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The role of creation mode and social networking mode in knowledge creation performance: Mediation effect of creation process

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ABSTRACT

This study proposes and empirically examines a research model that incorporates the knowledge creation mode and social networking mode to describe knowledge creation performance. The mediation effect of the knowledge creation process is explored in terms of socialization, externalization, combination, and internalization (SECI). The data collected from the manufacturing and service industries in Taiwan were analyzed. The goal-driven mode and web topology are found to be significantly associated with product or service creation primarily because of the creation efficacy aspect. The SECI with web topology has a mediation function when the goal-driven mode is adopted. Implications and suggestions are also provided.

1. Introduction

The implementation of a knowledge management (KM) program in the KM system life cycle generally involves five major stages: knowledge creation, knowledge acquisition/storage, knowledge sharing, knowledge practice, and knowledge appraisal [47]. In particular, knowledge creation deals with aggregated value in several ways, such as sharing mental, emotional, cognitive, and active knowledge [37]. It has distinct and dynamic characteristics that involve such factors as strategy, communication, and processes [6,50]. Although existing studies have identified the important aspects and antecedents that are linked significantly to particular knowledge creation outcomes, they also pay limited attention to the effects of both creation modes (e.g., goal is predefined or not predefined) and the social networking mode (SNM) (e.g., networking by way of hub or web topology) on the creation outcomes. The role of the SECI model (socialization, externalization, combination, and internalization) [33] in these effects on creation outcomes is still under investigation.

In general, the need for knowledge creation to maintain competitive advantage compels organizations to innovate the products and services they deliver to their customers, as well as business management. In practice, organizations develop strategies (e.g., culture-embedded product or service development) that will guide knowledge creation efforts and achieve better creation performance (CP) [21,31]. In a dynamic and fast-changing environment, however, guiding a particular creation task toward the goal is generally not easy. For example, a goal (e.g., defined or undefined) may affect the thinking space and behavior, topologies used to interact and collaborate, and creation processes toward creation outcomes. In this regard, Kao et al. [18] investigated large manufacturing companies with >20 patents in Taiwan and revealed that the knowledge creation mode (KCM) has different effects on creation outcomes. This analysis indicates that a non-predefined goal (goal-free mode) can significantly and positively influence creation outcomes, particularly for product or service creation. In addition, the particular mode with a defined goal (goal-driven) negatively influences creation outcomes. This result implies that a predefined goal is not likely to be a strategy for knowledge creation in the context of larger manufacturing companies with >20 patents in Taiwan. However, the applicability of this finding to both manufacturing and service industries that have fewer patents in developing regions (e.g., Taiwan) but that advocate creation is still unknown.

The creation mode related to a defined or undefined goal may be too straightforward to sufficiently describe creation outcomes. The creation mode may be affected by the process model that drives human thinking behavior toward idea generation and implementation [6,27,36,40]. For example, SECI can improve the

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dynamic conversion process of tacit and explicit knowledge toward positive creation outcomes [6,20,24]. However, Martin-de-Castro et al. [27] conducted a study based on two empirical tests with firms, which revealed that knowledge creation does not constitute a unique process; knowledge creation is generally associated with culture, geographical, and cluster-based arguments. Therefore, further information about the contribution of the SECI process in the creation modes to the creation outcomes is also needed.

Knowledge creation is a multidimensional issue that covers the areas of organizational behavior, leadership, human behavior, technology, environment, and strategy, and their combinations as well. Collaborative creation is an important strategy that organizations adopt to maintain competitiveness [2,20,21]. For example, Khodakarami and Chan [20] reported that collaborative systems likely significantly encourage organizational members to externalize their innovative ideas, whereas analytical systems help integrate these ideas. However, the effects of how members interact on CP still need to be explored. For example, knowledge creation strategies will be improved if a relevant mode is determined, that is, strong central connections and weak associations with one another (e.g., hub topology) or strong one-to-one relationships with others (e.g., web topology) [7]. Evidently, creation outcomes may change along with the change in the adopted creation mode and SNM.

With a relevant creation process presented by SECI [33], members or customers can collaboratively construct new knowledge based on the knowledge that other members possess through communication and interaction [2,26,28]. For example, Mahr and Lievens [26] reported that community users prefer explicit knowledge that members provided, which can be easily integrated into the development of new products or services. Therefore, a creation group is gradually regarded as the atomic union for decoding, deposition, retrieval, and knowledge creation, which can speed up creation tasks. However, the mode that members use to interact within a network may significantly influence creation outcomes [12,15,16]. For example, a network with strong centralization reflects that a group's thinking behavior is based on coaching and learning. This mode refers to hub or core–periphery, in which interaction and communication emphasize knowledge combination and manipulation [5,12]. When expressing a highly distributed interaction, the mode refers to a web or periphery that primarily focuses on knowledge creation through socialization and externalization [3]. However, SECI presented by socialization or externalization that supports the effect of the SNM on the creation outcomes requires further exploration.

Considerable efforts for either examining the theory or performing the confirmatory experiment have been devoted to concept sharing, factor examination, solution finding, and phenomenon exploration in knowledge creation. By specifying the context of manufacturing and service industries in Taiwan, the current research aims to propose and examine a research model that describes knowledge CP by considering the creation mode, SNM, and the SECI process. Because of the data collection limitations in knowledge creation (e.g., company regulations, policies, and privacy) in Taiwan, the current exploratory study adopts an empirical quantitative method and analyzes survey data to derive findings, implications, and suggestions. The rest of the paper is organized as follows. Section 2 presents the antecedents and gaps in the literature on knowledge creation based on the literature review. Research arguments are then hypothesized. Section 3 describes the research method, including the research model, sample, measure, and data analysis techniques. Section 4 presents the data analysis results, discussion, and implications. Finally, Section 5 concludes the research.

2. Related concepts and research hypotheses

2.1. Knowledge CP

Identifying the relationship between knowledge creation and its value to organizations is generally difficult because of the complex relationships among the contributors, particularly when a quantitative approach is applied. For example, high product profits may have multiple contributors (e.g., favorable design, manufacturing technology, pricing strategy, marketing strategy, and pre- and post-service system) and sub-contributors (e.g., favorable idea exchange mode; effective use of social media for the product design; and excellent machine, financial engineering, and leadership). By examining the relationship between the knowledge-related factors and the KM performance index of Korean firms, Lee et al. [47] reported that knowledge creation has the highest weight linked to performance, which is represented by several financial factors, including stock price, price-to-earnings ratio, and research and development (R&D) expenditure, which is translated from management performance. However, tangible performances from product and service creation, manufacturing process creation, management creation, or even strategy creation have not been addressed, probably because of the complexity of measurement and the difficulty of data collection. For example, the data they used to present knowledge creation are based on a questionnaire survey with a seven-digit scale [47]. Moreover, in the context of the high-tech industry in Taiwan, product creation presented by volume, market share, and patents was used to predict the technology commercialization performance [44]. The responses of the subjects were also rated on a five-digit scale. Eventually, the indices for evaluating knowledge CP are needed, whereas creation tasks are executed because of value justification for the created knowledge. In general, the evaluation indices for knowledge creation include five aspects: (1) product or service CP, (2) manufacturing or service process CP, (3) management CP, (4) strategy CP, and (5) organization CP [13,18].

Product or service CP measures the technical performance of new product or service development, such as effectiveness and adaptability. Manufacturing or service process CP pertains to the process of a program, service, and product, including cost, quality, delivery due date, flexibility, and innovation. Management CP examines the effect on the organization through the implementation of the managerial process, plan, flexibility, integration, communication, coordination, and employee cohesiveness. Strategy creation focuses on new product or service positioning, new usage, and redistribution of value activities to enhance competitiveness. Organization CP addresses behavior creation that measures abilities and experiences, such as coordination with international sales, repair and service, establishment of an international brand, as well as planning and management of international distribution. However, the present study only adopts the first three CP indices presented by product or service, manufacturing or service process, and management to address the dependent variables [37] because of the complexity of evaluating strategy and organization CP. Moreover, except the data officially announced by companies (e.g., in their public financial reports), the subjects in Taiwan generally have difficulty in providing internal code information related to knowledge creation because of data unavailability and the prohibition and privacy policies of their respective companies. Alternatively, they tend to provide answers based on perceived concepts, information, experience, and understanding, which are related to knowledge creation for questionnaire items. Thus, the applied measure indices for the current research are based on a five-digit scale questionnaire.

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To obtain the advanced concepts and develop the potential factors as independent variables linked to the aforementioned types of CP, a review of the related literature is conducted and summarized in Table 1 with context remarks. The column of operational category is used to group the research variables used to predict knowledge creation. For example, Lin et al. [44] confirmed that cross-functional collaboration could influence knowledge CP in the high-tech industry of Taiwan. Therefore, this variable is grouped under the "Networking" category. Certain observations were made from the table. On the one hand, studies on Taiwanese industries and organizations mostly focus on the categories of Networking and Creation process. This implies that research thus far has not focused on the effect of whether a goal is predefined or not on creation outcome. On the other hand, those in the context of other countries likely cover three categories, namely Networking, Creation process, and Creation mode. In particular, case or multi-case studies are conducted to explore findings when the creation mode is concerned.

Importantly, while these studies contributed remarkable insights in general and variables used to predict knowledge creation in particular, the effects of both creation modes presented by a predefined goal or a non-pre-defined goal and the SNM presented by hub or web topology on the creation outcomes in the context of Taiwan still need further investigation. Moreover, the

Table 1
Factors linked to creation performance.

Main variables	Operational category	Context	References
Knowledge sharing		High-tech industry (Taiwan)	[43]
Cross-functional collaboration		High-tech industry (Taiwan)	[44]
E-service and cooperation capability		Financial service industry (Taiwan)	[45]
Network embeddedness and absorptive capability	- Networking	R&D consortia (Taiwan)	[50]
Knowledge-sharing capability		High-tech industry (Taiwan)	[42]
Network structure		Textile company (Taiwan)	[25]
Knowledge sharing, group cohesiveness		Government-supported R&D institutes (Taiwan)	[15]
Knowledge creation process	- Creation process	Financial research institute (Taiwan)	[24]
Entrepreneurial orientation, knowledge creation process		Securities and futures institute (Taiwan)	[40]
Organization missions and value, process, technology use	- Creation process - Creation mode - Innovative technologies	KM consultation agents (Taiwan)	[51]
Creation objective, culture	- Creation mode - Culture	Manufacturing industry (Taiwan)	[18]
Patent, firm size, R&D expenditure	- Patent - Firm features	Small to medium-sized enterprise (Taiwan)	[48]
Patents, publications	- Patent	Pharmaceutical industry (Taiwan)	[46]
Patent		TFT-LCD industry (Taiwan)	[49]
Knowledge creation process		Cases in electronics, education, and health (Canada)	[20]
Knowledge creation process	- Creation process	Firms (USA and Spain)	[27]
Knowledge creation process		Cases in IT and Bank (German and Swiss)	[3]
Knowledge creation process, social network	- Creation process - Networking	Various industries (Finland)	[16]
Knowledge creation process, knowledge sharing		A case of IT and multimedia business (Japan)	[21]
Knowledge sharing		Mobile service (Nokia Group (Finland)	[26]
Knowledge sharing		A case of food manufacturing company (Italy)	[28]
Social network	- Networking	Telecommunication projects (Multiple nations)	[5]
Social network		Research institutes in Biomedicine (N/A)	[30]
Social structure		Space industry (Multiple nations)	[22]
Communication, virtuality		Electronic products (The Netherlands)	[23]
Goal definition		Four cases (USA)	[41]
Goal definition		A case in European electricity industry (N/A)	[19]
Goal definition	- Creation mode	Education (N/A)	[1]
Goal definition		Denmark	[11]
Goal direction		Eight cases in biotechnology industry (USA)	[17]

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role of the creation process presented by the SECI is also explored. It should be noted that the current research did not consider the patent variable, although some of the reviewed literature used it to describe the CP in the context of Taiwan (Table 1) [46,48,49]. There are three reasons. First, patents might not be suitable for describing the CP in the Taiwanese service industry (e.g., financial services and human resource services). Second, patents might not be applicable for investigating the management creation that results from the managerial process, innovative plan, flexibility, integration, coordination, employee cohesiveness, etc. Finally, according to the Department of Statistics, Ministry of Economic Affairs, Taiwan [52], the patent includes three main categories (i.e., invention, utility, and design) in which management creation is not covered. Research arguments and hypotheses with respect to the SNM, creation mode, and creation process are presented in the following section.

2.2. Social networking mode

Through the advancement of social media technology, a sophisticated communication environment has emerged in which individuals communicate, coordinate, and collaborate for various purposes. Knowledge is usually generated through various types of individual social interactions [8,16,21,30,39,42,43]. For example, Fuller et al. [8] integrated the customer conceptions to develop medical equipment using social software (e.g., networked virtual environments). Importantly, the social networking topology formed through other member interactions can influence the creativity and development of new knowledge [25,30]. McFadyen et al. [30] reported that ego network density and average tie strength could affect knowledge creation through a collaborative mechanism. This finding was supported by Chuang and Lin [45], who confirmed a significant relationship between cocreation and firm performance in the Taiwanese financial service industry. Lin et al. [50] also confirmed the significant effect of network embeddedness on knowledge transfer and development in the Taiwanese R&D consortia. However, how networking topology with respect to web-oriented or hub-oriented influences CP is not addressed in these studies.

The networking topology is usually measured based on the behavior of the members, which is characterized by centrality, density, and cohesion. For example, when the social networking exhibits a hub mode, most communications primarily occur with the core member (e.g., leader) and most information flows between the core and periphery members [4]. In such a mode, members have strong links to a core figure and weak associations among one another. Consequently, knowledge creation highly depends on the core member who possesses the ability of data analysis, combination, and integration to develop creative ideas [7,22]. However, Leenders et al. [23] argued that the contribution of the periphery members is possibly overlooked within the hub mode and would likely lead to negative effects on CP. By contrast, when social networking is structured as a web mode, information flows equally among members, and members have strong one-to-one connections with others who have similar or additional needs. Thus, the knowledge creation process occurs via the interactions and collaborations of all members. Leenders et al. [23] reported that the knowledge created through the web mode performs better. This finding was confirmed by Huang [15], whose empirical study revealed the antecedents of performance of the technology R&D teams of the Industrial Technology Research Institute in Taiwan. The network tie, which is represented by the interaction among team members, is significantly associated with team cohesiveness toward better performance. By analyzing data from a case study of a textile company in Taiwan, Luo [25] found that a networking structure with a full connection could significantly influence the performance of an improvement team. The consultative ties among team members are associated with their knowledge exchange and combination, while their friendship ties do not influence their performance.

Conversely, Kodama [21] reported that leaders could direct and facilitate business innovation through networked strategic communities. Therefore, the leadership-oriented networking mode could benefit CP by efficiently and effectively guiding creation direction in communities. Gratton and Erickson [9] argued that a leader should consider both task-oriented (e.g., hub topology) and human-oriented (e.g., web topology) relation behaviors to maintain efficient and effective creation activities, as both of these behaviors could contribute to group task success in a social networking environment. A dilemma could be observed from these findings. On the one hand, the hub mode encourages the creative concept and opinion convergence among the members, but it also decreases the willingness of these members to interact and participate if the other factors remain the same. On the other hand, the web mode encourages participation and contribution, although it results in opinion divergence and ineffective creation.

Therefore, the current research attempts to explore the effect of the SNM, which presents different communication topologies, on CP. The first hypothesis is as follows:

H1. The social networking mode significantly influences knowledge creation performance.

2.3. Knowledge creation mode

Knowledge creation depends on the process of generating new knowledge through the accumulation and integration of existing knowledge to achieve such a goal as new product or service development, management enhancement, and manufacturing process improvement. A goal is a desired future accomplishment that can also represent an allocation of efforts and commitments [11,17,19,51]. To achieve the final desired outcome, several subgoals are derived from the main goal to direct the effort or resource allocation of an individual or a team. By examining the key factors influencing the KM performance of the Executive Yuan of Taiwan, Chang et al. [51] reported that the mission and value of an organization could influence the KM implementation process toward KM merit. However, the effects of the creation mode, with or without a goal, on creation outcomes remain unknown. Generally, a goal and its subgoals lead to different resource allocations and form various stimulation and interaction mechanisms to encourage the participation of individuals in the creation process [37]. Accordingly, knowledge creation may depend on two primary modes, namely goal-driven and goal-free modes [11,18].

In the goal-driven creation mode, the goal is determined, fixed, and regarded as an important manifestation that must be satisfactory [14,35]. Hsia et al. [14] proposed a goal-driven method for acquiring and creating knowledge for the business-to-customer (B2C) application model used in Taiwanese electronic businesses. Although a B2C website was used as an example to demonstrate the developed method, the knowledge creation outcome should also be verified. Implementing the goal-driven mode could partly fulfill the defined goal by emphasizing the existing knowledge and its effectiveness in allowing individuals to acquire the related knowledge for the next knowledge creation and to ensure that the knowledge creation activities can help achieve the ultimate goal [14,17,38]. Therefore, the top-down approach is among the most effective ways for finding innovative ideas and solutions in the goal-driven creation mode. For example, in an early study, Kavakli and Loucopoulos [19] proposed and demonstrated a goal-driven approach to business process modeling as a part of an enterprise knowledge-modeling framework, which aims to provide defined goals and add value to customers.

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However, the goal of knowledge creation is often intangible and ill-defined. Therefore, setting a goal for knowledge creation is difficult because the goal may change based on what is learned and experienced during the creation process [11,41]. The goal-free creation mode is then introduced. In this mode, employees have complete freedom to perform their work and create procedures according to the set guidelines. Freedom is a core value used to drive innovation, and configuration familiarity is used to strengthen the concept-emphasizing strategy rather than the mean-ends analysis [41]. In the goal-free creation mode, the bottom line is a virtual target under a freethinking environment that is not important, unnecessary for appropriation, is flexible and adaptable, and can be value-added. This mode allows the achievement of any target rather than a pre-defined target. The main advantage of the goal-free mode is the support of the concept-emphasizing strategy, which can help reduce stage effects or cognitive loads to develop creative ideas [1].

The previous exploratory study on large manufacturing companies with at least 20 patents in Taiwan [18] reported that the goal-driven mode negatively influenced CP, whereas the goal-free mode positively and significantly influenced CP. The product or service CP was insignificant, whereas manufacturing and management were significant with regard to the effects of the goal-driven mode. The current study argues that further examination is necessary when the context involves small to medium-sized companies in Taiwan, and networking topology is concurrently incorporated to describe the CP. Thus, the second hypothesis is formed.

Moreover, different creation modes may lead to different interaction styles and toward better CP. For example, members of the creation group will likely need directions of effort or resource allocation when they are assigned a goal (e.g., goal-driven); therefore, they tend to learn and accumulate goal-related experiences and problem-solving knowledge to efficiently reach the goal. In this case, social networking will present a topology similar to the hub mode. Alternatively, when no goal is given (e.g., goal free), members freely interact, and the outcomes will mainly depend on the generation of innovative ideas and novel concepts via sharing and collaboration [39]. In this case, social networking will present a topology similar to the web mode. Therefore, the current research argues that the creation mode will also influence the SNM, and the third hypothesis is proposed:

H2. The knowledge creation mode significantly influences knowledge CP.

H3. The knowledge creation mode significantly influences the social networking mode.

2.4. Knowledge creation process

Knowledge creation is a multidimensional issue that has developed its own process characteristics. Fundamentally, the knowledge that an organization owns is the outcome of the collaborative process of personal knowledge [34]. Nonaka and Takeuchi [32] introduced the SECI model by explaining the dynamic conversion process of tacit and explicit knowledge, which enables firms to improve the efficiency of knowledge creation by embedding knowledge internally and transferring internal knowledge into activities or procedures. The literature has confirmed that cultivating an environment with relevant creation processes suitable for knowledge creation has advantages [6,31]. To the extent of the SECI model, Esterhuizen et al. [6] proposed a framework that guides the use of knowledge creation processes as a mechanism to improve creation. In particular, a requisite variety with the abundant resources available should be created in the framework.

The literature also indicates that SECI has considerable effects on organizational performance [24,33,40,51]. For example, Tsai and Li [40] reported that SECI significantly influences new venture performances, while mediating the effect of new venture strategies on performance. However, Martin-de-Castro et al. [27] reported that formal processes might not be applicable to knowledge creation because of the various arguments about culture, geography, and cluster. Therefore, the effect of the relationship among the creation mode, SNM, and SECI toward CP (e.g., product or service and management) requires further investigation.

As mentioned previously, the KCM that addresses a defined or undefined goal may affect the creation outcomes. To reach a common goal, the members must change their perceptions of the knowledge development process from a process of socialization to internalization and share a common perception on idea generation. To support this concept, Li et al. [24] analyzed data from 165 entrepreneurs from the Taiwanese manufacturing and service industries. They reported that the knowledge creation process mediates the relationship between entrepreneurial orientation and firm performance. This finding indicates that, given the creation efficacy, the creation process may help members reach their goals and maintain a freethinking space.

Conversely, members can generate ideas without a common goal, rather than follow the spiral route of SECI, which may lead to unpredictable but value-addable creation outcomes. Moreover, the effect of the SNM that hub or web topology represents is indicated in H2 in the current research. However, the SECI process may affect its effect on creation merits, whereas a particular mode influences the creation outcomes [16]. For example, a hub topology presents a social networking environment in which the core member handles most tasks related to guidance, information transition, combination, and integration to derive final creation outputs. In this case, the use of SECI related to the guidelines proposed by Esterhuizen et al. [6] might not be obvious comparatively and might have less effect on creation outcomes. Alternatively, a web mode allows members to freely interact about any topic and content within the social networks, therefore stimulating the willingness to participate, and encourages interactions and collaborations. In this case, the SECI may share or even fully take over the effect of the web mode on creation outcomes. Therefore, the current research argues that SECI mediates the effect of the creation mode and SNM on CP. The fourth and fifth hypotheses are formulated as follows:

H4. The knowledge creation process mediates the effect of the creation mode on creation performance.

H5. The knowledge creation process mediates the effect of the social networking mode on creation performance.

3. Method

The present study incorporated the KCM, SNM, and knowledge creation process into the research model (Fig. 1) to describe knowledge CP. Two independent variables were involved, namely KCMs, which are represented by the goal-driven mode and goal-free mode, and the SNM, which the hub mode and web mode presented. CP was the dependent variable, presented by product or service, manufacturing or service process, and management. The knowledge creation process (KCP) was the mediator, presented by the SECI model.

The proposed theoretical model was examined, and the hypotheses were tested using an empirical quantitative approach for two reasons. First, several articles in the KM domain, despite not contributing much to knowledge creation in particular, can be

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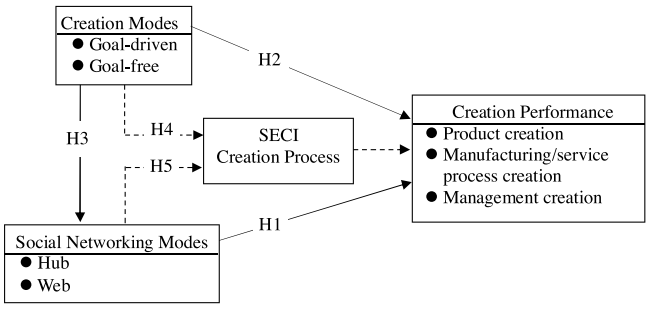

Fig. 1. Research model.

used to help develop the domain concepts, explore the research gaps, identify the research questions, develop the research arguments, define the research hypotheses, and build the research model for the manufacturing and service industries in Taiwan. Second, previous studies and our own research experience in Taiwan have shown that the regulations, policies, and privacy of organizations may hinder the targeted subjects from providing "practical" data or from participating in face-to-face interviews given the sensitive topic of "creation" in a tensely competitive environment. Before finalizing the research method used to derive the research findings and implications, several of our contacts suggested that the data collection might be difficult and advised that a survey instrument be used instead. Therefore, we performed several tasks to encourage our subjects to provide the necessary data and participate in the exploratory study. First, practical company data were not collected through qualitative interviews (e.g., "How many new products has your company had in the market for the past five years, and what do the data imply?" and "Does your company provide a goal before developing a creation idea, and why?"). Second, a questionnaire was used to collect data. The subjects also voluntarily wrote comments in the questionnaire. Third, each subject was given a shopping voucher worth TWD 100. Finally, the subjects willingly answered the questionnaire items according to their experience, information, understanding, and perceptions after they were assured that their responses would remain confidential. In this case, the limitations of the empirical quantitative study were addressed. The measure, sample, and data analysis techniques are described in detail in the following sections.

3.1. Measure

The questionnaire for the variables was developed based on the related literature and was measured using the Likert five-point scale on the question items, where 1 represented "strongly disagree" and 5 represented "strongly agree." Before distributing the questionnaire to the targets, a series of in-depth interviews with specialists related to the fields of knowledge creation, social networking, knowledge creation process, and CP were conducted to make the designed questionnaire understandable to the subjects. The pilot test was conducted on 25 individuals to ensure the readability, reliability, and validity of the questionnaire. The questionnaire is shown in Table 3 in a concise manner.

The KCM has 14 question items based on three main stages [11,18,35,38,51]: (1) procedure of goal setting, (2) process of goal reaching, and (3) goal achievement. The characteristics of the goal-driven mode are as follows: (1) the goal is predefined, (2) the goal is regarded as important and goal setting is satisfactory, and (3) the goal is fixed. By contrast, the goal-free mode characteristics are as follows: (1) no goal is defined, (2) any outcome is regarded as the bottom line of achievement, and (3) the goal is flexible and side effects are marked. The SNM consists of two different networking topologies, the hub and web. The hub mode presents a centralized membership, whereas the web mode highlights a distributed membership. Eight items were used according to the characteristics proposed by the research arguments and previous studies. [4,7,22,23] The knowledge creation process is mainly based on the SECI model, which consists of socialization, externalization, combination, and internalization [32,33]. A total of 16 items were used for SECI. The CP variable consisted of three dimensions: (1) product or service, (2) manufacturing or service process, and (3) management. The items developed for these dimensions were generally based on previous studies [13,18]. Eight items were for product or service CP, seven for manufacturing or service process, and six for management. The subjects were also asked to provide comments, opinions, and suggestions with respect to the research survey. Moreover, both industry and capital were regarded as control variables in the research model to maintain independence.

3.2. Sample

The population of the manufacturing and service industries, which acted in knowledgeable works and encouraged creation tasks for product or service, manufacturing or service processes, and management, was targeted as the research context. The top

Table 2
Descriptive statistics of sample.

Item	Scale	Frequency	Relative frequency
Company			
Industry	Manufacturing	89	57.05%
	Service	67	42.95%
Number of employees	<100	15	9.6%
	100–1000	21	13.5%
	1000–1500	15	9.6%
	>1500	105	67.3%
Capital (Billion in Taiwan dollars)	<0.1	16	10.3%
	0.1–5	50	32.0%
	5–10	19	12.2%
	>10	71	45.5%
Questionnaire answerer			
Department	Research and Development	53	34.0%
	Manufacturing	41	26.3%
	Management (financial, human resource, marketing, etc.)	62	39.7%
Management level	Low	42	27.0%
	Middle	93	59.6%
	High	21	13.4%

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500 companies listed according to capital by the China Credit Information Service (CCIS), Taiwan (2012), was considered in the present research. The CCIS has been established for >50 years and is reputed to be one of Taiwan's leading credit information agencies. It offers a wide range of consulting services and near-real-time and in-depth business information by providing a membership-only database, containing business rankings, financial information, business directories, and other categories. Moreover, the subjects were asked to answer the questionnaire from the organization's viewpoint, rather than personal opinions for obtaining relevant experience or information. Therefore, questionnaires were sent to the companies' administrative departments. To increase willingness to participate, vouchers were given to the respondents. A total of 169 questionnaires were returned after 4 weeks. After eliminating 13 invalid questionnaires that either were incomplete or had single answers, 156 valid questionnaires were obtained, indicating a 31.20% valid return rate. Although the return rate is not very high, we think the number of valid returned questionnaires is acceptable for moving to the next steps. The details of the descriptive statistics are shown in Table 2. The majority of the

Table 3
Factor analysis results.

Factor	Sub-factors	Items	Question	Cronbach's α	
KCM	GD	1-1	Goal is usually defined		
		1-2	Setting a goal is important		
		1-3	Employees work toward the achievement of a defined goal		
		1-4			
		1-5	Achievements satisfy the expected goal		
		1-6	Baseline of achievements of a goal is acceptable.		
		1-7	Part of goal achievements is accepted.		
		1-8	Discussion is within the context of a goal	0.897	
			Discussion is ignored without a goal		
	GF	1-9	Goal is usually not defined or flexible		
		1-10	Any outcome of a goal is acceptable		
		1-11	Discussion of any subject is acceptable		
		1-12	Any outcome is better than nothing		0.893
		1-13	Any discussion is allowed	0.778	
SNM	HUB	2-1	Interactions follow regulations		
		2-2	Interactions focus on some core members		
		2-3	Information is exchanged by way of some members		
		2-4	To freely exchange information is not acceptable	0.829	
	WEB	2-5	Free interaction is allowed		
		2-6	Free communication is allowed		
		2-7	Information/knowledge exchange occurs among members		
		2-8	Free collaboration is allowed	0.825	0.872
KCPr	KCPr	3-1	Social participation is frequent		
		3-2	Interactions are through types of forums		
		3-3	Socialization occurs frequently		
		3-4	Intention to learn things is obvious		
		3-5	Various meetings facilitate experience sharing		
		3-6	Comments and new ideas are freely expressed		
		3-7	Opinions are openly presented		
		3-8	Collaboration of study frequently occurs for creation		
		3-9	The shared information and knowledge are studied		
		3-10	The shared information and knowledge are integrated with existing knowledge		
		3-11	The shared concepts, comments, and opinions are integrated internally.		
		3-12	New knowledge is developed.		
		3-13	Integrated knowledge is internalized.		0.968
KCPe	PdP	4-1	Creative product/service development project achieves the defined objective.		
		4-2	Customers are satisfied with the creative products/services.		
		4-3			
		4-4	Creative product/service market share increases gradually		
		4-5	Diverse product/service design satisfies multiple demands		
		4-6			
		4-7	Creative product/service profitability gradually increases		
		4-8	Creative product/service sales gradually increase	0.919	
			The number of creative products/services gradually increase		
			Outputs from creative product/service development are more than the cost of inputs		
	PcP	4-9	Creative manufacturing/service process benefits productivity and delivery capability		
		4-10	Creative manufacturing/service process stabilizes product quality		
		4-11	Creative manufacturing/service process increases operation efficacy		
		4-12	Creative manufacturing/service process simplifies operation steps		
		4-13	Creative manufacturing/service process reduces cost and improves functions		
		4-14	Budget on creative manufacturing/service process gradually increases		
		4-15	A considerable part of the profit is derived from the creative manufacturing/service process	0.924	
	MnP	4-16	Innovative management is among the more important strategies		
		4-17	Innovative management ideas and suggestions benefit operations		
		4-18	Innovative management is recognized		
		4-19	Management tasks improve gradually		0.943
		4-20	Creative management policies are regulated		
		4-21	Creation management helps the organization adapt to a dynamic and unpredictable environment	0.929	

GD: Goal driven; GF: Goal-free; HUB: Hub topology; WEB: Web topology; KCPr: Knowledge creation process; KCP: Knowledge creation performance; PdP: Product performance; PcP: Process performance, MnP: Management performance.

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companies have >1500 employees (67.3%), and 45.5% of the companies have a capital of >10 billion (TWD). Among the questionnaire respondents, 39.7% were in the management department, 34.0% in the research and development department, and 26.3% in the manufacturing department (e.g., financial or human resource), which implies that the sampled companies adequately covered the areas of product or service, manufacturing or service process, and management.

4. Results

4.1. Reliability

The exploratory factor analysis was conducted to derive actual composites and confirm reliability and validity [10]. The internal consistency of the factors was considered acceptable when Cronbach's α was >0.7 or close to 0.7. The Kaiser–Meyer–Olkin (KMO) and Bartlett test results confirmed the suitability of the factor analysis (0.891 and 0.000 for KCM, 0.841 and 0.000 for SNM, 0.946 and 0.000 for knowledge creation process, and 0.900 and 0.000 for CP). Factor analysis was conducted using principal component analysis with max rotate. Four factors were extracted (Table 3) based on the criteria that the eigenvalue and the factor loading had to be >1 and 0.5, respectively. One question item was removed from the goal-free driven mode and three from SECI, which did not meet the required criteria. In addition, the average variance extracted (AVE) value for all of the composites was above 0.5 (Table 4), and the square root values of AVE were greater than the correlation coefficient among the composites (Table 4), which confirmed the validity of the model. The hypotheses were tested using the structural equation model to derive results, which is described in detail in the following section.

4.2. Hypothesis tests

The results of the hypothesis tests are divided into two parts. The first part pertains to level 1, which includes relationships among the creation mode, SNM, creation process, and CP. Based on the factor analysis results, the second part pertains to the level including relationships among goal-driven and goal-free modes for the variable of creation mode, hub, and web for SNM, and product or service, manufacturing or service process, and management CP for CP. The mediation effect of the SECI is also observed. The details are described in the following section.

4.2.1. Results for level 1

Table 5 shows that both knowledge creation and SNM significantly influence the knowledge creation process (refer to models M1-2 and M1-3). Table 6 shows that the KCM, SNM, and the knowledge creation process significantly influence the knowledge CP (models M1-5, M1-6, and M1-8), which supports hypotheses H1 and H2. When the knowledge creation process is incorporated as a mediator into the model, the effect of the creation mode on CP decreases from 0.520 to 0.243 of the coefficient value (M1-7). The reduced value of 0.243 implies a strong effect. The explained variance increases from 0.265 to 0.527 ($\Delta R^2 = 0.262$). Thus, the knowledge creation process does not completely mediate the effect of the creation mode on CP, which does not support H4. The result of M1-9 shows that the effect of the SNM on CP decreases from 0.234 to 0.143 of the coefficient value. Therefore, the effect becomes weaker. In addition, the explained variance increases from 0.152 to 0.499 ($\Delta R^2 = 0.347$). Thus, the knowledge creation process slightly mediates the effect of the SNM on CP, which supports H5. Finally, the analysis of the effects of the creation mode and SNM is presented in Table 7. The result in model M1-11 confirms hypothesis H3. The variable of capital significantly influences the SNM (M1-10), albeit not strongly. However, this variable becomes negligible when the KCM is introduced into the model, implying that the level of capital may have a weak effect on the way group members socialize. However, the current research does not extend beyond this point and suggests this area as a topic for future research.

Table 5
Analysis results for level 1 (1).

Dependent	Knowledge Creation Process		
Model	M1-1	M1->2	M1-3
Control variable:Industry	−0.021	0.028	−0.024
Control variable:Capital	0.002	−0.041	−0.064
Independent: Knowledge creation mode	–	0.476***	–
Independent: Social networking mode	–	–	0.393***
R^2	0	0.222	0.151
F value	0.035	14.491***	9.008***

***$p < 0.01$.

4.2.2. Results for level 2

Table 8 lists the results for level 2, which reveals that the goal-driven mode and web mode significantly influence CP presented using the product or service (M2-3). For the effect on the manufacturing or service process performance, only the goal-driven mode is significant (M2-7), whereas for management creation, the goal-driven mode, goal-free mode, and web mode are significant (M2-11).

In addition, Table 8 shows the mediation effect of the creation process represented by SECI. For the product or service CP, the

Table 4
Correlation coefficient of factors.

	CR	AVE	GD	GF	HUB	WEB	KCPr	PdP	PcP	MnP
GD	0.897	0.529	0.727							
GF	0.778	0.479	0.567***	0.692						
HUB	0.829	0.593	0.383***	0.222**	0.770					
WEB	0.825	0.575	0.407***	0.148*	0.605***	0.758				
KCPr	0.872	0.549	0.488***	0.310**	0.341***	0.347**	0.741			
PdP	0.919	0.564	0.382***	0.150*	0.252**	0.325***	0.496***	0.751		
PcP	0.924	0.550	0.483***	0.232**	0.268**	0.313***	0.564***	0.568***	0.742	
MnP	0.929	0.653	0.498***	0.409***	0.254**	0.303**	0.682***	0.405***	0.622***	0.808

CR: Composite reliability; AVE: average variance extracted.
GD: Goal driven; GF: Goal-free; HUB: Hub topology; WEB: Web topology; KCPr: Knowledge creation process; PdP: Product/service performance; PcP: Process performance, MnP: Management performance.
Diagonal line expresses the square root of AVE.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

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Table 6
Analysis results for level 1 (2).

Dependent	Knowledge Creation Performance					
Model	M1-4	M1-5	M1-6	M1-7	M1-8	M1-9
Control variable: Industry	−0.023	−0.008	0.03	0.014	−0.026	−0.011
Control variable: Capital	−0.007	−0.008	−0.054	−0.03	−0.072	−0.032
Independent: Knowledge creation mode	–	–	0.520***	0.243**	–	–
Independent: Social networking mode	–	–	–	–	0.234**	0.143*
Independent: Knowledge creation process	–	0.694***	–	0.581***	–	0.639***
R^2	0.001	0.482	0.265	0.527	0.152	0.499
ΔR^2	–	0.481	0.264	0.262	0.151	0.347
F value	0.04	47.129***	18.233***	42.035***	9.052***	37.555***

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

Table 7
Analysis results for level 1 (3).

Dependent	Social networking mode	
Model	M1-10	M1-11
Control variable: Industry	0.008	0.045
Control variable: Capital	0.167*	0.124
Independent: Knowledge creation mode		0.363***
R^2	0.027	0.156
ΔR^2		0.129
F value	2.162	9.382***

*$p < 0.1$; ***$p < 0.01$.

Table 9
Analysis result for level 2 (2).

Dependent	Social networking mode			
	Hub mode		Web mode	
Model	M2-13	M2-14	M2-15	M2-16
Control variable: Industry	0.070	0.036	0.015	0.054
Control variable: Capital	0.025	0.021	0.037	0.079
Independent: Goal driven	–	0.418***	–	0.541***
Independent: Goal-free	–	−0.058	–	0.181*
R^2	0.051	0.192	0.012	0.282

effect power of the goal-driven mode remains significant, whereas the web mode does not when the creation process is introduced into the model. This result indicates that the effect of the goal-driven mode decreases from 0.335 to 0.202 and that of web decreases from 0.196 to 0.126. In particular, the value of 0.126 implies that the effect is no longer strong. In addition, the explained variance of M2-4 increases from 0.183 to 0.293 ($\Delta R^2 = 0.110$). Thus, SECI does not completely mediate the effect of the goal-driven mode, whereas the effect of web mode on the product or service CP is mediated. For the manufacturing or service process CP, the effect of the goal-driven mode remains significant, although it decreases from 0.446 to 0.302 (M2-8). Moreover, the explained variance increases from 0.253 to 0.383 ($\Delta R^2 = 0.130$). Thus, SECI does not completely mediate the effect of the goal-driven mode on the manufacturing or service process CP. No mediating effect is observed on the web mode (M2-8). For the management CP, the effect power of the goal-driven mode and web mode does not remain significant, whereas that of the goal-free mode (M2-12) remains significant. The result of M2-12 shows that the effect power of the goal-driven mode decreases from 0.296 to 0.104, whereas that of the web mode decreases from 0.178 to 0.087 and that of the goal-free mode declines from 0.238 to 0.188. These results imply that the effect power of both the goal-driven and web modes on management CP is no longer strong, whereas that of the goal-fee mode remains strong. Furthermore, the explained variance increases from 0.296 to 0.526 ($\Delta R^2 = 0.230$). Thus, SECI mediates the effect of both the goal-driven mode and web mode, whereas the goal-free mode has no effect on the management CP. Finally, Table 9 reveals that the goal-driven mode significantly influences both the hub and web modes, whereas the goal-free mode significantly influences the web mode (M2-14 and M2-16), albeit weakly.

5. Discussion and implications

Table 10 presents a summary, which includes the variables and sub-variables used, the arguments of the present study, and

Table 8
Analysis results for level 2 (1).

Dependent variable	Knowledge Creation Performance											
Sub-variables	Product/service creation performance				Manufacturing/service Process creation performance				Management creation performance			
Model	M2-1	M2-2	M2-3	M2-4	M2-5	M2-6	M2-7	M2-8	M2-9	M2-10	M2-11	M2-12
CV: Industry	−0.021	−0.010	0.005	−0.001	0.000	0.012	0.040	0.033	−0.038	−0.024	0.003	−0.006
CV: Capital	−0.009	0.008	0.008	0.026	−0.004	−0.005	−0.010	0.010	−0.022	−0.023	−0.067	−0.040
Indep.: Goal driven	–	–	0.335***	0.202**	–	–	0.446***	0.302**	–	–	0.296**	0.104
Indep.: Goal-free	–	–	−0.026	−0.097	–	–	−0.035	−0.072	–	–	0.238**	0.188**
Indep.: Hub	–	–	0.029	−0.021	–	–	0.043	−0.011	–	–	0.009	−0.063
Indep.: Web	–	–	0.196**	0.126	–	–	0.108	0.056	–	–	0.178*	0.087
Mediator: KCPr (SECI)	–	0.496***	–	0.391***	–	0.564***	–	0.424***	–	0.682***	–	0.564***
R^2	0.001	0.246	0.183	0.293	0.000	0.318	0.253	0.383	0.002	0.467	0.296	0.526
ΔR^2	–	0.245	0.182	0.110	–	0.318	0.253	0.130	–	0.465	0.294	0.230
F value	0.04	16.564***	5.549***	8.747***	0.001	23.644***	8.420***	13.117***	0.129	44.339***	10.435***	23.426***

CV: Control variable; Indep.: Independent sub-variable; KCPr: Knowledge creation process; SECI: Socialization, externalization, combination, and internalization.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

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comparisons to previous research as well as research findings and implications.

First, the KCM significantly influences the overall CP as well as the SNM (Table 5). These findings are consistent with the previous research reports of Hsia et al. [14], Kavakli and Loucopoulos [19], McFadyen et al. [30], Liu and Liu [43], and Chang et al. [51]. In the manufacturing and service industries, subjects are likely to accept that the KCM, presented by the predefined or non-predefined goal, influences the next activities and resource allocation strategies, resulting in dissimilar CP. Moreover, the incoming creation tasks for group members will influence the learning and socializing processes within the group once the creation mode is determined, particularly the way they interact and communicate with the leader. This condition will possibly result in the different topologies that group members form and interact in.

Second, the goal-driven mode is significant for all CP dimensions, whereas the goal-free mode is only significant in the management (Table 8). This finding is consistent with Kavakli and Loucopoulos [19], Hsia et al. [14], McFadyen et al. [30], and Chang et al. [51], but inconsistent with Kao et al. [18] and Martins and Terblanche [29]. Therefore, the subjects from the manufacturing and service industries are likely to respond to the importance of goal setting for creation tasks. The subjects also demonstrate that a goal should be given in advance to help agglomerate the cognition

Table 10
Summary of theoretical implications.

Current research			Previous research argument and findings	Research findings and implications
Factors	Sub-factors	Research arguments	Comparison	
Knowledge creation mode	Goal-driven mode	1. A goal that is predefined influences the performance of knowledge creation presented by product/service, manufacturing/service process, and management 2. A goal that is predefined influences the social networking mode	Consistent with [14,19,30,51] Partially consistent with [11] Inconsistent with [18,29]	- Subjects likely accept the significant effect of the creation mode on the overall creation performance and on the overall social networking mode - Subjects likely accept the significant effect of the goal-driven mode on the creation performance presented by product/service, manufacturing/service process, and management - Subjects likely accept the significant effect of the goal-free mode on the creation performance presented only by management - Subjects likely accept the significant effect of the goal-driven mode on both the hub and the web mode of social networking - Subjects likely accept the significant effect of the goal-free mode on the social networking mode presented only through the web
	Goal-free mode	1. A goal that is not predefined influences the performance of knowledge creation presented by product/service, manufacturing/service process, and management 2. A goal that is not predefined influences the social networking mode		
Social networking mode	Hub mode Web mode	A communication topology presented by hub influences the performance of knowledge creation presented by product/service, manufacturing/service process, and management A communication topology presented by web influences the performance of knowledge creation presented by product/service, manufacturing/service process, and management	Consistent with [23,42,50] Partially consistent with [7,12,15,16,20,25,26,30,42,45] Inconsistent with [21]	- Subjects likely accept the significant effect of the social networking mode on the overall creation performance - Subjects are not likely to accept the significant effect of the hub mode on the creation performance presented by product/service, manufacturing/service process, and management - Subjects likely accept the significant effect of the web mode on the creation performance presented only through product/service and management
Knowledge Creation process	–	1. Knowledge creation process represented by SECI mediates the effect of knowledge creation mode on knowledge creation performance presented by product/service, manufacturing/service process, and management 2. Knowledge creation process represented by SECI mediates the effect of knowledge creation mode on knowledge creation performance presented through product/service, manufacturing/service process, and management	Consistent with [24] Partially consistent with [6,20,27,40,51]	- Subjects likely accept the significant effect of the SECI process on the overall knowledge creation performance - Subjects likely accept that the SECI process slightly mediates the effect of the goal-driven mode and fully mediates the web mode on the product/service creation performance - Subjects likely accept that the SECI process slightly mediates the effect of the goal-driven mode on the manufacturing/service process creation performance - Subjects likely accept that the SECI process completely mediates the effect of the goal-driven mode and fairly or slightly mediates the effect of the goal-free mode on the management creation performance - Subjects likely accept that the SECI process fully mediates the web mode on the management creation performance

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and thinking behavior of group members for new product or service creation, manufacturing or service process, and management. Unlike companies in the manufacturing industry with ≥20 patents [18], the present study obtains a sample from the top 500 companies in Taiwan, which are mostly small to medium sized and usually adopt incremental and efficiency-oriented creation strategies. For this particular creation strategy, such companies likely prefer a goal-driven mode to maximize resources. Subjects also accept the importance of being goal-free as adopted only for management creation, which covers a variety of aspects (e.g., managerial plan, supply chain management, and customer relationship management), unlike, comparatively, the main characteristic of product or service and manufacturing or service process creation that needs technology, service professionals, and experience. This is expected because companies in the manufacturing and service industries in Taiwan have accumulated considerable experience by integrating different management theories, aspects, and ideas in the past few decades. In this regard, the bottom-up approach based on a goal-free mode is used to encourage management innovation.

Third, the goal-driven mode is significantly associated with both the hub mode and web mode, whereas the goal-free mode is associated only with the web mode (Table 9). Thus, when companies from the manufacturing and service industries in Taiwan adopt a goal-driven creation strategy, they will likely take on both social networking topologies. Nevertheless, the web mode is likely to be adopted if the goal-free mode is chosen. On the one hand, to have an efficient and effective creation task, the core member (or leader) of the creation group of a company likely dominates the entire creation task if the companies predefine a goal. In this case, they are likely to prefer a hub mode to ensure that everything related to the creation task is manageable or even controllable. However, the finding shows that the hub mode and the web mode are associated with being goal-driven. The main reason for this finding can be observed in several comments in the returned questionnaires: although members formally communicate and interact with core members, they frequently have informal interactive activities at the same time to share concepts, information, and knowledge sharing through social media. Its purpose is to shape the hub mode because equal and free interactions are beneficial for determining innovative solutions of unknown questions in a collaborative manner. This situation in Taiwan is supported by the analysis results that the hub mode has no significant effect on any dimension of CP (Table 8). On the other hand, when companies do not predefine goals (goal-free mode), they allow achievements in creation tasks [18,29]. This finding confirms this type of social networking topology that only the web mode is associated with the goal-free creation mode (Table 9).

Fourth, the SNM significantly influences knowledge CP (M1-8, Table 6), which is consistent with our expectation and the reports by Fuller et al. [8], McFadyen et al. [30], Liu and Liu [43], Lin et al. [44] Chuang and Lin [45], and Lin et al. [50] that social networking contributes to organizational performance. Usually, creation group members engage in different levels of interaction or collaboration with others to exchange knowledge resources they own to better achieve creation outcomes. In this situation, the interaction among members and the group leader results in different styles of social networking and very possibly produces diverse types of resource integration, which affect final creation outcomes. However, the second-level analysis results reveal that the hub mode has no significant effect on any dimension of performance. By contrast, the web mode has a significant effect on both product or service and management CP (M2-3 and M2-11 in Table 8). Thus, the hub mode is not likely to be a predicator of knowledge creation, which is consistent with the argument of Leenders et al. [23] but inconsistent with that by Gratton and Erickson [9] and Kodama [21]. On the one hand, the core leader usually wields authority to dominate social activities, which, in consequence, may restrict willingness of participation, information and knowledge sharing, and the exchange of concepts and ideas. The unequal position among group members likely limits sharing behavior toward less CP. However, based on case study analysis, Kodama [21] reports that leaders guide and facilitate business innovation outcomes through networked strategic communities in the context of information technology (IT) and multimedia business in Japan, probably because creation efficacy and leadership culture are the main concerns, implying a special need in cases (e.g., Japanese culture) where the current research findings in Taiwan do not hold.

On the other hand, with equal opportunity and almost full freedom to interact with members and group leaders, group members are likely to behave in a web network in which participation, collaboration, coordination, and integration are encouraged for knowledge creation. In general, a creation group member who is allowed to freely interact as a social behavior in nature produces deeper trust and better social and emotional relationships. In consequence, they may generate new ideas for products or services and management, which supports one of the research findings of Khodakarami and Chan [20]. Thus, both product or service and management creation is associated with the web mode of social networking. This finding is consistent with the argument by Leenders et al. [23] that free and frequent interactions among members will encourage members to engage further in knowledge creation collaboration. However, such a condition does not support the effect of the web mode on the creation of manufacturing or service process. M2-8 (Table 8) shows that a goal-driven mode for the creation efficacy concern and a relevant supporting creation process may be necessary in the context of the manufacturing and service industries in Taiwan because of such salient features as manufacturing professionals, technology, and experience that group members should have.

Fifth, Table 6 reveals that the creation process (SECI) significantly influences knowledge CP (M1-5), which is consistent with research arguments and reports by Li et al. [24] and Tsai and Li [40]. The SECI slightly mediates the effect of the creation mode (M1-7) and SNM on CP (M1-9). Moreover, the SECI slightly mediates the effect of the goal-driven mode on product or service and process CP (M2-4 and M2-8, Table 8), and it fully mediates that on management CP (M2-12, Table 8). As mentioned previously, the creation process presented by SECI is highly likely to influence human thinking behavior toward idea generation and solution development. When a goal is predefined, the creation process will likely focus on the goal-oriented activities presented by sharing, interaction, and collaboration through socialization, externalization, combination, and externalization. The research finding shows that SECI plays a supportive role that is embedded in the creation task to link the defined goal toward creation outcomes in Taiwan's manufacturing and service industries, in particular for product or service and manufacturing or service process creation. Similarly, SECI can support the goal-free strategy (M2-12) toward management creation outcomes. However, combining SECI with a goal-driven strategy in terms of a management creation outcome is not recommended, as it will reduce the effect of the goal-driven mode.

Finally, SECI fully mediates the effect of the web mode (M2-4 and M2-12) on product or service and management creation outcome. This observation partially supports the framework guideline of SECI use proposed by Esterhuizen et al. [6] and the finding by Martin-de-Castro et al. [27]. Essentially, knowledge creation needs frequent interactions to develop creation ideas. The research finding implies that SECI should not be introduced into the model because it may reduce the effect power of web topology that presents a free interaction behavior, which may in turn affect the creation outcome of product or service and management.

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Unlike the argument by Gratton and Erickson [9] that a leader should own both task- and human-oriented relation behaviors, the present finding indicates that SECI likely weakens the effect power of the web mode in the context of a product or service and management creation task in Taiwan's manufacturing and service industries. As Fournier and Lee [7] argued that the web mode (e.g., online communities on the Internet) should allow, or even encourage, chaos, conflicts, and even thrives while developing creation ideas, the leader should initiate social activities, encourage free comments and opinions, welcome continuous feedback, engage in regular communication, and support creation contribution, without being too involved in regulation (e.g., a formal process). Moreover, these findings echo Blumenberg et al. [3], who reported that the web mode emphasizes the way group members socialize and externalize for knowledge creation without too much restriction. To this extent, the present finding confirms that although the SECI shows an effect on CP (M1-5, Table 6), the focus should not be coping with the networking method presented using web topology for product or service and management creation. This may explain the finding of Martin-de-Castro et al. [27] that the knowledge creation process may not always provide a unique approach to attain creation outcomes.

5.2. Implications

This study has theoretical and practical contributions. The study develops theoretical arguments and addresses the gaps that have been identified in research, particularly in the effect of the creation mode and SNM on CP and in the mediation effect of the creation process presented by SECI. The research findings from the level 1 analysis confirm the significance of the effect of the creation mode and SNM on CP. The mediation effect of the creation process presented by SECI is also recognized. The findings from the level 2 analysis confirm that the goal-driven mode is significantly associated with the CP presented by product or service, manufacturing or service process, and management. The goal-free mode influences management CP. The hub mode has no significant effect on CP. The web mode has a significant effect on both product or service and management CP. Moreover, the results also provide evidence that SECI weakens the effect of being goal driven on the product or service and manufacturing or service process CP and fully mediates the effect on the management CP. It also fully mediates the effect of the web mode on both product or service and the management CP. Some findings are consistent with arguments and findings (e.g., the web mode) in previous studies, whereas others are not (e.g., the goal-driven mode and hub mode), mainly due to different research focuses, subjects, contexts, and times conducted. The present study also provides a discussion in detail as well as deepens theoretical arguments, in particular, and advanced concepts, in general, in the context of Taiwan's manufacturing and service industries.

Certain implications are presented for practice. First, for the knowledge creation service providers, agents, and consultants, the research findings provide a structural analysis for the determinants of knowledge creation according to the perception of subjects from manufacturing and service companies, including the creation mode and SNM as well as the creation process. In addition to examining the effect of the creation mode and SNM on CP in level 1 analysis, level 2 effects for sub-variables of goal driven, goal-free, hub, web, and SECI were analyzed. The results suggest that knowledge creation service providers, agents, and consultants for manufacturing and service companies in Taiwan at this particular time and context should accentuate the goal-driven creation mode to attract attention to their clients. On the one hand, companies with predefined goals can maximize their tangible and intangible resources for the target in the tensely competitive environment. Given that the manufacturing or service industry has a dynamic and fast-changing environment, the goal-free creation mode could help determine management solutions or ideas to adjust to changes. Moreover, knowledge creation service providers, agents, and consultants for manufacturing and service companies should recommend the goal-driven mode for innovatively managing a particular goal achievement task in any dimension of CP and goal-free performance for innovative management in terms of all aspects.

Second, knowledge creation service providers, agents, and consultants for manufacturing and service companies in Taiwan should focus more on the manner in which group members interact with their leader. The findings indicate that the hub mode is no longer appreciated due to the need for free participation willingness, free interaction, and free sharing of opinions and comments. Therefore, the web mode, which does not have as much control of the leader, is recommended when product or service and management creation is concerned. In particular, organizations should develop a free channel by which creation group members, including their leader, can communicate with each other to efficiently and effectively foster creation ideas for their product or service and management.

Third, the study reveals that subjects from manufacturing and service companies likely accept SECI as the mediation variable, which slightly or fully influences the effect of the goal-driven mode and the web mode on CP. Knowledge creation service providers, agents, and consultants for manufacturing and service companies should emphasize the creation process presented by SECI to their clients. To do so, SECI should be conducted with the strategy of goal-driven creation, particularly when product or service and manufacturing or service process creation are concerned. However, they should not recommend the SECI when management creation is the focus and a goal is provided, because SECI will likely remove the effect power of goal-driven mode on management CP. Moreover, when the focus is the product or service and management creation for a manufacturing and service firm and the web interaction topology is adopted, creation service providers should not consider SECI. Basically, to better reach the defined goal, group members should have a free channel through which they communicate with their clients. Toward this aim, they can efficiently and effectively allocate and use their resources as well as maintain an active creation behavior. They are given a wider thinking space as well.

Finally, no single solution can guarantee creation outcomes. Nonaka et al. [34] reported that knowledge creation is a multidimensional issue. As such, its outcome is the output of a dynamic but collaborative mechanism that involves several conditions. The current research findings for a particular time under a specific context provide knowledge creation service providers, agents, and consultants with alternatives to manage knowledge creation better. For product or service creation, the goal-driven mode plus the web mode should be used. Similarly, the SECI with free communication topology in each stage (e.g., socialization and externalization) is recommended based on the strategy of presetting a goal. For manufacturing and service process creation, the goal-driven mode plus the SECI creation mechanism is advocated; however, no particular evidence indicates that the SNM could be adopted. For management creation, both the goal-driven and goal-free modes as well as the web mode are suggested; when adopting the web mode, the SECI process mechanism should not be involved to keep the interaction platform free from chaos and conflicts and to even thrive with various creative outcomes.

6. Conclusion

This paper discussed the importance of variables of the KCM, SNM, and creation process, and considered these variables as the

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potential antecedents of CP. The current study developed a theoretical model and empirically examined the relationships between independent and dependent variables in the context of the manufacturing and service industries of Taiwan. In essence, the current model is not a complex model involving many theories and arguments to concurrently and comprehensively describe the knowledge CP. The findings of the current study differ from those in previous studies, in particular, for knowledge creation service providers. Early studies tended to focus on issues of technology, culture, strategy, and leadership without emphasizing the goals (predefined and otherwise); the interaction topology that group members adopt with their leader; and the role of the creation process. Moreover, under knowledge creation policy and strategy, the findings of this study can serve as an aid for researchers, consultants, and government agencies to provide manufacturing and service companies with alternative solutions for their knowledge creation tasks.

Although the current study has identified the effect of the independent variables on the dependent variable as well as the mediation effect of SECI on their relationships, other variables are considered to vary in their effect on CP. From the perspective of the real and virtual worlds, knowledge creation is increasingly changing the competitiveness of organizations in industries, and it is believed to be advantageous to business development. However, many unknown details about the creation efficacy of various needs and wants should still be identified. These details continuously exist with regard to the creation configuration and environment that address both the physical and virtual interactions. Exploring these issues by incorporating the current research focus into culture diversity, business policies, behavioral cognition, and organizational dynamics for different industries in different countries may be valuable to the service providers of knowledge creation. Moreover, this research involved an empirical quantitative study in which the data collection method for different organization levels and divisions may have caused variances due to the different levels of abstraction, perception, or even cognition [36]. Therefore, based on the findings and implications of the current exploratory research, another research area may be investigated in the form of a case or multi-case study to generate additional in-depth findings for the variable relationships and to give knowledge creation service providers more appropriate solutions in the context of Taiwan and other countries.

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