How does Social Capital work in Regional Innovation Systems? The Moderating Role of Contract Design

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Abstract

Social capital theory is frequently cited by more and more studies in many social science fields. The primary objectives of this study are to better realize with the effect of social capital on the cooperative performance of regional innovation systems, and to explore an important moderating effect of the contract design, which can reinforce trust level between partners.

This study focused on the SMEs in the central Taiwan, which covers a wide range of economic activities and comprises several industrial clusters, and surveyed by questionnaire. Using regression analysis, the empirical results indicated that: (1) there is a positive relationship between social capital and the cooperative performance of regional innovation systems; (2) the contracts facilitate corporate and trust among partners, then enhance the relationship between social capital and the performance of regional is enhanced as well. This research contributes to regional innovation field by disentangling the moderating role of contracts, which is also a good help to facilitate the flow of resources, knowledge transfer and organizational learning between members, thereby strengthen the competitiveness of the region.

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1   Introduction

In knowledge economy, knowledge, technology and innovation in the industry gradually occupy enough to affect their economic performance and competitive position, in the region through the promotion of knowledge, technology transfer and diffusion will help firms to enhance the regional innovation system more competitive. The concept of Regional Systems of Innovation (RSI) has recently become popular among academics of various disciplines. A regional innovation system consists of innovation networks[1] aiming at increasing the innovative capability of the system.

In the central Taiwan, including Taichung City, Changhua City, Nantou City, economic activities covered the Science Park, Taichung Industrial Park, Changhua Coastal Industrial Park of the technology industry, precision machinery industry , electronic components, machinery equipment, metal products, plastic products, chemical fiber and textile manufacturing materials for the country to provide a considerable contribution to economic development, but also the formation of regional industrial clusters.

In addition to social capital between partners, we find that trust and contracts have been viewed as two important mechanisms to safeguard opportunistic behavior and maintain cooperation[2]. Although the effectiveness of contracts and trust in governing inter-organizational and their effects on financial and cooperative performance have been widely studied (e.g. Luo[3], Poppo and Zenger[4]), there is limited empirical evidence as to how they affect manufacturers' innovation performance and there are few studies that examine how the contracts and social capital affect enhancing the cooperative performance of regional innovation systems. In this paper we seek to investigate the influence of the three dimensions of social capital and the contracts on the cooperative performance of regional innovation system. Some researchers tend to reduce goal incongruence and preference divergences amongst partners, and are widely acknowledged as essential to inter-firm collaboration[5]. Moreover, although many researchers have admitted that trust and contracts interact with each other, whether they are substitutes or complements is the subject of controversy. Moreover, contracts and cooperation are interrelated because a contractual arrangement serves as a framework within which cooperation proceeds.

This study focused on the SMEs in the central Taiwan, which covers a wide range of economic activities and comprises several industrial clusters. The primary motive for us was an empirical gap in the research where the key concepts of social capital to cooperative performance of regional innovation systems. Therefore, the main objectives of the article are: (1) to better realize with the effects of social capital on the cooperative performance of regional innovation systems, (2) to explore the important moderating effects of the contract design effects of social capital on the cooperative performance of regional innovation systems.

The expected results of this study are as follows: First, social capital and regional innovation system of cooperative performance is positive correlation with the results of the past literature. Second, by the contract, so that increased confidence in the member's area, and enhance the level of trust between partners, and building social capital affect the performance of regional innovation systems in co-operation. Our research contributions will provide guidelines for managers to decide how to choose control mechanisms in managing the cooperative performance within partners and devote their efforts and resources in improving regional innovation systems performance.

2   Literature Review

2.1 Regional Innovation Systems

The concept of RSI originated from discussions about national innovative system (NIS) and usually refers to related works. Cooke [6] defines an RSI as a system "in which firms and other organizations are systematically engaged in interactive learning through an institutional milieu characterized by embeddedness ". Asheim and Isaksen [7] add that "an (regional) innovation system consists of a production structure (techno–economic structures) and an institutional infrastructure (political–institutional structures)". The concept of RSI evolves from the premise that innovation is a process that relies on a variety of factors that are internal and external to firms.

The internal mechanisms that seem to be related to the dynamic of the system:

(1) **Interactive learning**

Interactive learning is at the center of the RSI concept, and learning is closely connected to innovation. Then interactive learning can be understood as the process that generates learning between actors who participate in the innovation process. It also refers to an interactive process of knowledge generation shared by innovator actors (firms, institutions) and shaped by institutional routines and social conventions [8]. Innovation arises among SMEs via active participation in innovation networks and/or cooperation with other firms and organizations. The ability to innovate is thought to be linked to the extent to which an actor learns through diffusing knowledge. Thus interactive learning appears to be a productive strategy adopted by firms to compensate for knowledge the learning process may lack which the firm itself cannot provide.

According to some author[9], innovation in SMEs results from a process of interactive learning. In describing innovation as an interactive process, Rothwell [10]argues that successful innovative firms are generally plugged into external sources of technological expertise and advice, an idea also espoused by Albaladejo and Romijn [11], who underpinned the mobilization of external resources for innovation.

Interactive learning, through connections they establish, enables firms to increase know-how information and provide external expertise on innovation processes. Due to the increasing speed of technological change, interactive learning offers fixed-cost reductions in procurement and distribution. By shortening product life cycles, interactive learning can positively influence management of speed and help reduce uncertainties in technological innovation.

Interactive learning occurs in many forms depending on the context and the process involved. Interaction occurs in either a vertical or a horizontal way. Horizontal networks are favored within RSI because they convey knowledge and information that is crucial to innovation. Gelsing [12] distinguishes between two forms of industrial networks that occur horizontally. The trade network is the result of linkages between user–producer trades, and the knowledge network is the flow of know-how information and exchanges that are favorable to innovation.

(2) **Knowledge production**

While learning is generally an organized process, knowledge is developed and shared in a less-structured environment. Somewhat humble and unostentatious [13] knowledge appears in four categories: know-what, know-why, know-who, and know-how [14]. As

Lundvall and Johnson [14] state: "These categories refer to the possibilities to carry through transactions with economically relevant knowledge and to combine pieces of knowledge in new ways". Shared knowledge is an important aspect of RSI because it helps increase its interactive learning capabilities. It requires a high degree of trust among actors and sharing of common cultural, institutional, and entrepreneurial activities. Knowledge is socially embedded, created, and reproduced through social interaction. Mechanisms promoting knowledge and interactive learning enhance the advantage of proximity and social embeddedness, as I discuss below.

(3) Proximity
The role and importance of proximity have three implications for RSI. First, they are related to the benefits generated by the forces of spatial agglomeration. Rich agglomeration economies provide firms that are engaged in interactive learning with a critical mass of inputs/outputs for them to use and interact with. Agglomeration forces also provide a general framework that determines the behavior of firms and institutions concerning practices regarding relationships with local suppliers and customers, shared infrastructures, and others externalities. Second, proximity is related to the logic of transaction costs. Indeed, with more physical proximity, it becomes less costly to exchange and communicate knowledge and information. In this way, proximity increases the speed of communication between firms and reduces related costs. Third, proximity can be related to social and cultural matters. Due to the high trust and understanding necessary to communicate tacit knowledge, a lack of common social and cultural understanding can impede relations between close actors. As noted by Lundvall [15], "when cultural differences are present, certain types of messages will be difficult to transmit and decode. Cultural differences between users and producers may block the interaction."
Thus, proximity in the context of RSI is not just a matter of geographical distance but just as important, the degree to which economic, organizational, relational, social, and cultural realities are shared.

(4) Social embeddedness
Central to the concept of RSI is the notion of embeddedness. This notion considers the role of personal relations and networks. Such relations result from an anticipation that interactions will lead to profitable growth. Such networks and interactions involve "a social embedded process which cannot be understood without taking into consideration its institutional and cultural context" [16]. From this perspective, embeddedness emerges in regions that have a significant concentration of firms and institutions, a high degree of shared social and cultural values, and various resources that can be used to generate new production and processes. Storper [17] refers to these elements as the "untraded interdependencies" because they are embedded in a specific context that cannot be "reproduced" or "sold", and still are critical for collective and interactive learning to occur. Within an RSI, embeddedness is mostly concerned with the relation between interactive and collective learning and the nature of knowledge exchanges between firms and institutions. This is a strategic dimension to embeddedness.
As Lyons [18] states: embeddedness of firms is expected to strengthen the milieu by developing a sense of common industrial purpose and social consensus; common ways of perceiving economic and technical problems and solutions; and the development of extensive institutional and informal support that encourage innovation, skill formation,

and the circulation among the firms.

Within an RSI, such a notion has to be more clearly defined, not only to understand its link to a knowledge agent's willingness to transfer information, but also to the recipient's ability to absorb it.

2.2 Social Capital Theory

Social capital is a resource which gives an organization or a network the capacity to use and utilize the material, economic and intellectual resources of the whole collective – as well as social resources reaching outside the collective. Generally social capital can be defined in this context as a necessary but insufficient part of the innovative capability of the network. Social capital is gaining prominence as a concept that provides a foundation for describing and characterizing a firm's set of relationships.

Dimensions of social capital

In this research, we adopt a definition of social capital similar to that offered by Nahapiet and Ghoshal [19]. We define social capital as the aggregate of resources embedded within, available through, and derived from the network of relationships possessed by an individual or organization—a definition that accommodates both the private and public good perspectives of social capital. The central proposition in this view of social capital is that networks of relationships are a valuable resource for the individual or organization. With social capital as a public good, members of an organization can tap into the resources derived from the organization's network of relationships without necessarily having participated in the development of those relationships [20]. In this paper we seek to understand how knowledge moves within networks and how social capital affects the regional innovation systems. To achieve this objective, we adopt Nahapiet and Ghoshal's [21] three dimensions of social capital: structural, cognitive, and relational.

(1) Structural Dimension

The structural dimension of social capital involves the pattern of relationships between the network actors and can be analyzed from the perspective of network ties, network configuration, and network stability. Network ties deal with the specific ways the actors are related. Ties are a fundamental aspect of social capital, because an actor's network of social ties creates opportunities for social capital transactions [22].

The configuration of a network structure determines the pattern of linkages among network members. Such elements of configuration as hierarchy, density, and connectivity affect the flexibility and ease of knowledge exchange through their impact on the extent of contact and accessibility among network members [23].

Network stability is defined as change of membership in a network. A highly unstable network may limit opportunities for the creation of social capital, because when an actor leaves the network, ties disappear. While stability is not a major issue in intra-corporate networks unless there are frequent corporate restructuring activities, it is a much studied concept in the alliance area, perhaps because of the high instability rate usually attributed to this particular network form [24].

(2) Cognitive Dimension

The cognitive dimension represents the resources providing shared meaning and understanding between the network members [19]. The two facets of the dimension we

address are shared goals and shared culture among network members. Shared goals represent the degree to which network members share a common understanding and approach to the achievement of network tasks and outcomes.

Shared goals. We follow Tsai and Ghoshal [25] in using the term shared vision, which embodies the collective goals and aspirations of the members of an intra-corporate network. When a shared vision is present in the network, members have similar perceptions as to how they should interact with one another. This can promote mutual understandings and exchanges of ideas and resources. Thus, a shared vision can be viewed as a bonding mechanism that helps different parts of a network integrate knowledge.

Shared culture. Although the headquarters of an intra-corporate network may try to impose its corporate culture in all worldwide operations, each operation is geographically embedded in local or national culture [26].

(3) Relational Dimension

The relational dimension focuses on the role of direct ties between actors and the relational, as opposed to structural, outcomes of interactions. Among the facets of this dimension, such as trust, norms, and identification, we focus on trust, both because of space limitations and because trust is a critical factor affecting inter-firm knowledge transfer and creation [27]. Trust plays a key role in the willingness of network actors to share knowledge. A lack of trust may lead to competitive confusion about whether or not a network firm is an ally [28]. A partner firm needs to signify its trustworthiness through the way it behaves in the alliance. Moreover, trust is process based, in the sense that firms regularly test each other's integrity, moving from small, discrete exchanges of limited risk to more open-ended deals that subject the parties to substantial risk [29].

Social capital in Building Regional Innovation Systems

There are four main roles social capital has in developing regional innovation capability. Firstly, it affects the productivity of the network by reducing general uncertainty in specialization and division of labor. Secondly, it reduces the transaction costs in the network. Thirdly, it affects the coordination costs of the network. These three effects are connected to the internal dynamics and efficiency of the network. Fourthly, and perhaps most importantly, it affects the amount and diversity of knowledge achievable by an actor [30]. The apparent weakness of innovative capability that Frombold-Eisebith [31] refer to, is in fact connected to two 'distortions' of social capital: closure of the network and collective blindness Closure refers to the way a network separates itself from its environment [31].

2.3 Contract

Formal contracts may signal distrust of your exchange partner and by undermining trust, encourage, rather than discourage, opportunistic behavior [32]. Trust and contracts have been viewed as two important mechanisms to safeguard opportunistic behavior and maintain cooperation [2]. In particular, an effective contract prescribes appropriate behavior for supplier chain partners in addition to routines for the distribution of outcomes [3]. Although the effectiveness of contracts and trust in governing inter-organizational and their effects on financial and cooperation performances have been widely studied (e.g. Joskow[33]; Williamson [34]), there is limited empirical evidence as

to how they affect manufacturers' innovation performance and there are few studies that examine how the contracts and social capital affect enhancing the cooperative performance of regional innovation systems.

The more complex is the contract, the greater is the specification of promises, obligations, and processes for dispute resolution. The structure of the exchange is primarily governed by the contract that helps obviate moral hazards and attenuate the leeway for opportunism. In this paper we seek to understand how knowledge moves within networks and how social capital affects the cooperative performance of regional innovation systems.

Contracts are formal, written agreements between two or more business partners that provide a legally bound, institutional framework in which each party's rights, duties and responsibilities are specified [3]. It explicitly prescribes roles and obligations, determines the content of the exchange and the division of outcomes, and specifies penalties for violating contractual specifications [4]. It also establishes the condition for the process of the exchange. Contract completeness reduces transaction costs, contractual hazards, and operational risks, which in turn boosts business performance [33]. A contract is an important mechanism used to inhibit opportunism [34]. If all parties' behaviors are confined by contract completeness, free-riding opportunities will become more limited. Moreover, a well-specified contract already in place can mitigate the adverse effect of uncertainty in a multi-party game on venture performance. Contract completeness further gains in importance under high investment uncertainty, long duration, and nontrivial commitment [35]. In addition, a complete contract safeguards each party's interests and regulates each party's behavior, commitment, and responsibility. This helps reduce transaction costs related to multiple parents, mitigating the negative impact of multiple parents on venture performance. Moreover, contract completeness encourages resource sharing and integration among multiple parents. Finally, contractual completeness may facilitate the development of trust among partners so that vulnerability is both lower and less amenable to exploitation [36].

Contracts and cooperation are interrelated because a contractual arrangement serves as a framework within which cooperation proceeds. Sufficiently elaborate and carefully constructed contracts will provide a framework for behavior, determine the pattern of outcome distribution, state the punishment for violating contractual agreements and prescribe appropriate behavior in the supply chain relationship, along with each partner's roles and obligations [4]. Thus, contracts are hypothesized to play a critical role in supply chain relationships [37].

3   Research Hypotheses

In our research, we first review the literature on regional innovation systems and better realize social capital in building regional innovation systems. We seek to use contracts as a moderator and develop our conceptual model and the research framework is shown in Fig 1, and derive our corresponding hypotheses, followed by a description of our methodology and the results of our empirical analysis.
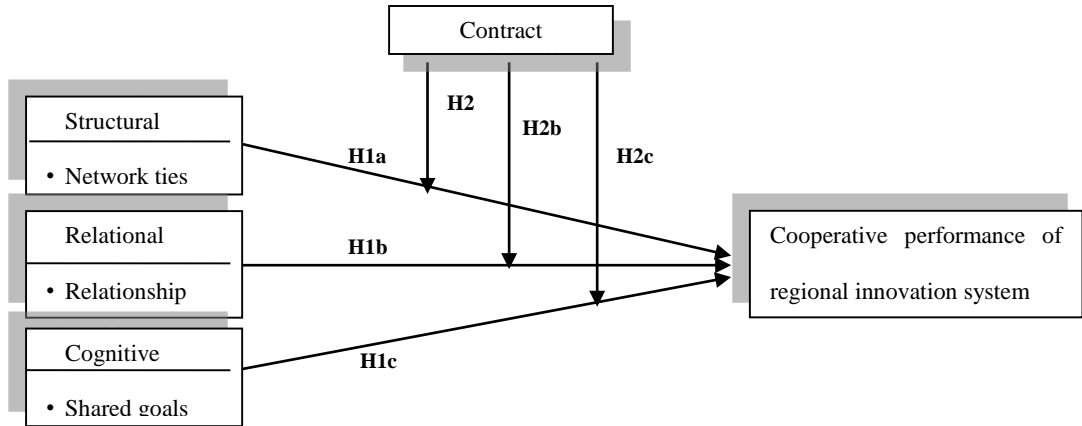
Figure 1: Research Framework

3.1 Social Capital and Cooperative Performance of Regional Innovation System

For this paper we adopt a definition of social capital similar to that offered by Nahapiet and Ghoshal [19]. We define social capital as the aggregate of resources embedded within, available through, and derived from the network of relationships possessed by an individual or organization.

Cooke defines an RSI as a system "in which firms and other organizations are systematically engaged in interactive learning through an institutional milieu characterized by embeddedness" [6]. Shared knowledge is an important aspect of RSI because it helps increase its interactive learning capabilities. It requires a high degree of trust among actors and sharing of common cultural, institutional, and entrepreneurial activities. Sharing is easier when firms have the same values, background, and understanding of technical and commercial problems, whereas tacit knowledge is much more difficult to share because it implies new meaning in the form of new methods and new products. Such networks and interactions involve "a social embedded process which cannot be understood without taking into consideration its institutional and cultural context" [16]. From this perspective, embeddedness emerges in regions that have a significant concentration of firms and institutions, a high degree of shared social and cultural values, and various resources that can be used to generate new production and processes.

Innovation refers to the conversion of knowledge into new products, services, or processes to be introduced on the market (or the introduction of significant changes into existing ones). More specifically, innovation and firms' capacity to innovate can be associated with the capacity to combine and exchange knowledge resources [38].

Social capital is gaining prominence as a concept that provides a foundation for describing and characterizing a firm's set of relationships. We adopt Nahapiet and Ghoshal's [21] three dimensions of social capital: structural, cognitive, and relational. There are four main roles social capital has in developing regional innovation capability. Firstly, it affects the productivity of the network by reducing general uncertainty in specialization and division of labor. Secondly, it reduces the transaction costs in the network. Thirdly, it affects the coordination costs of the network. These three effects are connected to the internal dynamics and efficiency of the network. Fourthly, and perhaps

most importantly, it affects the amount and diversity of knowledge achievable by an actor [30]. Therefore, we propose:

Hypothesis 1a: There is a positive relationship between structural and the cooperative performance of regional innovation systems.
Hypothesis 1b: There is a positive relationship between cognitive and the cooperative performance of regional innovation systems.
Hypothesis 1c: There is a positive relationship between relational and the cooperative performance of regional innovation systems.

3.2 Contract and Cooperative Performance of Regional Innovation System

Trust and contracts have been viewed as two important mechanisms to safeguard opportunistic behavior and maintain cooperation [2]. In particular, an effective contract prescribes appropriate behavior for supplier chain partners in addition to routines for the distribution of outcomes [3]. In addition, a complete contract safeguards each party's interests and regulates each party's behavior, commitment, and responsibility. This helps reduce transaction costs related to multiple parents, mitigating the negative impact of multiple parents on venture performance. Moreover, contract completeness encourages resource sharing and integration among multiple parents.

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Sufficiently elaborate and carefully constructed contracts will provide a framework for behavior, determine the pattern of outcome distribution, state the punishment for violating contractual agreements and prescribe appropriate behavior in the supply chain relationship, along with each partner's roles and obligations [4]. Thus, contracts are hypothesized to play a critical role in supply chain relationships [37].

Relative to contracts, social capital is informal, formed by interaction and social ties. When *contracts* and *social capital* combined together, which means under trustworthy relationship the firms can follow specific instruction as well, so these two may lead to better effects on cooperative performance. Thus, we proposed the contracts may exert positive interactive effect on the relation between social capital and cooperative performance that:

Hypothesis 2a: The contract may exert a positive interactive effect on the relation between network ties and the cooperative performance of regional innovation systems; i.e. when the contracts are constructed well, the positive relation between network ties and performance would be stronger.
Hypothesis 2b: The contract may exert a positive interactive effect on the relation between relationship and the cooperative performance of regional innovation systems; i.e. when the contracts are constructed well, the positive relation between relationship and performance would be stronger.
Hypothesis 2c: The contract may exert a positive interactive effect on the relation between shared goals and the cooperative performance of regional innovation systems; i.e. when the contracts are constructed well, the positive relation between shared goals and

performance would be stronger.

4   Sample and Procedures

Data was gathered from firms in central Taiwan industrial clusters. We got 164 respondents totally. To make sure the respondent know the cooperation well, those who never cooperate with other units and those cooperation less than one year are wiped out. Finally, 122 samples are included, and the effective response rate is 74%. More than half firms chose university or research institution for cooperation, and most of them come from engineering and IC industries.

Most of them are small and medium enterprises, with less than 100 employees. They participated the cooperation project for over 3 years in average, and 50 firms co-work with other units under formal contracts.

We adopted Nahapiet and Ghoshal's [21] three dimensions to measure social capital. The items from Lee [39] were used to capture cooperative performance. Five-point Likert scale was used ranging from (1) strongly disagree to (5) strongly agree. And the *alpha*s of these constructs ranged from .72 to .86, which were in acceptable level.

Table 1: Analysis of discriminant validity

	M	SD	1	2	3	4	5
1 network ties	3.87	.49	(.72)				
2 relationship	3.59	.48	.37**	(.74)			
3 shared goals	3.98	.49	.45**	.57**	(.83)		
4 contract	3.90	.40	.35**	.33**	.37**	(.85)	
5 cooperative performance	3.72	.39	.30**	.29**	.36**	.40**	(.86)

$^*p < .05$ $^{**}p < .01$

$N = 122$；the values shown in ( ) were Cronbach's *alpha*

5   Analysis and Results

The hypotheses are tested by OLS regression. The dependent variable is cooperative performance of RIS and three interactive effects are tested separately. In model 1, network ties is first included and reaches statistical significance ($R^2 = .09$, $\beta = .30$, $p < .05$), which indicates H1a is supported. Then interaction variable, contract, is included and significant too ($\Delta R^2 = .10$, $\beta = .33$, $p < .05$). And then, the interaction term of network ties and contract is in, however, the model is not significant ($\Delta R^2 = .00$, $p > .05$), which means H2a is not supported.

In model 2, relationship is first included and reaches statistical significance ($R^2 = .09$, $\beta = .29$, $p < .05$), which indicates H1b is supported. Then interaction variable, contract, is included and significant as well. And then, the interaction term of relationship and contract are in, and the model reaches statistical significance ($\Delta R^2 = .03$, $p < .05$). Besides, the coefficient of interaction term is positive ($\beta = .17$), indicating a positive interaction on main effect, which means H2b is supported.

In model 3, shared goal is first included and reaches statistical significance ($R^2 = .13$, $\beta = .37$, $p < .05$), which indicates H1c is supported. Then interaction variable, contract, is included and significant as well. And then, the interaction term of shared goal and contract is in, however, the model is not significant ($\Delta R^2 = .01$, $p > .05$), which means H2c is unsupported.

6 Discussions and Conclusion

6.1 Theoretical and Practical Implications

The main objectives of the article are: to better realize with the main effects of social capital on the cooperative performance of regional innovation systems, and to explore the important moderating effects of the contract on the main effects. The results confirmed the main effects of network ties, relationship, and shared goals, which corresponded with the results of past research.

However, only one of the interactive effects, the interaction between relationship and contracts, was realized. Taking a step further, contracts construction was still positively related to cooperative performance, though did not exert a moderating effect on the main effects of network ties and shared goals. One possible explanation may lie in the relatedness of social capital and contracts. Relative to relationship ($r = .33$), the correlation of contracts and network ties ($r = .35$) and that of contracts and shared goals ($r = .37$) were higher, thus, they may be hard to exert more effect above the main effects. Another reason may be concerning statistical power. Limited in firm-level research, this work possessed a somehow small sample. Therefore, it's hard to detect all of the three moderating effects.

Our research provides some guidelines for managers to decide how to choose control mechanisms in managing the cooperative performance within partners of regional innovation systems performance. Contract construction may be a possible way to improve the cooperative performance; at least, it exerts an interactive effect above the main effect of relationship construction, which implies formal policy my co-work with informal interaction. However, the additional explanation rate is not high (3%), which indicates there may be other potential moderators. This work focuses on the policy construction (i.e., contract), whereas the characteristics of the cooperative partners themselves, such as the motivation and ability, should be worthy of further investigation in the future.

6.2 Future Direction

An examination of facilitating cooperation and trust among partners then enhancing the relationship between social capital and performance reveals some direction for future research. First and obviously, the sheer number of relationships illustrates the complexity of this area. The introduction of moderators into regional innovation systems adds a level of complexity that has not yet as much been examined empirically. Second, virtually all the existing theoretical and empirical studies of inter-organizational knowledge transfer are based on a single network type, without any reference to the boundary conditions. The question of how far the results of these studies can be generalized from one network type to another rarely has been examined.

6.3 Limitations

This paper is not without limitations. First, we discuss mostly the SMEs in the central Taiwan. Second, our discussion of major network types is limited, in that it applies to the more typical members of each network type. Third, there may be other factors besides contracts can facilitate cooperation and trusts among partners, then enhance the relationship between social capital and the performance of regional is enhanced as well. Finally, there are multiple facilitating conditions for each facet of the social capital dimensions; we identified what we view as the most critical ones. For example, a condition we were unable to explore all SMEs in Taiwan for industrial districts and how the regional innovation be formed.

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