The Positive Effect of Inward and Outward Capability on New Product Development Performance

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Abstract--**This study develops an original framework of inward and outward capability to explore the positive effect of adaptive ability (inward capability) and relationship learning (outward capability) on new product development performance through the partial mediator - resource integration. The study employed questionnaire survey and collected data from 167 Taiwanese manufacturing companies. Confirmatory factor analysis and Structural Equation Modeling (SEM) are applied to verify the hypotheses. This study classifies Taiwanese manufacturing companies into three groups – highly, medially, and lowly capable companies. The results show that resource integration of highly capable companies are the most, and those of medially capable companies are the next, while those of lowly capable companies are the least. This study asserts companies should invest in both inward and outward capability. This study combines the concepts of inward and outward capability to develop an integral conceptual model of new product development performance to explore its managerial implications.**

I. INTRODUCTION

Successful new product development becomes an important determinant for a company [11, 30]. In this study, adaptive ability is regarded as an inward capability, and relationship learning is regarded as an outward capability. Simply having inward capability is not enough for enhancing company's performance. Companies must be able to have the both inward and outward capability to improve resource integration and new product development performance. Adaptive ability is an inward capability which is defined as the ability to adjust operational strategy to face rapid changes [29]. Adaptive ability gives the company a better chance of responding to a larger range of future changes. On the other hand, relationship learning is an outward capability which regarded to improve future behaviors through joint learning activities with their partners [37]. To improve new product development performance, companies are motivated to engage in learning activities in order to gain some control under the increasing global competition. Relationship learning creates information sharing that increases the integration of knowledge [12]. However, there is no research exploring the both inward and outward perspectives of capability. Therefore, this study wants to fill this research gap.

While company's inward and outward capability has direct effects on new product performance [6, 42], integration is likely to mediate the relationship between capability and new product development performance. Integration means to the cooperation and communication between internal and external sides. An integrated product development process exploits both internal and external information sources [40]. Internal integration needs mutual comprehension from each functional area to share knowledge and coordinate the overlapped process [40]. External integration is related to the ability which gains further information by external partners through relationship networking [37, 40]. When a company can adjust their resources and organizational structure to face uncertainty, it has a better chance to integrate its resources. Successful new product development emerges from unique combinations of resources and capability [24, 30]. The ability of integrating resource can neutralize threats for companies. To date, research which deals with antecedent of resource integration is scant in professional literature. This research selects the two antecedents are adaptive ability and relationship learning, and the consequent is new product development performance, thereby providing insight into resource integration which plays a mediating role among inward capability, outward capability and new product development performance in Taiwanese manufacturing industry.

The structure of this study is as follows. A literature review is discussed in section 2, and five hypotheses are also proposed in this section. In section 3, this study describes the methodology, the sample and data collection, and the measurements of the constructs. In section 4, the descriptive statistics, reliability of the measurement, factor analysis, correlation coefficients between constructs, and the results of measurement and structural model are shown. In section 5, this study mentions the discussions about the findings and implications, and possible directions for future studies.

II. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

A. The positive effect of adaptive ability and relationship learning on resource integration

Adaptive ability is an inward capability. Adaptive ability can adjust operational strategy, organizational structure and resource investment in companies to face rapid changes [29]. As the environment shifts, resource advantages can become disadvantages if there is no attempt to refresh the resource stock. Companies reconfigure their resources and modify their current capabilities which can acquire and utilize knowledge. A company devotes to developing the ability to sense the need to reconfigure the company's resource

structure [2]. Adaptive ability can be applied to alternative uses may give the company a better chance of responding to a larger range of future changes. To improve a company's adaptive ability, companies are motivated engage in handling higher environmental complexity. Therefore, the total stock of collective information is expanded continuously and the company's ability to exploit such information is correspondingly improved.

Integration is the process of achieving unity of effort among the various subsystems in the organization [33]. Integration empowers the recombination specialized knowledge, whereby the ensuring sum is greater than its components [38]. It is important for companies to have highly couples procedures and routines with all of the departments to import and process information [36]. A company increases its integration capability for the long run should create conflict-resolution mechanisms. Mutual comprehension from each functional area makes it possible to coordinate the overlapped process and avoid conflicts [40]. In order to assure long-term growth and survival in complex environments, companies should display a clear understanding of its status and do some reactions. When a company has the ability to adjust its strategy and structure, the company can integrate resources to generate new applications and meet changing market demands.

Relationship learning is an outward capability which regarded to improve future behaviors between companies and their partners [37]. Relationship is networking connections between companies and their partners. Relationship is built up by mutual trust [9]. Taiwanese manufacturing companies usually have high-quality relationships with their partners not only for decreasing transaction costs but also for increasing cooperation and efficiency [12]. Networking partners of a company do not only contain suppliers, but also includes customers, competitors, consultants, government agencies, universities, research institutions, market research organizations, advertising agencies, and sales agents [29]. Relationship learning can share information, experiences and develop relationship-specific memories with targeted partners [9, 34]. Through relationship learning form partners, companies share valuable know-how with partners in return for access to the stock of valuable knowledge [12, 18]. Manufacturing companies can exchange knowledge and information with their suppliers, which enables them to learn from each other and demonstrate superior performance [41]. The supports from external institutions and key partners can help companies to survive and grow. Companies can learn from their partners to know where the weakness is and how to overcome the defects. Relationship learning enables companies to obtain crucial information and knowledge from their networking partners [37]. Interorganization knowledge-sharing routine is a regular pattern of interactions that permits the transfer, recombination, or creation of specialized knowledge. These partnerships produced stronger competitive positions than those achievable by the companies operating individually [12, 18]. Relationship learning can determine the company's capability to integrate, build and reconfigure the company's resources [30, 37]. Companies learn from partners can help to integrate the information from diverse resources and facilitate the efficiency in company's operation [36]. Based on the mention above, this study implies the following hypothesis:

Hypothesis 1 (H_1). Adaptive ability is positively associated with resource integration.

Hypothesis 2 (H_2). Relationship learning is positively associated with resource integration.

B. The positive effect of resource integration on new product development performance

Resource acquisition cannot ensure successful resource application. Companies allocate or access their resource from adaptive ability and relationship learning to gain their information and knowledge. Moreover, companies also need resource integration capability to ensure resource application. Companies have to establish mechanisms to recognize external knowledge sources and need to utilize knowledge through the sequential processes to integrate knowledge [15]. Mutual comprehension from each functional area makes it possible to coordinate the overlapped process and facilitates integration. Resource integration helps companies to anticipate downstream development problems, making it easier, quickly solve and correct them, and improves understanding of each departments in the organization, and helps to quickly fix the problems that may arise during the product development process [25].

Several studies have proposed the importance of integration for new product development success [1, 16, 39]. Integration of knowledge provides options for companies to expend in new markets and businesses in the future [14]. Key successful factors of new product development can be regarded as strategy and information integration [11]. It is important for a company to exchange marketing and technological information through the innovation process [39]. Companies require the integration ability to produce creative and innovative ideas to develop new products [10]. Companies commercialize internal and external knowledge using outside and inside pathways to develop new products [30]. Successful new product development requires knowledge input from a variety of internal and external sources to determine how to be designed into the new product [7, 13]. Moreover, the well-integrated knowledge about the external environment, combined with knowledge of internal capability, provide important clues about new product development [23]. Therefore, this study proposes the following hypothesis:

Hypothesis 3 (H_3). Resource integration is positively associated with new product development performance.

C. The positive effect of adaptive ability and relationship learning on new product development performance

New product development is an important process which

companies sustain their competitive strength. Successful new product development can create "isolation mechanisms" which protect profit margins and allow benefits to be gained [40]. New product development performance will be outstanding if a company has the ability to make good use of information, and then makes proper strategies to face uncertainty. Successful new product development can make imitation more difficult and allow companies to sustain their advantages better [23]. According to institutional theory, companies pay attention to the impacts of external effects about companies' strategies [27]. The essence of management is to cope with change. Companies have to handle change in external environment through and appropriate strategy of a matching structure [27], such as development product in a new market. To face uncertainty, companies' survivals depend on the adjustment capability. Adjustments effect the companies' operations that facilitate the company to be adaptive during environmental variation [27]. Therefore, adaptive ability enables a company to resist fluctuations in its market and develop new product to fit environment [8].

For manufacturing companies, accessing knowledge and information from their customers enables them to provide and to develop more valuable products. Possessing more knowledge and information about their suppliers enables them to choose proper components and qualified suppliers to satisfy their needs and wants [41]. From the relational view of competitive advantage, relationship learning is an important approach for enhancing competitiveness [34]. The relevant partners can identify ways to improve the quality, reliability, and speed of information and knowledge sharing. Companies involve in sharing knowledge and collaboration can extend their own knowledge base to improve relationship efficiency [19]. Knowledge acquired in relationship learning can build diversified knowledge that allows companies to attain new ideas [43]. The relational value would be the introduction of new product lines, or the extension into a new product [36]. Relationship learning enables companies to obtain crucial information and knowledge from their networking members for developing new product. Hence, this study implies the following hypothesis:

Hypothesis 4 (H4). Adaptive ability is positively associated with new product development performance.

Hypothesis 5 (H_5). Relationship learning is positively associated with new product development performance.

This study summarizes the literature into a new managerial framework. This study seeks to improve understanding of the associations among adaptive ability, relationship learning, resource integration and new product development performance. The main purpose of this study is to explore the positive effect of adaptive ability and relationship learning on new product development performance via the mediator: resource integration. This study shows the research framework in Fig. 1.

III. METHODOLOGY AND MEASUREMENT

A. Data collection and the sample

The unit of analysis in this study is the business level and focused on the manufacturing industry in Taiwan. In addition, the sample is randomly selected from the "2012 Business Directory of Taiwan." Respondents are top managers, CEOs, managers of manufacturing, marketing, human resource management, purchasing, finance or R&D departments. To increase the survey response rate, each company is called and confirmed the names and job titles of the respondents. Then, explained the objectives of this study prior to mailing of the questionnaire. The respondents are asked to return the completed questionnaires within two weeks after mailing.

Moreover, to avoid common method variance (CMV), different respondents answer the different constructs in the questionnaire. The respondents of "adaptive ability" are CEOs, managers of manufacturing or human resource management departments; those of "relationship learning" are CEOs, managers of purchasing or manufacturing departments;

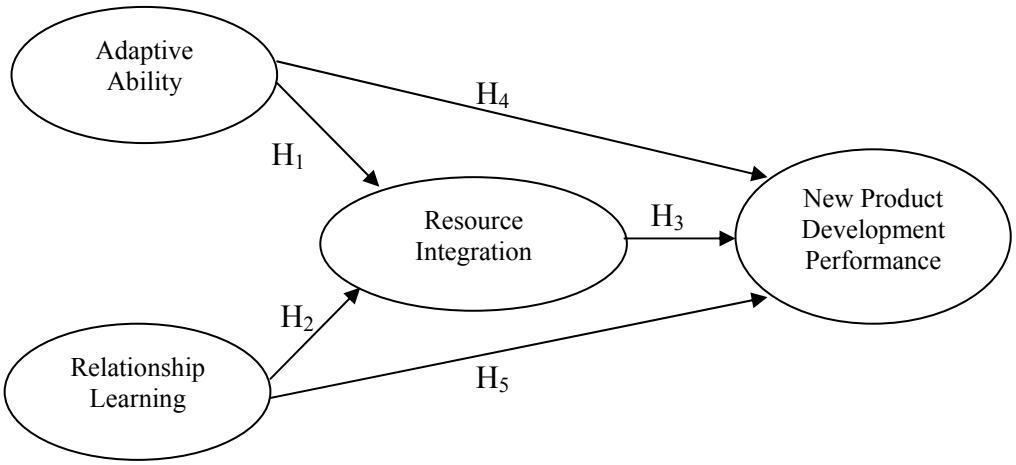


Fig. 1 Research framework

those of "resource integration" are managers of human resource management, finance or manufacturing departments; those of "new product development performance" are CEOs, managers of marketing or R&D departments in Taiwanese manufacturing companies. If no one refuses to answer the questionnaire, it means the questionnaire is valid. This questionnaire can present the level of adaptive ability, relationship learning, resource integration and new product development performance of the company. This study sent 500 questionnaires to the companies. There are 167 valid questionnaires, and the effective response rate is 33.4%.

B. Measurements of variables

The measurement of the questionnaire items in this study is by use of "five-point Likert scale from 1 to 5" rating from strongly disagreement to strongly agreement. The measurements of the constructs in this study as follow:

Adaptive ability. The measurement of adaptive ability includes three items: (1)whether the company can adjust operational strategy to face rapid changes ; (2) whether the company can adjust organizational structure to face rapid changes; (3) whether the company can adjust resource investment and allocation to face rapid changes [8, 22, 29].

Relationship learning. Relationship learning is defined as the interaction learning activities between companies and their partners, such as customers, suppliers, and network members to exchange and to share information, knowledge, and technologies [37]. The measurement of relationship learning includes three items: (1) whether the company exchanges information related to the technology with its relevant partners; (2) whether the company frequently influenced by its relevant partners to evaluate and adjust the routines in processes; (3) whether the company establish joint teams with relevant partners to discuss future strategic issues [12, 37].

Resource integration. The measurement of resource integration includes three items: (1) whether the company's resources allocation, such as human, technical and financial resources, are in line with the vision and mission of the company; (2) whether there is extensive communication between all of the departments in the company; (3) whether the company's procedures and routines are highly couples with all of the departments in the company [5, 28, 36].

New product development performance. This study referred to pervious empirical studies about the measurements of new product development performance and developed the following seven items: (1) whether the commercialization pace of the new products of the company is faster than that of the major competitors; (2) whether the new products open new market to the company; (3) whether the new products can meet the needs of customers; (4) whether the ratio of the successful new product development projects in the company is more than that of the major competitors; (5) whether the new products attain the goal of expected sales; (6) whether the new products attain the goal of expected profitability; (7) All in all, the new products in the company are successful [17, 30, 38, 35].

IV. EMPIRICAL RESULTS

This study utilized Structural Equation Modeling (SEM) to verify the research framework and hypotheses. SEM is a statistical technique for testing and estimating causal relationships in a more powerful way which takes into account the modeling of interactions, nonlinearities, correlated independents, measurement error, correlated error terms, multiple latent independents each measured by multiple indicators, and one or more latent dependents also each with multiple indicators. The antecedents of the research framework are adaptive ability and relationship learning, and the consequent is new product development performance, while resource integration is the mediator. SEM of this study included two levels of analysis - the measurement model and the structural model.

A. Results of the measurement model

This study demonstrates the means and standard deviations of the constructs and the correlations among them in Table 1. There are positive correlations among the four constructs: adaptive ability, relationship learning, resource integration, and new product development performance. This study shows the result of factor analysis in Table 2. Every construct in this study can be classified into only one factor. This study applies confirmatory factor analysis (CFA) to verify the validity and reliability in the measurement model. The results of the CFA indicate that the measurement model exhibits the acceptable levels of the model fit (GFI=0.926, NFI=0.983, RMSEA=0.045).

There are several measures to confirm the reliability and validity of the measurement. One measure of reliability is to examine the loadings of each of the constructs' individual items. With respect to the quality of the measurement model, the loadings (λ) of items of the constructs listed in Table 3 are all significant. Table 3 lists the Cronbach's α coefficients for the measure of reliability. In general, the minimum requirement of the Cronbach's α coefficient is 0.7 [26]. Because the Cronbach's α coefficients of the four constructs are more than 0.7, the measurement of this study is acceptable in reliability. In addition, it is also important to verify whether the validity of the measurement is acceptable. There are three ways to verify the validity of the measurement. First, the study refers to previous studies to design questionnaire items. Prior to mailing to the respondents, seven experts and scholars modified the questionnaire in the first pretest. Subsequently, the authors distributed the questionnaires to twelve CEOs or the managers of manufacturing, marketing, human resource, purchasing, finance, or R&D departments in different Taiwanese manufacturing companies. They fill in the questionnaires and to identify ambiguities in terms, meanings, and issues in the second pretest. The questionnaire of this study has high level of content validity. Second, this study

applies Fornell and Larcker's measure of average variance extracted (AVE) to access the discriminative validity of the measurement [21]. The AVE measures the amount of variance captured by a construct through its items relative to the amount of variance due to the measurement error. To satisfy the requirement of the discriminative validity, the square root of a construct's AVE must be greater than the correlations between the construct and other constructs in the model. For example, the square roots of the AVEs for the two constructs, adaptive ability and relationship learning, are 0.849 and 0.775 in Table 3 which are more than the correlation, 0.258, between them in Table 1. This demonstrates there is adequate discriminative validity between adaptive ability and relationship learning. The square roots of all constructs' AVEs in Table 3 of this study are all more than the correlations among all constructs in Table 1. Therefore, the discriminative validity of the measurement in this study is acceptable. Third, the AVEs of the four constructs are more than 0.5 in Table 3. It means that the convergent validity of the four constructs is acceptable. In sum, there are adequate reliability and validity in the measurement of this study according to the above analysis.

TABLE 1. MEANS, STANDARD DEVIATIONS, AND CORRELATIONS OF THE CONSTRUCTS

Constructs	Mean	Standard Deviation	(A)	(B)	(C)
A. Adaptive Ability	3.860	0.687			
B. Relationship Learning	3.906	0.640	0.258**		
C. Resource Integration	3.874	0.720	0.376**	0.339**	
D. New Product Development Performance	3.767	0.662	0.384**	0.409**	0.395**

Note: ** p<0.01.

TABLE 2. FACTOR ANALYSIS OF THIS STUDY.

Constructs	Number of Items	Number of factors	Accumulation percentage of explained variance
A. Adaptive Ability	3	1	78.424%
B. Relationship Learning	3	1	73.672%
C. Resource Integration	3	1	79.518%
D. New Product Development Performance	7	1	70.673%

TABLE 3.THE ITEMS' LOADINGS (Λ) AND THE CONSTRUCTS' CRONBACH's α • COEFFICIENTS AND AVEs

Constructs	Items	λ	Cronbach's α	AVE	The square root of AVE
A. Adaptive Ability			0.861	0.721	0.849
	AA1	0.853			
	AA2	0.821**			
	AA3	0.873**			
B. Relationship Learning			0.820	0.601	0.775
	RL1	0.734			
	RL2	0.836**			
	RL3	0.752**			
C. Resource Integration			0.869	0.703	0.838
	RI1	0.965			
	RI2	0.784**			
	RI3	0.751**			
D. New Product Development Performance			0.931	0.670	0.818
	NPD1	0.717			
	NPD2	0.908**			
	NPD3	0.764**			
	NPD4	0.797**			
	NPD5	0.819**			
	NPD6	0.869**			
	NPD7	0.743**			

Note: ** p<0.01.

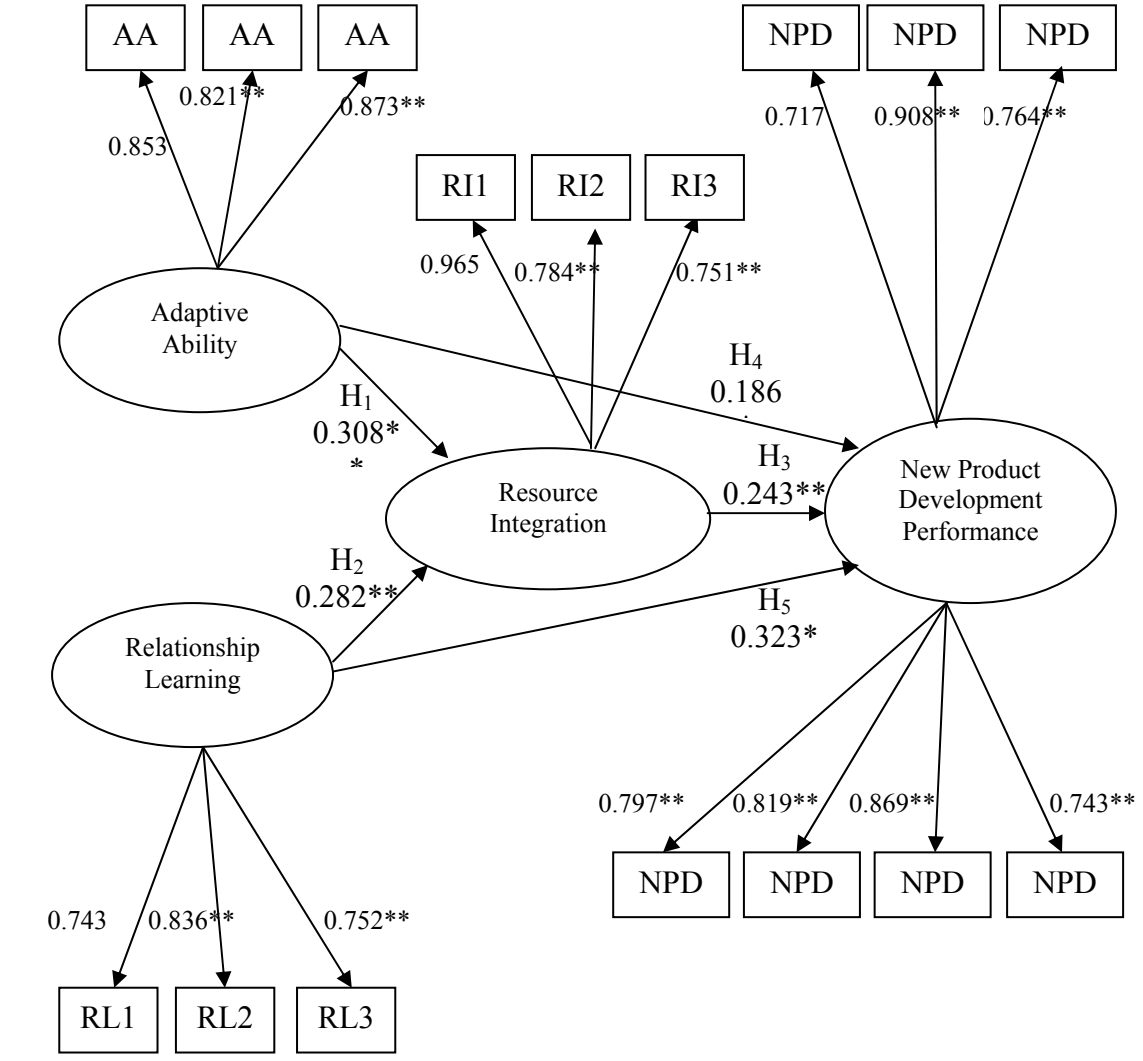
B. The results of the structural model

This study verifies the empirical results of the hypotheses in this section. The results of the structural model are presented in Table 4 and Fig. 2. The measures of overall fit indicate the fit of the structural model is acceptable (GFI= 0.930, CFI=0.986, NFI=0.941, RMSEA=0.041). Adding or deleting any paths in this research framework would not significantly improve the fit. The residuals of the covariance are also small and centered near 0. All of the five paths are in Table 4. The results of the full model are shown in Fig. 2. According to Table 4 and Fig. 2, the results are supported for all of the hypothesized effects in the research model. Therefore, this study verifies that resource integration is a partial mediator in this model. This study finds out resource integration partially mediates the positive relationship among adaptive ability, relationship learning and new product development performance.

TABLE 4. THE RESULTS OF THE STRUCTURAL MODEL

Hypothesis	Proposed effect	Path coefficient	Results
H_1	+	0.308**	H_1 is supported
H_2	+	0.282**	H_2 is supported
H_3	+	0.243 **	H_3 is supported
H_4	+	0.186*	H_4 is supported
H_5	+	0.323**	H_5 is supported

Note: * p<0.05, ** p<0.01.



GFI= 0.930, CFI=0.986, NFI=0.941, RMSEA=0.041
Note: † p<0.1,* p<0.05, ** p<0.01.

Fig. 2 The results of the full model

C. Further exploration of the data

As shown in Fig. 3, this study classifies the manufacturing companies in Taiwan into three groups by the levels of adaptive ability and relationship learning. This study defines the adaptive ability is high when it is higher than the median value of the entire sample's adaptive ability. On the contrary, it is defined as low when its adaptive ability is lower than the median value of the entire sample's adaptive ability. Similarly, this study also defines relationship learning is high or low in the same way. The first group is named "Highly Capable Companies" and both of its adaptive ability and relationship learning are high; the second group is named "Medially Capable Companies" and either its adaptive ability or relationship learning is high; the third group is named "Lowly Capable Companies" and both of its adaptive ability and relationship learning are low. The total sample size in the study was 167 including 65 highly capable companies, 70 medially capable companies, and 32 lowly capable companies. The study applies t test to explore whether resource integration among three groups of companies are significant different. Table 5 shows that resource integration of highly capable group is significantly higher than those of medially and lowly capable group, and resource integration of medially capable group is significantly higher than those of lowly capable group. It is imperative for lowly capable companies to increase both of their adaptive ability and relationship learning to enhance their resource integration. In addition, there are two types of medially capable companies: the first type has high adaptive ability and low relationship learning capability, and the second one has low adaptive ability and high relationship learning capability. Therefore, if medially capable companies want to facilitate their resource integration, the first type of medially capable companies should increase their relationship learning capability and the second one of medially capable companies should increase their adaptive ability. Table 6 shows that new product development performance of highly capable group is significantly higher than those of lowly capable group. New product development performance of medially capable group is significantly higher than those of lowly capable group. Therefore, if companies want to enhance new product development performance, companies should increase their relationship learning capability and their adaptive ability.

TABLE 5. DIFFERENCE ANALYSIS OF RESOURCE INTEGRATION AMONG THREE GROUPS OF COMPANIES

Construct	Groups	Mean	A-B	A-C	B-C
Resource Integration	Highly Capable Companies (A)	4.144	0.320* (2.687)	0.706** (4.513)	0.386* (2.979)
	Medially Capable Companies (B)	3.824			
	Lowly Capable Companies (C)	3.438			

Note: * p<0.05, ** p<0.01. The number in the bracket is the t value.

TABLE 6. DIFFERENCE ANALYSIS OF NEW PRODUCT DEVELOPMENT PERFORMANCE AMONG THREE GROUPS OF COMPANIES

Construct	Groups	Mean	D-E	D-F	E-F
New Product Development Performance	Highly Capable Companies (D)	3.958	0.226 (1.941)	0.507** (3.802)	0.282* (2.156)
	Medially Capable Companies (E)	3.733			
	Lowly Capable Companies (F)	3.451			

Note: * p<0.05, ** p<0.01. The number in the bracket is the t value

		Relationship Learning: High	Relationship Learning: Low
Adaptive Ability	High	Highly Capable Companies	Medially Capable Companies
	Low	Medially Capable Companies	Lowly Capable Companies

Fig.3 The classification of the companies

V. CONCLUSIONS AND IMPLICATIONS

This study utilizes structural equation modeling (SEM) to explore the positive effect of adaptive ability and relationship learning on new product development performance via the mediator: resource integration. In this study, all of the five hypotheses are supported. This study also verifies the partial mediation role of resource integration. There are several contributions to the mediation role in the following. First, besides adaptive ability and relationship learning have the direct impact on new product development performance, resource integration is also positively associated with new product development performance. If companies want to enhance new product development performance, they should not only focus on adaptive ability and relationship learning, but also focus on resource integration. Second, the increase of adaptive ability and relationship learning can help companies to enhance resource integration. Hence, companies can integrate their resource to enhance the positive influence of adaptive ability and relationship learning on new product development performance. Third, previous research does not explore the mediation role of resource integration among adaptive ability, relationship learning and new product development performance. This study fills this research gap and verifies that resource integration has a partial mediation effect among adaptive ability, relationship learning and new product development performance.

This study combines the concepts of inward and outward capability to develop the research framework. This study suggests that companies should focus on adaptive ability and relationship learning which can enhance resource integration because it is positively associated with new product development performance. If companies want to integrate their resources and enhance new product development performance, they should raise their adaptive ability and relationship learning. However, research which deals with the antecedent of resource integration is scant in professional literature. Previous research focused on the either inward or outward capability on new product development performance, but there was no research taking into the effects of both. This study summarized the literature on the inward capability: adaptive ability and outward capability: relationship learning into a new managerial framework. The results show both of the two antecedents of resource integration and new product development fit the model exactly from the result of SEM.

This study classifies the manufacturing companies in Taiwan into three groups - “highly capable companies,” “medially capable companies,” and “lowly capable companies” - by the levels of adaptive ability and relationship learning. This study demonstrates that resource integration of highly capable companies are significantly higher than those of the other two groups, and resource integration of medially capable companies are significantly higher than those of lowly capable companies. In this study, it is important for lowly capable companies to raise both adaptive ability and relationship learning to enhance its resource integration. The results of this study can not only demonstrate the theoretical significance in the field of capability and new product development performance, but also contribute to Taiwanese manufacturing companies as reference to put much emphasis on their adaptive ability and relationship learning.

There are three academic contributions in this study. First, this study incorporates inward and outward capability into the RBV research. According to RBV, knowledge is the most important assets that a company can control, and the challenge of uncertainty is how companies turn knowledge into capability for new products [4, 31, 32]. By addressing the link among inward capability, outward capability and resource integration, this study presents a novel perspective for new product development. Second, this study asserts the partial mediation role of resource integration that suggests a role for cooperating and communicating between internal and external sides. Companies integrate their resources to ensure resource application. Key successful factors of new product development can be regarded as strategy and knowledge integration [11]. Third, in the Chinese context, relationship is important for their connections. Comparing with Westerners, the Chinese have a much stronger tendency to divide people or groups into categories and treat them in different ways [20]. In a relation-centered society, relationship learning is highly selective and enables companies to obtain crucial information from their networking partners. However, relationship has received scant attention in new product development literature. To verify the social-cultural settings in Taiwanese manufacturing companies, this research employed an empirical study by use of the questionnaire survey.

Abundant research opportunities exist in this research framework. The research object of this study is the manufacturing industry of Taiwan, so the future studies can focus on other industries or areas and compare with this study. This study is conducted in Taiwanese context. It is an interesting issue to test whether the hypotheses are supported in other countries. In order to verify whether the hypotheses can be generalized to the rest of the world, future studies can select other countries as the research object and compare with this study. This study verifies hypotheses by use of questionnaire survey, only providing cross-sectional data, so that this study cannot observe the dynamic changes of adaptive ability and relationship learning in the different stages of the development of Taiwanese industry through longitudinal data. Therefore, future studies can set forth toward the longitudinal study to find out the different stages of the development in manufacturing industry. Finally, this study hopes the research results are beneficial to managers, researchers, or policy makers in manufacturing industry of Taiwan, and contribute to relevant studies and future researches as reference.

REFERENCES

[1] Abecassis-Moedas C. and S. Mahmoud-Jouini, "Absorptive capacity and source-recipient complementarity in designing new products: An

empirically derived framework," *The Journal of Product Innovation Management,* vol. 25, pp. 473-490, 2008.
[2] Amit R. and P. J. H. Schoemaker, "Strategic assets and organizational rent," *Strategic Management Journal,* vol. 14, pp. 33-46, 01, 1993.
[3] Appleyard, M. M. "How does knowledge flow? Interfirm patterns in the semiconductor industry," *Strategic Management Journal,* vol. 17, pp. 137-154, 1996.
[4] Barney, "Firm resources and sustained competitive advantage," *Journal of Management,* vol. 17, pp. 99-120, 1991.
[5] Budhwar, P. S. "Strategic integration and devolvement of human resource management in the UK manufacturing sector," *British Journal of Management,* vol. 11, pp. 285-302, 2000.
[6] Burgelman, R. A. "Intraorganizational ecology of strategy making and organizational adaptation: theory and filed research," *Organization Science,* vol. 2, pp. 239-262, 8, 1991.
[7] Calantone, R. J., S. T. Cavusgil, J. B. Schmidt and G. Shin, "Internationalization and the dynamics of product adaptation—An empirical investigation," *Journal of Product Innovation Management,* vol. 21, pp. 185-198, 2004.
[8] Chakravarthy, B. S. "Adaptation: A Promising metaphor for strategic management," *Academy of Management Review,* vol. 7, pp. 35-44, 1982.
[9] Chen M. J. and D. Miller, "The relational perspective as a business mindset," *The Academy of Management Perspectives,* vol. 25, pp. 6-18, 2011.
[10] Chen, C. "Technology commercialization, incubator and venture capital, and new venture performance," *Journal of Business Research,* vol. 62, pp. 93-103, 2009.
[11] Chen, Y. S., M. J. J Lin and C. Chang, "The influence of intellectual capital on new product development performance - The manufacturing companies of Taiwan as an example," *Total Quality Management & Business Excellence,* vol. 17, pp. 1323-1339, 2006.
[12] Chen, Y. S., M. J. J. Lin and C. H. Chang, "The positive effects of relationship learning and absorptive capacity on innovation performance and competitive advantage in industrial markets," *Industrial Marketing Management,* vol. 38, pp. 152-158, 2, 2009.
[13] Chen, Y. S., S. Lai and C. Wen, "The influence of green innovation performance on corporate advantage in Taiwan," *Journal of Business Ethics,* vol. 67, pp. 331-339, 2006.
[14] Chirico F. and C. Salvato, "Knowledge integration and dynamic organizational adaptation in family firms," *Family Business Review,* vol. 21, pp. 169-181, 2008.
[15] Cohen W. M. and D. A. Levinthal, "Absorptive capacity: A new perspective on learning and innovation," *Administrative Science Quarterly,* vol. 35, pp. 128-152, 1990.
[16] Cooper, R. G. "The dimensions of industrial new product success and failure," *The Journal of Marketing,* vol. 43, pp. 93-103, 1979.
[17] Driva, H., K. S. Pawar and U. Menon, "Performance evaluation of new product development from a company perspective," *Integrated Manufacturing Systems,* vol. 12, pp. 368-378, 2001.
[18] Dyer J. H. and H. Singh, "The relational view: Cooperative strategy and sources of interorganizational competitive advantage," *Academy of Management Review,* vol. 23, pp. 660-679, 1998.
[19] Fang, S. R., S. C. Fang, C. H. Chou, S. M. Yang and F. S. Tsai, "Relationship learning and innovation: The role of relationship-specific memory," *Industrial Marketing Management,* vol. 40, pp. 743-753, 2011.
[20] Farh, J., A. S. Tsui, K. Xin and B. Cheng, "The influence of relational demography and guanxi: The Chinese case," *Organization Science,* vol. 9, pp. 471-488, 1998.
[21] Fornell C. and D. F. Larcker, "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error," *Journal of Marketing Research,* vol. 18, pp. 39-50, 1981.
[22] Fox-Wolfgramm, S., K. B. Boal and J. G. Hunt, "Organizational adaptation to institutional change: a comparative study of first-order change in prospector and defender banks," *Administrative Science Quarterly,* vol. 43, pp. 87-126, 1998.
[23] García-Morales, V. J., A. Ruiz-Moreno and F. J. Llorens-Montes, "Effects of technology absorptive capacity and technology proactivity on organizational learning, innovation and performance: an empirical examination," *Technology Analysis & Strategic Management,* vol. 19, pp. 527-558, 2007.
[24] Grant, R. M. "Toward a knowledge-based theory of the firm," *Strategic Management Journal,* vol. 17, pp. 109-123, 1996.
[25] Griffin, A. "Modeling and measuring product development cycle time across industries," *Journal of Engineering and Technology Management,* vol. 14, pp. 1-24, 1997.
[26] Hair, J. F., R. E. Anderson, R. L. Tatham and W. C. Black, *Multivariate Data Analysis.* New Jersey: Prentice-Hall, Inc, 1998.
[27] Hoffman, A. J. *From Heresy to Dogma: An Institutional History of Corporate Environmentalism.* CA: Stanford Business Books, 2001.
[28] Kim, H., Y. Kim and C. Park, "Integration of firm's resource and capability to implement enterprise CRM: A case study of a retail bank in Korea," *Decision. Support System,* vol. 48, pp. 313-322, 2010.
[29] Kim, N. and J. H. Pae, "Utilization of new technologies: organizational adaptation to business environments," *Journal of the Academy of Marketing Science,* vol. 35, pp. 259-269, vol. 35, 2007.
[30] Kleinschmidt, E. J., U. De Brentani and S. Salomo, "Performance of global new product development programs: A Resource-Based View," *Journal of Product Innovation Management,* vol. 24, pp. 419-441, 2007.
[31] Knight G. A. and S. T. Cavusgil, "Innovation organizational capabilities and the born-global firm," *Journal of International Business Studies,* vol. 35, pp. 124-141, 2004.
[32] Kogut B. and U. Zander, "Knowledge of the firm, combinative capabilities, and the replication of technology," *Organization Science,* vol. 3, pp. 383-397, 1992.
[33] Lawrence, P. R. and J. W. Lorsch, "Differentiation and integration in complex organizations," *Administrative Science Quarterly,* vol. 1, pp. 1-47, 12, 1967.
[34] Li, L. "Relationship learning at trade shows: Its antecedents and consequences," *Industrial Marketing Management,* vol. 35, pp. 166-177, 2006.
[35] Olson, E. M., O. C. Walker Jr and R. W. Ruekert, "Organizing for effective new product development: The moderating role of product innovativeness," *Journal of Marketing,* vol. 59, pp. 48-62, 1995.
[36] Saraf, N., C. S. Langdon and S. Gosain, "IS application capabilities and relational value in interfirm partnerships," *Information Systems Research,* vol. 18, pp. 320-339, 2007.
[37] Selnes F. and J. Sallis, "Promoting relationship learning," *Journal of Marketing,* vol. 67, pp. 80-95, 2003.
[38] Souder, W. E. "Managing relations between R & D and marketing in new product development projects," *Journal of Product Innovation Management,* vol. 5, pp. 6-19, 1988.
[39] Souder, W. E. *Managing New Product Innovations.* KY: Lexington Books Lexington, 1987.
[40] Tessarolo, P. "Is Integration enough for fast product development? an empirical investigation of the contextual effects of product vision," *Journal of Product Innovation Management,* vol. 24, pp. 69-82, 2007.
[41] von Hippel, E. ""Sticky information" and the locus of problem solving: Implications for innovation," *Management Science,* vol. 40, pp. 429-439, 1994.
[42] Wu, W. and A. Leung, "Does a micro-macro link exist between managerial value of reciprocity, social capital and firm performance? The case of SMEs in China," *Asia Pacific Journal of Management,* vol. 22, pp. 445-463, 2005.
[43] Yung I. and M. Lai, "Dynamic capabilities in new product development: the case of Asus in motherboard production," *Total Quality Management & Business Excellence,* vol. 23, pp. 1125-1134, 2012.