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The Configuration of Social Network Structure and Knowledge Innovation Capability in the Taiwanese Orchid Industry

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Abstract. *This study provides a significant extension of social network theory to the Taiwanese orchid industry context by explicating the effect of knowledge innovation among organizational collaborations, which is embedded to the configuration of social network structure. Hypotheses were tested utilizing data drawn from successful government-funded applications for orchid projects from 1992 to 2006, as detailed in the GRB (Government Research Bulletin). A total of 401 projects were collected from 132 organizations participating in the study. The study findings make three main contributions to the theoretical implications of organizational collaboration and knowledge innovation in the configuration of social network structure. Specifically, the configuration of social network structure reveals the crucial effect of the combination of structural characteristics on the different forms of knowledge innovation capability. First, the findings demonstrate that government-funded organizations which span structural holes acquire considerably more research projects than other organizations. Second, the network position of degree centrality dominates the performance of the collaborative relationship. Third, the formation of a collaborative network in the Taiwanese orchid industry is embedded in a type of open network.*
Keywords: Social network, Orchid industry, Innovative knowledge, Structural holes.

1. **Introduction.** The market expansion of a formatted industry from local to international, achieved through the updating of high-technology knowledge innovation, is a subject of long-standing interest in organizational management research. Several recent studies have led to important insight into the linkages between the social network structure in which organizational collaboration of knowledge innovation is embedded and the performance of organizational innovation [5][22][25][1][28][4][31]. Studies have examined network characteristics influences on the capacity for organizational collaboration.

However, there remains a lack of empirical evidence about the effect of network structure configuration on the performance of cooperative approaches that shape knowledge innovation. In this article, discussed are the distinctive network characteristics in the relationship of organizational collaboration as well as the interactions among the network structure units. In respect of the above, this study focuses on the emergence of the Taiwanese orchid industry for two reasons. First, the foundations of Taiwan's orchid industry and its technological developments lie firmly in the soil of this small island rather than in that of a western society. This particular industry differs from the computer, semiconductor and LCD industries that originate in the OEM industry and inherit overseas

pioneering technology, in so far as the Taiwanese orchid industry is borne out of a popular Taiwanese hobby. Evolving out of hobby status, the cultivation of orchids has now become an international industry. Such an original industry provides a rich and meaningful source of data for investigation into the industry's potential capability.
Second, with respect to Taiwanese orchid industry research data, studies focusing on the relationship between the structure of innovative knowledge networks and the capability of innovation are somewhat scarce. Through increased adoption of technology in the flower industry, in addition to biotechnological research, some researchers have adopted a management analysis approach in the flower industry. In this respect, there are two main categories of research: the industry marketing model and technological upgrading analysis. Previous findings have had difficulty interpreting the capability of knowledge innovation among collaborative organizations; it has also been difficult to undertake serious analysis to show the mechanism through which the collaboration among actors in a network affects the performance of knowledge innovation in the Taiwanese orchid industry. Recently, scholars have stressed that examining the performance of organizational collaboration from a social networks structure in which the relationship of collaboration is embedded is, in theory, an appropriate approach. A number of studies have been undertaken in this area with respect to the biotechnology and semiconductor industries, among others. However, the orchid industry differs considerably from those industries, due to the fact that an orchid is a living product and requires a different industrial environment In view of this, understanding of knowledge innovation in the orchid industry cannot be gained by reference to current research findings alone. Hence, the present study consults the findings of research into social network structure, builds a theoretical configuration research model, and attempts to unlock the relationship between the configuration of network structure and the performance of knowledge innovation capability in the Taiwanese orchid industry.
The paper begins with an introduction and brief literature review. The remainder of the paper is organized into the following four sections: establishment of hypotheses based on social network theory; explanation of the method employed in the study; collection of data to establish the network relationship, measurement of the variables and testing of the hypotheses; and finally, a summary of the discussion.

2. **Theory and Hypotheses Development.**

Organizations approach innovative knowledge by integrating aspects of the organizational network as they are unable to accomplish innovation by themselves [23] [9] [22]. Recently, several researchers have made their contributions to scholarship by examining the relationship between social network structure and the development of innovation capability in a general way. Network structure arises from the inherent characteristics of technologies that populate an industry; there is no authority and the network self-organizes [17]. When the researcher encounters a different kind of industry, they cannot copy the working model of the collaboration network.
All they can do is to observe the social network relationship among the actors and the entire structure of the social network if they wish to comprehend the social network collaboration model [28]. The standpoint adopted is that the social network structure is a key factor affecting innovation capability [1][4][5][25].

In the structure, social networks are formally defined as a set of nodes (or network members) that are tied by one or more types of relations [30][20]. In the paper, I exploit the configuration of social network structure, which includes the network of nodes, linkages and formation.

2.1. **Collaboration Organization and Knowledge Innovation Capability.** Networks generate rules that determine the type of relationships formed and define the organizing principles of coordination [17]. In networks, collaboration is embedded in communities of learning that transcend the boundaries of a single organization. When the actors participate in the communities, they share their ideas and knowledge with others; the organization learns and forms knowledge both visibly and invisibly [23].

In the context of shared knowledge innovation, collaborative relationships among companies are rare, with more than 90% of such relationships being among universities and research centers. In high-technology industries in particular, organizations tend to encourage cooperation with research centers [11][17]. In general, although organizations cannot apply the results of academic research in a direct way, they are able to adopt the advanced high technological developments earlier than other organizations, which help them to establish their competitive advantage in the industry. The majority of scholars consider that connections between university and company will be mutually beneficial [2][11][10][24].

In general, the contribution of academic research to industry innovation tends to be underestimated. In fact, such research provides industries with many indirect advantages, for example, the quality of human resources. In the knowledge-sharing community, government-funded research is especially useful in encouraging researchers to communicate with members of the particular technological social group with which they are collaborating [7]. Cockburn et al. (2000)[7] pointed out further that if companies can approach government-funded research organizations and academic communities, they will be better able to adopt innovative technology and generate greater efficiency.

In addition, government-funded research units are important for sharing knowledge that is embedded in a knowledge-exchange community. Moreover, Taiwanese scholars' findings indicate that those organizations which are government-funded research units make important contributions to the upgrading of technology and knowledge innovation in the initial stage of an industry, such as Taiwan's semiconductor and bicycle industries [21][18]. Similarly, many scholars stress the importance for industry innovation of the interaction between university and industry, or public and private research units [7] [23]. In this study, I highlight the characteristics of the development of a Taiwanese industry and combine previous findings to provide a more comprehensive investigation of the attributes of unit. Consequently, the following hypothesis is made:

Hypothesis 1. Government-funded research organizations will have an enhanced knowledge collaboration capability.

2.2. **Collaboration Position and Knowledge Innovation Capability.** In a network, the individual who both creates and transfers knowledge operates as an agent [3]. When the originating source of industry knowledge is more complex, the innovation root lies in the organizations and not in the individual [15]. Focusing upon the relationships among the collaborating units that successfully implement research projects, the present study highlights the social network collaboration model as a suitable perspective from which the performance of knowledge innovation can be investigated [4].

Moreover, the social network structure model determines the nature of the relationships among network members and the principles of cooperation [16]. The actor's position in the social network structure illustrates the relationship between their action in the social network and the actor. The actor situated in the central position is more active than others with respect to innovation [14]. In terms of sharing knowledge in the organization, the central actor acquires new resources more easily than others [27]. At the same time, the presence of academic universities and top researchers provide greater cohesion in

the social network structure. This finding suggests that the star researchers who have more prestige and greater government funding are key players in the process of spillover and geographic agglomeration [31]. A similar situation occurs in informal technology-transferring activities, where the scientist with a track record of patent applications is a desirable resource for a firm [12]. Consequently, the following hypothesis is made:

Hypothesis 2. In social network structure, the more connections the organization acquires through the establishment of collaborative links with other organizations, the greater the number of projects acquired by the organization.

2.3. **Collaboration Network Formation and Knowledge Innovation Capability.** The paper focuses on two ways of illustrating the relationship among actors who connect with each other and demonstrate the propensity for acquiring knowledge capital: open networks and closed networks. In the structure of open social networks, the actors do not connect with network members. Practically, they have the greatest chance of obtaining a wide range of useful information. Scholars tend to focus more on structural holes. These holes indicate that the actor who is located on either side of the hole can acquire several different kinds of information. Therefore, if the actor has access to a wealth of structural holes, it is valuable to connect with those to whom the actor does not directly connect. Maximizing the structural holes spanned or minimizing redundancy between actors is an important aspect of constructing an efficient, information-rich, innovational collaborative network [5]. Consequently, the following hypothesis is proposed:

Hypothesis 3. The greater the number of structural holes spanned by an organization, the greater the number of projects acquired by the organization.

In contrast, closed networks indicate that actors connect with other actors in a dense way. In such networks, intensive relationships are formed. In the analysis of closed social network structures, the stability of the network is emphasized [8][29]. In discussion of knowledge innovation, several scholars have expressed contrasting opinions to those based on the structural holes principle, believing that closed networks are useful in raising the capability of knowledge innovation. The main factor upon which collaborative relationships are formed is trust as this is the type of bond that actors in the closed networks are able to promote [29] [1] [16][4]. As detailed above, collaborating and acquiring resources depend on two kinds of theoretical model, hence:

Hypothesis 4a. The more dense the organization network is, the greater the number of projects acquired by the organization.

Hypothesis 4b. The less dense the organization network is, the lower the number of projects acquired by the organization.

3. **Taiwanese Orchid industry.** The Taiwanese people's love of the orchid is something of a cultural tradition. Specifically, the cultivation of orchids for competition purposes is a popular national pastime, and is regarded in similar vein to the pastimes of gambling, the cultivating of mind, and treasure hunting. Because award-winning orchids are highly valued and sought much, investors in horticulture have attempted to mass produce the orchid. Typically, the scale of orchid production was small because the standardization of quality, a crucial factor in mass production, was difficult to attain.

Until 1986, the Taiwan Sugar Company, a government-owned corporation with outstanding technology in biotechnology R&D, managed the orchid industry. The company attempted to mass produce and export the product. With its development into a business through the Taiwan Sugar Company and the resulting standardization of orchid production, the orchid industry gradually emerged, leading to the development of other orchid-related organizations. Unfortunately, even though large-scale companies dominate

the industry and export substantial quantities of orchids, the existence of research centers integrated within those organizations remains rare. In such circumstances, where businesses are well-managed despite the absence of research centers, of crucial importance to both the industry and management research is clear understanding of the high technology used by those companies that assists in resolving and/or preempting management issues relating to long-distance orchid transportation and production standard control.

Practically, Taiwanese society adheres to traditional agriculture values. The government has established a large number of agriculture research centers and universities that focus on agriculture. The focus of organizations established around the farming industry has been to serve local farmers by assisting them with problems relating to planting technology, the conventional service already established prior to the emergence of the orchid industry. Naturally, the relationship between knowledge innovation and industrial development inherits from the same pattern and implements mutual benefit, as the orchid industry is formatted.

The analysis above is based on the evidence provided by my interview data. In sum, unlocking the factors relating to the building of knowledge innovation in the orchid industry is a significant issue. In light of this, the best way to exploit the relationship between upgrading technology and innovation performance should start with the configuration of a collaboration network.

4. **Methodology.**

To be able to capture the configuration of organizational interaction and performance in a complex collaboration network, I use data collected form the GRB (Government Research Bulletin, GRB) and in-depth interviews with large-scale company managers, small-size enterprise managers and researchers in the Taiwanese orchid industry. Quantitative data are used to test the hypotheses and draw the collaboration network relationships. At the same time, empirical data are utilized to assist in both the explanation of the hypotheses results and the context analysis of the collaboration network graphs.

4.1. **Data Collection.**

To test the hypotheses presented above, successful applications for orchid projects from 1992 to 2006, as detailed in the GRB (Government Research Bulletin) were collected. The GRB contains the details of all successful applications made by researchers for project funding provided by the government on an annual basis. In addition, it holds on its database details of project counts, collaboration data and organization-attribute data in all fields. To obtain data from GRB for four reasons, first, as described in the previous section, patterns of interaction between famers and researchers have been long-established in Taiwanese agriculture. The interview data demonstrate that the same interactive mechanism also affects the way in which knowledge is exchanged in the orchid industry. In an institutional environment, GRB is a powerful database in which details of cooperative innovations among research units are saved for the analysis of knowledge innovation performance. Second, some of the studies addressing the question of collaborative social network have used patent counts [1]. However, in the orchid industry, such an approach is inappropriate because the Taiwanese orchid industry is only in its infancy. As a consequence, the number of patents is low and therefore unable to indicate the nature of cooperative innovation. Third, as there are few *R&D* departments in Taiwanese orchid companies, it is difficult to collect formal company documents. From the interview analysis, the knowledge-sharing interaction among collaborative organizations can be seen to be free-flowing; a distinguishing feature of the Taiwanese orchid industry. Fourth, in practice, interaction among actors is not straightforward. Indeed, [30] argued that the interaction between government-funded research units and enterprises is not free-flowing,

but is rather a type of market mechanism. A contract is necessary to preserve knowledge capital among the actors. This explains the other aspect of knowledge exchange; when the actors sign a contract, the focus of collaboration will become clearer [23]. In view of this, in the present study, survey data collected from the GRB (Government Research Bulletin) were utilized. This database stores information about organizations that applied for projects, organizations that obtained funding, and the kinds of projects applied for annually in Taiwan. In the study, all of the successful project applications relating to orchids were extracted. The total number of projects collected this way was 401. A total of 132 organizations were involved in collaboration networks.

4.2. **Measurement of Variables.** To test the hypotheses presented above and to produce the research findings, linear regression is used in the study. Below, the variables in the research are interpreted. Dependent Variable The number of successful project applications, Project No. This variable is derived from the number of successful project applications awarded to the organizations. The number indicates the capability of the organization that received formal project funding and the number of projects implemented by the organization. Independent Variables Funded, Fund.N1P0 From 1992 to 2006, a large number of organizations sought projects and collaborations with other units. This variable is included to ascertain whether the source of funding affected the organization's project acquisition capability. For example, the Taiwan Sugar Company was classified as a company receiving government funding. Besides classification, the study surveys the source of funding to ascertain the extent to which funding further influences social network collaboration capability. A value of 1 indicates that the funding for the organization is from the government; while the value of 0 indicates that the funding is from a private unit. Structural Holes Efficiency In the study, the structure of collaboration networks is measured by translating a 2-mode matrix to a 1-mode matrix. In the new matrix, the value in cell shows the number of projects in which organizations i and j participate jointly. In accord with normal practice in sociological research, which requires the use of a binary value, the matrix value is translated into a binary value. After translating the matrix, Burt's measure of structural holes efficiency for each actor in the network is calculated [5] using the following formula:

$$\frac{\sum_{j}\left[1-\sum_{q}p_{iq}m_{jq}\right]}{\mathrm{N}}, q=1, j \tag{1}$$

The component p_{iq} represents the proportion of is network that is invested in a given altered q, and m_{jq} represents the marginal strength of js contact with q. The denominator gives is value of structural holes a range between 0 and 1. A higher value means that the leading organization in the project has to process more non-redundant resources from the network.

Table 1. Frequency of Projects

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Sum.
Number	8	19	17	8	16	3	11	16	28	30	28	45	51	59	62	401

Degree Centrality

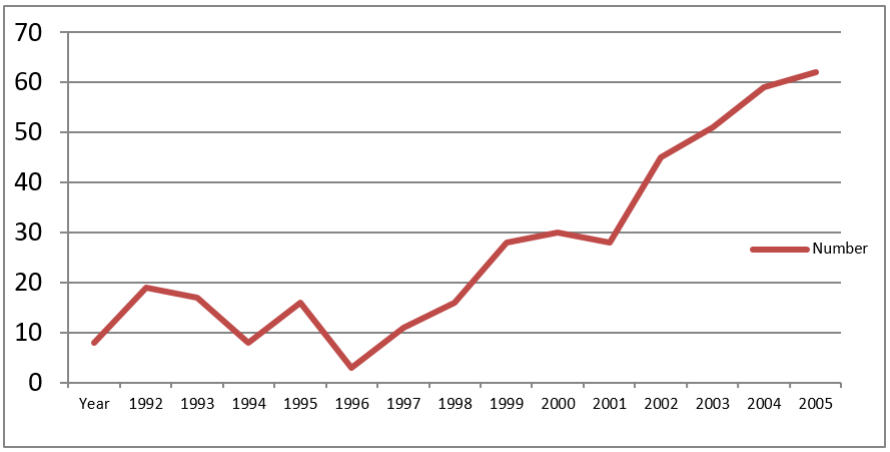

FIGURE 1. Frequency of Projects

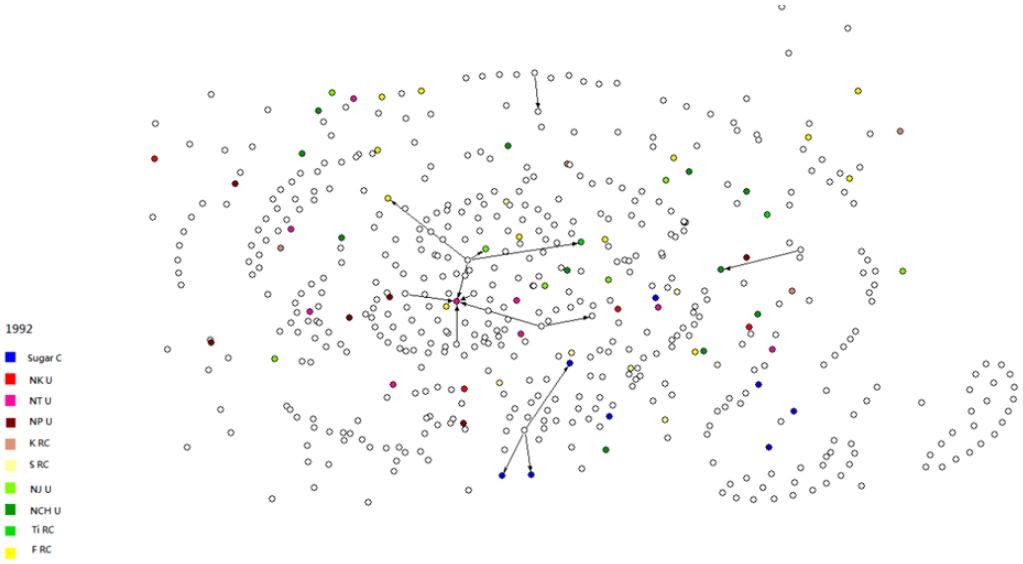

FIGURE 2. Collaboration network 1992

The degree centrality nodes represent how many actors connect to other actors directly. This variable is a crucial value in observing the structure of a social network. This variable is included to clarify the extent to which the relationship among actors affects an organization's project acquisition capability. Density This variable refers to the proportion of the number of lines. It is included to indicate whether the actor is in a closed or open network. The value ranges from 0 to 1, where 0 indicates that the actor is not closely connected and 1 indicates that the actor is closely connected.

Control Variables

Organizational Classification

I include a dichotomous variable in the model. The data reveal two kinds of organization in the social network: university and research center. The variable determines the extent to which organization classification affects the likelihood of obtaining project funding.

5. Results.

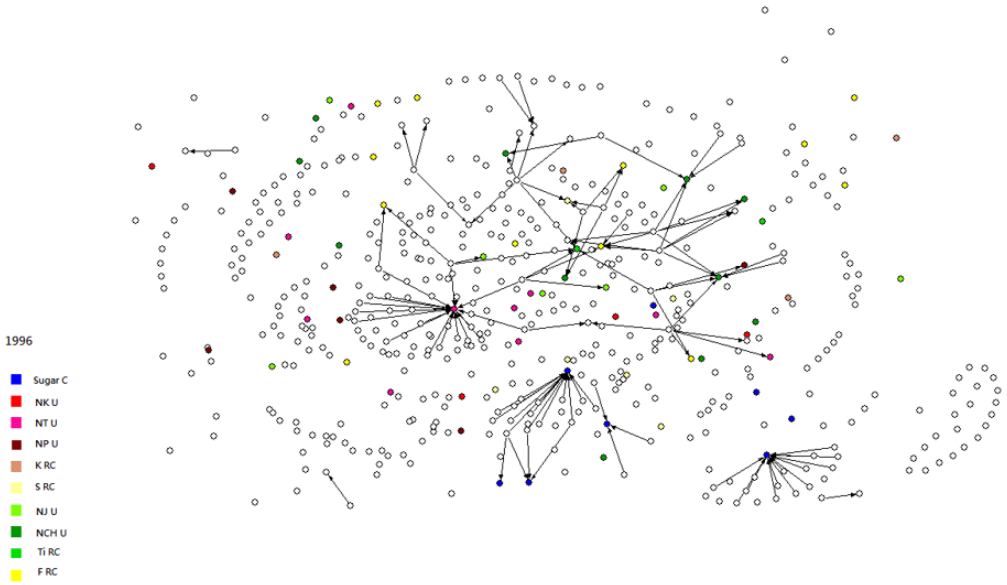

FIGURE 3. Collaboration network 1996

5.1. **Data Description.** In the study, successful orchid project applications from 1992 to 2006, detailed in the GRB (Government Research Bulletin), are collected and used as research data, as shown in Table 1 and Figure1. Before 1992, there were no projects on the database. In contrast, since 2001, the number of projects has increased rapidly. The total number of projects collected for this study is 401 projects; with 132 organizations involved in collaborative networks also being collected.

5.2. **Graph Description.** The data referred to in the previous section are used to construct the collaborative networks and to form an affiliation matrix that informs us of the pattern of participation of organizations in the projects. The network is represented in a 2-mode matrix X with N rows and M columns. The rows consist of actors, i.e., the organizations in the networks; the columns comprise the events, i.e., the projects. Hence, in this study, the affiliation network contains 132 rows and 401 columns, representing the collaboration network in 1992, 1996, 2001 and 2005. The graphic representation of this matrix is presented in Figure 2 to Figure 5.

In the initial stage, not many projects are related to the orchid industry, the main units being National Taiwan University and the Taiwan Sugar Company. 5 years later, the main units have not changed substantially, the dominant units are still National Taiwan University and the Taiwan Sugar Company. There are three trends in the transformations of the collaboration relationships at this time: first, National Taiwan University is connected with more units; second, the Taiwan Sugar Company continues to conduct research and make developments alone; third, other kinds of research center have acquired projects and are participating in collaborations. At this stage, the orchid industry has been developing for 10 years, with agriculture-related units beginning to acknowledge its development. From the graph, we can see that the collaboration network has increased to such an extent that even the Taiwan Sugar Company has sought collaboration with other units. In addition, according to the field investigation, there are several structural transformations in the organization because some employees in the organization have transferred to related research units. This situation leads to the forming of a novel collaborative relationship that has a powerful effect on the knowledge innovation model. For example, we can see the emergence of a KRC node which did not previously have any connection.

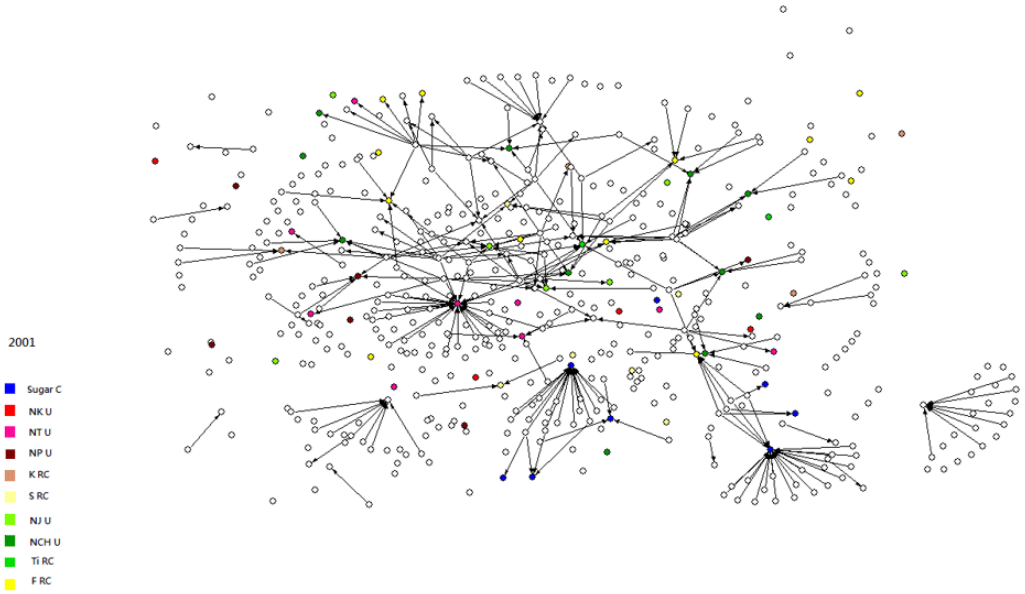

FIGURE 4. Frequency of Projects

At this stage, the orchid industry has been established for almost 15 years. On the basis of the graph, it can be argued that the knowledge innovation collaboration network shapes the industrys development because the collaboration network reveals the richness of the connection relationship. Next, data are used to measure the network structure and to test hypotheses.

5.3. **Data analysis.** Table 2 depicts descriptive statistics and correlations for measurement of variables. It shows that the mean of Project No. is 4.29, illustrating that the number of organizations acquiring projects is approximately 4. The mean of organizational classification indicates that when the organization is university or research center, the probability is approximately .5. It is evident from the mean of Fund N1P0 that the organizations with unit funding from the government are able to acquire more projects. The mean of density is .81, which indicates that the majority of actors are in a high-density network.

TABLE 2. Means, Standard Deviations, and Correlations (N=132)

	Mean	Std. Deviation	Project No	Organizational Classification	Fund.N1P0	Structural Holes Efficiency	Degree Centrality	Density
Project No.	4.29	6.785	1					
Organizational Classification	.477	.501	.065	1				
Fund.N1P0	.91	.289	.146	-.225**	1			
Structural Holes Efficiency	.252	6.519	.345**	-.022	-.018	1		
Degree Centrality	5.52	.286	.587**	.062	.127	.436**	1	
Density	.810	.273	-.404**	-.075	.075	-.352**	-.429**	1

Table 3 depicts the results for our hypotheses. The overall results support the expectations presented in hypotheses 1, 2, 3 and 4b. Model 1 has only two variables, representing the base model with the control variable and Fund.N1P0. The coefficients for Fund.N1P0 are positive and significant ($^*p < 0.05$), thus supporting hypothesis 1. Structural holes efficiency is added in Model 2, which provides broad support for hypothesis 1 and hypothesis

3. Fund.N1P0 results in the increased likelihood of project acquisition. Otherwise, Model 2 also supports hypothesis 3 as coefficients for structural holes efficiency are positive and significant ($^{***}p < 0.001$).

Model 3 supports hypothesis 2 as the coefficients for degree centrality are positive and significant. Structural holes efficiency is added in Model 4, as coefficients for structural holes efficiency are not significant, in the same social network structure, while coefficients for degree centrality are positive and significant. Model 5 supports hypothesis 4b as the coefficient for density is negative and significant ($^{***}p < 0.001$). Moreover, just as in Model 6, it is evident that when structural holes efficiency is added, hypothesis 3 and 4b are supported; structural holes efficiency increases the likelihood of an organization's search for the acquisition of more projects. In the same network structure, the open organizational network acquires an increasing number of projects.

Table 3. Determinants of Successful Project Applications

	Model1	Model2	Model3	Model4	Model5	Model6	Model7
Control Variables							
Organizational Classification	.103	.112	.048	0.57	.078	.089	.051
	(0249)	(.181)	(.512)	(.439)	(.341)	(.263)	(.482)
Dependent Variables							
Fund.N1P0	.169*	.178*	.084	.095	.195*	.195*	.116
	(.050)	(.035)	(.255)	(.198)	(.018)	(.015)	(.116)
Structural Holes Efficiency		.350***		.122		.234**	.082
		(.000)		(.126)		(.005)	(.281)
Degree Centrality			.573***	.518***			.452***
			(.000)	(.000)			(.000)
Density					-.413***	-.329***	-.184*
					(.000)	(.000)	(.022)
Adj. R Square	.016	.134	.336	.343	.181	.224	.365

Notes: N= 132, standard errors are in parentheses
*p<0.05; **p<0.01; ***p<0.001

Model 7 supports both hypothesis 2 and hypothesis 4b as the coefficients for density are negative and significant. When the higher score for degree centrality increases the likelihood of acquiring projects, the score for density is negative. Moreover, when the coefficient for density and degree centrality are significant, the coefficient for structural holes efficiency is not significant. This result both supports and provides greater clarity to the argument above. The coefficient for organizational classification in the models is not significant. There is insufficient evidence in the study to prove whether the organization classification will affect project acquisition in the collaboration network.

6. **Discussion.** This paper is an initial attempt to clarify how the configuration of network structure affects the relationship between organizational collaboration and knowledge innovation. The approach shows the dynamic interaction among actors' characteristics in the social network structure. Consequently, the study results support the hypotheses and the empirical analysis proves the theory.

The study has three main contributions with respect to theoretical implications for collaboration and knowledge innovation in the Taiwanese orchid industry. First, the research explains the relationship between actors characteristics and collaboration network formation. The result confirms Burts structural holes theory with respect to innovating new technology. It also suggests that government-funded organizations that span structural holes acquire considerably more research projects than other organizations.

Second, the research verifies the network position of degree centrality that dominates the performance of collaborative relationships. When the knowledge innovation capability is considered through degree centrality, the difference in organization funding will not be a crucial factor. Furthermore, when the significance of degree centrality is adopted, the characteristics of structural holes begin to disappear in collaboration network interaction.

Third, the study shows the transformation of configuration in social network structure. The observation baseline is from structural holes theory to degree centrality, revealing that the formation of a collaboration network is a type of open network. The arguments and results from this study are important for two main reasons. First, in general, according to previous results, the fields of biotechnology incur more time and costs, and the structure of collaboration innovation tends to be a closed network. The general consensus is that organizations pursue the acquisition of social capital in order to remain stable [1][6][7][31][11]. However, the results of this research challenge this generally-held view. The organization has the capacity to obtain more projects by accessing more non-redundant resources. Moreover, the organization possibly has a large number of connections with other actors but is not acting within a closed network structure. One possible explanation is that the knowledge collaboration relationship in the Taiwanese orchid industry is built mainly to pass on information and opportunity and not to construct the mutual trust among the actors [8][5][29].

Second, explanation of the analysis of the study results includes the traditional background of the Taiwanese orchid development and collaborative network graphs on an annual basis. From the graphs shown in Figure 1-4, National Taiwan University and the Taiwan Sugar Company began to undertake research in the orchid industry. Indeed, later, the two organizations became dominant in this research field. This combination of empirical data and testing result explains the research unit pattern and the research model's development track. Furthermore, the result confirms previous scholars' arguments that the social network structure is inert and that the characteristics of actors in the social network are established early in the history of the network.

At the same time, this study has a number of limitations. As quantitative data were collected from the beginning of the industry to 2006, the data explain the development of a start-up industry; thus, further research is encouraged to investigate the industry in its more mature stage.

Additionally, the study utilizes three network structures: structural holes, degree centrality and density to test collaboration in knowledge innovation. In view of the fact that there are other variables that could be used to test such collaboration, it would be useful for future research to use other variables to provide greater insight into knowledge innovation.

7. **Conclusions.** This study provides a significant extension of social network theory to the Taiwanese orchid industry context by explicating the effect of knowledge innovation among organizational collaborations, which is embedded in the configuration of social network structure. An important finding is that the organization with government funding that has maximum structural hole-span will acquire more research projects than other organizations. Additionally, the findings confirm the importance of the research purpose in consideration of the configuration of network structure. When the characteristics of collaborative positions are observed in the study, the degree centrality can be seen to dominate the performance of knowledge innovation. Furthermore, the formation of network is a type of open network from multiple points of analysis. The result above combines the perspective of theory and empirical data. Moreover, the study integrates the managerial and theoretical implications in the Taiwanese orchid industry.

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