external validity than case studies. Also, in this study, we tried to conceptualize and develop measures based on the motivation theory. Therefore, this study extends the theory to the MIS research field in general and to open innovation in particular. Especially, in the situation that many researchers are conducting studies about four types of organizational fairness (i.e., distributive, procedural, interpersonal, and informational fairness) and their impacts on employees' attitudes and behaviors (Colquitt et al.

2001; Kernan and Hanges 2002; Roch and Shanock 2006), more diverse perspectives about the consequences of organizational fairness are needed. In this perspective, this study has the theoretical contributions. For IT practice, this study provides valuable insights to organizations (i.e., it can help understand which factors affect the NIH and the NSH/OUH attitudes for successful open innovation) and help them develop their own innovation strategy. For example, since we found that perceived organizational fairness has a direct effect on NIH attitudes, it may be better for organizations to focus mainly on organization fairness, rather than motivation and commitment, to have more successful open innovations.

However, this study also has a few limitations. In this study, motivation refers to intrinsic and extrinsic motivations to work with IT professionals rather than to work with external parties. That is, we do not consider the situation IT professionals' work with external parties. We think that it is probably why H1 and H2 were not supported by our analysis results. Therefore, it is necessary to understand motivations to work with external parties in open innovation processes in future research. Also, we used the convenient sampling method (i.e., snowball sampling), and tested our proposed model using only 72 responses (small data set). In future research, it needs to collect enough data sets for more precise analysis and interpretation of the results of this study. Finally, the proposed constructs in this study show around 10% explanation power on NIH and NSH/OUH attitudes. Therefore, it needs to find more factors in future research.

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Appendix: Measurement Items			
Construct	Definition	Items	Key References
Perceived Organizational Fairness	Perceived Distributive Fairness	<ol style="list-style-type: none"> 1. When considering the responsibility of doing a task, I consider performance compensation to have been executed fairly. 2. When considering my experience and career, I consider performance compensation to have been executed fairly. 3. When considering a task, which I accomplished successfully, I consider performance compensation to have been executed fairly. 4. When considering the degree of effort I placed on a particular task, I consider performance compensation to have been executed fairly. 	(Colquitt 2001)
	Perceived Procedural Fairness	<ol style="list-style-type: none"> 1. When I do a job, I can make consistent decisions because of standardization in decision-making procedures. 2. When I do a job, I can collect accurate data that are needed in decision making. 3. When I do a job, I receive useful feedback on decision making and on the execution of my work. 4. When I do a job, I take the opportunity to give an opinion or make an objection. 	(Colquitt 2001)
	Perceived Interpersonal Fairness	<ol style="list-style-type: none"> 1. When I do a job, my opinion is respected by my boss and by my junior and senior co-workers. 2. When I do a job, my boss and my junior and senior co-workers show consideration and interest. 3. When I do a job, I am treated by my boss and by my junior and senior co-workers kindly and considerately. 4. When I do a job, I am treated by my boss and by my junior and senior co-workers sincerely. 	(Colquitt 2001)
	Perceived Informational Fairness	<ol style="list-style-type: none"> 1. When I do a job, I receive a timely feedback. 2. When I do a job, I receive the appropriate information. 3. When I do a job, I receive the necessary information sufficiently. 	(Colquitt 2001)
Motivation	Intrinsic Motivation	<ol style="list-style-type: none"> 1. I feel happy and satisfied with my work. 2. I am motivated through my work. 3. I participate in my work positively. 	(Herzog 2011)
	Extrinsic Motivation	<ol style="list-style-type: none"> 1. When I get an opportunity to build my career or receive my salary, I become motivated. 2. When I receive recognition for my performance, I feel motivated. 3. When the company supports me for my abilities or expertise, I feel motivated. 	(Herzog 2011)
Perceived Organizational Commitment	Affective Commitment	<ol style="list-style-type: none"> 1. I sincerely consider the problem of company as my own. 2. I feel a strong sense of belongingness with the company. 3. I feel an emotional attachment to the company. 4. In this company, I feel like a member of a family. 	(Lee et al. 2001; Meyer and Allen 1991; Meyer et al. 1993)
	Continuance Commitment	<ol style="list-style-type: none"> 1. If I quit the company, I would suffer more losses than gains. 2. If I quit the company, I would lose many things, which is why I should not quit. 3. If I quit the company, I would be in trouble and lose so much. 4. If I leave the company, there would be few alternatives for me. 	(Lee et al. 2001; Meyer and Allen 1991; Meyer et al. 1993)
	Normative Commitment	<ol style="list-style-type: none"> 1. If I leave the company, I would feel guilty. 2. I deem it my duty to remain in the company. 3. Even if quitting the company is profitable for me, I think that 	(Lee et al. 2001; Meyer and Allen 1991;

		<p>it is not good.</p> <p>4. Even if I get a better offer from other companies, I think that leaving the company is not good.</p>	Meyer et al. 1993)
NIH Attitudes	<p>Degree of trust in one's own technological (knowledge) competence /</p> <p>An attitude toward the external acquisition of knowledge that is more negative than an ideal economic attitude would be (Lichtenthaler and Ernst 2006)</p>	<p>1. I prefer developing myself, such as my knowledge and expertise, rather than depend on experts or other companies.</p> <p>2. I prefer developing myself, such as my knowledge and expertise, which I need in dealing with other companies.</p> <p>3. Even if expertise or technology is not offered by another company, I can execute the task successfully.</p> <p>4. I do not feel comfortable soliciting expertise or technology from another company in doing my job.</p> <p>5. I feel that soliciting expertise or technology from another company affects my competitiveness.</p>	(Herzog 2011)
NSH (OUH) Attitudes	<p>Fear of losing control over technology (knowledge) /</p> <p>An attitude toward the external exploitation of knowledge that is more negative than an ideal economic attitude would be (Lichtenthaler and Ernst 2006)</p>	<p>1. If a task-related technology or idea is licensed or associated with outside vendors, I lose control over my own technology or idea.</p> <p>2. A task-related technology or idea must be used in my own company only.</p> <p>3. A task-related technology or idea must be licensed exclusively.</p> <p>4. Market expansion/sale of my task-related competitive technology or ideas should be sold through channels within our company rather than having the same licensed or made part of a partnership.</p>	(Herzog 2011)