Knowledge Sharing, Social Capital and Firm Performance in Technological Clusters of Taiwan Science Parks: An Innovation Strategy Perspective

Ming-Huei Chen, Hong-Yan Wang, Yu-Yu Chang, Ava Hung
National Chung Hsing University, Taichung, Taiwan, R.O.C.

Abstract--**Many scholars illustrate that innovation is the most important determinant of technological firm performance and the existing evidence has indicated the crucial role of knowledge flow and social interaction among partners in innovation activities, but little research has linked knowledge sharing and social capital with firm performance from a holistic perspective of innovation strategy. This paper, therefore, aims to explore the relationships between knowledge sharing, social capital, and firm performance with regard to the effects of innovation strategies, which consist of collaboration strategy, in-house R&D strategy, and outsourcing strategy. To test the proposed hypotheses in this study, a sample of 209 technology-based companies in Taiwan Science Parks was examined through structural equation modeling. A variety of research stream, including innovation, systemic innovation, strategic alliance, knowledge management and social capital, has been used as theoretical lens in this paper. By embracing multiple perspectives, the paper's findings contribute to a better understanding of how collaborative knowledge sharing and social capital impact firm performance through affecting the three distinct innovation strategies. Based on our empirical findings, managerial implications to technological firm leaders and interesting phenomena in clustered Science Parks are discussed.**

I. INTRODUCTION

With the market characteristic of short product life cycle and a high rate of new product introduction, the innovation is the key for an organization's survival. Based on the view of systemic innovation approach, technology firms not only strive for their network centrality in an innovation system [1], but also is a key to commercializing the product as well as playing a role in the economic development. Cooper and De Brentani [2] proposed that a firm's innovation capability is the most important determinant of product performance. How to use the firm's strategy to harmonize internal and external requirements at a given point in time has a very critical relationship with its internal innovation capability and the external environment. However, being innovative is not sufficient for success [3]. Firms need to be able to implement innovation in the organizational culture, and to be sure that markets will value that innovation [4, 5]. Innovative performance is determined by market dynamics, where the consumer preferences are dependent on the degree of customer satisfaction, and the firms implement market orientation competency to identify, respond to, and satisfy customer demands [3]. Likely, Verona [6] illustrated that product innovation's impact on the firm's performance is affected by the firm's technological, marketing and integration capability.

A number of papers suggest that resources, dynamic capabilities, and knowledge are closely interlinked to achieve competitive advantage [7, 8, 9]. Recently, many studies have encouraged systemic inter-disciplinary research in the innovation field and called for more research exploring inter-organizational collaboration and interaction in value co-creation [10, 11]. Being in an extremely fast-paced, technology-driven environment [12], integrated circuit (IC) semiconductor firms, which are characterized by their capital and technologically intensive, are clustering in Taiwan's science parks (TSP) along with other industries. This particular background provides a good incentive to empirically conduct research on technological companies in science parks [13].

The science park has been recognized as an engine of economic development, a source of intellectual capital, a platform for social networking, an incubator of entrepreneurs, and a hub of cooperation among academia, R&D institutes, and firms. The multiple functions of the science park are increasingly influenced by government policies and the industrial environment. Since the Hsinchu Science Park (HSP) in Taiwan was established in 1980, Taiwan economic condition has been rapidly upgraded from a traditional agriculture-based economy to a hi-tech-driven industrial economy within a few decades. Taiwan's successful science park model, incorporating R&D and manufacturing activities, is substantially different from the original research-based models in the Western countries. Following the Hsinchu science park model, the Southern Taiwan Science Park (STSP) and the Central Taiwan Science Park (CTSP) were set up in 1995 and 2003, respectively. Additionally, the World Economic Forum (WEF 2012-2013) report [14] reveal that Taiwan ranks 1st in term of state of cluster development, possesses "undeniable" innovation ability and has fully developed into an innovation-driven economy. Given the cluster effects of the science parks, many world-leading companies of global integrated circuit semiconductor and optoelectronic supply chains are now clustered in the TSP, giving them a high ranking in global competition.

Since Lundvall [15] suggests the important relationship between technology and knowledge flows in the innovation system. Damanpour [16] also highlights the innovation process involves the acquisition, dissemination, and use of new and existing knowledge. Further, Nahapiet and Ghoshal's [17] propose the linking relationship between the social capital and knowledge networks. Many previous researches have also shown that knowledge sharing is positively related to performance [18, 19], but there is still short of an integrated empirical study on how firm's

innovation activities affect performance in the context of industrial clusters. Given the competitive advantages of clustered industries and partners' multi-dimensional collaboration with geographic proximity, the TSP business model enhances not only the complex infrastructural relationships among participants but also sophisticated context (soft and hard) related to intra- and extra-institutional capability. The TSP serves as an interesting platform to explore firms' innovation activities within technological clusters. Therefore, this paper seeks to identify the determinants of a firm's cluster-innovation strategy and their impacts on performance, extending the existing research to further explore specific innovation phenomena lead to so-called cluster effects in the science parks.

This paper is based on the innovation, systemic innovation, strategic alliance, marketing, knowledge sharing and social capital theory. The contribution of this paper is three-fold: **Firstly**, comparing with the organizational competence approach, we find the customer satisfaction measure function is directly and positively significant. The results show that customer satisfaction is a proper tool in evaluating the value of those intangible capability and resources yielding by the innovation. In contrast with partially ambiguous outcomes (findings) presented by some researches using traditional financial and the other indirect measures, this paper's findings more clearly indicate how customer satisfaction can significantly lead to better financial performance. **Secondly**, Based on systematic and integrated interdisciplinary approaches to explore relationships with innovation performance, this paper identifies the meso (cluster) - and micro (firm)-level determinants of firm's strategy and its impact on performance. **Thirdly,** given the specific characteristics and environment, some findings in the firms' innovation phenomena in TSP are unique and differentiated, which may be affected by moderators in the competitive and turbulent global environment. The paper's findings empirically prove that the knowledge sharing and social capital can positively enhance innovation performance by the mediating of firm's strategy in cluster industries. **This article will be structured as follows. We start with our theoretical model and develop a propositional framework on the antecedents and consequences of project learning during new technological innovation. Next, we describe the research design that was set up to validate our conceptual framework. Following the discussion of our results, we formulate the major conclusions and management implications of our study.**

II. LITERATURE REVIEW AND HYPOTHESIS DEVELPMENT

Some studies propose that the performance of innovation development (R&D) can be driven by variables of a different nature; externally, it can be associated with the presence of peculiar agents (partners), and internally, it can be due to the leveraging of organizational capabilities [6]. Since the research will be more accurately represented when multiple rather than single views are incorporated. Based on resource-based view, systemic Configurational perspective, and organizational competence approach, the paper provides an overview framework for studying relationships among knowledge sharing, social capital, and performance in innovation activity.

A. Innovation and Firm Innovation Strategy

Thompson [20] defined "innovation" as the generation, acceptance, and implementation of new processes, products, or services for the first time within an organizational setting. Other scholars have defined innovation as the development and implementation of new ideas [21]; as being new products or services as well as new administrative systems [22]; as the ability of the organization to adopt or implement new ideas, processes, or products successfully [23]. Technological innovation includes the activity that facilitates new product development, production process, and the R&D of those relevant technologies. Whereas Siguaw, Simpson, and Enz [24] argued that performance outcomes, including market position, operational efficiency, and financial success, are directly determined by innovation form, rate, and type. The existing literature has categorized the innovation forms into "radical (disruptive) innovation", "incremental (sustaining) innovation", "system innovation", and "next-generation technology innovation" [25, 26]; or **"**technology- and administration-related innovations" [16]. Many studies refer the radical innovation as incredibly significant degree of change (or impacts) on the technology, market, process, and existing products and business [27]; as the potential to "shift market structures, represent new technologies, require customer learning, and induce behavior changes" [28]. On the contrary, the incremental innovation is change gradually. Here we use both of "incremental" and "radical" innovation forms. In Damanpour's work, "technical innovations" pertain to products, services, and production process technology, whereas "administrative innovations" involve organizational structure and administrative process [16].

The innovation strategy has been defined as an organization's coordination of its internal structures, systems and processes with its external product markets and environmental conditions at a given point in time to yield novel and valuable technical outputs in order to seize market opportunities [29]. Therefore, the innovation strategy type can be classified into "collaborative", "in-house R&D", and "outsourcing". The deployment of appropriated and unique innovation strategy by synthesizing different actors and embedded organizational capabilities is a core integrating competence [30, 31] through which the leader can further improve the final performance [6]. The collaborative innovation strategy is defined as firm's innovative activity, which involves the creation of technical innovations and enables the firm to gain financial and other resources for developing technology [32]. Basing on the resource-based logic, the firm develops its resource competence to obtain a

sustained competitive advantage. Access to external complementary resources is one way necessary to achieve the advantage [8]. The literature has suggested that collaborative innovation strategy is pervasively adopted by technological companies since it has many implications for a firm's effectiveness and efficiency when introducing new technologies. Generally, the main motivations to collaborate are to exploit economies of scale, to gain low cost entry into new markets, to learn from competitors, to strategically manage uncertainty, to manage costs and risks, and to facilitate tacit collusion [7]. On the contrary, the predominance of in-house innovation strategy has been shown to not only generate new knowledge but also contribute to the firm's learning capability, absorptive capacity, and integration capability [33, 34). As suggested in the literature, an in-house innovation strategy is related to a technological firm's self-innovation policy [22], self-controlling over risk [35], and cultivation of innovation capabilities [34]. Whereas outsourcing is the act of one company contracting with another company to provide products or services that might otherwise be performed by in-house employees. Outsourcing is also viewed as an attractive business proposition to improve innovation, productivity, reduce costs and increase competitiveness [22, 36, 37]. The switching cost is significantly important matter in the strategic choice to continue outsourcing, switch vendors, or backsourcing [38]. Thus this paper encompasses the collaborative, in-house and outsourcing innovation strategies to formulate the framework.

B. A Systemic Configurational Perspective on Knowledge sharing and Innovation Strategy

Since Schumpeter [39] emphasize new information and new knowledge (exogenous or endogenous) can create opportunities. Be viewed as a main source of new knowledge creation and successful innovation, knowledge learning and sharing in the innovation activity is triggered by problem-solving process stimulated by gaps between potential and effective performance in conditions of uncertainty, complexity, and conflict [40]. Whereas Lundvall [15] suggests that the innovation system includes institutions and organizations aiming at the development, diffusion and use of innovations, which explains relationship between technology and knowledge flows in R&D activity [16]. Many previous researches have shown that knowledge sharing is positively related to performance [18, 19]. The systemic innovation theory refers "being cooperation and interactive learning key to success" as a central concept [15]. Therefore the innovative knowledge systems is defined as a set comprised of a network of actors and institutions that develop, diffuse, and use innovative knowledge together with the interaction relationships among them [41]. Innovation initiatives not only depend heavily on employees' knowledge, skill, and experience [42], but also on the organization's knowledge resources and core competences in the value creation ecosystem [43]. Likely, the dynamic capability theory propose that enterprise success depends upon the discovery and development of opportunities; the effective combination of internally and externally generated inventions; efficient and effective technology transfer inside the enterprise, between and among enterprises and other institutions within the business ecosystem [8].

Knowledge sharing refers to the provision or receipt of task information, know-how, and feedback regarding a product or procedure [44]. Sharing information as a means to ensure a uniform knowledge among team members is crucial preliminary in decision making and action. According to knowledge-based view (KBV), considering firms' capabilities as bodies that generate, use and distribute knowledge, the knowledge integration constitutes a driving force in the development of new products (R&D) and performance of the firm [45]. Many authors also highlight knowledge sharing, both within and outside of groups, plays a fundamental role in the effectiveness of organizations [46], creating and sustaining competitive advantages [8], upgrading product development capability [47], reduce uncertainty [48], and developing creative ideas and innovation [19]. In addition, other scholars stress that innovation is a systematically complex knowledge flow process, undertaken internally or externally, between firms and other actors [49, 50, 51].

Science Park is one kind of clusters. A cluster is defined as a group of firms from the same or related industries located geographically near to each other [52]. Some researchers found the positive relationship between cluster and innovation [53]. Firms in the cluster should be more innovative than others for some reasons: agglomeration economies [54], efficient scale [53], exploiting collective knowledge [55], better access to common knowledge [56], and network-based effect especially enhancing social interaction [57]. In addition, Bell's study proposed that clusters and network centrality should enhance firm innovativeness and influence important firm outcomes [58].

Cluster effects will also arise partially because there is common knowledge available to members of the cluster [59] that is not consciously transmitted among them, or is transmitted via chance meetings between executives that are fostered by geographic proximity. Common knowledge is augmented and reinforced by public information sources [56]. Over time, executives in geographically proximate firms share a common background and understanding (knowledge), which forms a cluster level of absorptive capacity[33, 60]. The ability to understand and exploit this cluster level absorptive capacity is also enhanced by the common lineage and heritage of the firms in the cluster and their executives when they 'run across each other' in chance settings [56]. In sum, by synthesizing those different systemic-related perspectives, we propose that knowledge sharing includes internal and external types within the innovative ecosystem.

C. Internal knowledge sharing

Internal (intra-organizational) knowledge sharing refers to collective beliefs or behavioral routines related to the spread

of learning among different individuals or units within an organization [61, 62]. In reference to organizational approach contexts, people can learn, not only from their own direct experiences, but also from the experiences of others through feedback, explanation, help, or advice [63]. In general, new opportunities for knowledge sharing depend on the access to a variety of task-related information [64], decision makers' support and knowledge sharing culture in the organization [65], and the intra and external networks for employees to participate their performance evaluation or public recognition [66]. Therefore the paper suggests the following hypotheses:

H1. Internal knowledge sharing and the technological innovation strategy the firm develops in the science park.

H1a. The internal knowledge sharing is positively related to the collaborative innovation strategy of the technological firm located in science parks.

H1b. The internal knowledge sharing is positively related to the in-house innovation strategy of the technological firm located in science parks.

H1c. The internal knowledge sharing is positively related to the outsourcing innovation strategy of the technological firm located in science parks.

D. External knowledge sharing

Access to external complementary resources can be necessary to achieve competitive advantage [8]. External knowledge sharing is referred as the exchange of general overviews, specific requirements, analytical techniques, progress reports, and results with other division members, non-division members, or customers. External knowledge sharing would be more strongly associated with performance when work groups are more structurally diversified [66]. Uzzi suggested that the informal friendship and communication network provides an important source of novel information useful in innovation. The managerial network provides relatively high-trust context in which to communicate tacit information among firms [67]. In addition, firms with multiple information sources are less likely to miss vital information as multiple information sources provide multiple channels to discover new information, and can combine information in novel ways to generate innovation [68]. Given knowledge is not equally available for all competitors, to obtain complementary knowledge from outside firms is an efficient way of improving innovation capability. Here we suggest the following hypotheses:

H2. Knowledge sharing with external partners and the technological innovation strategy the firm develops in the science park.

H2a. Knowledge sharing with external partners is positively related to the collaborative innovation strategy of the technological firm located in science parks.

H2b. Knowledge sharing with external partners is positively related to the in-house innovation strategy of the technological firm located in science parks.

H2c. Knowledge sharing with external partners is positively related to the outsourcing innovation strategy of the technological firm located in science parks.

E. The Resource-based View on Social capital with external Partner and Innovation Strategy

The resource-based view (RBV) generates a list of critical resources, such as knowledge, learning, culture, teamwork, and human capital, the firm must possess in order to gain sustained strategic advantages [7]. The RBV define the core competence as a bundle of inimitable aptitudes, skills, and technologies that the firm performs better than its competitors, whereas Prahalad and Hamel [36] referred the core competence as the company's collective knowledge, learning within and between organizations, about how to collaborate and integrate diversified product skills and multiple technologies to enhance competitive advantage. Therefore, learning makes capabilities consistent with the properties of rent generation [8]. Since the core competences are composed of knowledge, one of the most important contributions in linking social capital to knowledge networks is that of Nahapiet and Ghoshal [17], which focus on social capital capability, the competitive advantages, and intellectual capital creation through individual or organizational relationships; which define social capital as 'the sum of actual and potential resources within, available through, and derived from the network of relationships possessed by an individual or social unit; which illustrate the link between social capital and knowledge flow is related to some factors such as accessing, motivation, capability and the anticipation of value; which provide the theoretical basis for explaining the incremental value to the knowledge development process beyond a person's own capabilities when he interacts with others [69].

As innovation occurs through the interaction of different tacit knowledge and experiences among different individuals [70]. Additionally, the knowledge flow derived from innovation is not automatically absorbed and free to use, high quality social interaction relationship with external partner enhances the continuous conversion of tacit and explicit knowledge developed internally and externally [71], and acts as the key to unlocking new sources of competitive advantage [36]. With the close and high frequency interaction or trading relationship between enterprises and external institutions, the firm can gain and use complementary knowledge of these institutions and then facilitate product innovation and technical distinctiveness [43]. From the view of network tie, entrepreneurs have differential access to existing information, the central proposition of social capital theory is that networks of relationships constitute a valuable resource for the conduct of social affairs, providing their members with "the collectivity-owned capital"--a 'credential' which entitles them to credit in the innovation process [72]. The networks are particularly important for developing innovations in complex and quickly changing market conditions [43] and dynamically reshaped by the structural variety and

multi-complexity in collaborative activity [73]. Some authors find that the firms' innovation performance is significantly related to the investment in inter-organizational knowledge alliance networks [74].

Specifically, to explore the role of social capital in the creation of intellectual capital, Nahapiet and Ghoshal [17] propose to consider the three facets: the structural, the relational, and the cognitive dimensions. The structural embeddedness considers the properties of the social system and network of relations as a whole, describing the impersonal configuration of linkages between people or units; the relational dimension describes the kind of personal relationships people have developed with each other through a history of interactions [72]; the cognitive dimension refers to those resources providing shared representations, interpretations (norms), and systems of meaning among parties [17]. This paper includes the three dimensions of social capital and suggests the following hypotheses:

H3. Social capital with external partners and the technological innovation strategy the firm develops in the science park.

H3a. Social capital with external partners is positively related to the collaborative innovation strategy of the technological firm located in science parks.

H3b. Social capital with external partners is positively related to the in-house innovation strategy of the technological firm located in science parks.

H3c. Social capital with external partners is positively related to the outsourcing innovation strategy of the technological firm located in science parks.

F. Innovation Financial and non-financial performance

The relationship between new innovative technology and firm's performance is positively supported by many empirical studies [42]. On the contrary, some authors highlight that being innovative is not enough for success. The firm needs to be able to implement innovation in the organizational culture and be sure that markets will value that innovation [4, 5, 75]. It implies that Innovation performance is not only determined by market dynamics where the consumers' preferences largely hinging on the degree of customer satisfaction, but also organizational capability building which rarely works at initial stage in contributing to financial report.

Since earlier studies use the patent count as a measure of technological innovation performance. But the assessment of a patent's technological implication and the economic value are implicitly and widely varied. In contrast, recent research has proposed that performance measures include new product or project success and application [76], new production lines, modifications, and derivatives [77]. Due to the traditional shortcomings in intangible and qualitative values, many scholars also complained that important non-financial information, such as reputation, institutional competency, social network and interaction relationships among partner, customer satisfaction, and intangible capabilities in firm, cannot see in the traditional financial report [78]. Additionally, following after the traditional financial measures have been transformed from the unique measure system to a multiple measures systems, several scholars proposed using both of the financial and non-financial measure to assess firm's innovation performance [79]. Blazevic and Lievens [80] further defined the non-financial performance as a long-term operational objective that emphasizes the importance of increasing customer loyalty, attracting new customers, and enhancing the image and reputation of a firm. Beside, only a few studies proposed using market position, operational efficiency or the organizational innovation competence to assess the firm's intangible performance [24]. The literature discussing the mechanism (or measure) to evaluate the non-financial performance is still limited. Because the term of customer satisfaction measure is more definite and commonly adopted than the implicitly non-financial concept, thus we adopt both of financial and customer satisfaction performance measures to assess the firm's performance.

G. An Organizational capability perspective on Innovation Strategy and Customer Satisfaction

Innovation is an intra- and extra-organizational process from a new concept, and then research development, engineering design, production and marketing. Based on sensing opportunities and threats, seizing those opportunities, and reconfiguring resources to maintain competitiveness, the dynamic capability view suggests that new technological strategy implementation is related to organizational (dynamic) capabilities, which is aim to gain, release, integrate and reconfigure resources in managerial and organizational processes and lead to strong impacts on the performance [8, 12]. A number of authors also assert the organizational capabilities are composed of knowledge, their wellspring is learning internally and externally by integrating the different technical competencies developed in various departments and institutes [8, 33]. Therefore, the innovative capabilities of enterprises not only depend on the internal R&D department, but also the manufacture, marketing and financial management department. Especially the effective cooperation among those divisions is the key to improve the technological innovative capabilities.

In addition, some authors have linked knowledge sharing to the learning and market orientations capabilities would lead to improvements in innovation activities and customer satisfaction [81]. Bailey and Pearson [82] define the customer satisfaction as the sum of one's feelings or attitudes toward a variety of factors affecting the situation. Therefore, it is defined as the sum of m user's weighted reactions to a set of n factors. The relationship between market orientation and innovation is generally assumed to be robust [75, 83]. Likewise, many authors confirmed that market orientation has significantly positive impact on the success of launching

highly innovative products [84]. The market orientation is conceptualized as an organizational culture made up of customer orientation, competitor orientation, and inter-functional coordination [3], but in the strength of the market orientation-performance relationship, those of competitor orientation and inter-functional coordination do not approach a level of significance [85]. Whereas the customer orientation is defined as understanding target customers in order to generate sustainable higher value – for which customers' needs, desires and present or potential perceptions must firstly be identified, then be responded, and finally be satisfied [3, 86]. Therefore, the outcome of implementing customer orientation will lead to high degree of customer satisfaction and in turn result in superior performance. Those dynamic market orientation competences are alignment with sensing, seizing, and reconfiguring resources competences based on organizational capability viewpoint. In addition, many previous studies using the non-financial performance approach are mainly based on customer satisfaction to clarify the relationship which states firms with greater innovativeness will be more successful in responding to customers' needs and in developing new capabilities to achieve better performance [62]. Given the prior positive relationship between market orientation and innovation performance, it is reasonable to propose that positive relationship exist between customer satisfaction and innovation based on its constant relation between market orientation and customer orientation. The paper considers the positive relationship between innovation strategy and customer satisfaction. It is therefore hypothesized that:

H4. Technological innovation strategy the firm develops and customer satisfaction.

H4a. The firm's collaborative innovation strategy is positively related with the customer satisfaction.

H4b. The firm's in-house innovation strategy is positively related with the customer satisfaction.

H4c. The firm's outsourcing innovation strategy is positively related with the customer satisfaction.

H. Customer Satisfaction and Financial Performance

Superior corporate performance is derived from a commitment to total customer satisfaction and the focus on total customer satisfaction thereby fosters continuous innovation. Financial performance is a measure of how well a firm uses assets to generate revenue from its business model [87], whereas customer satisfaction is a measure of non-financial measures [80]. To further link the relationships between customer satisfaction and financial performance, some studies have shown the reasons why customer satisfaction can improve profitability as follows: customer retention and repeat purchase, word of mouth, and consumer loyalty, behavioral intentions, and willingness to pay premium prices for products [88, 89]. But other authors even suggest that high satisfaction alone is not a sufficient predictor of greater loyalty [90]. We find that the relationships between customer satisfaction and financial performance are still ambiguous and even contradictory. A further sophisticated discussion is presented as follows:

Based on the marketing approach, many studies have substantiated this positive co-relation between the market orientation and business performance [83]. Because customer satisfaction is a consequence of market (customer) orientation, that positive relationship between customer satisfaction and performance would be proposed on the base of a theoretical rationale. In fact, it has been shown that a positive and significant co-relationship exists between customer satisfaction (satisfied and loyal customers) and financial performance [91]. On the contrary, Tornow and Wiley [92] suggested that the relationship between customer satisfaction and financial performance may not be positive. From another viewpoint of institutional behavior, although some studies have highlighted that a firm's future profitability has positively significant relationship with non-financial information [78], there are few detailed discussions related to the value-transformed process or moderator function. Other papers have proposed that a firm's innovative outputs contributing to financial revenue may have the problem of organizational lag [93]. Likewise, Siguaw et al. [24] used the innovation cycle rate to explain that the firm's innovation strategy indirectly shaped performance through building of competencies (technology, employee, operation, and market competence) or the organizational competence [24]. These different outcomes indicate that the overall value of innovation is not always immediately apparent, tangible or quantitative, but rather it is realized only over time and after competencies are built and actualized [94]. Considering the processes affecting performance, some studies have proposed that the market orientation should be viewed as an antecedent of performance from the view of organization's behavioral approach [84]. But it is viewed as a moderator with a complementary impact on performance by the way of innovation according to other studies [23, 84]. Although some researchers have attributed the contradiction in outcomes to a variety of moderators in environmental and technological turbulence [77], we propose that a higher degree of customer satisfaction will yield superior financial performance. Therefore, it is posited that:

H5: The firm's customer satisfaction is positively related to its financial performance.

We here concluded the overall casual relationships and the research framework (shown in Figure 1).

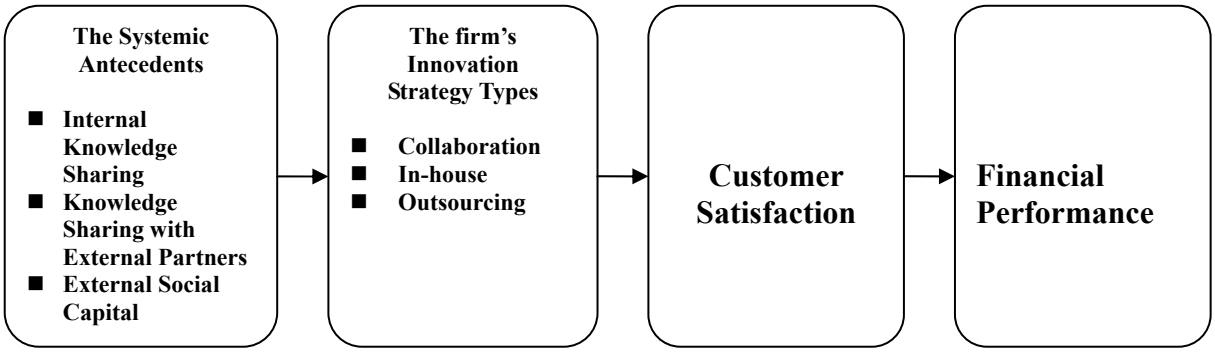


Figure 1. Research Framework

III. METHODOLOGY

A. Data Collection

The value of the qualitative model is to identify performance objective through expert opinion, capture this information in a robust decision framework, and consider related technical, market, and cost factors all together. But those qualitative parameters to assess heterogeneous technological innovation projects and their subjective option value are very widespread complicated and differentiated due to various moderator factors (such as industries types, firm size and embedded capability etc.), thus data were collected using a questionnaire survey. The structured questionnaire was verified based on meetings with several managers from companies in Taiwan science parks, including the Hsinchu Science Park, the Central Taiwan Science Park, and the Southern Taiwan Science Park. Questions used 5-point Likert-type scales ranging from strongly disagree, "1," to strongly agree, "5". We mailed questionnaires to the executive managers (CEO or relatively high-ranking executives) of all 813 firms retrieved from the "Science Park Business Directory." To ensure that respondents were qualified to participate in the study, we attached a cover letter outlining the objectives of the research to specify that the questionnaire should be completed by a high-ranking executive in the company. We also assured respondents of the confidentiality of their answers and asked them to reply to all questions as honestly as possible. Within three weeks of the initial mailing, we received only 19 responses. We followed up by telephone, fax, and e-mail for two months during September and October, 2010. This boosted the final response to 209 usable questionnaires, for a valid response rate of 25.7%.

B. Measurement scales

The technological innovation strategy types used in the study are collaborative, in-house and outsourcing strategies. Whereas the innovation form is generally divided into "Radical" and "Incremental" innovation [25], we used six items to measure the technological innovation strategy.

By offering a platform (such as cross-functional workshops, knowledge fairs) to bring employees together and encouraging knowledge sharing culture within the organization, internal knowledge sharing is measured with a three items adapted from Käser and Miles [95]. In contrast, by fostering a culture supporting knowledge sharing and provides incentives for employees to participate public forums and interactions in knowledge sharing with external partners, the external knowledge sharing is measured with four items adapted from the study of Cummings [66]. According to Nahapiet and Ghoshal's [17] proposition, the external social capital which is based on the prerequisites of trust, common norms and credit is measured by eleven items manifested in three dimensions: structural capital, relational capital, and cognitive capital. To adequately quantify the performance, we used four indicators adapted from Blazevic and Lievens [80] to measure the degree of customer satisfaction. In contrast, based on proposals by Avlonitis et al. [79], three items were used to measure the firm's financial performance. A detailed description of the questionnaire items and the operational definitions of variables used in this study are summarized and shown in TABLE 1.

C. Assessing Common Method Bias

We undertook the procedures recommended by Podsakoff et al. [96] to reduce the magnitude of common method bias. First, we conducted Harman's one-factor test on all of the items to examine the potential problem of common method variance. The result showed that no single factor emerged, nor did one general factor account for most of the covariance in the variables. Thus common method bias is unlikely to be a serious problem in the data [96]. Second, with the use of confirmatory factor analysis, as suggested by Hair et al. [97], we tested the model fit. In all cases, the measurement model showed a superior fit to the data and adding the additional method factor did not significantly improve the model fit.

TABLE 1. OPERATIONAL DEFINITION OF OBSERVED VARIABLES

Variables	Operational Definition	Sources
Social Capital	Structural Capital Rational Capital Cognitive Capital	Nahapiet and Ghoshal (1998)
Technological innovation strategy	Collaboration innovation (R&D) Strategy The firm's activity directly involves the creation of technical innovations and enables the firm to gain financial and other resources for developing technology ●radical (disruptive) innovation will result in totally new product and create new market, while ●incremental (sustaining) innovation is the kind of innovation providing better products or services in the current market. In-house innovation (R&D) Strategy self-innovation, self-controlling over risk, development, and returns ●radical (disruptive) innovation ●incremental (sustaining) innovation Outsourcing innovation (R&D) Strategy	Hamel et al. (1989); Faems, et al. [32];
Knowledge Sharing	Internal knowledge sharing External knowledge sharing	Käser and Miles [84]; Cummings [57]
Customer Satisfaction	The degree (extent) to which the customer satisfy or enjoy the product (or service) he purchase ●increasing the degree of customer loyalty ●improving perceived image ●attracting more new customer ● reputation	Blazevic and Lievens [69]; Avlonitis, et al. [68]
Financial Performance	Financial performance refers to a measure of how well a firm uses assets to generate revenue from its business model ●reaching sales target ●reaching profit target ●reaching the market share target	Blazevic and Lievens [69]; Avlonitis, et al. [68]; Siguaw et al., [24]

D. Validity and reliability

The validity and reliability of construct measure is examined by using confirmatory factory analysis (CFA) as based on the factor loadings of each item onto the a priori defined factors. Hair et al. [97] proposed the reliability is measured by the Cronbach α, while the convergent validity is tested by the composite reliability (CR) and average variance extracted (AVE). Based on the results of CFA shown in TABLE 2, all indicators of factor loading are in line with the criteria of reliability (> 0.5). In addition, the results of CFA show that almost all the AVE indicators are greater than 0.5 and all the CR indicators (0.82~ 0.91**)** are greater than 0.7 [97], indicating that those criteria of convergent validity are satisfied [97]. The outcome shows the research model is appropriate for internal consistency. The discriminant validity is assessed using the χ^2 difference test [97]. Given all AVE indicators of each construct ranged from .53 to .79 (as shown in TABLE 2), which is above the corresponding squared correlation coefficients, the test results indicate this criterion is met as well. In addition, we also processed the correlations analysis (shown in TABLE 3). The result shows that all indicators of correlation except two indicators, outsourcing with "customer satisfaction" and "financial performance", are significant at the 0.01 level (2-tailed).

The proposed hypotheses were tested with Structural Equation Model (SEM). The advantage of SEM is that it offers a simultaneous test of an entire system of variables in a hypothesized model and thus enables assessment of the extent to which the model is consistent with the data [98]. We then implemented two steps using structural equation models

TABLE2. RESULTS OF CONFIRMATORY FACTOR ANALYSIS

Constructs	Dimensions	AVE	CR
Knowledge Sharing	Internal knowledge sharing	.68	.86
	External knowledge sharing	.58	.84
Social Capital	Structural capital	.53	.82
	Relational capital	.68	.91
	Cognitive capital	.79	.88
Technological Innovation Strategy	Collaboration strategy	.79	.88
	In-house R&D strategy	.81	.90
	Outsourcing strategy	.84	.91
Firm Performance	Customer satisfaction	.66	.88
	Financial performance	.77	.91

TABLE 3. MEANS, STANDARD DEVIATIONS, AND CORRELATIONS

Variable	Mean	SD	1.	2.	3.	4.	5.	6.	7.	8.
1. Knowledge Sharing within the Firm	**4.14**	**0.68**								
2. Knowledge Sharing with External Partners	**3.75**	**0.67**	**.572****							
3. External Social Network	**4.07**	**0.52**	**.579****	**.706****						
4. Collaborative Strategy	**3.91**	**0.80**	**.309****	**.540****	**.570****					
5. In-house Strategy	**4.33**	**0.67**	**.499****	**.395****	**.440****	**.290****				
6. Outsourcing Strategy	**3.08**	**1.11**	**.210****	**.322****	**.198****	**.254****	**.184****			
7. Customer's Satisfaction	**4.07**	**0.61**	**.345****	**.467****	**.532****	**.376****	**.431****	**.103**		
8. Financial Performance	**3.33**	**0.91**	**.247****	**.379****	**.433****	**.307****	**.280****	**.062**	**.590****	

*. Correlation is significant at the 0.05 level (2-tailed)
**. Correlation is significant at the 0.01 level (2-tailed)

(SEM) to assess and validate the model fit. First, the measurement scale model is employed to assess the proposed causal model. All indicators of measurement model (χ^2=591.32; p<0.01; CFI = .96, GFI = .854, RMSEA =.05) show that the model has a good fit in the research. Second, to prevent the sensitivity to sample size [99], we also tested the fit of the structure model, and all indicators of structural model show a good fit vis-à-vis the reference measurement: (χ^2=607.16; p<0.01; CFI = .96, GFI = .852, RMSEA =.05). The result of SEM is summarized in TABLE 4.

E. Demographics and Characteristics:

Of the 209 returned questionnaires, 14 were incomplete for the paid-in capital item reply. The remaining 195 valid and complete samples were divided into three ranges on the basis of paid-in capital: (1) Lower than NT5 millions: 111 companies, (2) from 5 to 30 million NT dollars: 52 companies, and (3) higher than 30 million NT dollars: 32 companies. This shows that more than half of sample companies in this study have paid-in capital under 30 million NT dollars (US one million dollars) indicating that 83.2% (163/195) respondents can be considered as small to medium enterprises (SMEs). All other demographics and characteristics of samples are shown in TABLE 5.

TABLE 4. SUMMARY OF MODEL FIT INDEXES

Model Fit	CMIN(χ^2)	DF	GFI	IFI	CFI	RMSEA
Measurement Model	591.320	396	.854	.959	.959	.049
Structural Model	607.155	407	.852	.958	.958	.049

Notice: IFI >0.90；CFI >0.90；RMSEA <0.05 (good), <0.08 (mediocre)

TABLE 5. DEMOGRAPHICS AND CHARACTERISTICS

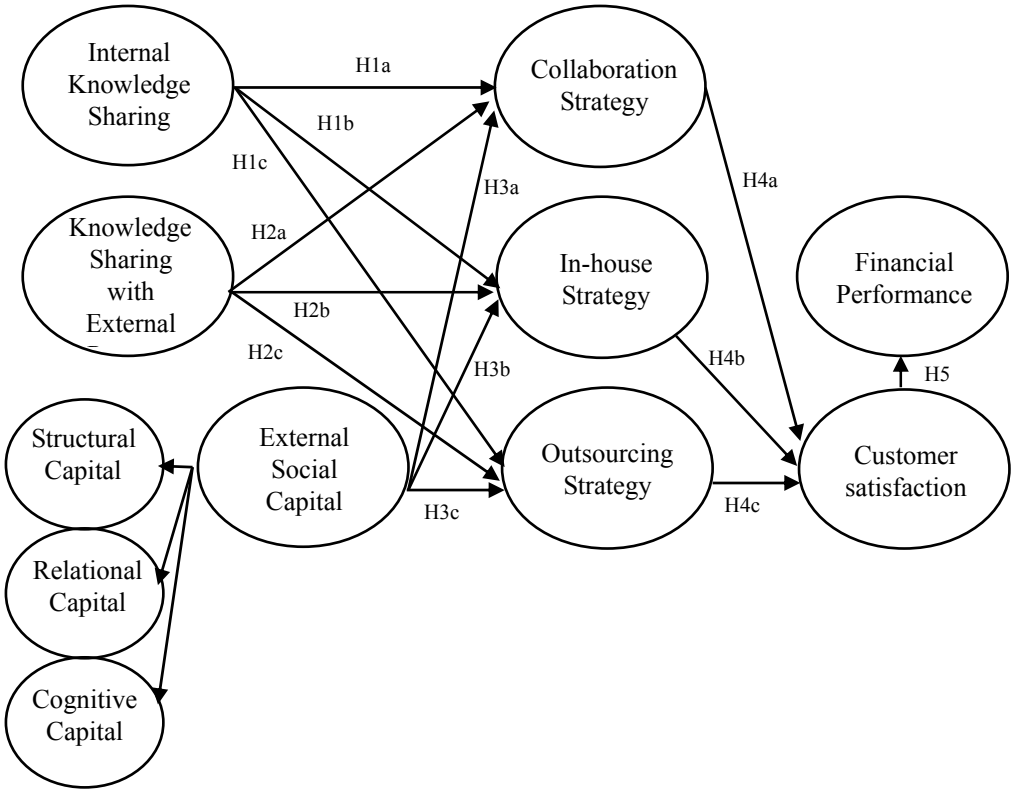
Industry types		Photoelectric and green power (N=48)	Precision Machinery (N=50)	Communication and computer peripheral (N=24)	Integrated circuits (N=32)	Biotechnology (N=33)	Others (N=22)
Employees	**Mean**	**1311.29**	**434.93**	**3274.58**	**2046.52**	**119.64**	**465.44**
	SD	**(3673.48)**	**(1509.55)**	**(8888.32)**	**(4131.88)**	**(207.83)**	**(869.23)**
R&D Employee	**Mean**	**98.67**	**41.18**	**261.25**	**166.52**	**37**	**57.33**
	SD	**(274.74)**	**(71.52)**	**(565.65)**	**(246.33)**	**(117.31)**	**(160.84)**
R&D personnel Ratio	**%**	**7.52%**	**9.47%**	**7.98%**	**8.13%**	**30.93%**	**12.32%**
2009 Annual Turnover (million TWD)	**Mean**	**20283.65**	**2135.43**	**26583.44**	**12607.22**	**338.41**	**2184.55**
	SD	**(72941.67)**	**(5127.73)**	**(110887.6)**	**(27636.68)**	**(823.48)**	**(3692.35)**
2009 R&D Expense (million TWD)	**Mean**	**363.61**	**133.15**	**628.66**	**923.93**	**39.50**	**46.82**
	SD	**(1302.87)**	**(375.92)**	**(1735.32)**	**(2143.20)**	**(59.42)**	**(180.69)**
2009 R&D Ratio (R&D expense /Turnover)	**%**	**1.79%**	**6.24%**	**2.36%**	**7.32%**	**11.67%**	**0.72%**
Intellectual Property Rights Number	**Mean**	**187.76**	**45.93**	**180.38**	**371.24**	**12.6**	**15.36**
	SD	**(943.71)**	**(124.4)**	**(428.29)**	**(669.61)**	**(17.25)**	**(16.04)**
New product Development Number	**Mean**	**128**	**115.63**	**183.62**	**201.27**	**14.38**	**19.42**
	SD	**(358.44)**	**(487.98)**	**(326.54)**	**(382.12)**	**(18.05)**	**(18.19)**

Notice: 1 US$ = 30 NT$
R&D personnel Ratio = R&D Employee / Total Employee

IV. RESULTS

Using SEM to analyze the data, results of the research framework are shown in Figure 2. Most indicators of 13 hypotheses except 5 indicators demonstrate positive significance, as shown in TABLE 6.

The Hypothesis 1a (H1a) has negatively significant relationship between internal knowledge sharing and with collaboration strategy by the indicator (β = -0.21, p = 0.027); meanwhile the H1b states the relationship between internal knowledge sharing and in-house strategy is also supported by the result (β = 0.45, p <.001); but the H1c (β = 0.1, p <0.284) is not significant. In the aspect of external knowledge sharing, with indicators of H2a (β = 0.35, p =.016) and H2c (β = 0.48, p <.001), we propose that knowledge sharing with external partners is positively related to the collaboration and outsourcing strategy the firm develops. On the contrary, the H2b indicator (β = 0.03, p =0.839) shows an insignificant outcome. In the respect of social capital with external partners, the H3a indicator (β = 0.50, p <.001) states that social capital with external partners is positively related to the collaboration strategy. On the contrary, the indicators of H3b (β = 0.15, p = 0.33) and H3c (β = -0.27, p = 0.084) show that external social capital has not significant impact on in-house and outsourcing strategy. The H4a indicator (β = 0.35, p <.001) shows that the firm's collaborative strategy is positively significant with the customer satisfaction. Similarly, the H4b indicator (β = 0.45, p <.001) states that the firm's in-house R&D strategy is also very strong positively. But the H4c indicator (β = 0.0, p =.983) illustrates that outsourcing is not significant and relative with β = 0.0. The results of H4a and H4b indicate that collaboration strategy and in-house R&D strategy contributes significantly to customer satisfaction. Conversely, the outsourcing in innovation strategy is rarely adopted by the firm in TSP. Furthermore, the H5 indicator (β = 0. 63, p <.001) shows that customer satisfaction is positively significant to the firm's financial performance. Additionally, it is interesting to find that H1a's negative significance is consistent with the H2a's positive significance for the reverse relationship between them.



Standardized Coefficients (β)	Path Coefficients (P-value)
H1a: -0.21	P: 0.027*
H1b: 0.45	P: ***
H1c: 0.10	P: 0.284
H2a: 0.35	P: 0.016*
H2b: 0.03	P: 0.839
H2c: 0.48	P: ***
H3a: 0.50	P: ***
H3b: 0.15	P: 0.330
H3c: -0.27	P: 0.084
H4a: 0.35	P: ***
H4b: 0.40	P: ***
H4c: 0.00	P: 0.983
H5: 0.63	P: ***

Figure 2. Results of structural equation modeling

TABLE 6. RESULT OF HYPOTHESIS TESTING

Hypothesis		p-value	Result
H1	Knowledge sharing within the firm and the technological innovation strategy the firm develops.		
H1a	Knowledge sharing within the firm is positively related to the collaboration strategy of technological innovation the firm develops.	0.027	Supported
H1b	Knowledge sharing within the firm is positively related to the in-house strategy of technological innovation the firm develops.	0.000	Supported
H1c	Knowledge sharing within the firm is positively related to the outsourcing strategy of technological innovation the firm develops.	0.284	Not supported
H2	Knowledge sharing with external partners and the technological innovation strategy the firm develops.		
H2a	Knowledge sharing with external partners is positively related to the collaboration strategy of technological innovation the firm develops.	0.016	Supported
H2b	Knowledge sharing with external partners is positively related to the in-house strategy of technological innovation the firm develops.	0.839	Not supported
H2c	Knowledge sharing with external partners is positively related to the outsourcing strategy of technological innovation the firm develops.	0.000	Supported
H3	Social capital with external partners and the technological innovation strategy the firm develops.		
H3a	Social capital with external partners is positively related to the collaboration strategy of technological innovation the firm develops.	0.000	Supported
H3b	Social capital with external partners is positively related to the in-house strategy of technological innovation the firm develops.	0.330	Not supported
H3c	Social capital with external partners is positively related to the outsourcing strategy of technological innovation the firm develops.	0.084	Not supported
H4	Technological innovation strategy the firm develops and customer satisfaction.		
H4a	The firm's collaboration strategy of technological innovation is positively related to the customer satisfaction.	0.000	Supported
H4b	The firm's in-house strategy of technological innovation is positively related to the customer satisfaction.	0.000	Supported
H4c	The firm's outsourcing strategy of technological innovation is positively related to the customer satisfaction.	0.983	Not supported*
H5	Customer satisfaction is positively related to the financial performance	0.000	Supported

Note:
*: It is empirically reasonable for the rational and conceptual inexistence of the cause-effect hypotheses with $\beta = 0.0$.

V. DISCUSSION

The purpose of this paper is to explore the relationships of knowledge sharing and social capital on firm performance by the mediation effect of technological innovation strategy. Knowledge sharing approach is suggested by many authors to contribute to the competitive advantage. More recently, some studies empirically discuss the effects of knowledge sharing on various aspects of innovation. However, few researches link knowledge sharing, innovation and firm performance from a holistic perspective [42] and rarely analyze the relationship between firm performance and knowledge sharing with internal and external stakeholders. According to H1a and H1b indicators, the paper finds the internal knowledge sharing is negatively significant with collaboration strategy and significantly positive with in-house R&D strategy. Further, with H2a and H2c we also find the external knowledge sharing is positively related to the collaborative and outsourcing strategy, those significant results illustrate the employment of innovation strategy depends on the knowledge with which the firm can share (assess, acquire, diffuse, and use) to the others. Additionally**,** those strategies can be adopted frequently and even simultaneously by hi-tech tenants in TSP to enhance competitive edges. Given the prior significant relationships (H1a, H1b, H2a, and H2c) between knowledge sharing and innovation strategy, the hybrid combination paradigms would be various and complicated in application to enhance competitive edges due to the theoretically possible 15 multi-compound matrix. In addition, the evolution of contingent (appropriated) hybrid paradigm is reshaped by firm's specific factors (e.g. heterogeneous or homogeneous, size, etc.) and systematic factors (soft and hard) in turbulent environment. Simultaneously concern both of characteristics of sample data (SMEs and technical-intensive) and prior significant cluster indicators (H1a, H1b, H2a, and H2c), we extensively interpret that the knowledge sharing (internal or external) relationships is critical to small-medium enterprises with technical-intensive knowledge flow.

As to social capital with external partners, the H3a ($\beta = 0.50$, $p < .001$) positive relationship only to the collaborative innovation strategy implies that social capital capability is not complementary with in-house and outsourcing innovation strategy. Some analyses are illustrated as follows: **Firstly**, The in-house or outsourcing innovation strategy are self-developed respectively by insider or outsider only without external social interaction involved between partners based on the view of organizational boundary. **Secondly**,

recently many hi-tech companies engage in learning by doing and self-developed tools (in-house innovation) to prevent the tactic know-how leak and even conversely limit individual social capability based on intellectual protection. **Thirdly**, from empirical viewpoint of source-based approach, most of outsourcings are implemented by public purchase based on the cost-effectiveness consideration in strict competitive environment. In addition, some prior researches show that social capital may be a double edged sword which is not only a resource in facilitating outsourcing but also a burden that undermines the rationality of decision makers [100]. On the contrary, Nam et al. [101] even identified the negative impact of social capital on IT outsourcing, explaining that outsourcing decisions are not only based on current IT needs and capabilities, but also involve past industrial ties and future economic opportunities. **Fourthly**, despite many prior studies propose positively complementary relationships between internal R&D and external technology sourcing in firm's innovation activities and performance, this finding based on the cluster indicators of H3a, H4a, and H5 is not only consistent with some author's proposition that the firm's innovation performance is significantly positive to network (structural) capital investment in dynamically inter-organizational knowledge alliances [74], but furthermore also significantly positive to social capital in the term of rational. Thus we here highlight more precisely and extensively the positively complementing relationship between internal R&D and external technology sourcing in firm's innovation activities and performance incurs only when the firm with collaborative innovation strategy is not only capable of external social capital with partners but also the knowledge integrated capability internally and externally. This finding is in line with some authors' assertion that the impact of tacit knowledge on radical innovation appears only when combining high levels of social capital [102]. Similarly, the mere existence of strong social capital or knowledge sharing with partners does not guarantee the complement performance of innovation.

Original Equipment Manufacturing (OEM) refers as a company whose products are used as components in another company's product. The OEMs generally work closely with the company that sells the finished product (often called a "value-added reseller" or VAR) and customize the designs based on the VAR's needs. Whereas Original Design Manufacturing (ODM) is defined as the activities of this unique type of a contract manufacturer often performs for its clients (customers). In reference of the their business models (OEM, ODM, and Component Module Move Service) and characteristics of sample data (SMEs and technical-intensive), we find that most of Taiwan's high-tech industries adopt not only technical-oriented but also customer-oriented innovation strategy to increase the degree of customer satisfaction and speed to the market. The finding is consistent with many prior researches mainly based on customer satisfaction measures studies [83, 88, 89]. Additionally, given the indicators of H4a and H4b, the paper also finds that collaborative and in-house innovation strategies contribute significantly positive to customer satisfaction. It implies that innovation strategy must in line with market demand especially in extreme global competitive environment. Conversely, the outsourcing strategy is insignificant in hi-tech related innovation activity proven by the H4c's indicator. The finding is that outsourcing strategy is rare to be adopted by the technological firm with OEM, ODM, and Component Module Move Service business model.

Both organizational innovation and technological capabilities for products and processes can lead to superior firm performance. Likely, several scholars propose that innovation technology rare works initially and often takes a long time to become viable, thus the firm's innovative outputs contributing to financial revenue may have the problem of time lag or so-called organizational lag [93]. Many researchers universally believe that customer satisfaction is more future-oriented and thus can yield better performance. Furthermore, with synthesizing the positive result of H5 along with the H4a and H4b's outcomes of directly and positively significant relationships, we find out the customer satisfaction is a more proper than other kinds of non-financial measure in term of performance evaluation.

VI. CONCLUSIONS AND MANAGERIAL IMPLICATIONS

From synthesizing those different perspectives, the outcomes explain more explicit and comprehensive interrelationships between constructs. In summary, the paper provides some findings and managerial implications to innovation-related manager and policymaker illustrated as follows: **Firstly**, we find the knowledge sharing (internal or external) is critical factor in innovation process, especially to small-medium enterprises with technical-intensive knowledge flow in this paper. The finding demonstrate that the more small-medium the firm is, the more extensive knowledge-sharing should be, which is quite contrary to the empirical phenomena of lacking knowledge-sharing in SMEs for their less resources and attention dedicated to it. The outcomes show knowledge sharing is not appropriated only by the big company. Conversely, the SMEs with technical-intensive knowledge flow shall pay more attention and resources in this field to enhance competitive capability. **Secondly**, despite many scholars propose the positively complementing relationship between internal R&D and external technology sourcing in firm's innovation and performance, we here highlight more precisely and extensively the proposition incurs only when the firm with collaborative innovation strategy is capable of external social capital with partners and the dynamic knowledge integration capability. The paper's findings empirically prove that the knowledge sharing and social capital can positively enhance innovation performance. **Thirdly**, the paper's outcomes illustrate that Taiwan's hi-tech industries in TSP are adopting not only technical-oriented but also customer-oriented

innovation strategy to increase the degree of customer satisfaction. It implies that innovation strategy must in line with customer satisfactions especially in extreme global competitive environment. **Fourthly**, synthesizing the statistical results and sample's characteristics of technology-intensive and innovative-intensive, we empirically find following phenomena: 1) three principle strategies can be adopted frequently and even simultaneously by hi-tech tenants in TSP, but rare the outsourcing strategy. In addition, the hybrid (combination) strategy paradigms, reshaped by firm's specific and environmental factors, would be more various, contingent, and complicated in application to enhance competitive edges in extreme velocity environment; 2) The firms may not only take social interactions with suppliers and customers in the vertical (homogeneous) value-chains integration, but also with their diverse (heterogeneous) value-chains partners in academia, R&D institutes and related firms in the quest for competitive edges, improved performance and innovation results. The finding is consistent with the proposition that heterogeneity across cluster types is important in firm's innovation [103]. Thus the paper summarize that the greater extreme innovation-intensive competition in velocity environment faced by the firm, the more comprehensive knowledge sharing and social capital capability in correspondence with the firm's extensive alliances and interdisciplinary integration. The comprehensive knowledge sharing and social capital integrated capability is the key for the success of innovation.

Those findings illustrate some managerial implications as follows: 1) given the job's nature of innovation policymaker will be more challenge, sophisticated and ambidextrous, knowledge-sharing is the interactive learning key to success; 2) given multiple information sources provide multiple channels to discover new information and generate innovation, along with the innovation process is more complicated, longer, flexible variety and contingency, the collaborative innovation works only when the firm possess simultaneously both of external social capital with partners and dynamic knowledge integration capability; 3) some international leading companies recently engage in learning by doing and self-developed tools to prevent the tactic know-how diffusion and even conversely limit individual social capability based on intellectual protection. The trend inevitably impedes and disturbs the flow of advanced technical knowledge and the dissemination of innovation activity; 4) the high-quality institutional interaction and communication network in infrastructure and high-trust context are demanded in more multidimensional, intra or inter-functional and even multinational social activity. These have been associated with the dimensions of managerial processes, structures, information and managerial systems, networks, and culture positively related to final performance.

A. Limitations and future research

A number of shortcomings in the paper shall be noticed in explaining and applying the findings in practical execution. **First**, because the data samples are technical manufacturing companies with innovative- intensive capabilities, the outcome would not fit for the service and other non-manufacturing firms. **Second**, since some firm-level control variables (such as firm size, capital, age, and diversification) and moderators in environment have not been discussed, the manager shall take those variables into account in implementing the strategy and performance evaluation. **Third**, since the industry type is not analyzed, the contingent and appropriated strategy for specific industry would be different from one another.

To advance empirical findings and applications, some future researches are proposed as follows: **First**, some prior innovation theory considered that the benefit of collaborative innovation hinge on the interaction among constituents. The study in evaluating the degree of firm's social capital capability among cluster-innovative partners is limited. **Second**, given the ambiguous argument of organizational (time) gap between the innovation activities and financial performance, the paper using organizational competence measure to justify, and evaluate the intangible non-financial performance is limited. **Third**, the research is limited in empirically exploring the relationships between industry types and innovation strategy types.

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