

The Relationship Between Team Diversity and New Product Performance: The Moderating Role of Organizational Slack

Chung-Jen Chen, Yung-Chang Hsiao, Mo-An Chu, and Kae-Kuen Hu

Abstract—The relationship between team diversity and new product performance is often assumed to be linear. This assumption has been challenged conceptually and empirically, but results to date have been inconsistent. This study examines this issue based on behavioral theory and social identity theory. The empirical results generally supported our expectations of the inverse U-shaped relationship between team diversity and new product performance. We also hypothesized and found that organizational slack moderated the curvilinear relationship between team diversity and new product performance. A questionnaire survey on 118 new product development projects in Taiwanese firms is collected to test the hypotheses. We conclude by discussing the managerial implications of these findings for the use of team composition to the new product projects in personnel selection.

Index Terms—New product development, organizational slack, team diversity.

I. INTRODUCTION

NEW PRODUCT development is widely recognized as an essential enabler for firms to sustain their competitive advantages in the volatile commercial environment [1]–[7]. However, in the current highly competitive marketplace, firms are under increasing pressure, such as the accelerating technology development, changing consumer preference, and shortening product life cycles, to successfully develop new products that are timely and responsive to customer needs [4]. Owing to its increasing importance and difficulties, a number of studies have paid attentions to investigate the determinants to the performance of the new product development but some of the results, such as in the team and organizational levels, are confusing and mixed. Therefore, this study is interested in reviewing and re-examining the effects of the team and organization level determinants on the new product development.

This study will pay attentions to the role of team-level determinants, specifically the team diversity, in the new product development. Prior studies have explored the impact of team

diversity on the performance of new product development but the results are mixed and inconsistent [8]–[11]. Some studies argue that team diversity is positively associated with the performance (see e.g., [4], [12]–[17]), while the other studies suggest the negative effect of the team diversity on the performance (see e.g., [3], [18]–[23]). These arguments imply that the team diversity may act as a “double-edged sword” [10] or “mixed blessing” [24] and that two forces, positive and negative, may govern the relationship between team diversity and new product performance. Accordingly, this study proposes that the team diversity would have a nonlinear effect on a new product performance from the perspectives of the behavioral theory and the social identity theory. Based on the behavioral theory, this study argues that the team diversity would foster the broader perspectives, generate innovative ideas, and evaluate the possible solutions to the problem in the new product development process. In line with previous research of team composition (see e.g., [25], [26], [11]), this study suggests that task-relevant information sharing—that is, the exchange, discussion, and integration of ideas, knowledge, and insights pertaining to assigned tasks—is the primary process, whereby diversity can exert positive effects on the subsequent performance of new products. On the other hand, from the viewpoint of the social identity theory, this study argues that the team diversity would result in adverse effects, such as the deficiencies of 4Cs (i.e., communication breakdowns, coordination costs, collaboration conflict, and consensus difficulties) in homogeneous teams. These potential negative effects of heterogeneity can disrupt task-relevant information sharing, and thus, impede performance (see [3], [26]–[28]).

The 4Cs model consists of four components—communication, coordination, collaboration, and cohesiveness [29]. These four components are interrelated, interdependent in an organizational setting, and vital in any organizational structure. This model uses its four components as reliable parameters in determining and measuring organizational effectiveness. This model is very simple, and is based on the assumption that only the four parameters (i.e., communication, coordination, collaboration, and cohesiveness) are sufficient to monitor and measure the organizational effectiveness. There are several number of interrelated factors and subfactors in an organizational setting that can affect the success, failure, or effectiveness of an organization, but 4Cs model assumes that all these factors and subfactors can be combined and can be represented through the 4Cs and that is why the 4Cs are sufficient for measuring the effectiveness of an organization.

Manuscript received October 28, 2014; revised May 4, 2015; accepted June 22, 2015. Date of publication August 6, 2015; date of current version October 16, 2015.

C.-J. Chen and K.-K. Hu are with the Graduate Institute of Business Administration, College of Management, National Taiwan University, Taipei 10617, Taiwan (e-mail: mcjchen@ntu.edu.tw; d99741004@ntu.edu.tw).

Y.-C. Hsiao is with the Department of Business and Management, College of Science and Engineering, National University of Tainan, Tainan 700, Taiwan (e-mail: ychsiao@mail.nutn.edu.tw).

M.-A. Chu is with the Department of Business Administration, Hwa Hsia University of Technology, Taipei 235, Taiwan (e-mail: chumoan@cc.hwh.edu.tw).

Color versions of one or more of the figures in this paper are available online at <http://ieeexplore.ieee.org>.

Digital Object Identifier 10.1109/TEM.2015.2458891

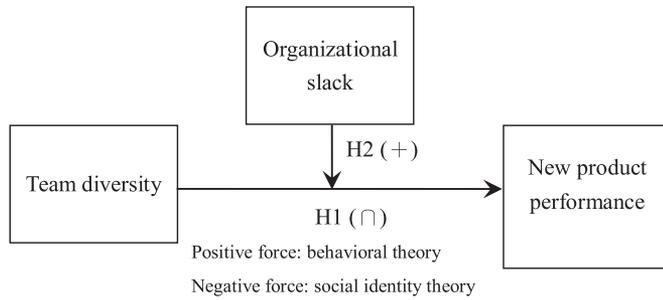


Fig. 1. Theoretical model and the proposed hypothesis.

In addition, this study also concerns the issue regarding how to leverage organizational slack to support the selected team diversity approach. Prior studies have recognized the importance of organizational slack for product innovation (see e.g., [1], [30]–[32]). In the process of new product development, organizational slack is recognized as a critical facilitator to provide sufficient resources for developing new products (see [15], [32]–[39]). In viewing new product as an output of a complex social system, in which diverse team members interact with each other, some prior studies suggest the possible contextual role of organizational slack (see e.g., [28]–[31], [35], [36], [39]–[46]). Therefore, besides reexamining the relationship between the team diversity and the new product performance, this study will further explore the moderating role of organizational slack in these relationships.

Therefore, this study focuses on investigating the effects of team diversity and organizational slack on new product performance. The conceptual model of this study is presented in Fig. 1. The two major research questions that we seek to address through this conceptual framework are the following. First, does an increase in the team diversity enhance new product performance? Second, what is the role of organizational slack (absorbed and unabsorbed slacks) in explaining the relationship between team diversity and new product performance? Therefore, the curvilinear relationship (Hypothesis 1) and the moderated relationship (Hypothesis 2) were hypothesized in this study to focus on the role that organizational slack plays in moderating the curvilinear relationship between team diversity and new product performance. The rest of this paper is set out as follows. Section II considers the previous literature and sets out the hypotheses of this study. Following that is Section III, which presents the methodology for this study. Then, this paper presents the results of the empirical study in achieving the goals as set out above in Section IV. In Section V, this paper discusses the managerial implications and highlights future research directions.

II. THEORETICAL BACKGROUND AND HYPOTHESES

A. Team Diversity and New Product Performance

Team diversity, in the context of new product development, is defined as the degree to which team members are similar or dissimilar in background characteristics, such as functional experience and tenure (see [8], [47]–[49]). Differences in

functional experience and tenure reflect the breadth of team composition among new product development members (see [13], [50]). Team composition can be categorized into homogeneous team (narrow functional specialists) and heterogeneous team (broad generalists). Homogeneous team members have little or no differentiation in terms of functional experience and tenure and perceive themselves as sharing the same salient characteristics [11]. In contrast, heterogeneous team members can categorize themselves with multifaceted backgrounds and functional specializations in the teams [48]. However, some meta-analytical studies in the area of team diversity have provided conflicting results on the choice of the two categories (see [8], [9], [24]).

Some scholars suggest adopting the homogeneous team (see e.g., [3], [8], [18]–[23], [27], [51]–[55]), while others propose utilizing the heterogeneous team (see e.g., [4], [7], [12]–[17], [45], [50], [56]–[59]) for improving the innovation outcome of the firm. These mixed and inconsistent results imply that there are both positive and negative forces governing the relationship between team diversity and new product performance. (see e.g., [7], [34], [40], [43], [60]). Accordingly, this study argues that an optimal level of team diversity would exist for the new product development projects to achieve the better performance.

Team diversity is beneficial to the new product performance from the perspective of a behavioral theory (see [15], [56]). The behavioral theory explicitly adopts the assumption of bounded rationality and emphasizes on the benefits of the comprehensiveness of the knowledge developed and evaluated by dissimilar participants during the decision-making process for finding solutions to problems (see [15], [61]). From the perspective of behavioral theory, new product development participants with diverse background characteristics can effectively develop creative solutions to reduce the technology and market problems, such as customer demand fluctuations and unpredictable competitor actions (see [15], [34], [62], [63]). When team members have diverse functional backgrounds, they are able to bring in different ideas and perspectives (see [24], [25], [64], [65]). As the diverse team members generate more ideas and perspectives, they are more likely to reframe problems and further generate more alternatives to solve the problems in the innovation process; thus, contributes to better new product outcomes (see [1], [59], [65]). Moreover, a broader range of team members are likely to avoid similar thought patterns and silo thinking, and thus, lead to systematic evaluation and decision effectiveness in the new product development process (see [7], [14], [60]). In this respect, diversified teams are necessary for pooling various individual cognitive ideas and perspectives to solve complex problems in the new product development activities (see [4], [12], [56]). Accordingly, from the viewpoint of behavioral theory, heterogeneous teams of new product development projects are more likely to have complementary knowledge and expertise with varied ideas and perspectives, and, thus, better able to generate creative solutions to solve new product development problems, identify commercial innovation opportunities, and, subsequently, develop valuable new products (see [11]–[13], [16], [45], [50], [57]).

However, excessive team diversity may be detrimental to the new product performance from the perspective of the social identity theory (see [66]–[68]). Social identity theory uses similarities and dissimilarities as a basis for categorizing people into groups. According to the theory, people who are different are less likely to interact and collaborate with one another than those who are similar because they do not consider others belonging to the same social category, and, thus, do not share the same social identity (see [66], [69]). The diversity of the new product development team may trigger the social identity process, and cause the deficiencies of the 4Cs. The dissimilarities of functional experience and tenure are likely to give rise to communication difficulties and coordination costs that may impede heterogeneous team to generate coherence (see [3], [8], [18], [23], [27], [55], [64]). Hence, team members with nonoverlapping knowledge would fall into the overdiversification trap, where widely varying perspectives and opinions among members can make reaching decision consensus difficult and time consuming (see [8], [23], [42]). In other words, the increased diversity in the group would cause less frequent communication and collaboration, aggravates heavy coordination cost, and takes longer to become cohesive, and thus, results in unimproved new products, reduced efficiency, and slower introduction of new products (see [3], [19], [24], [54]). Accordingly, when the diversity of functional characteristics among team members reaches beyond a certain point, further increases in the level of team diversity among the new product development members produce no additional benefits but decrease returns of the new product development projects (see [50]–[53]).

According to the above discussion, this study proposes that there is a curvilinear relationship between team diversity and new product performance. As the two related forces, positive and negative, govern the relationship, an optimal level of team diversity for the new product performance would exist. Before the optimal level, the increase of team diversity would enhance new product performance. On the other hand, new product performance would decrease as team diversity increases after the optimal level. In light of the above reasoning, the following hypothesis is developed.

Hypothesis 1: The relationship between team diversity and new product performance is inverse U-shaped, with the slope being positive at low levels of team diversity and negative at high levels of team diversity.

B. Moderating Role of Organizational Slack

The slope of the inverse U-shaped between team diversity and new product performance could vary in magnitude with specific contextual factors (see [28], [29], [42], [44], [45]). Organizational slack is identified as a key contextual factor that is closely linked to innovation performance (see [6], [40], [43], [46]). It is the source of funding for firms to develop capabilities in introducing new products and entering into new market (see [35], [39], [40]). Organizational slack provides abundant resources, which allow managers more discretion to pursue new innovation projects characterized with high uncertainty and risk and increase the extent of their environmental response (see [6], [30], [32]–[35]).

The above proposition suggests that team diversity entails both benefits and costs in the new product development process. The benefits associated with team diversity results mainly from a wide array of ideas and perspectives, while the costs come from the inefficient implementation of the 4Cs. The rationale for the positive interaction between team diversity and organizational slack rests on the argument that high levels of organizational slack can heighten the benefits, while mitigating the costs associated with team diversity in the new product development projects. Based on the behavioral theory, the increase of team diversity can enhance a breadth of ideas and perspectives in the new product development projects, and thus, help the teams strengthen their competency to solve problems and making decisions. The competency can be further strengthened if the diverse teams receive sufficient resources. Also, organizational slack provides heterogeneous teams with sufficient resources to respond to the environmental opportunities or threats, and, therefore, contributes to innovation outcomes.

On the other hand, based on the social identity theory, high levels of diversity produce unwanted costs due to the inefficient implementation of the 4Cs. The degree to which such unwanted costs leading to impaired new product performance, however, may depend upon the extent of slack resources to which the teams receive. Organizational slack not only provides new product development teams with the abundant resources for the pursuit of new innovation ideas and opportunities, but also become the cushion for conflict resolution, competitive tensions, and cohesiveness difficulties, associated with a high level of team diversity. In addition, organizational slack provides the necessary resources for facilitating coordination and communication among the heterogeneous team members. Accordingly, this study proposes that organizational slack can strengthen the benefits of competency to solve problems and making decisions, while lessening the unwanted costs caused by the 4Cs associated with the team diversity. Accordingly, organizational slack is expected to positively moderate the inverted U-shaped relation between team diversity and new product performance. The above reasoning leads to the following hypothesis.

Hypothesis 2: Organizational slack positively moderates the inverse U-shaped curvilinear relationship between team diversity and new product performance.

III. METHOD

A. Data Collection and Sampling

This study investigates on the inverted U-shaped curvilinear relationship between team diversity and new product performance. Further, the authors also extend our analysis to view slack as a moderator to affect the curvilinear relationship. A survey questionnaire was developed to collect data for testing the validity of the hypotheses. The questionnaire encourages the respondents to focus on the most recent one new product development project with which they were familiar. Variables in the questionnaire included background information, team diversity, slack, and new product performance. All independent variables were measured using multiitems and seven-point Likert scales. In our survey, we chose the new product development projects

in the top 5000 firms of Taiwan listed in the China Credit Information Service Incorporation database as the survey population. Each year the database provides rankings for business in Taiwan and China based upon their revenue. A stratified random sampling method was used to divide the population into five nonoverlapping groups or strata based on the total assets held by the top 5000 companies in this study. A stratified sample in our survey was randomly selected from five levels of the top 5000 as follows: 1) rankings 1 through 1000; 2) rankings 1001 through 2,000; 3) rankings 2001 through 3000; 4) rankings 3001 through 4000; and 5) rankings 4001 through 5000. A random sample of 700 questionnaires with a cover page that explained the purpose of this study was then equally chosen 140 firms from each stratum. Our sample was a representative of the Taiwanese population because the sampling frame was generated by a stratified random sampling process based on the firm size. For each firm, the project manager was asked to complete a questionnaire concerning his/her perceptions of new product performance and background information within the business unit, while the team diversity and slack variables in the questionnaire were filled out by the product champions in order to avoid common method variance problem. After follow-up e-mails and telephone reminders, 130 responses were received but seven of them were incomplete and five of them did not have any experience in new product development. The remaining 118 valid and complete questionnaires were used for the quantitative analysis with responsive rate of 16.8%. Although this response rate was not as high as one might wish, it was consistent with other studies on new product development. However, it is possible to achieve valid generalizations from studies with low response rates unless there is a good reason to believe that the respondents that had participated in the survey do in fact differ from that had not, suggesting that these differences would make the results of this study unreliable. Therefore, the possibility of nonresponse bias was checked by comparing the characteristics of the respondents to those of the original population sample. The calculated *t*-statistics for the sales ($t = -0.848$, $p = 0.134$), number of employee ($t = -1.376$, $p = 0.336$) and capital ($t = -0.669$, $p = 0.459$) were all statistically insignificant, suggesting that there were no significant differences between the respondent and nonrespondent groups.

B. Measures

1) *Dependent Variable*: Following prior new product development studies (see e.g., [2], [5], [6], [49], [63], [64]), we used survey measures to assess the new product performance because objective performance measures were often unavailable or inaccurate for new product development projects. An 11-item measure, adopted from [70] study, was used to indicate the extent to which firms were satisfied with the achievements in the new product development project. These 11 items included four market items (fulfill customers' needs, capture high market share, create a new market, create a new product line), four management items (meet product specifications, meet unit cost objectives, meet timing goals, meet project's budget goals), two technology items (develop new technology, enhance skills

to handle new technology), and one overall assessment item (be a business success). Exploratory factor analysis supported only one factor; thus, this study averaged the 11 items as an overall new product performance measure. The Cronbach alphas ($\alpha = 0.89$) for the new product performance scales was exceeding the 0.40 threshold.

2) *Independent Variables*: Team diversity reflects the breadth of team's demographic differences, including functional background heterogeneity and tenure heterogeneity, in the new product development project. We adopt the basic methodological approach used by [11], [34], and [49] to develop a composite measure of team diversity. Recipients were asked to indicate the number of team members in the new product development project and report the functional background and tenure of the team members. Blau [71] index of heterogeneity, $1 - \sum p_i^2$, was used to calculate functional diversity, where P is the proportion of individuals in a category and i was the number of categories. Tenure heterogeneity was gauged by using the coefficient of variation (standard deviation divided by the mean) of team member's respective tenures on the company. Allison [72] has noted that among heterogeneity measures the coefficient of variation is preferable when interval-level data, such as age or time frames were used. Based on Ferrier [34], we calculated a parsimonious composite diversity index, the sum of the functional background diversity and tenure diversity. High scores for the composite index indicated that a high degree of team diversity in the projects. Further, following the approach of [27], we used the quadratic terms of team diversity to test the curvilinear relationship.

3) *Moderating Variables*: Organizational slack refers to the stock of excess resources available to an organization during a given planning cycle [32]. Since organizational slack can be deployed at any time in a variety of ways, it is difficult to measure organizational slack directly [32]. Hence, researchers have measured organizational slack using various accounting data (see [33], [38]). Following Tan and Peng [39], this study assessed two components of project-level slack—unabsorbed slack and absorbed slack. Unabsorbed slack implied a lack of structural constraints, and it can be easy-to-redeploy in a range of new product development activities. A three-item scale was used to measure unabsorbed slack to reflect the extent to which the firm's retained earnings, financial resources, and debt financing with banks had been sufficient for the project. In addition, absorbed slack factor was structurally constrained by other resources with which it coexisted, further limiting the ability to redeploy it in the new product development contexts. Hence, respondents were asked two items to provide their assessment on whether the new product development project was developed under available engineered capacity and human resource. All of the measures and expectation sign of the independent variables are presented in Table I.

4) *Control Variables*: To empirically test the effects of team diversity and organizational slack on new product performance, this study includes in the model a range of controls to account for the project-level (such as team size), firm-level (such as firm age and firm size), and industry-level (such as industry type) variables that are likely to influence the new product performance

TABLE I
EXPLANATION FOR MEASURE OF RELATED DIMENSIONS

Variable	Measure	Expectation
Dependent Variable I. New product performance	An 11-item measure, adopted from Davila's [70] study, was used to indicate the extent to which firms were satisfied with the achievements in the new product development project. These 11 items included four market items (fulfill customers' needs, capture high-market share, create a new market, create a new product line), four management items (meet product specifications, meet unit cost objectives, meet timing goals, meet project's budget goals), two technology items (develop new technology, enhance skills to handle new technology), and one overall assessment item (be a business success).	
Independent Variable I. Team diversity	We adopt the basic methodological approach used by Wiersema and Bantel [11], Ferrier [34], and Sarin and McDermott's [49] to develop a composite measure of team diversity to reflect the breadth of team's demographic differences, including functional background heterogeneity and tenure heterogeneity, in the new product development project.	Inverted U
Moderating Variable I. Organizational slack	Following the work of Tan and Peng [39], a three-item scale was used to measure unabsorbed slack to reflect the extent to which the firm's retained earnings, financial resources, and debt financing with banks had been sufficient for the project. A two-item scale was used to measure absorbed slack to reflect whether the new product development project was developed under available engineered capacity and human resource.	+

in the analysis. The first group of the control variable that might cause a potential confounding effect on the new product performance relates to the project-level characteristics. Team size was measured as the number of members of new product development product team from the information that the respondent of our questionnaire offered. As the raw team size was skewed (skewness = 4.66), we recoded this variable based on a natural log transformation of the scores. Therefore, the skewness statistic of the distribution of these scores was 1.08 and reduced the impact of skewed data, outliers, and unequal variation. A second group of variables that should take into account possible alternative explanations for variations in new product performance is related to firm-level characteristics. This paper has included in the regressions the firms' length of operation (age) and their book value (size). The former was operationalized by the number of years since the firm has operated in its major product market, while the latter was measured as the amount of net sales associated with each firm as the end of observed year. In our model, logarithmic values were used to avoid a violation of parametric analysis assumptions. Finally, the last group of variable captures the characteristics of the industry level. Since industry differences may be a potential influence on new product outcome, we asked respondent firms in our sample to describe the principle industry type in which they are belonged to. Industry type was categorized as a dummy variable with 1 representing high-tech industry sector, with 0 for low-tech industry sector.

IV. RESULTS

This study attempts to hypothesize an inverse U-shaped curvilinear relationship between team diversity and new product performance and the moderating role of organizational slack in the curvilinear relationship in the context of new product development project. Table II contains the means, standard deviations, and correlations for all the variables included in this study. The

hypotheses are tested by the hierarchical moderated regression analysis, which allows for a comparison between alternative models with and without interaction terms (see [45], [70], [73]).

Table III displays the results of hierarchical moderated regressions regarding the main effects and interaction terms on the dependent variable. Model 1, in Table III, includes only the four control variables, and Model 2 add the set of independent and moderator variables: team diversity, unabsorbed slack and absorbed slack, in addition to the control variables. Models 3 and 4 test our two hypotheses regarding the interaction effects between team diversity and two slack factors. Interaction terms are created by multiplying the relevant variables together. Given the scale differences and potential multicollinearity concerns between the independent variables of team diversity and the moderators of the unabsorbed slack and absorbed slack factors, we center the items prior to combining them for each interaction term [74]. We then run two separate regression models, which include interaction terms, one with the unabsorbed slack interaction terms, control variables, and main effects (Model 3), and the other with the absorbed slack interaction terms, control variables, and main effects (Model 4). Following this order, below we present the results for control variables, followed by the results regarding the main effect hypotheses (Hypotheses 1) and the results relating to the moderation hypotheses (Hypotheses 2).

Model 1, in Table III, is the baseline model consisting only of four control variables. This model indicates that the combination of control variables does not have significant impact on the dependent variable ($F = 0.65$, $R^2 = 0.02$). Model 2, in Table III, captures the main effects of the independent and moderator variables on the dependent variable. This model is significant at the $p < 0.001$ level ($F = 3.57$, $R^2 = 0.21$) and explains an additional 19 percent of variance over what the control variables alone explain. Hypothesis 1 predicts that team diversity in new product development project has an inverse U-shaped curvilinear relationship with new product performance. The coefficient

TABLE II
MEANS, STANDARD DEVIATIONS, AND CORRELATIONS

Variables	Mean	S.D.	1	2	3	4	5	6	7	8
1. Age (log)	1.35	1.10								
2. Sales (log)	6.91	0.86	0.00							
3. Team size (log)	1.14	0.42	-0.08	0.24						
4. Industry (dummy)	0.50	0.50	0.47	-0.20	-0.23					
5. Team diversity	1.17	0.33	0.03	0.03	0.19	0.01				
6. Unabsorbed slack	5.02	1.12	-0.01	-0.08	0.19	-0.03	-0.09	(0.70)		
7. Absorbed slack	5.77	0.86	-0.01	-0.02	-0.15	0.09	-0.15	0.19	(0.78)	
8. NPD performance	5.41	0.73	-0.02	0.12	0.05	-0.09	-0.07	0.33	0.11	(0.89)

Note: Correlations greater than |.19| are significant at the .05 level, and greater than |.26| are significant at the .01 level (two tailed *t*-test)

TABLE III
RESULTS OF HIERARCHICAL REGRESSION ANALYSIS

Variable	Hypothesis Tested	New product development performance			
		Model 1	Model 2	Model 3	Model 4
<i>Controls</i>					
Intercept		4.64	0.06	0.16	-0.05
Age (year)		0.00	0.00	0.00	0.00
Sales (log)		0.08	0.15	0.16	0.15
Team size (log)		0.07	-0.03	-0.11	-0.01
Industry (dummy)		0.13	0.09	0.10	0.08
<i>Main effects</i>					
Team diversity			7.74***	7.68***	7.84***
Team diversity square	1		-3.36***	-3.35***	-3.39***
Unabsorbed slack			0.24***	0.14	0.25***
Absorbed slack			0.06	0.06	0.13
<i>Interaction effects</i>					
Unabsorbed slack × team diversity				0.83†	
Unabsorbed slack × team diversity square	2a			-0.56*	
Absorbed slack × team diversity					0.24
Absorbed slack × team diversity square	2b				-0.23
<i>Model statistics</i>					
R-square		.02	.21	.24	.21
Change in R from Model 1			.19***	.22***	.19***
ANOVA F		0.65	3.57***	3.31***	2.90***
Number of new product development projects		118	118	118	118

for the linear term of team diversity is positive, while the coefficient for the squared term is negative. These findings are all significant at the $p < 0.001$ level, and then, clearly reveal a strong inverse U-shaped effect of team diversity on new product performance, in which new product development projects with moderately heterogeneous team members would outperform those with homogeneous team members and very heterogeneous team members. Accordingly, the results support Hypothesis 1.

Next, this study examines the contextual factors of slack between team diversity and new product performance. Models 3 and 4 add the two dimensions of slack, unabsorbed and absorbed, and their interaction terms with the team diversity, respectively. Model 3 is statistically significant at the $p < 0.001$ level ($F = 3.31, R^2 = 0.24$) and explains an additional 3% of variance over what the main effects of the independent variables explains. Similarly, Model 4 is statistically significant at the $p < 0.001$ level ($F = 2.90, R^2 = 0.21$). Hypothesis 2 is assessed in Models 3 and 4. As shown in the Model 3 of Table III, the coefficient of the interaction term between team diversity and unabsorbed slack is found to have a marginally significant and positive moderating effect on the relationship between team

diversity and new product performance ($\beta = 0.83, p = 0.08$). Stronger results emerged for the squared term, with significant findings for new product performance ($\beta = -0.56, p < 0.05$). On the other hand, Model 4 of Table III indicates that the coefficients of the linear ($\beta = 0.24, p = 0.67$) and the squared ($\beta = -0.23, p = 0.57$) interaction terms between team diversity and absorbed slack are both not significant; therefore, these results provide partial support for Hypothesis 2.

To add to the robustness of our results, we develop the 2-D and 3-D graphs to illustrate the curvilinear relationship between team diversity and new product performance measure under different levels of unabsorbed slack as shown in Figs. 2 and 3. In Fig. 2, we divide the dataset into high-unabsorbed-slack new product development projects (scoring one standard deviation above the mean) and low-unabsorbed-slack new product development projects (scoring one standard deviation below the mean). Fig. 2 depicts a curvilinear relationship that performance increases initially and then decreases as team diversity increases. An optimal level of team diversity would result in the best performance under a given level of unabsorbed slack. These findings further support Hypothesis 1. In addition, Fig. 2

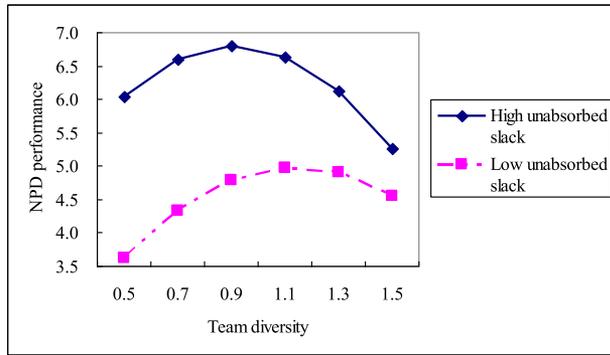


Fig. 2. Moderating effect of unabsorbed slack on the curvilinear relationship between team diversity and new product development performance: A 2-D graph.

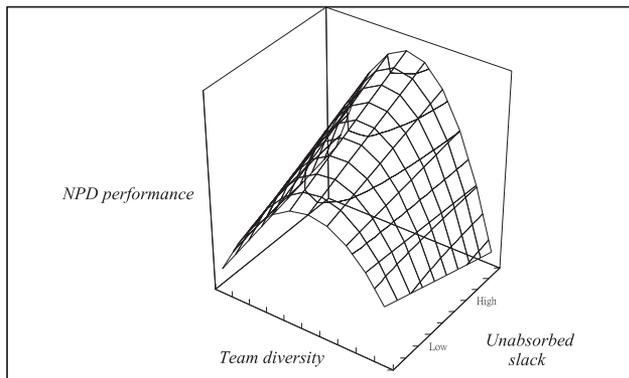


Fig. 3. Moderating effect of unabsorbed slack on the curvilinear relationship between team diversity and new product development performance: A 3-D graph.

indicates that the arc of team diversity is flatter when new product development projects possess lower levels of unabsorbed slack. Accordingly, the optimal point for high-unabsorbed-slack curve is 0.9, while that for low-unabsorbed-slack curve is 1.1. These results further support Hypothesis 2 and imply that the optimal level of the team diversity moves toward the left side when new product development projects possess more unabsorbed slack. Furthermore, Fig. 3 provides the graph generated from the 3-D analysis. The graph reveals the complexity of the curvilinear relationship and the moderating role of unabsorbed slack and is generally supportive of the hypotheses.

V. DISCUSSION AND CONCLUSION

This study examines the effects of team diversity and organizational slack on new product performance from the perspectives of behavioral theory and social identity theory. The results show support for the inverse U-shape curvilinear relationship between team diversity and new product performance, with moderately heterogeneous team diversity exhibiting better new product performance than homogeneous teams and very heterogeneous teams. These findings indicate that an optimal level of team diversity exists. Before reaching the optimal level, the increase of team diversity results in an increase in new product performance. However, the positive relationship between team diversity and new product performance change directions after

the optimal level. By integrating the arguments of prior related studies about the positive benefits (see e.g., [4], [7], [12]–[17], [45], [50], [56]–[59]), and the negative impacts (see e.g., [3], [8], [18]–[23], [27], [51]–[55]) of the team diversity, this study proposes two underlying forces to explain this relationship. According to the behavioral theory, the positive force is the formation of the collective knowledge structure providing the benefits of the broader perspectives, generates innovative ideas, and evaluates the possible solutions to the problem, while the negative force, from the perspective of the social identity theory, is the interaction costs associated with plaguing effective operation of the 4Cs. Taken together, these arguments suggest that the proper way to think about the relationship between team diversity and new product performance is an inverted U-shaped function.

Thus, the following question to ask is what level of team diversity is optimal for each new product development project? Answering the question would depend on a number of factors and organizational slack is one such important factor. This study argues that organizational slack would positively moderate the effect of team diversity on new product development outcome. The empirical evidences provide support for the hypothesized contingent effects. These results imply that organizational slack works as a possible source of funding to strengthen the benefits and lessen the costs associated with team diversity in the new product development projects. The empirical evidences in this research echo prior studies' calls (see e.g., [28]–[31], [36], [36], [40]–[44]) by providing a contextual condition to specify that team diversity and new product development are contingent upon organizational slack. According to the behavioral theory, organizational slack is beneficial to strengthen employees' varied ideas and perspectives in the high heterogeneous team by effectively providing abundant resources to pursue new innovation projects in the face of environmental opportunities and threats, thus contributes to new product performance. Moreover, based on the social identification theory, organizational slack is also helpful in mitigating the 4Cs costs associated with heterogeneous team by improving communication frequency, reducing coordination conflict, promoting collaboration behavior, and attaining consensus ultimately resulting in higher new product performance.

The findings of this study contribute to the theoretical development of a conceptual model for explaining the relationships among team diversity, organizational slack, and new product performance. Theoretically, this study proposes two underlying forces to hypothesize the inverse U-shaped effect of team diversity on new product development outcome. This study introduces the new concept of team diversity as a strategic arrangement to stimulate new product development outcome. Accordingly, this study provides some significant implications for the growing body of research on human side of product innovation. In addition, this study identifies the moderating role of organizational slacks on the new product performance. Following the suggestions of previous research, this study hypothesizes that organizational slack positively interacts with team diversity on new product performance. By specifying the contingent role of organizational slack, this study provides a better understanding on how firms can efficiently and

effectively manage their resources in the product innovation process.

The second contribution of this study is the derivation of empirical support for the model's prediction using data from actual cases. This study contributes to the literature by empirically examining the relationships among team diversity, organizational slack, and new product performance. The results prove that the use of team diversity would explain the firm's new product performance in curvilinear way; however, when organizational slacks are added as a moderator, the curvilinear relationship would become stronger. Thus, this study demonstrates that organizational slack vary in affecting new product development. The findings of this study fill the gap in the literature that is lack of empirically examining the effects of team diversity and organizational slack on new product performance.

The findings of this study should be interpreted with caution in light of several limitations. First, only one New Product Development (NPD) case choosing arbitrarily by respondents, though they were asked to pick the typical one, may not reflect all the facts since many firms had more than one NPD experience. Second, our data were obtained through self-report. This aspect of this study does not differ from the previous literature. However, in this study, the likelihood of common method variance is low because the dependent variable was obtained from different sources. Third, this study introduces that team diversity and new product performance are contingent upon only organizational slack. Other factors, such as organizational structure and innovation strategy, may also have an impact on the relationship. Future research can explore how these factors contingently contribute to improve or deprave the impact of team diversity on new product performance. In addition, this study has tested the moderating effect of organizational slack. An investigation of organizational slack as antecedent of team diversity is strongly encouraged for future research. Finally, this study only investigates Taiwanese firm, cultural limitation may exist, and future research may broaden sample of firms across national boundaries to generalize the empirical results herein.

To conclude, team diversity and organizational slack are valuable resources for firms to utilize for superior new product performance and sustainable competitive advantages. The viewpoints in this study highlight the optimal use of team diversity and the crucial importance of the moderating role of organizational slack in the development of new products.

REFERENCES

- [1] H. R. Greve, *Organizational Learning from Performance Feedback: A Behavioral Perspective on Innovation and Change*. Cambridge, U.K.: Cambridge Univ. Press, 2003.
- [2] S. Im, Jr. and J. P. Workman, "Market orientation, creativity, and new product performance in high-technology firms," *J. Marketing*, vol. 68, pp. 114–132, 2004.
- [3] R. T. Keller, "Cross-functional project groups in research and new product development: Diversity, communications, job stress, and outcomes," *Acad. Manage. J.*, vol. 44, pp. 547–555, 2001.
- [4] E. M. Olson, Jr., O. C. Walker, and R. W. Ruekert, "Organizing for effective new product development: The moderating role of product innovativeness," *J. Marketing*, vol. 59, pp. 48–62, 1995.
- [5] R. Sethi and Z. Iqbal, "Stage-gate controls, learning failure, and adverse effect on novel new products," *J. Marketing*, vol. 72, pp. 118–134, 2008.
- [6] X. M. Song and M. Montoya-Weiss, "The effect of perceived technological uncertainty on Japanese new product development," *Acad. Manage. J.*, vol. 44, pp. 61–80, 2001.
- [7] K. Talke, S. Salomo, and K. Rost, "How top management team diversity affects innovativeness and performance via the strategic choice to focus on innovation fields," *Res. Policy*, vol. 39, pp. 907–918, 2010.
- [8] S. K. Horwitz and I. B. Horwitz, "The effects of team diversity on team outcomes: A meta-analytic review of team demography," *J. Manage.*, vol. 33, pp. 967–1015, 2007.
- [9] A. Joshi and H. Roh, "The role of context in work team diversity research: A meta-analytic review," *Acad. Manage. J.*, vol. 52, pp. 599–627, 2009.
- [10] F. J. Milliken and L. L. Martins, "Searching for common threads: Understanding the multiple effects of diversity in organizational groups," *Acad. Manage. Rev.*, vol. 21, pp. 402–433, 1996.
- [11] M. Wiersema and K. Bantel, "Top management team demography and corporate strategic change," *Acad. Manage. J.*, vol. 35, pp. 91–121, 1992.
- [12] K. A. Bantel and S. E. Jackson, "Top management and innovations in banking: Does composition of the top team make a difference?," *Strategic Manage. J.*, vol. 10, pp. 107–124, 1989.
- [13] J. S. Bunderson and K. M. Sutcliffe, "Comparing alternative conceptualizations of functional diversity in management teams: Process and performance effects," *Acad. Manage. J.*, vol. 45, pp. 875–894, 2002.
- [14] M. Crawford and A. Di Benedetto, *New Products Management*, 8th ed. New York, NY, USA: McGraw-Hill, 2006.
- [15] R. Cyert and J. March, *A Behavioral Theory of the Firm*. Englewood Cliffs, NJ, USA: Prentice-Hall, 1963.
- [16] L. H. Pelled, K. M. Eisenhardt, and K. R. Xin, "Exploring the black box: An analysis of work group diversity, conflict, and performance," *Administr. Sci. Quart.*, vol. 44, pp. 1–28, 1999.
- [17] G. S. Van der Vegt, E. Van de Vliert, and X. Huang, "Location-level links between diversity and innovative climate depend on national power distance," *Acad. Manage. J.*, vol. 48, pp. 1171–1182, 2005.
- [18] N. S. Argyres, "Evidence on the role of firm capabilities in vertical integration decisions," *Strategic Manage. J.*, vol. 17, pp. 129–150, 1996.
- [19] I. Goll, N. B. Johnson, and A. A. Rasheed, "Top management team demographic characteristics, business strategy, and firm performance in the US airline industry: The role of managerial discretion," *Manage. Decision*, vol. 46, pp. 201–222, 2008.
- [20] S. E. Jackson, K. E. May, and K. Whitney, "Understanding the dynamics of diversity in decision making teams," in *Team Effectiveness and Decision Making in Organizations*, R. A. Guzzo and E. Salas, Eds. San Francisco, CA, USA: Jossey-Bass, 1995, pp. 204–261.
- [21] K. A. Jehn, C. Chadwick, and S. M. B. Thatcher, "To agree or not to agree: The effects of value congruence, individual demographic dissimilarity and conflict on workgroup outcomes," *Int. J. Conflict Manage.*, vol. 8, pp. 287–306, 1997.
- [22] J. S. Leonard, D. I. Levine, and A. Joshi, "Do birds of a feather shop together? The effects on performance of employees' similarity with one another and with customers," *J. Org. Behav.*, vol. 25, pp. 731–754, 2004.
- [23] C. J. Nemeth and B. M. Staw, "The tradeoffs of social control and innovation in small groups and organizations," in *Advances in Experimental Social Psychology*, L. Berkowitz, Ed., New York, NY, USA: Academic, 1989, vol. 22, pp. 175–210.
- [24] K. Williams and C. O'Reilly, "Forty years of diversity research: A review," in *Research in Organizational Behavior*. B. M. Staw, L. L. Cummings, Eds. Greenwich, CT, USA: JAI Press, 1998, pp. 77–140.
- [25] D. C. Hambrick, T. Cho, and J. M. Chen, "The influence of top management team heterogeneity on firms' competitive moves," *Administr. Sci. Quart.*, vol. 41, pp. 659–684, 1996.
- [26] D. Van Knippenberg, C. K. W. D. Dreu, and A. C. Homan, "Work group diversity and group performance: An integrative model and research agenda," *J. Appl. Psychol.*, vol. 89, pp. 1008–1022, 2004.
- [27] J. Alexander, B. Nuchols, J. Bloom, and S. Lee, "Organizational demography and turnover: An examination of multifactor and nonlinear heterogeneity," *Human Relations*, vol. 48, pp. 1455–1480, 1995.
- [28] J. A. Chatman, J. T. Polzer, S. G. Barsade, and M. A. Neale, "Being different yet feeling similar: The influence of demographic composition and organizational culture on work processes and outcomes," *Administr. Sci. Quart.*, vol. 43, pp. 749–780, 1998.
- [29] S. Auh and B. Menguc, "Top management team diversity and innovativeness: The moderating role of interfunctional coordination," *Ind. Marketing Manage.*, vol. 34, pp. 249–261, 2005.
- [30] J. L. C. Cheng and I. F. Kesner, "Organizational slack and response to environmental shifts: The impact of resource allocation patterns," *J. Manage.*, vol. 23, pp. 1–23, 1997.
- [31] F. Damanpour, "Organizational innovation: A meta-analysis of effects of determinants and moderators," *Acad. Manage. J.*, vol. 34, pp. 555–590, 1991.
- [32] N. Nohria and R. Gulati, "Is slack good or bad for innovation?," *Acad. Manage. J.*, vol. 39, pp. 1245–1264, 1996.

- [33] L. J. Bourgeois, "On the measurement of organizational slack," *Acad. Manage. Rev.*, vol. 6, pp. 29–39, 1981.
- [34] W. Ferrier, "Navigating the competitive landscape: The drivers and on sequences of competitive aggressiveness," *Acad. Manage. J.*, vol. 44, pp. 858–877, 2001.
- [35] G. George, "Slack resources and the performance of privately held firms," *Acad. Manage. J.*, vol. 48, pp. 661–676, 2005.
- [36] A. Keegan and J. R. Turner, "The management of innovation in project based firms," *Long Range Planning*, vol. 35, pp. 367–388, 2002.
- [37] M. S. Kraatz and E. J. Zajac, "How organizational resources affect strategic change and performance in turbulent environments: Theory and evidence," *Org. Sci.*, vol. 12, pp. 632–657, 2001.
- [38] J. V. Singh, "Performance, slack, and risk-taking in organizational decision making," *Acad. Manage. J.*, vol. 29, pp. 562–585, 1986.
- [39] J. Tan and M. W. Peng, "Organizational slack and firm performance during economic transitions: Two studies from an emerging economy," *Strategic Manage. J.*, vol. 24, pp. 1249–1263, 2003.
- [40] C. J. Chen and Y. F. Huang, "Creative workforce density, organizational slack, and innovation performance," *J. Business Res.*, vol. 63, pp. 411–417, 2010.
- [41] W. Cohen and D. Levinthal, "Absorptive capacity: A new perspective on learning and innovation," *Administ. Sci. Quart.*, vol. 35, pp. 128–152, 1990.
- [42] P. L. Curseu and S. G. L. Schrujijer, "Does conflict shatter trust or does trust obliterate conflict? Revisiting the relationships between team diversity, conflict, and trust," *Group Dyn., Theory, Res. Pract.*, vol. 14, pp. 66–79, 2010.
- [43] Y. F. Huang and C. C. Chen, "The impact of technological diversity and organizational slack on innovation," *Technovation*, vol. 30, pp. 420–428, 2010.
- [44] E. Kearney and D. Gebert, "Diversity and enhancing team outcomes: The promise of transformational leadership," *J. Appl. Psychol.*, vol. 94, pp. 77–89, 2009.
- [45] O. Richard, T. Barnett, S. Dwyer, and K. Chadwick, "Cultural diversity in management, firm performance, and the moderating role of entrepreneurial orientation dimensions," *Acad. Manage. J.*, vol. 47, pp. 255–266, 2004.
- [46] A. Ruiz-Moreno, V. J. Garcia-Morales, and F. J. Llorens-Montes, "The moderating effect of organizational slack on the relation between perceptions of support for innovation and organizational climate," *Personnel Rev.*, vol. 37, pp. 509–525, 2008.
- [47] D. Ancona and D. F. Caldwell, "Demography and design: Predictors of new product team performance," *Org. Sci.*, vol. 3, pp. 321–341, 1992.
- [48] D. C. Lau and J. K. Murnighan, "Demographic diversity and faultlines: The compositional dynamics of organizational groups," *Acad. Manage. Rev.*, vol. 23, pp. 325–340, 1998.
- [49] S. Sarin and C. McDermott, "The effect of team leader characteristics on learning, knowledge application, and performance of cross-functional new product development teams," *Decision Sci.*, vol. 34, pp. 707–739, 2003.
- [50] A. A. Cannella, J.-H. Park, and H. U. Lee, "Top management team functional background diversity and firm performance: Examining the roles of team member colocation and environmental uncertainty," *Acad. Manage. J.*, vol. 51, pp. 768–784, 2008.
- [51] J. A. Chatman and F. J. Flynn, "The influence of demographic heterogeneity on the emergence and consequences of cooperative norms in work teams," *Acad. Manage. J.*, vol. 44, pp. 956–974, 2001.
- [52] D. A. Harrison, K. H. Price, and M. P. Bell, "Beyond relational demography: Time and the effects of surface- and deep-level diversity on work group cohesion," *Acad. Manage. J.*, vol. 41, pp. 96–107, 1998.
- [53] D. A. Harrison, K. H. Price, J. H. Gavin, and A. T. Florey, "Time, teams, and task performance: Changing effects of surface- and deep-level diversity on group functioning," *Acad. Manage. J.*, vol. 45, pp. 1029–1045, 2002.
- [54] K. A. Jehn, G. B. Northcraft, and M. A. Neale, "Why differences make a difference: A field study of diversity, conflict, and performance in workgroups," *Administ. Sci. Quart.*, vol. 44, pp. 741–763, 1999.
- [55] B. S. Lawrence, "The black box of organizational demography," *Org. Sci.*, vol. 8, pp. 1–22, 1997.
- [56] C. Boone, W. Van Olfen, A. Van Witteloostuijn, and B. De Brabander, "The genesis of top management team diversity: Selective turnover among top management teams in Dutch newspaper publishing, 1970–94," *Acad. Manage. J.*, vol. 47, pp. 633–656, 2004.
- [57] T. H. Cox and S. Blake, "Managing cultural diversity: Implications for organizational competitiveness," *Acad. Manage. Exec.*, vol. 5, pp. 45–56, 1991.
- [58] R. J. Ely, "A field of group diversity, participation in diversity education programs, and performance," *J. Org. Behav.*, vol. 25, pp. 755–780, 2004.
- [59] A. Schulze and M. Hoegl, "Knowledge creation in new product development projects," *J. Manage.*, vol. 32, pp. 210–236, 2006.
- [60] M. Dayan and C. A. Di Benedetto, "The impact of structural and contextual factors on trust formation in product development teams," *Ind. Marketing Manage.*, vol. 39, pp. 691–703, 2010.
- [61] L. Argote and H. R. Greve, "A behavioral theory of the firm—40 years and counting: Introduction and impact," *Org. Sci.*, vol. 18, pp. 337–349, 2007.
- [62] T. Miller and M. D. C. Triana, "Demographic diversity in the boardroom: Mediators of the board diversity–firm performance relationship," *J. Manage. Studies*, vol. 46, pp. 755–786, 2009.
- [63] X. M. Song and M. E. Parry, "A cross-national comparative study of new product development processes: Japan and the United States," *J. Marketing*, vol. 61, pp. 1–18, 1997.
- [64] C. J. Chen, "Information technology, organizational structure, and new product development—The mediating effect of cross-functional team interaction," *IEEE Trans. Eng. Manage.*, vol. 54, no. 4, pp. 687–698, Nov. 2007.
- [65] J. Griffiths-Hemans and R. Grover, "Setting the stage for creative new products: Investigating the idea fruition process," *J. Acad. Marketing Sci.*, vol. 34, pp. 27–39, 2006.
- [66] H. Tajfel, *Human Groups and Social Categories*. Cambridge, U.K.: Cambridge Univ. Press, 1981.
- [67] J. C. Turner, "Social comparison and social identity: Some prospects for intergroup behavior," *Eur. J. Soc. Psychol.*, vol. 5, pp. 5–34, 1975.
- [68] J. C. Turner, "Towards a cognitive redefinition of the social group," *Social identity and Intergroup Relations*, H. Tajfel, Ed. Cambridge, U.K.: Cambridge Univ. Press, 1982, pp. 15–40.
- [69] D. Byrne, *The Attraction Paradigm*. New York, NY, USA: Academic, 1971.
- [70] A. Davila, "Short-term economic incentives in new product development," *Res. Policy*, vol. 32, pp. 1397–1420, 2003.
- [71] P. M. Blau, *Inequality and Heterogeneity*. New York, NY, USA: Free Press, 1977.
- [72] P. Allison, "Measures of inequality," *Amer. Soc. Rev.*, vol. 43, pp. 865–880, 1978.
- [73] J. Jaccard and R. Turrisi, *Interaction Effects in Multiple Regression*, 2nd Ed. Newbury Park, CA, USA: Sage, 2003.
- [74] L. S. Aiken and S. G. West, *Multiple Regression: Testing and Interpreting Interactions*. Newbury Park, CA, USA: Sage, 1991.



Chung-Jen Chen received the Doctorate degree in strategy and technology management from Rensselaer Polytechnic Institute, Troy, NY, USA, in 1999.

He is currently a Professor with the Graduate Institute of Business Administration, College of Management, National Taiwan University, Taipei, Taiwan. His current research interests include the fields of new product development and innovation management. He has published papers in *IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT*, the *Journal of Engineering and Technology Management*, the *Journal of Business Research*, the *Journal of World Business*, *R&D Management*, *Research Policy*, and other journals.



Yung-Chang Hsiao received the Doctorate degree in technology and innovation management from National Cheng Kung University, Tainan, Taiwan, in 2010.

He is currently an Assistant Professor with the Department of Business and Management, College of Science and Engineering, National University of Tainan, Tainan. His current research interests include innovation management and knowledge transfer. He has published papers in the *Journal of World Business*; the *Journal of Business Research*; the *Journal of Engineering and Technology Management*; the *Journal of Business and Industrial Marketing*; the *International Journal of Manpower, Innovation: Management, Policy, and Practice*; and *Organization and Management*.



Mo-An Chu received the Doctorate degree in technology and innovation management from the Graduate Institute of Business Administration, National Cheng Kung University, Tainan, Taiwan, in 2010.

He is an Assistant Professor with the Department of Business Administration, Hwa Hsia University of Technology, Taipei, Taiwan. His current research interests include the fields of new product development and innovation management. He has published papers in the *Journal of Business Research*, the *Journal of Engineering and Technology Management*, and other journals.



Kae-Kuen Hu is currently working toward the Ph.D. degree with the Graduate Institute of Business Administration, National Taiwan University, Taipei, Taiwan.

His current research interests include technology and innovation management, academic-industry collaboration, and entrepreneurship.