

## Investigating the Role of Collaborative Innovation Networks and Customer Participation on New Product Performance Cinnagen Co

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### Abstract

*The impact of collaborative innovation networks on the process of corporate performance has attracted particular attention in recent years. Collaborative innovation networks comprise a collection of suppliers, customers, competitors, universities and research institutes. This study aimed to investigate the role of collaborative innovation networks and customer participation on the performance of new products of Cinnagen Co. Structural equation technique using the least squares method with Smart PLS software was used to analyze the data. The results show that there is no significant direct relationship between customer participation and new product development, but this variable has a direct and significant effect on the performance of the new product, mediated by attraction capacity variables and innovation capabilities. The results also show that collaborative innovation networks mediate innovation capabilities that influence new product performance.*

**Key-words:** Collaborative Innovation Networks, Innovation Capability, Customer Participation, Product Performance.

### 1. Introduction

In an increasingly competitive global business environment, companies have realized the need to invest in new product development (NPD) in order to stay in the market and gain competitive advantage [1]. NPD is recognized as a resource-intensive and expensive process that is associated with high risk [2]. Previous research has identified diverse internal and external resources (such as innovation capability) and external capabilities (such as collaboration with channel members and

attraction capacity) as contributing factors to NPD success [1, 3]. Collaboration with various external factors such as suppliers, customers, competitors and research organizations has improved the knowledge sharing and market knowledge gained by the company and has led to the development of existing knowledge base and thereby enhances the innovation capability of the company [4]. In previous research collaborations with foreign actors have been identified as one of the most important external factors affecting NPD performance [4, 5].

Collaborative innovation networks mean that companies interact with different partners such as suppliers, customers, competitors, and research organizations to develop new products [6]. Increasing the company's access to complementary resources, facilitating the exchange of explicit and implicit knowledge and reducing the risk of research and development activities through the distribution of related costs among partners are considered as key benefits of collaborative innovation networks [7]. In line with previous research that defined collaborative innovation networks as “the extent to which channel members participate in new product development innovation processes” [8], this study also focuses on collaborative innovation networks between channel members (such as suppliers and customers) and non-channel members. (Such as competitors, universities and research institutes), and we consider this collaboration to be a feature of the innovation process [5]. Numerous studies have also investigated the impact of different types of innovation networks on new product development [4]. Luzzini et al. and Najafi Tavani et al. in their research showed that collaborative innovation networks have a positive impact on new product performance [2, 6]. Also in their research, product and process innovation capabilities were considered as mechanisms through which collaborative innovation networks lead to improved product performance. Product and process innovation capabilities are the most important internal resources that can influence the achievement of superior performance [9]. On the other hand, the relationship between collaborative innovation networks and product and process innovation capabilities depends on the extent of the firm's attraction capacity [6]. Attraction capacity is helpful in identifying external ideas that are more marketable, redefining and classifying issues and problems, and applying specific environmental knowledge to implement new product solutions [10]. Past research, on the other hand, has emphasized that customer participation in the new product development process is essential to ensure the success of the new product [11]. Customer participation means the extent to which customers are involved in the new product development process [12]. Consumers are therefore seen as an integral part of the new product development process chain [13]. On the other hand, customer involvement can be incorporated into customer activities by sharing needs and providing NPD-related solutions that the company is unaware of. This includes customer involvement in various new product

development activities such as idea generation, knowledge sharing and joint development [11]. Many studies on the benefits of customer participation in the new product development process to achieve greater success by reducing costs [14], improving decision making [15], emphasizing increasing knowledge and complementary resources [16] and promoting new product innovation [12]. Wang et al. in their research showed that that customer participation as the information provider (CPI) mitigates customer-developer conflict, customer participation as the co-developer (CPC) increases it. Furthermore, the nature of new products moderates such effects. Market newness attenuates the role of CPI in mitigating conflict and reduces the positive effect of CPC on conflict; by contrast, technology newness increases the influence of CPC on conflict. The empirical results from a sample of 181 high-tech firms in China largely support these propositions, which offer important implications for customer participation research and practices [17]. Wang & Hu in their research showed that that there are significant positive relationships between collaborative innovation activities, knowledge sharing, collaborative innovation capability, and firm's innovation performance. Moreover, it is expected that knowledge sharing plays a partial mediating role in the relationships between collaborative innovation activities and firm's innovation performance. Collaborative innovation capability exhibited a moderating effect on collaborative innovation activities - innovation performance relationship [18].

On the other hand, the effectiveness of customer participation in new product performance and commercialization of innovative new products is also conditional on the capacity to absorb; as such, (attraction capacity) is a key factor in enhancing the impact of customer participation on new product performance [13]. As mentioned above, the main purpose of the present study is to investigate the role of collaborative innovation networks and customer participation in the performance of new products by Cinnagen co.

Table 1- Variables affecting new product performance

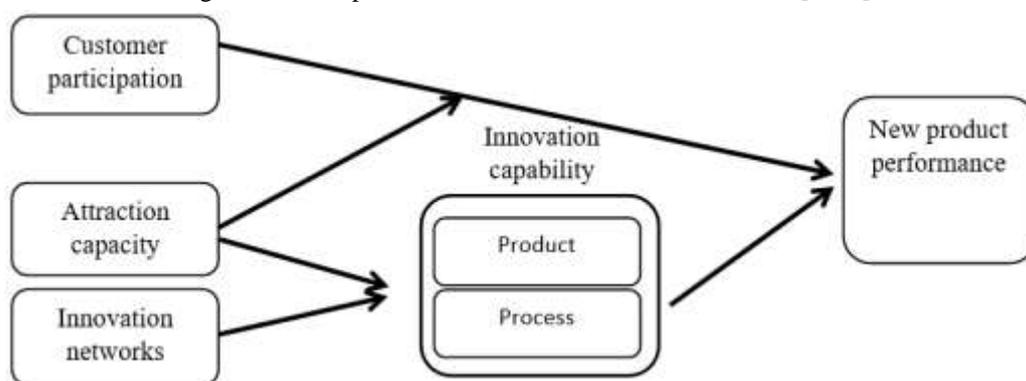
Variable name	References
Customer participation	[11], [12], [13], [14], [4] and [5]
Innovation capability	[3], [1], [6] and [9]
Attraction capacity	[3], [1], [13], [10] and [6]
Collaborative Innovation Networks	[7], [4], [2] and [6]

## 2. Research Method

Since this study is applicable to subsidiaries of Cinnagen co and other pharmaceutical companies, it is of practical purpose and is a descriptive-survey method. In this research, library

method was used to extract research background and field method was used by questionnaire tool for data collection. The questionnaire used in this study includes indicators derived from the research of Morgan et al. [13] and Najafi Tavani [6]. Indicators in this study are 6: collaborative innovation networks, product innovation capability, process innovation capability, new product development, and customer participation and attraction capacity: Based on the indices studied, the conceptual model of research was obtained as shown in Figure 1. According to the purpose of the study, managers and experts of research and development units, market development, quality control, production, and trading in Cinnagen Pharmaceutical Company were considered as the statistical population in this study. According to a request from the deputy chief of staff at the headquarters of the company, the volume of the community was 137 people. Due to the limited number of the statistical population, the total volume of the statistical population was considered as sample size. However, considering the number of completed and returned questionnaires, data from 98 questionnaires were used in the analysis process. It should be noted that the number of questionnaires completed according to Morgan table is proportional to the size of the statistical population. Cronbach's alpha coefficient was used to evaluate the reliability of the questionnaire with alpha coefficient above 0.7 in all cases. Also, content analysis/expert judgment was used to confirm the validity of the questionnaire. Also, the validity of the indices was evaluated by confirmatory factor analysis, finally, structural equation technique was used to analyze the data using the least squares method with Smart PLS software.

Figure 1- Conceptual Model of Research: From Research [6, 13]



### 3. Findings

After completing questionnaires and coding and data entry into the software, data analysis was performed. Based on the data obtained from the questionnaires, the demographic characteristics

of the respondents indicate that the highest frequency of the respondents with the educational level is the MA with 65.3%. In terms of service history, the most frequent group is less than 5 years with 59.2%. Also, the highest frequency in terms of organizational unit of respondents was related to research and development unit with 63.3%.

### 3.1. Exterior Model (Measurement Model)

As stated, the outer model is equivalent to confirmatory factor analysis. In other words, to evaluate the model, the exterior model is used to measure the relationships of hidden variables with their measurement items. The outer model examines the relationship of the items or the same questions to the questionnaire with the constructs. In fact, until the questionnaire questions are fixed, the hidden variables are well measured, the relationships cannot be tested. The exterior model was used to show that the hidden variables were correctly measured. The results of the measurement model are presented in Table 2. It should be noted that indices 16 and 26 had a factor load less than 0.7 after running the model and were omitted and the model was implemented without these indices.

Table 2- Models outer partial least squares (measurement model)

Component	Index	Index code	Factor load	Determination coefficient	Component	Index	Index code	Factor load	Determination coefficient
Collaborative innovation networks	Cooperation with suppliers	a1	0/809	0.373	Customer participation	Presenting ideas	a21	0/822	0.295
	Collaborate with customers	a2	0/736	0.298		Business Evaluation	a22	0/797	0.301
	Collaborate with competitors	a3	0/736	0.272		Product Design	a23	0/836	0.159
	Collaboration with research institutes and universities	a4	0/838	0.333		Product Testing	a24	0/717	0.267
Replacement of products and services	a5	0/735	0.087	Control and supervision		a25	0/821	0.236	
Innovation capability	Development of products and services	a6	0/782	0.095	Attraction capacity	Using industry information resources	a27	0/774	0.083
	Development of environmentally friendly products	a7	0/831	0.093		Utilizing information sources beyond the industry	a28	0/779	0.080
	Improved product design	a8	0/860	0.099		Sharing ideas	a29	0/844	0.082
	Reduce the time of development of new products	a9	0/816	0.096		Support units	a30	0/878	0.087
	Creating related technologies	a10	0/869	0.102		Fast flow of information	a31	0/846	0.079
	Basic and key technology absorption	a11	0/900	0.119		Exchange of information	a32	0/847	0.087
	Reduce production costs	a12	0/874	0.105		Applying new knowledge	a33	0/920	0.085
	Access to knowledge and innovation in manufacturing	a13	0/904	0.110		Attract new knowledge	a34	0/878	0.096
	Access to knowledge processes and systems	a14	0/882	0.107		Linking new knowledge and insights	a35		0.086
	Effective production	a15	0/890	0.107		Applying new knowledge	a36		0.083
New product development	Sales growth	a17	0/796	0.226	Supports prototype development	a37		0.093	
	Market share	a18	0/937	0.300	Adapting new technology and knowledge	a38		0.093	
	return on investment	a19	0/929	0.284	Efficient use of new technology	a39		0.085	
	Customer Satisfaction	a20	0/884	0.312					

### 3.2. Validation of Research Tools

In this study, the validity of the questionnaires was confirmed by expert judgment. Divergent and convergent validity was also performed with SMART PLS software. Cronbach's alpha was used to measure the reliability of the questionnaire and the calculated Cronbach's alpha for all factors was higher than 0.7, so the questionnaire has the necessary reliability. In order to study the model, first the external model is used to measure the relationships of hidden variables with the items. The external model of the relationship between the items or the same questionnaire questions with constructs was examined. Average variance extracted (AVE) for reliability and Cronbach's alpha coefficient are for reliability. In order to calculate convergent validity, Fornell and Larcker [19] have proposed the use of the extracted mean variance criterion. At AVE of at least 0.5, validity indices have good convergence. This means that a hidden variable is able to explain more than half of the variance of its indexes (explicit variables) on average. The results of the validity of each of the research constructs with Cronbach's alpha, AVE and composite reliability indices are presented in Table 3. Given that the appropriate value for the Cronbach's alpha coefficient is above 70%, it is evaluated as optimal for a composite reliability greater than 0.7 [20] and for AVE greater than 0.5 [19]. According to the research findings in the table above, all of these criteria have adopted appropriate values for current variables, therefore, the convergence reliability and validity of the present study can be confirmed.

Table 3- Combined validity of each of the research tools

Dimensions	Number of questions	Cronbach's alpha	AVE	Combined validity
Collaborative innovation networks	4	0.786	0.610	0.862
Product and process innovation capability	12	0.968	0.711	0.972
New product development	4	0.910	0.789	0.937
Customer participation	5	0.959	0.695	0.964
Attraction capacity	14	0.860	0.640	0.899

### 3.3. Structural Model Testing

Testing the structural model by examining the path coefficients (numbers on the path) tests the significance of the path coefficients of the research hypotheses. According to the fitted model above standardized regression coefficient, the impact of absorption capacity and innovation capability on new product performance is directly significant, which has regression coefficients of 0.561 and 0.308, respectively. The standardized regression coefficient of the impact of customer participation mediated by the capacity of absorption and innovation capability on indirect product performance is

indirectly equal to 0.454 (0.136 + 0.318). Also the standardized regression coefficient of the impact of innovation network mediated by innovation capability on indirect product performance is indirectly equal to 0.040. To investigate the extent to which the dependent variables of the research were predicted and explained by the independent variables. The coefficient of determination ( $R^2$ ) is used to connect the measurement part and the structural part to the structural equation modeling and indicates the effect that an exogenous variable has on an endogenous variable. The value of this coefficient for the impact of new product performance on the independent variables studied is 0.759. The effectiveness of the innovation capability of the independent variables is 0.854. The adsorption capacity variable alone is affected by the customer participation variable with the coefficient of determination ( $R^2$ ) of 0.321. Diagram (1) shows these coefficients in the standard mode structural model test. Since in TLS software the t-statistic value is used to check the significance of the relationships and this value is 1.96 for 5% error. The significance of the t-test is compared to the value of 1.96, so that if the t-statistic is higher than the above value, the relationship is significant. Considering the above figure, except for the variable relationship of customer participation to new product performance, all t values were greater than 1.96. Therefore, except for the variable relationship of customer participation to new product performance, all model relationships are significant. In other words, customer engagement for direct leverage can have a significant impact on new product performance and does not have a direct impact on the study. Diagram (2) shows these coefficients in testing the research significance model.

Diagram 2- Research Structural Model Test

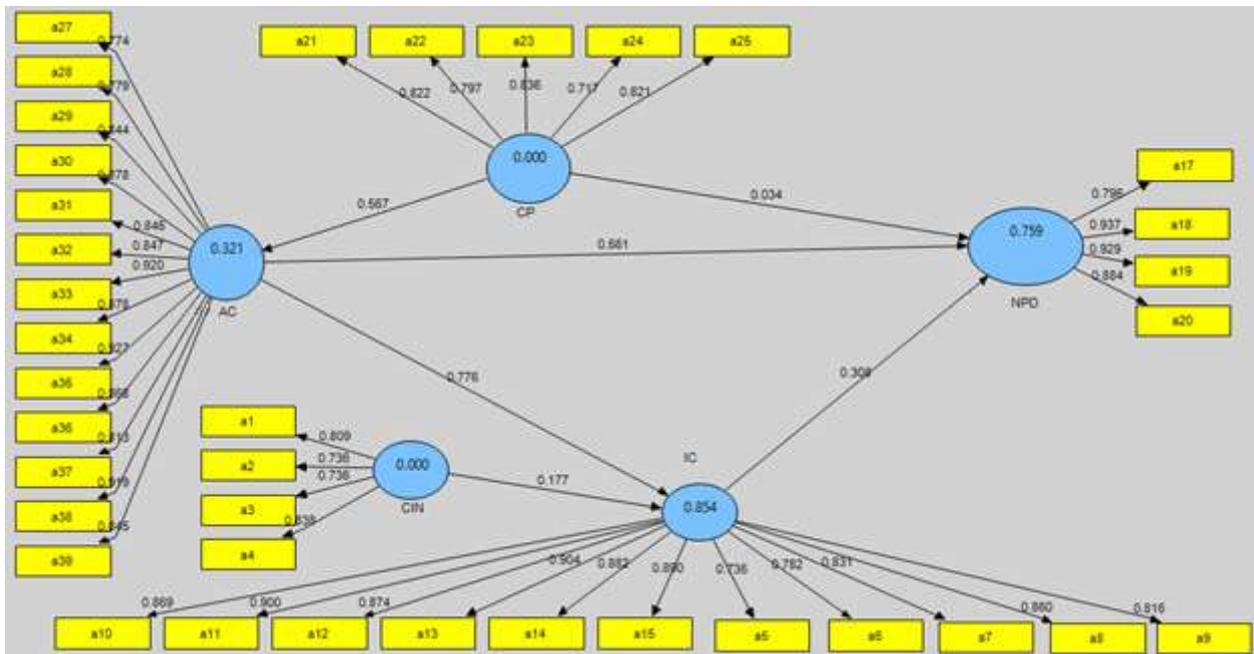
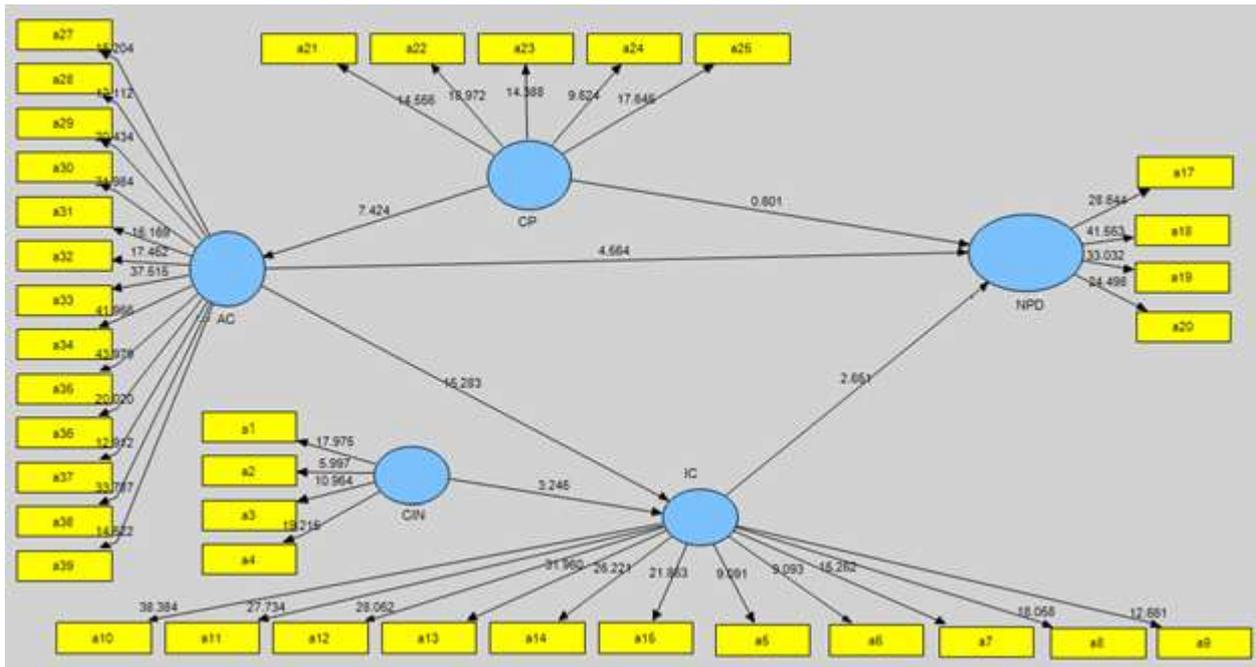


Diagram 2- Measure the overall model and the results of the hypotheses in a meaningful status



### 3.4. Goodness of Fit of Research Model

To assess the quality or validity of the model, the validity of the model, which includes the subscription validity index and the index of validity or redundancy, was used. The index of measure measures the quality of the measurement model of each block. The hash index, also referred to as Q2 Stone-Geysler, positive values indicate good and acceptable quality of the measurement and structural model. As it can be seen from Table (4), the share index and the hash index related to the research variables in the model are of good quality and indicate good fit of the model with respect to these indices.

Table 4- Subscription indices and Hash Index

Variable	CV Com	CV Red
Collaborative innovation networks	0.312	0.293
Product and process innovation capability	0.453	0.373
New product development	0.298	0.217
Customer participation	0.317	0.301
Attraction capacity	0.431	0.386

Table (5) shows some other indicators of the fit of the research model. According to the obtained data, the data collected are sufficient for fitting the hidden variables and therefore the results of the research model estimation are reliable and reliable.

Table 5 - Goodness of Fit of Overall Research Model

Variables	Acceptable limit	Observed value	Result
SRMR	Less than 0.08 [21]	0.085	Proper fitting
d-ULS	Less than 0.95 [22]	0.695	Proper fitting
Chi-square	Less than 1.96 [21]	3.099	Proper fitting
NFI	More than 0.25 [23]	0.523	Proper fitting

### 3.5. General Model Fit (GOF Criterion)

The GOF criterion is used to evaluate the fit of the overall model. Three values of 0.01, 0.25 and 0.36 are presented as weak, medium and strong values for GOF [24, 25].

This criterion is calculated by the following formula. The results indicate a value of 0.487 for GOF, which indicates a very good fit to the model.

$$GOF = \sqrt{\text{Communality} * \bar{R}^2}$$

Table 6- Criteria for calculating the overall fit of the GOF research model

Variable	CV Com	R2
Collaborative innovation networks	0.312	-
Product and process innovation capability	0.453	0.865
New product development	0.298	0.751
Customer participation	0.317	-
Attraction capacity	0.431	0.332

## 4. Discussion and Conclusion

The results show that customer engagement does not have a significant direct effect on new product performance. However, considering the  $R^2$  coefficient, the impact of new product performance on the independent variables studied is 0.751. This finding is in line with the results of the study by Morgan et al. [13]. That the effectiveness of customer engagement in new product performance and commercialization of new innovative products is also contingent on the capacity to absorb is thus a key factor in enhancing the impact of customer engagement on new product performance. This does not diminish the importance of using customer engagement, but rather represents the path and mechanism by which customer engagement can lead to the development and improvement of new company's product performance. The standardized regression coefficient, the impact of customer engagement mediated by the capacity of absorption and innovation capability on indirect product performance is indirectly equal to 0.454 (0.136 + 0.318). On the other hand, past

research has emphasized the importance of customer involvement in the new product development process to ensure the success of the new product [11]. The impact of the adsorption capacity on the yield of the new product is directly significant. The calculated regression coefficient is 0.561. The variable of absorption capacity alone is affected by the customer participation variable with a coefficient of determination of 0.567. This in some way illustrates the importance of customer engagement in improving the capacity of adsorption. Absorption capacity in identifying external ideas with greater marketability, redefining and classifying issues and problems and applying specific environmental knowledge to assist in the implementation of new product solutions is supported by Chandy et al. study [10]. The impact of innovation capability on the performance of the new product directly has a significant regression coefficient of 0.308. This finding is in line with the results of Najafi Tavani et al. [6]. In their research, they also considered product innovation and process capabilities as mechanisms through which collaborative innovation networks improve new product performance. Product and process innovation capabilities are among the most important internal resources that can influence the achievement of superior performance [3]. On the other hand, the relationship between collaborative innovation networks and product and process innovation capabilities depends on the extent of the firm's absorption capacity [6]. The effectiveness of the innovation capability of the independent variables is 0.854 [4]. Luzzini et al. [2] and Najafi Tavani et al. [6] in their research showed that collaborative innovation networks have a positive impact on new product performance. Since the purpose of this study is applied and the researcher is seeking more scientific and practical development of the results obtained from this research, therefore, according to the research, the research proposal is presented to Cinnagen Co and other industries which have a very important customer role:

1. Customer participation can influence the performance of a new product due to the innovative capacity of the company in product design and process.

So it can be a guarantee of success and assurance of new product performance in the market.

2. Changes in customer needs through customer participation can be transferred to the production system and awareness of customer needs is effective in optimizing the allocation of production facilities.

Such information and knowledge can be obtained from a variety of sources, including market research and customer interaction.

3. Creating targeted innovation networks and customer engagement alone will not achieve complete success. This requires innovative capabilities and the capacity to attract companies and organizations to share ideas or interests bilaterally.

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