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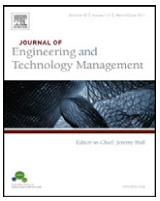

Understanding innovation performance and its antecedents: A socio-cognitive model

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ABSTRACT

Little attention in the previous literature has been paid to understanding employees' factors that drive customer development knowledge and performance from the perspective of social psychology. Drawing on social cognitive theory, this study validates a research model that examines the above issue. In the setting of new product development across high-tech firms in Taiwan, this study postulates that innovation self-efficacy, role conflict, and role ambiguity influence innovation performance directly and indirectly via the mediation of customer knowledge development and innovation outcome expectation. This study contributes to the social science literature by applying social cognitive theory to the rarely explored area of innovation performance and by presenting an operationalization of role stressors (i.e., role ambiguity and role conflict) in the area. Lastly, managerial implications and limitations from the empirical findings are provided.

Introduction

Global competition has changed the rules for managing the innovation function of business organizations (Fallah and Lechler, 2008). Companies competing in the worldwide market need to achieve significant innovation performance so that their products or services can be successful in the market (Fallah and Lechler, 2008; Chen, 2005). Innovation performance has been always a key concern for innovative firms. Innovation performance is defined as the extent to which a new product meets its financial and market goals in the marketplace (Rijsdijk et al., 2011). Metrics such as profitability,

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market share, and market growth rate have been widely used for measuring innovation performance (e.g., Agarwal et al., 2003; Joshi and Sharma, 2004; Rijsdijk et al., 2011). The previous literature (e.g., Chesbrough, 2003) suggests that innovative firms shift to an open innovation model, using a variety of external actors and sources to help them achieve and sustain innovation performance (Laursen and Salter, 2006). One of the major issues for innovation performance involves searching for customer knowledge that potentially has commercial value. Thus, many innovative organizations (characterized by an orientation toward creativity and innovative change, support for their members in functioning independently in the pursuit of new ideas) invest considerable amounts of time, money, and other resources in customer knowledge development (e.g., Laursen and Salter, 2006; Scott and Bruce, 1994). Such investment enhances the capability to apply and integrate customer knowledge to develop new products that suit the target customers. Composed of customer interaction process and learning process for employees, customer knowledge development is defined as an iterative process of developing an understanding of customer preferences via stages such as idea generation, concept refinement, product development, and product testing (Joshi and Sharma, 2004; Troy et al., 2001). Previous research indicates that customer knowledge development can significantly affect its innovation performance (Joshi and Sharma, 2004).

This study follows the concept of Joshi and Sharma (2004), who argue that customer knowledge development is a critical factor affecting innovative performance. Extending this concept, the study herein proposes the determinants of customer knowledge development in innovation contexts based on social cognitive theory (e.g., innovation self-efficacy). Self-efficacy in social cognitive theory refers to the ease or difficulty of performing a behavior for work-related performance, or the confidence in one's ability to perform the behavior (Cho et al., 2009; Stajkovic and Luthans, 1998). Innovative (or creative) endeavors require some internal, sustaining force that propels employees to persevere in the face of the challenges native to innovative work (Amabile, 1983; Bandura, 1997; Tierney and Farmer, 2002). Innovation self-efficacy (i.e., creative self-efficacy) providing such force or momentum with strong efficacy beliefs enhance the persistence level and the coping efforts employees will demonstrate when encountering challenging situations in the new product development (Tierney and Farmer, 2002). On the contrary, employees resisting engagement in their innovative behaviors when they have no efficacy beliefs in achieving the innovation (e.g., Ford, 1996) underscores the motivational relevance of self-efficacy for innovation (Tierney and Farmer, 2002). As such, social cognitive theory effectively explains employees' beliefs and faith about personal mastery and competence to increase performance in an explicit innovation context, and the resultant effects on behavior adjustment (Cho et al., 2009). The greater the confidence employees have about their ability to execute outcomes during innovation, the greater the probability of reaching their performance goals (Bandura, 1986). This is understandable because self-efficacy of employees will reinforce their positive behavior in the innovation process (Cho et al., 2009), consequently improving their innovation performance.

Social cognitive theory has proven helpful for understanding people's performance in academic learning (e.g., Pang and Cai, 2008), working (e.g., Martocchio and Judge, 1997), and using computer technologies (Cho et al., 2009; Compeau et al., 1999). Given the theory's focus on social and cognitive processes that govern human behavior, it can be useful for learning about employees' actions in dealing with the issues of customer knowledge and innovation performance. To the best of our understanding, social cognitive theory has been seldom used to study such issues (i.e., a research gap). As such, this study fills the research gap by building a model of customer knowledge development and innovation performance upon social cognitive theory. Little attention in previous research has been paid to explore what role customer knowledge development plays in social and cognitive processes to facilitate innovation performance, which is evaluated in this study.

In addition to social cognitive theory, this study further takes into account the role that stressors (i.e., role ambiguity and role conflict) play as two determinants of customer knowledge development and innovation performance. The previous literature that examines customer knowledge development and innovation performance has not yet included the role stressors of employees. Furthermore, in the previous literature, the influence of role stressors on performance has been controversial for decades (Tubre and Collins, 2000). First, meta-analyses of the role stressors and performance relationships in previous studies (e.g., Jackson and Schuler, 1985) were confined by small sample sizes

and sparse reporting of reliability estimates in primary studies (Tubre and Collins, 2000). Second, while some studies indicate the direct influence of the role stressors on performance, others suggest only that their indirect influence on performance exists (e.g., Beauchamp et al., 2002). This study complements previous studies by empirically testing both direct and indirect influences of role stressors on performance in innovation contexts.

Although factors such as role conflict, role ambiguity and self-efficacy have been respectively investigated in predicting job performance (e.g., Stajkovic and Luthans, 1998; Tubre and Collins, 2000), no previous study has considered them simultaneously in innovation issues from the perspective of customer knowledge development, which is tried herein by this research. For example, House and Rizzo (1972) discussed role conflict and ambiguity as critical variables in a model of job performance but there is no assessment regarding self-efficacy in the contexts of innovation or new product development. The goal of this research is to contribute to the knowledge of the relationship between innovation performance and its determinants (e.g., role conflict, role ambiguity and self-efficacy) by establishing and testing a model of the possible mediating processes (i.e., through customer knowledge development and innovation outcome expectation).

Collectively, in light of the aforementioned gap in the previous literature on innovation performance, this study provides important contributions for theoretical and practical reasons. Theoretically, the recent emergence of product innovation offers us a unique opportunity for building theories of customer-knowledge-oriented innovation, an increasingly relevant yet under-examined area of research. This study can help bridge the gap between customer knowledge development and social cognitive literature. From a practical standpoint, an improved understanding of the key determinants of innovation performance can help innovative organizations ward off negative effects caused by key antecedents in an effective manner.

Theory and research model

To build a research model of innovation performance (see Fig. 1), this study draws from key postulates and findings in social cognitive theory (Bandura, 2001). In this study's proposed model, innovation performance is influenced by innovation self-efficacy, role ambiguity, and role conflict directly and indirectly through the mediation of innovation outcome expectation and customer knowledge development. The rationales and justification about the model paths are provided in the following.

Social cognitive theory gives prominence to the concept of *self-efficacy*, which is defined as one's belief in his or her ability to perform a specific behavior (Bandura, 1997). In the innovation context, *innovation self-efficacy* can be defined as individuals' beliefs in their personal ability to develop target

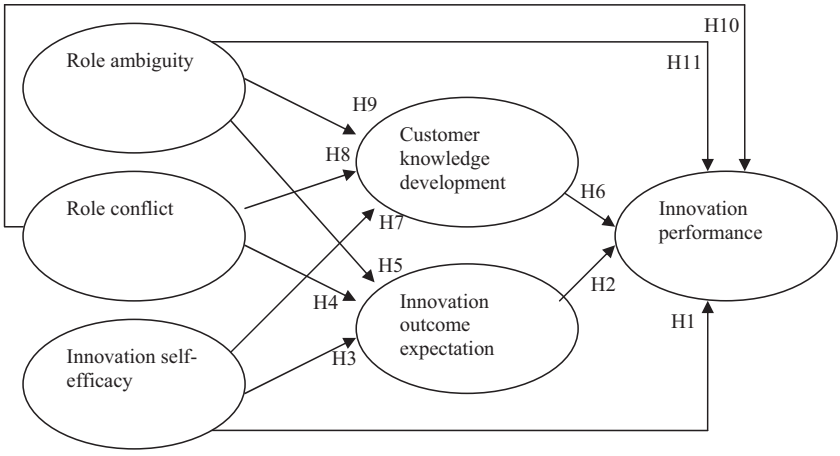

Fig. 1. Research model.

innovation. The notion of innovation self-efficacy suggests that one's anticipations of the positive outcomes of innovation development may not necessarily motivate a working behavior toward the innovation, unless such a person believes in having the ability to appropriately develop the target innovation. The previous literature suggests that if employees have very strong efficacy in learning, they are more likely to accept and apply learning tools that facilitate their innovation performance (Cho et al., 2009). Specifically, top managers with high self-efficacy are more active, attempt to proactively manage situations, and creatively solve problems as opposed to those with low self-efficacy (Tabak and Barr, 1999).

According to social cognitive theory, innovation self-efficacy plays an inevitable role in obtaining innovation performance. Self-efficacy is a motivational factor that influences employees' decision-making (Tabak and Barr, 1999). Employees with stronger self-efficacy are more likely to support or initiate innovative decisions and activities in the organization (Tabak and Barr, 1999). For that reason, employees with high self-efficacy about their capabilities of managing challenging innovative tasks are likely to achieve good innovation performance.

Self-efficacy is based on an individual's self-reflective capabilities, and strong beliefs in one's ability to conduct innovation development are likely to result in great levels of innovation performance (e.g., Bandura, 1986). Likewise, weak innovation self-efficacy beliefs are expected to cause negative effects on performance. This positive relationship between innovation self-efficacy and innovation performance has rarely been empirically validated in previous research. To complement previous research, this study develops the first hypothesis related to innovation self-efficacy as below.

H1. Innovation self-efficacy is positively related to innovation performance.

In addition to self-efficacy, the concept of self-evaluative outcome expectation is important to social cognitive theory (McAlister et al., 2008). Outcome expectation functions as the expectation that a given outcome is caused due to a particular behavior (McAlister et al., 2008). According to social cognitive theory, the expectation about self-evaluative outcomes can be more powerful than expectations about social and material outcomes for employees (McAlister et al., 2008). The postulation of this category of innovation outcome expectation helps explain how the innovation performance can be driven partly by employees' anticipation of how they feel about themselves to meet their own standards of approvable conduct in their new product development. Such rationale is rarely provided in the previous literature.

Social cognitive theory postulates that performance is the joint outcome of one's self-efficacy and his or her expectations of the outcomes (e.g., benefits). Most existing theories of innovation applications have focused on attitudes toward or outcome expectations for particular innovation (e.g., Compeau et al., 1999) and efficacy belief or actual abilities related to applying the innovation (e.g., technology self-efficacy) (Choi, 2004). In tradition, Bandura (1989) clarified that outcome expectation refers to the people's beliefs that there is a contingent relation between their action and the outcome of these actions (e.g., Seegers and Boekaerts, 1996). In the contexts of innovation and new product development, *innovation outcome expectations* are defined as judgments of or beliefs about the likely consequences of enacting specific working behaviors toward innovation development (Dickson, 1976; Ratten and Ratten, 2007). These beliefs are important, because people generally do not achieve a certain performance or perform a specific behavior unless incentive outcomes or positive results are expected from such behavior (Bandura, 2001). Given that innovation outcome expectation could fortify employees' behavior in the process of innovation (Pang and Cai, 2008), the performance is thus boosted. Hence, the hypothesis is derived as follows.

H2. Innovation outcome expectation is positively related to innovation performance.

In addition to the above associations, social cognitive theory postulates that self-efficacy influences one's perceptions of outcome expectations, because as Bandura (1978) states, "the outcomes one expects derive largely from judgments as to how well one can execute the requisite behavior" (p. 241). Since a person with low innovation self-efficacy will probably have less

likelihood of performing a given working behavior toward innovation and thereby have little chance of realizing the potential performance outcome of that behavior, he or she may view the target behavior as being less beneficial. That is to say, innovation self-efficacy is thus expected to affect innovation performance not only in a direct manner, but also indirectly, mediated by innovation outcome expectation. The positive association between self-efficacy and outcome expectation was empirically validated by Compeau et al. (1999) in their study of technology usage and is likely to also hold for innovation development herein. Therefore, this study states the hypothesis as below.

H3. Innovation self-efficacy is positively related to innovation outcome expectation.

Role stressors (i.e., role ambiguity and role conflict) have been widely examined across various areas such as organizational behavior (Boles and Babin, 1994), sales force management (Leigh et al., 2001), and innovation management (Gupta et al., 1986). While role ambiguity is defined as a lack of understanding and clarifying about job responsibilities and knowing what is expected in terms of employees' job performance (Ussahawanitchakit, 2008), role conflict is defined as the incompatibility (or conflicts) between one or more roles within an employee's role set (Hartline and Ferrell, 1996). With few exceptions (e.g., family firms) (Kellermanns and Eddleston, 2004), these two kinds of role stressors generally have a negative influence on outcome expectation in workplaces, which can be justified, respectively, in the followings.

When innovators perceive uncertainty about the expectations of different members (e.g., boss, customers) in their role set, such that fulfilling one role would make fulfilling the others more difficult (Chebat and Kollias, 2000) (i.e., high role conflict), they feel helpless due to the role conflict (e.g., Onyemah, 2008), eventually leading to their low level of outcome expectations. Specifically, when innovators perceive that they are unable to find a way to make every role partner satisfied (e.g., the demands of his or her boss and customers are incompatible) (e.g., Onyemah, 2008), their innovation outcome expectation is negatively affected (i.e., hopelessness for future outcomes). Thus, the hypothesis is derived as below.

H4. Role conflict is negatively related to innovation outcome expectation.

Role ambiguity represents the lack of clarity of role positions and expectations and the degree of uncertainty regarding the outcomes of one's role performance (Brief and Aldag, 1976). As role ambiguity increases, the ability of the employees to make accurate judgments decreases (Bagozzi, 1980), consequently resulting in a low level of outcome expectation in their job contexts of innovation. This is understandable because clear goal setting in people's job roles (i.e., a low level of role ambiguity) helps them pursue excellence and concentrate on attaining expected quality performance levels (Schunk, 1989; Smith, 2002). In the contexts of new product development, innovation outcome expectation is more likely strengthened if employees have a goal to strive for and are aware of what they can do (e.g., using their job position power) to achieve their goal. Therefore, the hypothesis about role ambiguity and innovation outcome expectation can be described as below.

H5. Role ambiguity is negatively related to innovation outcome expectation.

Social cognitive theory is concerned with explaining performance or behavioral outcomes, but does not provide some performance predictors that go beyond such individuals' beliefs as self-efficacy. Hence, this study draws from the knowledge management literature to examine the extent to which customer knowledge development (that which goes beyond individuals' beliefs) may affect innovation performance. Customer knowledge development facilitates a firm's efforts to produce a new product that successfully targets right customers, thus bringing about good profitability, market share, and market growth rate in the marketplace (i.e., innovation performance) (Rijsdijk et al., 2011). Such phenomenon suggests a positive relationship between customer knowledge development and innovation performance.

Traditionally, market research sheds light on what the customer knew and thought about a particular product, leading to valuable customer knowledge databases for marketing (Woodruff,

1997). To date, many enterprises emphasize on customer knowledge development during the innovation process since integrating customers' knowledge into new product development substantially improves innovation performance. Indeed, as innovation performance is the output of the customer knowledge development process, an understanding of customer knowledge (or preferences) is necessary for the creation of successful new products (Belbaly et al., 2007). Consequently, the relationship between customer knowledge development and innovation performance is derived as below.

H6. Customer knowledge development is positively related to innovation performance.

For knowledge developing practice, self-efficacy is important, because knowledge developing requires behavioral modification (Bandura, 1997). Employees' confidence about their capability of retrieving, combining, and assimilating customer knowledge in innovation contexts is an important factor that affects subsequent customer knowledge development (e.g., Pang and Cai, 2008). Note that innovation self-efficacy does not refer to employees' skills at performing specific innovation-related tasks, such as doing technological experiments, or setting an innovative formula. Instead, it assesses employees' judgment of their ability in a more encompassing mode, such as searching for innovation information (e.g., from customers or the Internet) or troubleshooting search problems (e.g., Adeyinka et al., 2007).

Whereas customer knowledge development for innovation is employees' behavior of developing their acquired knowledge from customers, innovation self-efficacy is a form of self-evaluation that impacts decisions about such behavior to undertake, the amount of effort and persistence to put forth when faced with difficulties, and eventually the mastery of the behavior (Hsu et al., 2007). Hence, employees with strong innovation self-efficacy are more likely to enact a behavior of developing and learning customer knowledge (e.g., Martocchio and Judge, 1997). Indeed, the previous literature indicates that self-efficacy has a significant impact on people's inclination to participate in voluntary knowledge developing or sharing (e.g., Bock and Kim, 2002; Pang and Cai, 2008). Consequently, the hypothesis about the influence of innovation self-efficacy on customer knowledge development is stated as below.

H7. Innovation self-efficacy is positively related to customer knowledge development.

Examining the negative effects of role ambiguity and role conflict, Kahn et al. (1964) indicate that boundary spanners (e.g., innovators, marketers, or vendors) interact with different role senders (e.g., co-workers) in many episodes (e.g., visits to customers, evaluation and feedback from customers) to obtain information, advice, assistance, direction, and knowledge from customers. Given the importance of such interaction, customer knowledge is unlikely developed under the case of substantial role ambiguity and role conflict – that is, when innovators perceive great role stressors (e.g., role ambiguity), they are likely to invest a lot of cognitive resources in seeking role clarification and reconciling conflicting demands (Onyemah, 2008). Nevertheless, since cognitive resources are limited, the resources allocated to clarifying responsibilities and reconciling demands cannot be invested in obtaining tasks such as developing customer knowledge and achieving customer satisfaction (via the interaction between innovators and customers) (e.g., Cohen and Wills, 1985; Nygaard and Dahlstrom, 2002). Thus, the negative influence of role stressors on customer knowledge development is presented as below.

H8. Role conflict is negatively related to customer knowledge development.

H9. Role ambiguity is negatively related to customer knowledge development.

The previous literature discusses how role stressors directly affect employees (Onyemah, 2008). For example, role ambiguity and role conflict are found to be negatively related to motivation and job performance (e.g., MacKenzie et al., 1998). Similarly, the correlation results in the previous literature show that role ambiguity and role conflict have significantly negative relations with sport performance and academic achievements (Abou et al., 2006). Given the above empirical validation for the negative relationship between role stressors and job performance, such a relationship is likely

to hold in the specific instance of innovation personnel as well. This expectation leads to our last two hypotheses below.

H10. Role conflict is negatively related to innovation performance.

H11. Role ambiguity is negatively related to innovation performance.

Methodology

Subjects and procedures

This study's proposed hypotheses were empirically tested using a survey of professionals across the R&D departments or project teams of innovation from high-tech firms in Taiwan. The personnel of high-tech firms were specifically recruited, because this population represents one of the largest groups of new production development and innovation in Taiwan and elsewhere. This study invited eight executive MBA students working professionally in high-tech firms to help with data collection. A total of 30 large IT firms in two science parks in Taipei and Hsinchu helped to provide access to their staff for our questionnaire survey. More specifically, these large firms were not start-up firms and had spent a positive amount of resources in their projects of collaborative new product development (NPD), which is defined as the product development activities performed jointly by a team and its potential customers. Such NPD is a common practice in high-tech firms in Taiwan to maintain their competitiveness in global competition by their strengthening customer knowledge development (e.g., Farrukh et al., 2003; Hung, 2004). Eventually, our target firms agreed to help us survey their staff who were familiar with NPD projects and various products introduced to the market, ensuring that our respondents had a broad view of the projects and consequently provided the valid information required in this study.

Of the 450 questionnaires distributed to the subjects, 302 usable questionnaires were returned for a response rate of 67.11%, containing 148 males (49.01%) and 154 females (50.99%). The good response rate is mainly due to the strong support of our sample firms in which their personnel departments helped trace the status of returned questionnaires. Whereas the sample contains 76 managers or supervisors (25.17%), it also reveals that 262 respondents (86.75%) have worked for their current organization for a year or more. A total of 132 respondents range between 20 and 29 years old (43.71%), while the other 170 respondents are older than 29 years old (56.29%). The correlation matrix of our data is presented in Appendix A.

This study uses four measures to reduce and detect common method bias. First, this study surveyed respondents without obtaining their names so as to reduce their suspicion or hesitation for factually filling out our questionnaire (i.e., anonymous survey). Second, this study originally inserted a few items unrelated to our constructs (e.g., how did they learn from co-workers), neutralizing the social desirability bias of the respondents (i.e., separation of scale items). Third, this study used tenure of respondents as the marker variable (Malhotra et al., 2006) since it is theoretically unrelated to constructs examined herein. After partial correlation adjustment, all significant zero-order correlations remained significant (i.e., use of a marker variable), suggesting that common method bias is not a fatal problem herein. Fourth, to test for the potential bias of common method variance, we conducted Harman's single factor test (Podsakoff and Organ, 1986). In our study, factor analysis extracted six factors explaining 19.26%, 17.74%, 17.44%, 16.03%, 15.74%, and 13.79% of the total variance. The lack of a single dominant factor explaining most of the variance indicates that potential common method bias is not a significant problem in our observed data.

Measures

The constructs in this study were measured using Likert-type scales adapted from the existing literature. Four steps were employed in choosing measurement items. To begin with, scale items in English from the existing literature were translated into Mandarin Chinese. The translated items were

then reworded to fit the contexts of innovation and customer knowledge development for R&D personnel by a focus group of five researchers (i.e., three graduate students and two professors) who were well-versed in innovation and organizational behavior research. This study further conducted two pilot tests with exploratory factor analysis to assess the quality of our measures and improve item readability and clarity. The focus group participants assessed the appropriateness of scale items and dropped them, if necessary, based on the pilot results. Lastly, the back-translation technique (Reynolds et al., 1993) was applied to examine a high degree of correspondence between the original and back-translated English questionnaires, assuring that this study's translation process did not introduce translation biases into our survey questionnaire.

Following the suggestion of Matsuno et al. (2002) to evaluate innovation performance in "competitive terms," this study applied the main competitor's new product performance as a reference point with which to compare the target company's new product performance on profitability, market share, market growth, and market attractiveness, which are popular metrics adopted for measuring innovation performance (Joshi and Sharma, 2004). Particularly, innovation performance was measured using four items modified from Joshi and Sharma (2004). Customer knowledge development was measured using four items drawn and also modified from Joshi and Sharma (2004). Innovation outcome expectation was measured using four items modified from Compeau et al. (1999), while innovation self-efficacy was measured using four items modified from Mosley et al. (2008). Finally, role conflict and role ambiguity were measured using four items, respectively, modified from Babin and Boles (1998). Appendix B presents all of our scale items.

Two pilot tests were conducted with 52 and 61 working professionals as subjects, respectively. Pilot test respondents were excluded from those in the subsequent actual survey. Subjects were asked to fill out the survey questionnaire and comment on any confusing item in the questionnaire. Besides, the pilot test data were subjected to exploratory factor analysis and reliability analysis to identify the measurement items that loaded poorly on their hypothesized scales, which were again worded or dropped. This iterative process of measurement refinement resulted in considerable improvement in scale validity and reliability. The results of exploratory factor analysis based on our second pilot dataset were presented in Appendix C. Although the factor loading for the fourth item of customer knowledge development was slightly lower than 0.60, it may be improved with a large sample size in our actual survey. Thus, this item was retained in our questionnaire. Meanwhile, the reliabilities for each construct in this pilot test were all larger than 0.70, confirming the acceptance of reliability for research instruments. Overall, our pilot tests showed that our scale items were appropriate for our actual survey.

Data analysis and results

The final survey data, with a sample size of 302 responses, were analyzed (with the CALIS procedural of SAS software) using a two-step structural equation modeling (SEM) approach proposed by Anderson and Gerbing (1988). CFA analysis was first done on all items corresponding to the six constructs measured in Liker-type scales. The second step examined the structural model for purposes of testing the hypotheses.

The goodness-of-fit of the CFA model was assessed using a variety of fit metrics, as shown in Table 1. The normalized chi-square (chi-square/degrees of freedom) of our CFA model was smaller than the recommended maximum of 3.0, the root mean square residual (RMR) was smaller than 0.05, the root mean square error of approximation (RMSEA) was smaller than 0.08, the comparative fit index (CFI) was greater than 0.90, the normed fit index (NFI) exceeded 0.90, and the non-normed fit index (NNFI) was greater than 0.90. The goodness of fit index (GFI) was slightly lower than the recommended value of 0.9. Collectively, these figures suggest that our hypothesized CFA model fit well with our empirical data (Bentler and Bonett, 1980).

Convergent validity was assessed using three criteria recommended by Fornell and Larcker (1981). First, as evident from the *t*-statistics listed in Table 1, all factor loadings statistically exceeded the required minimum of 0.60, the minimum needed to assure convergent validity of construct (Anderson and Gerbing, 1998). Second, the reliabilities for each construct exceeded 0.70, confirming the acceptance of reliability for research instruments. Third, the average variance extracted (AVE) for each

Table 1
Standardized loadings and reliabilities.

Construct	Indicators	Standardized loading	AVE	Cronbach's α
Innovation performance	IP1	0.82 (t=16.52)	0.62	0.86
	IP2	0.72 (t=13.57)		
	IP3	0.78 (t=15.28)		
	IP4	0.82 (t=16.28)		
Customer knowledge development	CKD1	0.78 (t=15.14)	0.61	0.86
	CKD2	0.87 (t=17.73)		
	CKD3	0.72 (t=13.72)		
	CKD4	0.75 (t=14.42)		
Innovation outcome expectation	IOE1	0.90 (t=19.46)	0.69	0.89
	IOE2	0.85 (t=17.87)		
	IOE3	0.80 (t=16.21)		
	IOE4	0.77 (t=15.35)		
Innovation self-efficacy	ISE1	0.90 (t=20.19)	0.80	0.94
	ISE2	0.90 (t=20.07)		
	ISE3	0.91 (t=20.38)		
	ISE4	0.88 (t=19.44)		
Role conflict	RC1	0.84 (t=17.37)	0.72	0.91
	RC2	0.85 (t=17.66)		
	RC3	0.85 (t=17.85)		
	RC4	0.86 (t=18.18)		
Role ambiguity	RA1	0.84 (t=17.35)	0.73	0.89
	RA2	0.94 (t=20.65)		
	RA3	0.78 (t=15.66)		

Goodness-of-fit indices (N=302): χ^2_{215}=504.40 (p-value<0.001); NNFI=0.93; NFI=0.90; CFI=0.94; GFI=0.88; RMR=0.03; RMSEA=0.07.
Note: An item was dropped from the model due to its poor loadings.

construct exceeded 0.50 (Fornell and Larcker, 1981), suggesting that the hypothesized items capture more variance in the underlying construct than that attributable to measurement error. Collectively, the empirical data of this study met all three criteria required to assure convergent validity.

Discriminant validity was detected by chi-square difference tests between an unconstrained model, where all constructs in our CFA model were allowed to co-vary freely with constrained models and where the covariance between each pair of constructs is fixed at one (Lin and Bhattacherjee, 2008). More specifically, this study's discriminant validity was assessed by chi-square difference tests based on the Bonferroni method, given that such a method is good in simultaneous pair-wise comparisons for the research constructs. Controlling for the experiment-wise error rate by our setting the overall significance level to 0.001, the critical value of the chi-square difference based on the Bonferroni method should be 15.89. In this study, chi-square difference statistics for all pairs of constructs exceeded this critical value of 15.89 (see Table 2), thus confirming good discriminant validity in the data herein. In summary, the above results suggest that instruments used for measuring the constructs of interest in this study were statistically adequate.

Structural model testing

This study transforms the above CFA model to a structural model that reflects the hypothesized relationships in our research model for testing of our hypotheses. To avoid unpredictable and systematic bias caused by individuals' demographic characteristics, four variables were included as control variables in our analysis: age in years, gender (0=female, 1=male), education, and position level (0=managers, 1=non-managers). The test results of our research model show that all the four control variables revealed insignificant main effects on innovation performance. Fig. 2 presents the empirical results of this analysis.

Table 2
Chi-square difference tests for examining discriminant validity.

Construct pair	χ^2_{215} = 504.40 (unconstrained model)	
	χ^2_{216} (constrained model)	χ^2 difference
(F1, F2)	868.66***	364.26
(F1, F3)	968.86***	464.46
(F1, F4)	1000.90***	496.50
(F1, F5)	1030.88***	526.48
(F1, F6)	1030.03***	525.63
(F2, F3)	975.81***	471.41
(F2, F4)	1010.72***	506.32
(F2, F5)	1034.24***	529.84
(F2, F6)	1044.67***	540.27
(F3, F4)	1221.93***	717.53
(F3, F5)	1241.43***	737.03
(F3, F6)	1014.34***	509.94
(F4, F5)	1646.31***	1141.91
(F4, F6)	1046.35***	541.95
(F5, F6)	1022.84***	518.44

F1 = innovation performance; F2 = customer knowledge development; F3 = innovation outcome expectation; F4 = innovation self-efficacy; F5 = role conflict; F6 = role ambiguity.
*** Significant at the 0.001 overall significance level using the Bonferroni method.

The empirical test results in Fig. 2 present that eight out of the eleven hypothesized relationships in our model were significant. First, innovation performance was significantly influenced by innovation self-efficacy ($\beta = 0.17$; $p < 0.01$) and innovation outcome expectation ($\beta = 0.18$; $p < 0.01$), thereby supporting H1 and H2. Innovation outcome expectation is significantly influenced by innovation self-efficacy ($\beta = 0.17$; $p < 0.01$) and role ambiguity ($\beta = -0.31$; $p < 0.01$) rather than by role conflict ($\beta = 0.03$; $p > 0.05$). As a result, H3 and H5 are supported, whereas H4 is not supported. Innovation performance is significantly influenced by customer knowledge development ($\beta = 0.38$; $p < 0.01$), thus supporting H6. Customer knowledge development is significantly influenced by innovation self-efficacy ($\beta = 0.27$; $p < 0.01$) and role ambiguity ($\beta = -0.15$; $p < 0.05$) rather than by role conflict ($\beta = 0.04$; $p > 0.05$). As a result, H7 and H9 are supported, whereas H8 is not supported. Lastly, innovation performance is significantly influenced by role conflict ($\beta = -0.15$; $p < 0.01$) rather than by role ambiguity ($\beta = -0.08$; $p > 0.05$), respectively, supporting H10 and not supporting H11.

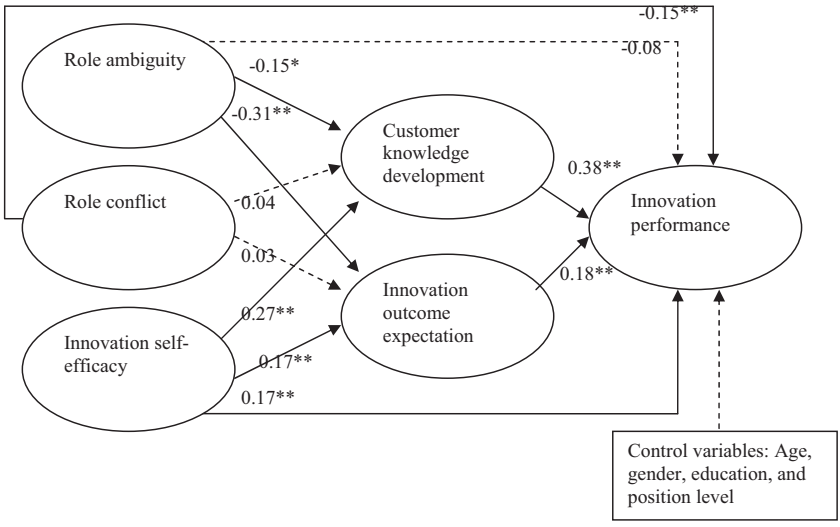

Fig. 2. Test results $^{*}p < 0.05$; $^{**}p < 0.01$.

To further confirm the mediation effects in the research model, this study conducted post hoc tests by controlling for customer knowledge development and innovation outcome expectation with our four control variables. The empirical results revealed that the significant and insignificant levels for all the model paths remain unchanged, confirming the full mediation effect for role ambiguity and the partial mediation effect for innovation self-efficacy.

Discussion

This research reports several findings of potential interest for innovation performance research in social psychology and organizational behavior. This study has provided an illustrative example of how social cognitive theory may be extended toward studying customer knowledge development and performance. Most previous models related to innovation have investigated organizational action and project characteristics as the independent variables of interest (e.g., Joshi and Sharma, 2004) without exploring the potential impact of individuals' role stressors or social cognition. The model of this study introduces antecedents beyond organizational action and project characteristics, substantially complementing the previous models. In this sense, the study herein helps expand the boundaries of extant innovation research by considering atypical role impacts on performance (e.g., role ambiguity) and by incorporating the research constructs from social cognitive theory within innovation research. Furthermore, the results provide some preliminary evidence of two mediators (i.e., customer knowledge development and innovation outcome expectation) – a nascent yet emerging area that bears tremendous potential for future research.

The unsupported H4, H8, and H11 are surprising and suggest that both role stressors (i.e., ambiguity and conflict) have effects on innovation performance through different model paths (e.g., direct paths or indirect paths). More specifically, role conflict has a direct effect on innovation performance rather than an indirect one through any mediator, suggesting that role conflict may be an explicit stressor with instant impacts on the performance of new product development. On the contrary, role ambiguity having an indirect effect on innovation performance through the two mediators (without any direct effect) suggests that role ambiguity may be an implicit stressor with gradual impacts on the performance of new product development. Nevertheless, the interesting test results for the unsupported hypotheses warrant further study, so that the true reasons behind the unsupported hypotheses are not misinterpreted.

This study demonstrates that social cognitive theory is applicable to understanding issues of innovation, just as it toward understanding usage issues of information technology in some previous studies (e.g., Compeau and Higgins, 1995). Given that social cognitive theory has received much less interest among innovation research compared to more popular research such as computer learning performance, this study provides an additional validation of this theory as a parsimonious yet powerful model of innovation and customer knowledge development.

The findings of this study bring on several implications for innovative firms. Specifically, management must understand what factors help improve performance directly or indirectly via our mediators. Our study finds that innovation self-efficacy is the most powerful factor having both direct and indirect effects on innovation performance, suggesting that management should not only design technical strategies to improve performance, but also provide users in need with educational programs that help improve their innovation self-efficacy. Such self-efficacy may be used and examined during the selection of employees for forming dynamic project teams. Once members have strong innovation self-efficacy, the possibility to achieve great performance can be enhanced.

Of the two predictors of role stressors, role conflict seems more directly influential than role ambiguity in damaging innovation performance. This phenomenon suggests that if managers perceive role stressors of employees, then they have to smooth their interorganizational communications among employees to avoid role conflict before taking role ambiguity into account. Once the role conflict is solved in a timely manner, management will win more time and resources in improving role ambiguity without great haste. Nevertheless, the negative effects of role stressors should be periodically measured among employees for managers' reference in conducting organizational reengineering.

The phenomenon regarding the direct effect of role conflict and the indirect effect of role ambiguity may have something to do with a firm's policy or its boundary spanning activity. Indeed, the previous

literature indicated that organization structure and supervisory style have little impact on the amount of role conflict employees perceive, while it was found that some aspects of supervisory policy might be useful in reducing the effect of role ambiguity (Walker et al., 1975). Similarly, another research on environmental uncertainty suggested that boundary spanning activity facilitated strong effects of role conflict, but it did not directly increase the effect of role ambiguity (Lysonski et al., 1988). Collectively, in the above examples, the direct influence of role conflict (rather than that of role ambiguity) on innovation performance is significantly strong.

In summary, those innovators striving for customer knowledge development and performance should keep in mind that increasing employees' self-confidence and clarifying their role in the firm are key points. Managers should avoid potential hydra-headed bureaucracy in their organization and make the firm function smoothly through frequent communication and by obtaining feedbacks from the employees regarding job role issues. Besides, a positive social impact this paper brings about is that customers in society should make a good use of their knowledge to play a critical role of co-producers in the innovation process, given that those firms efficiently developing customer knowledge are more likely to succeed in their innovation.

Limitations

The empirical results of this research should be interpreted in light of their limitations. First, since our study employs a sample from high-tech personnel in Taiwan, its findings may not precisely reflect the perceptions of similar groups in other countries due to cultural differences. The restricted nature of our sample suggests that any generalization of our findings to other cultural contexts should be made with caution.

The second limitation of our study is about language barriers between Chinese and English scale items. Note that this study surveys sample subjects in Chinese language, which is a language without either future or present tenses. For that reason, we may have ignored the issues of grammatical tenses in our English scale items, thus causing slight inconsistency across the English scale items for measuring different constructs. Nevertheless, due to our measurement refinement by our focus group and pilot tests repeatedly, our survey in Chinese is well acceptable.

The third limitation of our study is that there may be other predictors of customer knowledge development and innovation performance beyond self-efficacy, outcome expectation, and role stressors, which were together examined herein. For instance, individuals' satisfaction about their job may be an additional predictor of customer knowledge development. However, it may take future studies before such an inference is made. Besides, it is possible that role conflict may be a mediator between innovation performance and its exogenous factors, which could be verified in future research based on the theoretical literature view and discussion in depth. Given our theoretical focus on theories of social cognition and role stressors, we have limited our consideration of predictors of customer knowledge development and performance to those suggested by the theories, but future researchers are advised to consider other potential predictors and compare their explanatory ability to those examined in this study.

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Appendix A. Scale properties

Name	Inter-construct correlations[a]							
	Mean	Std	1	2	3	4	5	6
1. Innovation performance	2.36	0.60	*0.62*					
2. Customer knowledge development	3.82	0.61	0.43	*0.61*				
3. Innovation outcome expectation	3.99	0.65	0.35	0.31	*0.69*			
4. Role conflict	3.85	0.81	0.29	0.24	0.18	*0.80*		

Appendix A (*Continued*)

Name	Inter-construct correlations[a]							
	Mean	Std	1	2	3	4	5	6
5. Role ambiguity	2.75	0.88	−0.17	−0.01	−0.06	0.05	*0.72*	
6. Innovation self-efficacy	2.62	0.85	0.19	−0.12	−0.26	−0.01	0.24	*0.73*

[a] Diagonal elements (in italics) represent square root of AVE for that construct.

Appendix B. Measurement items

Innovation performance

Relative to our main competitor's new product, the performance of the new product developed by our firm is:

IP1. (a) Less profitable, (b) about equally profitable, (c) more profitable.
IP2. (a) Has a lower market share, (b) has about the same market share, (c) has a greater market share.
IP3. (a) Has a lower attractiveness to customers, (b) has about the same attractiveness to customers, (c) has a greater attractiveness to customers.
IP4. (a) Has a slower growth rate, (b) has about the same growth rate, (c) has a faster growth rate.

Customer knowledge development

CKD1. I went through lots of iterations based on customer feedback prior to launching the new product (or innovation) in the market.
CKD2. I developed and/or tested lots of new ideas over the course of my NPD process (or innovation).
CKD3. My NPD process (or innovation) involved numerous failed experiments.
CKD4. I learned about customer preferences as I worked with them through the new product iterations (or innovation iterations).

Innovation outcome expectation

If I continue striving toward innovation on the job,

IOE1. I expect I will be better organized.
IOE2. I expect I will increase my effectiveness on the job.
IOE3. I expect I will increase the quality of my job output.
IOE4. I expect I will increase the quantity of output for the same amount of effort.

Role conflict

RC1. I sometimes have to bend a rule or policy in order to carry out my job.
RC2. I receive incompatible requests from two or more people.
RC3. I do things that are apt to be accepted by one person and not accepted by others.
RC4. I receive assignments with inadequate resources and materials to execute them.

Role ambiguity

RA1. I feel uncertain about how much authority I have.
RA2. There are unclear, planned goals and objectives for my job.
RA3. The explanations are sometimes unclear as to what I have to do.
RA4. I am not sure what is exactly expected of me.

Innovation self-efficacy

ISE1. I am confident in meeting the quality demands of our NPD.
ISE2. I am confident in correcting the mistakes in our NPD.
ISE3. I am confident in maintaining performance of the NPD.
ISE4. I am confident in keeping up with the NPD pace of my firm.

Appendix C. Exploratory factor analysis of pilot test data

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
IP1	0.142	0.075	**0.859**	−0.091	−0.063	0.161
IP2	0.086	0.296	**0.622**	−0.035	−0.093	0.382
IP3	0.272	0.333	**0.707**	−0.093	−0.044	0.162
IP4	0.182	0.306	**0.780**	0.110	−0.294	−0.005
CKD1	0.031	0.249	0.350	−0.066	−0.060	**0.729**
CKD2	0.204	0.287	0.462	−0.003	0.020	**0.617**
CKD3	0.207	−0.015	0.035	0.065	0.048	**0.832**
CKD4	0.313	0.281	0.070	0.119	−0.295	**0.598**
IOE1	0.100	**0.769**	0.197	−0.039	−0.125	0.191
IOE2	0.034	**0.856**	0.224	−0.112	−0.140	0.093
IOE3	0.027	**0.851**	0.157	−0.011	−0.088	0.208
IOE4	0.087	**0.858**	0.152	−0.076	0.039	0.005
RC1	**0.878**	0.149	0.198	−0.006	−0.054	0.153
RC2	**0.870**	−0.042	0.189	0.130	0.016	0.078
RC3	**0.904**	0.029	0.127	0.030	0.101	0.129
RC4	**0.864**	0.126	0.046	−0.037	−0.061	0.143
RA1	−0.044	−0.101	−0.003	**0.769**	0.324	−0.009
RA2	0.062	−0.164	0.079	**0.673**	0.314	0.149
RA3	−0.029	0.079	−0.152	**0.878**	−0.007	0.110
RA4	0.125	−0.073	−0.009	**0.882**	0.069	−0.138
ISE1	−0.035	−0.032	−0.142	0.108	**0.912**	0.062
ISE2	−0.025	−0.190	−0.123	0.212	**0.866**	−0.028
ISE3	0.100	−0.030	−0.076	0.361	**0.725**	−0.263
Cronbach's α	0.86	0.80	0.89	0.92	0.85	0.87

Based on principal components technique with varimax rotation.
IP=innovation performance; CKD=customer knowledge development; IOE=innovation outcome expectation; RC=role conflict; RA=role ambiguity, ISE=innovation self-efficacy.

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