

The role of IT practices in facilitating relational and trust capital for superior innovation performance: the case of Taiwanese companies

IT practices in
relational and
trust capital

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Abstract

Purpose – The purpose of this study is to explore the moderating role of information technology (IT) practices in the increase of organizational capacity for generating innovation performance from its relational (internal and external) capital and trust capital.

Design/methodology/approach – Survey data has been collected from 102 publicly listed enterprises in Taiwan and is analysed by using symmetric structural equation modelling–partial least squares (SEM–PLS) and asymmetric fuzzy set qualitative comparative analysis (fsQCA) techniques.

Findings – The findings derived from SEM–PLS show that internal relationships and trust embedded in firms' relationships play a significant role in the innovation performance of Taiwanese enterprises, and reveal a more closed approach to innovation. The results also confirm the important role of IT advancement in amplifying the effect of internal and external relationships and trust formation on innovation performance. One more interesting note, the integration of fsQCA demonstrates several configurations that lead to superior innovation performance.

Research limitations/implications – The study was limited to Taiwanese companies with at least 200 employees. It might well be that the economically significant small business sector has distinct relationships with stakeholders, trust building strategies and IT practices, and that innovation performance depends on other macroeconomic effects. This study combines symmetric (SEM–PLS) and asymmetric (fsQCA) techniques to improve our understanding of the complementarities between relational and trust capital, and IT practices, and identify configurations that could yield organizational benefits for innovation outcomes.

Practical implications – This study provides new knowledge about IT utilization in the workplace which practitioners may use to capitalize on internal and external networks and enhance innovation performance.

Originality/value – Exploring together intellectual capital (IC) components and IT practices, this study merges IC and knowledge management (KM) streams of literature and adds to the prominent discussion on how IC and technology-based KM together contribute to superior innovation performance. In introducing the notion of equifinality, and testing our hypothesis by applying fsQCA, we also provide new ground for methodological discussions in the field of innovation performance.

Keywords Intellectual capital, Internal and external relational capital, Trust capital, IT practices, Innovation performance

Paper type Research paper



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1. Introduction

Academics, practitioners and policy-makers broadly agree that the organizational ability to innovate is based on knowledge-related issues (e.g. [Grant, 1996](#); [Nonaka and Takeuchi, 1995](#); [Hamilton, 2006](#); [Kianto et al., 2014](#)). The productive force behind organizational innovation is what organizations know, i.e. intellectual capital ([Inkinen, 2015](#); [Subramaniam and Youndt, 2005](#)), and their ability to manage and effectuate intellectual capital (IC) to achieve knowledge-based competitive advantages ([Davenport and Prusak, 1998](#); [Heisig, 2009](#); [Nonaka and Takeuchi, 1995](#); [Gold et al., 2001](#)).

However, due to the complex nature of global markets no single actor can provide an end-to-end solution and innovations on its own ([Chesbrough, 2003, 2012](#); [Pagani and Pardo, 2017](#)). There is a need for companies to create and maintain efficient and effective value and innovation networks with the right partners ([Nahapiet and Ghoshal, 1998](#); [Canhoto et al., 2016](#); [Ford et al., 2018](#)). Therefore, collaborative and network environments, and innovation co-creation through various kinds of networks and technologies, and the incorporation of knowledge from different internal and external sources to drive innovation performance of firms are now increasingly the focus of academic and practitioners' debate ([Chesbrough, 2003, 2012](#); [Cantwell, 2017](#); [Koch and Windsperger, 2017](#)).

The utilization of information technology (IT) has become a necessary means for managing knowledge flows within and outside organizational boundaries ([Cunha et al., 2015](#); [Katemukda et al., 2018](#)). That means that IT leverages knowledge management (KM) processes (creation, transfer, storage, use and re-use) and thereby ensuring that knowledge from the right source(s) arrives at the right time, in the most effective manner ([Adamides and Karacapilidis, 2018](#)), and in that way accelerates innovation ([Bontis et al., 1999](#); [Alavi and Leidner, 1999](#); [Rodríguez-Elias et al., 2008](#); [Katemukda et al., 2018](#)). Advanced IT enables wider membership in collaborative networks, increases diversity and richness of available knowledge, simplifies knowledge co-creation and re-use and supports collection and analysis of big data for instance ([del Giudice and della Peruta, 2016](#); [Mount and Martinez, 2014](#); [Adamides, and Karacapilidis, 2018](#)).

However, it is not technology alone that matters. Others found that trust makes relationships in internal and external networks stronger, which require effective IT infrastructure to enable synchronous collaboration of dispersed groups ([Adamides and Karacapilidis, 2018](#)) and only then present innovation generating potential. Hence, relational and trust aspects play a key role as well. The importance of different IC components in pursuing innovation potential is well-established, for example several studies suggest that certain (rather than all) IC components are associated with innovation performance (e.g. [Andreeva and Garanina, 2016](#); [Dumay et al., 2013](#); [Delgado-Verde et al., 2011](#); [Subramaniam and Youndt, 2005](#); [Cabello-Medina et al., 2011](#); [Cabrilo et al., 2018a](#)). However, relatively little is known about how the unlocking of the intellectual potential embedded in relationships with stakeholders and trust that strengthens these relationships and facilitates intra- and inter-organizational cooperation, knowledge flows, and co-creation of innovation unfolds (i.e. open innovation; see [Chesbrough, 2003](#)).

Therefore, in this study we reflect specifically on the relational and trust capital, as specific IC components, and knowledge-supportive IT practices to explore their joint effects on organizational innovation performance. Relational capital (RC) is referred here as the value and knowledge that resides in relationships with internal and external stakeholders ([Edvinsson and Malone, 1997](#); [Roos et al., 1997](#); [Nahapiet and Ghoshal, 1998](#)), and emergent trust capital is defined as the trust embedded in these relationships ([Mayer et al., 1995](#); [Inkinen et al., 2014, 2017](#)). Following [Inkinen et al. \(2015\)](#) and [Hussinki et al. \(2017b\)](#), we conceptualize knowledge supportive IT practices as the conscious and intentional managerial and organizational activities to utilize IT for information and knowledge search, analysis and distribution.

We split RC into internal and external RC, referring to the relationships with intra-organizational and inter-organizational stakeholders (Inkinen *et al.*, 2017; Cabrilo *et al.*, 2018a). Both, inter- and intra-organizational relationships, are important drivers of knowledge flows that facilitate and speed up innovation (Hsu and Fang, 2009; Martín-de Castro *et al.*, 2013; Chen *et al.*, 2006). In addition, by exploring internal and external relationships separately we can gain a deeper understanding about the openness of the innovation process in specific business contexts and shed light on how openness of the innovation process is linked with organizational performance.

In spite of the fact that technological competence helps companies to develop and maintain relationships and enable easier knowledge flows, thus increasing their innovative potential (e.g. Koch and Windsperger, 2017; Pagani and Pardo, 2017), surprisingly, empirical evidence on how RC complemented with trust and supported by advanced information technology facilitate innovations has been scarce and fragmented (Cunha *et al.*, 2015; Katemukda *et al.*, 2018). This is because relational and trust capital have been explored as IC components in the IC literature (Inkinen, 2015; Inkinen *et al.*, 2017), and IT systems have been mostly addressed as set of tools to enhance knowledge management (Katemukda *et al.*, 2018; Andreeva and Kianto, 2012; Alavi and Leidner, 2001; Kankanhalli *et al.*, 2003; Inkinen *et al.*, 2015), and therefore have been explored in KM literature. Although concepts of IC and KM both address knowledge-based issues (Kianto *et al.*, 2014) and are intertwined (Hussinki *et al.*, 2017b), they have been separately explored by the two streams of literature (Kianto *et al.*, 2014; Seleim and Khalil, 2011; Hussinki *et al.*, 2017a; Cabrilo and Dahms, 2018). Moreover, the network literature emphasizes the importance of networks and different knowledge sources for innovation, but it often ignores or only partly explores the role information technology plays in these complex interrelations (Koch and Windsperger, 2017). As a consequence, there exists a limited number of holistic models that combine theories and models to improve our overall understanding of the contingency and complex interrelations of innovation performance drivers.

To address the identified literature gap, this study explores the interrelationships and configurations of internal and external RC, trust capital, and IT practices that drive innovation performance. More specifically, we examine the moderating role of IT practices in the increase of organizational capacity to generate innovation performance from its relational and trust capital. When IT practices are tailored to facilitate relationships with stakeholders and promote trust, inter- and intra-organizational collaboration and value co-creation, the company has a greater chance to become agile, innovative and well-performing (Bharadwaj, 2000; Narula, 2014).

Innovation performance is defined in this study as the ability to create innovations along the dimensions of products and services, production methods and processes, management or marketing practices (Cabrilo and Dahms, 2018). As innovation performance is a complex business phenomenon that rarely has a single cause, apart from symmetric SEM-PLS, we use a new approach, labelled as 'configurational' analysis (Ragin, 2008; Fiss, 2011). This approach preserves complex causal conditions, and develops configurations of interconnected explanatory variables that jointly explain a certain phenomenon. The statistical technique associated with this configurational approach is qualitative comparative analysis (QCA) and its extension fuzzy set QCA (fsQCA). In this study, we combine techniques (SEM-PLS and fsQCA) to find combinations of selected IC components and IT practices that together drive superior innovation performance.

The conceptual model was tested in a Taiwanese business context by collecting large-scale quantitative survey data from enterprises with more than 200 employees. Taiwan belongs to the leading group of innovation-driven economies and is one of the IT kingdoms of the world (Wang and Chang, 2005). Although in empirical IC research the most actively studied companies have been Taiwanese (Inkinen, 2015), studies exploring the link between

multidimensional IC and IT practices for superior performance are scarce and limited either to studies that have explored direct links between IC components (human, structural and relational capital) and innovation performance (e.g. [Chen et al., 2006](#)) or studies of the IC-performance links in IT industry ([Wang and Chang, 2005](#)). In addition, [Huang and Liu \(2005\)](#) explored the interaction between innovation capital and IT capital and their synergy effects on firm performance in the top 1,000 Taiwanese companies.

Our study aims to contribute to current literature on the theoretical, empirical and practical level as follows. Theoretically, by exploring relational and trust capital together, as IC components, as well as IT practices, this study merges IC and KM streams of literature and adds to the prominent discussion on how IC and technology-based KM together contribute to superior innovation performance. We highlight the role of managers in utilizing technology and explicate how managerial actions can influence the performance of organizations possessing similar resources and operating in similar environments. On the empirical level, we combine symmetric and asymmetric techniques to analyse our data. In particular, we complement SEM with fsQCA to understand equifinality in the context of IC, IT practices, and innovation performance. From a managerial perspective, this study helps managers to use information technology to maximize value of relational and trust capital in building effective innovation strategies.

This article is organized as follows: [Section 2](#) briefly discusses the literature regarding external and internal relational and trust capital, IT practices, and innovation performance, before developing hypotheses. [Section 3](#) expounds the methodology applied in this study and analysis of results. [Section 4](#) presents the discussion of the most important findings. Lastly, [Section 5](#) concludes the paper and provides implications for practitioners and future research.

2. Literature review and hypotheses development

2.1 *The role of external and internal relational capital in innovation performance*

RC represents the value and knowledge embedded in the firm's web of relationships ([Cabrilo et al., 2018b](#)), i.e. the knowledge that reside in collective connections with various stakeholders ([Youndt and Snell, 2004](#)). Most typically, it is related to inter-organizational relations and knowledge embedded in relationships with external stakeholders such as customers, suppliers, partners, competitors, investors and the local community ([Sveiby, 1997](#); [Roos et al., 1997](#); [Kianto et al., 2010](#); [Bontis, 1998](#); [Wu et al., 2007](#)). [Bontis \(1998\)](#) has emphasized on external relationships as a great asset as companies enrich themselves by absorbing knowledge and capabilities from their environment. Although it is generally considered that relationships with customers are the crux of this type of capital ([Kianto et al., 2010](#)), there is increasing evidence about the importance of relations with other external stakeholders, such as suppliers ([Luzzini et al., 2015](#)), R&D partners ([Powell, 1998](#)) and universities ([Hong et al., 2007](#); [Guimón and Salazar-Elena, 2015](#)) in companies' innovation-creation capacities. However, besides studies prioritizing external relationships there are also studies that consider only intra-organizational ([Yang and Lin, 2009](#)), or both intra- and extra-organizational relations ([Yli-Renko et al., 2002](#); [Subramaniam and Youndt, 2005](#)), as relational capital.

Both, internal and external relations, are important sources of new knowledge, novel ideas and insights, and therefore can accelerate innovation performance ([Hsu and Fang, 2009](#); [Martín-de Castro et al., 2013](#); [Chen et al., 2006](#)). External relations become even more critical in the emerging context of open innovation ([Chesbrough, 2003](#); [Martin and Salmelin, 2018](#)). Collaboration with different external stakeholders such as suppliers, customers, competitors, universities, government institutions improves knowledge sharing and market knowledge acquisition by the firm, resulting in expansion of the firm's existing knowledge base, which in turn advances a firm's innovation capability ([Clauss and Kesting, 2017](#); [Luzzini et al., 2015](#);

Zhou and Li, 2012). Companies use their external relations to share risks related to new products and speed-up innovation process by getting complementary knowledge and access to local market know-how and new technologies which would otherwise not be available to them (Chesbrough, 2003; Ford *et al.*, 2018). However, intra-organizational relations and knowledge sharing within the boundaries keep the same importance for organizational innovation performance (Kostova *et al.*, 2016; Forkmann *et al.*, 2018). Internal networks leverage expertise and ideas within de-centralized organization, help to disperse the innovation skills throughout the organization, cultivate innovation leaders within groups, and support the full scope of innovation activity.

Thus, the relational capital is referred here as the value and knowledge that reside in relationships with internal and external stakeholders (Edvinsson and Malone, 1997; Roos *et al.*, 1997; Nahapiet and Ghoshal, 1998). It encompasses actual and potential knowledge-based resources embedded within, available through and derived from intra and inter-firm networks (Nahapiet and Ghosal, 1998). This IC dimension ensures a smooth flow of knowledge within and across organizational boundaries, enabling knowledge and ideas to be spread and used for innovation (Huizingh, 2011).

Following recent studies (Inkinen *et al.*, 2017; Cabrilo *et al.*, 2018a), we also argue that the intra-firm relationships should be addressed as a prime element of IC, distinctly from external relations. In this study, we split relational capital into 'internal' and 'external' components, which encompass relationships with internal and external stakeholders respectively. This is because internal and external relationships impact knowledge creation in different ways. Strong internal relationships serve as a crucial innovation pipeline allowing all parts of a company to exploit and further develop ideas, inventions, processes, practices, and innovations (Kostova *et al.*, 2016). Therefore, internal relational capital might be more beneficial for impacting innovation in terms of processes and managerial practices (Cabrilo *et al.*, 2018a). On the other hand, external relationships might be more beneficial in generating knowledge from customers, suppliers and competitors, market know-how, that is important for product/service and marketing innovation (Un and Rodríguez, 2018). For example, Chen *et al.* (2006) found that Taiwanese manufacturing companies emphasized the interactive 'relations' with their suppliers, clients, and partners, as their results showed the greatest influence of relational capital on new product development. Moreover, if locational attributes are of strategic importance for innovation, multinational enterprises become more interested in exploiting and accessing local knowledge through subsidiaries and their external networks (Poon *et al.*, 2013). Finally, Villena *et al.* (2011) found that intensive interaction with suppliers increased a firm's strategic performance, including product and process innovation.

Empirical evidence about the influence of relational capital has been mixed. In general, relational capital has a positive effect on innovation performance (Inkinen *et al.*, 2014; Delgado-Verde *et al.*, 2011), as knowledge is more effectively acquired from external stakeholders (Cantwell and Mudambi, 2005) and dispersed within the company's boundaries (Kostova *et al.*, 2016; Forkmann *et al.*, 2018). However, some studies find no impact of relational capital on innovation performance (Andreeva and Garanina, 2016). Exploring internal and external relational capital separately from each other, some studies found that only intra-organizational network serves as an innovation pipeline (Cabrilo *et al.*, 2018a), while others confirmed external networks being more significant for innovation (Delgado-Verde *et al.*, 2011).

Based on the previous conceptual arguments, we believe that strong internal and external network relations facilitates innovation performance. Hence, we hypothesize that:

H1. Internal relational capital is positively related to innovation performance.

H2. External relational capital is positively related to innovation performance.

2.2 The role of trust capital in innovation performance

Trust is a crucial social construct for organizations (Mayer *et al.*, 1995), and thus, it is asserted as an antecedent and a consequence in many of the IC and KM studies (e.g. Huotari and Iivonen, 2004; Politis, 2003; Kharabsheh, 2007; McNeish and Mann, 2010). Trust is not a behaviour, like collaboration or cooperation, neither a choice, like taking a risk, but an underlying psychological condition that can cause such actions (Sitkin *et al.*, 1998). Mayer *et al.* (1995) define trust as 'the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability or control that other party' (p. 712). Trust enhances cohesion and engagement in work relationships (Hsu *et al.*, 2011; Wu and Tsang, 2008), contributes to cooperation, collaboration and commitment (Mayer *et al.*, 1995), and increases the efficiency and effectiveness of knowledge creation and sharing (Blomqvist, 2002; Du *et al.*, 2017). In other words, constant flows of knowledge are due to long-term trusting relationships. In a high-trust work relationship, actors' behaviour is honest, sincere and fair (Leonidou *et al.*, 2002) which helps them to produce above-and-beyond results. However, low-trust work relationship limits actors' engagement and what they are willing to share and do.

We define trust capital (TC) as an organizational trust embedded in internal and external relationships (Mayer *et al.*, 1995; Inkien *et al.*, 2014, 2017), and consider TC as one of key drivers of inter and intra-organizational cooperation, knowledge sharing and transfer (Mayer *et al.*, 1995; Nahapiet and Ghoshal, 1998), and co-creation of innovation (Chesbrough, 2003; Nahapiet and Ghoshal, 1998; Inkien *et al.*, 2017). Organizational trust is hard to imitate and replace and therefore trust capital is a source of sustainable competitive advantage (Barney and Hansen, 1994) and strategically important intangible asset (e.g. Barney, 1991; Bounfour and Miyagawa, 2014).

Although trust is embedded in an organization's relationships, and might be consider as an attribute of relational capital (e.g. Nahapiet and Ghoshal, 1998; Kale *et al.*, 2000; Inkien *et al.*, 2017), we follow the definition made by Sitkin *et al.* (1998) that trust is an underlying psychological condition that cause a behaviour like engagement in relationship or cooperation, but not a behaviour by itself. Trust strengthens the relationship, and the relationship, in turn, provides more reasons to trust (McNeish and Mann, 2010). Therefore, studying trust as an independent IC dimension offers significant value, and has recently stimulated researchers to explore trust capital as independent and distinct IC dimension (Inkien, 2015; Inkien *et al.*, 2014, 2017; Hussinki *et al.*, 2017a).

Although the empirical IC literature with independent TC is very scarce, other studies demonstrate that trust contributes to socialization (Lawson *et al.*, 2009), cooperation and commitment (La Porta *et al.*, 1997), information and knowledge sharing (Carey *et al.*, 2011; Qureshi and Evans, 2013b), collaborative learning within stakeholder networks (Dovey, 2009), and successful new product development projects (Bstieler, 2006). For example, Vineburgh (2010) draws upon previous work stressing that individuals who display high levels of trust also display high levels of cooperation. Trust embedded in stakeholder networks increases the organizational absorptive capacity (Cohen and Levinthal, 1990; Zahra and George, 2002), i.e. capability to identify, integrate, and exploit external knowledge (Qureshi and Evans, 2013a; Ratten, 2004), which will further facilitate their innovation capability (Dovey, 2009). Furthermore, mutual trust between employees and business partners can reduce information asymmetry thus leading to improved innovation capabilities (Kulangara *et al.*, 2016; Inkien *et al.*, 2017; Camps and Marques, 2014; Prihadyanti *et al.*, 2012).

Trust can also reduce uncertainties and opportunism when including an external firm in an important innovation project (Ketchen and Hult, 2007; Pfeffer and Salancik, 2003), which is the case in open innovation processes. For example, trust was found to have a positive impact on inter-firm learning (Rebolledo and Nollet, 2011), and to facilitate R&D collaboration (Bstieler *et al.*, 2015) which positively impacts innovation performance.

In order to better understand the effects that TC has on the value of relationships, this study reflects on TC as an independent and distinct dimension of IC. We believe that TC is a key driver of knowledge sharing (Davenport and Prusak, 1998; Carey *et al.*, 2011) through improved formal and informal socialization (Lawson *et al.*, 2009), that accelerates collaborative learning (Dovey, 2009), organizational absorptive capacity (Cohen and Levinthal, 1990; Zahra and George, 2002) and significantly enhances innovation capabilities throughout the innovation networks. Thus, we posit that:

H3. Trust capital is positively related to innovation performance.

2.3 The role of IT practices in the relational/trust capital-innovation performance linkages

IT has brought remarkable benefits in terms of promoting inter- and intra-organizational communication, collaboration and facilitating and accelerating innovations which can then be delivered faster and cheaper (Adamides and Karacipilidis, 2006, 2018; Sarker *et al.*, 2012; Anderson and Hardwick, 2017; Majchrzak and Malhotra, 2013). Advanced technology enables greater access to and integration of complex data from internal and external sources, more dynamic knowledge flows within and across organizational boundaries (Zyngier, 2001; Adamides and Karacipilidis, 2018) and accelerates utilization of knowledge through experimentation and prototyping (Martin and Salmelin, 2018). As all of these processes are the key drivers of innovation-based competitiveness, firms' technological proficiency has become crucial competence today (Hussinki *et al.*, 2017b).

In order to cope with increasing online information, companies adopt new technological solutions that can better leverage knowledge over the firm (Alavi and Leidner, 2001; Edwards *et al.*, 2005), enable organizational learning (Carayannis, 1999), and support communication and knowledge flows between an organization and customers, suppliers and other stakeholders (Huysman and Wulf, 2004).

Technology is a tool to achieve organizational objectives by facilitating creation, dissemination and utilization of knowledge (Zyngier, 2001). Technological proficiency facilitates just-in time learning and knowledge sharing by increasing the means for communication and collaboration within company's networks (Kankanhalli *et al.*, 2003). Moreover, it allows quicker and location-independent access to a vast amount of electronic information and knowledge (Inkinen *et al.*, 2015), assists in storage and retrieval of the organizational memory (Andreeva and Kianto, 2012) and enables more rapid application of knowledge through workflow automation (Alavi and Leidner, 2001).

IT is an infrastructure, and rather than directly, makes an influence on innovation process indirectly by facilitating knowledge flows (Zyngier, 2001; Andreeva and Kianto, 2012; Adamides and Karacipilidis, 2018). It is not the possession of advanced technology that creates competitive advantage, but how companies use technology to effectively manage IC and create value, and whether IT systems are supported by appropriate managerial activities (Andreeva and Kianto, 2012). Therefore, in this study we explore IT practices that are referred to as systematic and deliberate managerial activities to use IT to leverage IC and facilitate knowledge management (Davenport and Prusak, 1998; Andreeva and Kianto, 2012; Kianto *et al.*, 2014). More particularly, we argue that IT practices moderate the influence of RC and TC on innovation performance, and investigate usability and usefulness of technology for supporting internal and external relational and trust capital to achieve high innovation performance.

IT practices help companies to develop and maintain networks/relational capital (Adamides and Karacipilidis, 2018), intra- and inter-organizational collaboration in supply-chain relationships (Sanders, 2007) and enable easier knowledge adoption and implementation, thus increasing their innovative potential (Pagani and Pardo, 2017; Adamides and Karacipilidis, 2018). This is because technology helps companies to better use

the knowledge from networks in innovation process, as they can more efficiently assess relevant knowledge residing at different points in the network and arranging its transfer to other points in the network where it is needed (Doz, 1996; Gulati, 1999). Moreover, IT infrastructure supports dispersed groups in asynchronous collaboration, attracts wider membership in value co-creation (Majchrzak and Malhotra, 2013; Malhotra and Majchrzak, 2016), and hence increases the diversity and richness of knowledge, and further increases a firm's innovation capability (Adamides and Karacapilidis, 2018). This implies that IT utilization is expected to increase the extent to which an organization is able to produce innovations by exploiting knowledge that is made available through relational capital (Gulati and Singh, 1998; Inkpen and Dinur, 1998; Kale *et al.*, 2000) and capitalizing on its relational capital.

Based on previous discussion we posit the following hypotheses:

H4a. IT practices positively moderate the relationship between internal relational capital and innovation performance.

H4b. IT practices positively moderate the relationship between external relational capital and innovation performance.

Trust is a necessary component of collaborative environments supporting and executing innovation (Latusek-Jurczak and Prystupa-Rządca, 2014). Traditionally, trust building processes are enabled by socialization and face-to face communication (Armstrong, 2006; Kharabsheh, 2007; Todorova and Durisin, 2007; Volberda *et al.*, 2010; Zahra and George, 2002), and mechanisms such as repeated interaction (e.g. ensuing familiarity). In the context of distributed teams (Bosch-Sijtsema *et al.*, 2011) and cooperation taking place in virtual environments (Cook *et al.*, 2009), these traditional mechanisms are usually unavailable. This is where technology comes in. As in digital era, communication and relations are depending more and more on technology (Martin and Salmelin, 2018), organizations try to adopt or adapt adequate IT practices to facilitate trust-building culture and also to facilitate knowledge sharing and knowledge transfer activities to accelerate innovation (Qureshi and Evans, 2013b; Adamides and Karacapilidis, 2017). Technology plays a big role in keeping remote organizations connected and engaged in knowledge sharing by simplifying real-time communication, streamline workflow and establishing required level of trust. Thus, it is important to explore how trust can influence innovation performance through enablers like IT practices. We believe that IT practices will increase the extent to which an organization is able to build and maintain collaborative environments and accelerate innovations based on trust capital.

H4c. IT practices positively moderate the relationship between trust capital and innovation performance.

Figure 1 shows the research framework of the study.

2.4 Asymmetric considerations

Performance outcomes have been argued to be reachable by several distinct paths that can lead to the same outcome. This is referred to as equifinality (Fiss, 2011). Equifinality moves away from the symmetric assumption that each dimension independently influences outcomes and instead suggests that there are multiple combinations of conditions that can lead to the same outcome. This is especially relevant in the context of this study given that intangible assets are likely to have a combinatory effect on performance outcomes (Milgrom and Roberts, 1995; Roberts, 2007). For instance, it might well be that there exist specific combinations of internal and external RC and TC that could serve organizations as substitute for the absence of IT practices and also lead to positive innovation performance.

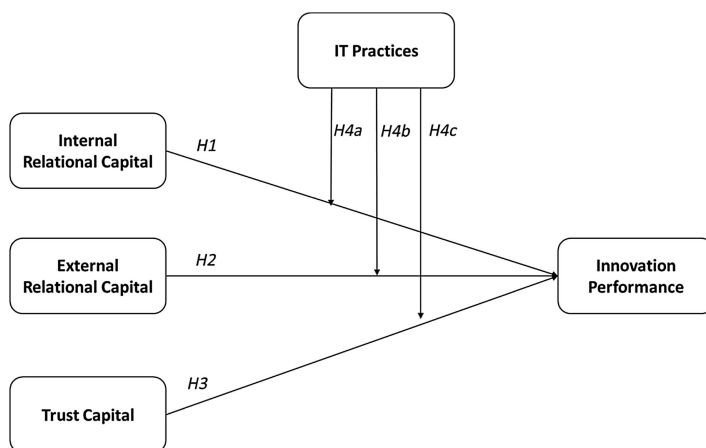


Figure 1.
Research framework

Hence, the incorporation of fuzzy set qualitative comparative analysis (fsQCA) method is seen as advantageous for the following reasons. First, it addresses the crucial interrelationship between theory development and statistical method. While symmetric analytical methods allow for the inclusion of interaction and mediation terms, there are statistical limits to the number of terms that can be included in such models (Feurer *et al.*, 2016). This implies that theory development is in danger of being driven by the statistical method rather than the other way around (Woodside, 2013). Second, fsQCA allows for the simultaneous inclusion of all possible relationships between conditions, which reduces the risk to omit relevant relationships. Third, a further advantage fsQCA brings to the traditional symmetric regression based analytical techniques is the ability to identify complementary or substitutive configurational constellations (Jackson and Ni, 2013).

Hence, we posit the final hypothesis as follows:

- H5.* More than one causal configuration consisting of external and internal RC, TC and IT conditions can lead to high innovation performance.

3. Research methodology

3.1 Research design

3.1.1 Data collection and sample. The data has been collected via a survey of public listed firms in Taiwan. The Taiwan Economic Journal (TEJ) database served as sample universe. We narrowed the number of companies down by focussing on those with more than 200 employees. That is because larger companies are more likely to engage with complex management techniques such as IT practises and show meaningful innovation output. After that, we randomly selected 580 firms out of 1,716 and contacted them via phone to establish personalised contact, explain the survey purpose, and to get the email address of the top management team member. Establishing personal contact is key to increase response rates in emerging economies (Najafi-Tavani *et al.*, 2018), and we focus on the top management team members as those key informants are most likely to be able to answer strategic level questions (John and Weitz, 1988).

In order to ensure data equivalence, forward and backward translation procedures have been followed. In addition, the questionnaire has also been pilot tested through a panel of practitioners and academics. The pilot test resulted only in minor wording changes. The resulting version was distributed via email and after several rounds of reminders we received

a total of 102 useable responses, which is equivalent to a favourable net response rate of 17.6% (see Table 1).

3.1.2 Measurement of constructs. We used well established scales to measure our constructs. This has been done to increase comparability of our findings with previous studies. Accordingly, our innovation performance construct has been adapted from Weerawardena (2003). Internal and external capital constructs have been inspired by Yang and Lin (2009) and Kianto (2008), whereas trust capital has been adapted from a recent study by Hussinki *et al.* (2017b). IT practises were inspired by the studies of Handzic (2011) and Negash and Gray (2008). The full constructs are provided in Table 2.

In order to ensure that common method bias and multicollinearity are not affecting our results, various steps have been taken. Ex ante, we have randomly distributed the constructs across the questionnaire, so that the respondents are unlikely to guess the full model. This is also in line with our framework design, which includes interaction terms that make it harder for the respondent to guess the final model. In addition, we also included objective variables in the model such as industry and firm size. Ex post, we also conducted a Harman’s one factor test (Podsakoff *et al.*, 2003). The results showed the emergence of four factors, with the largest explaining only 30.6% of the total variance. We investigated the variance inflation factors in our model to test for multicollinearity. None of the variance inflation factors was above the threshold of 5 (Hair *et al.*, 2014). Hence, neither common method bias nor multicollinearity should be deemed as a threat to the results of our analysis.

3.2 Analysis

3.2.1 SEM–PLS analysis. We applied SEM–PLS for our initial analysis since it is having less restrictive data and sample size requirements and it allows for the investigation of complex relationships between variables such as moderating effects (Hair *et al.*, 2012; Van Reijssen *et al.*, 2015). We proceeded in two steps. The first is the measurement model, which will be explained next and is followed by the structural model.

3.2.2 Measurement model. The most important aspect of the measurement model is to test for convergent and discriminant validity as part of confirmatory factor analysis procedure. This is necessary to proceed subsequently with the structural model analysis. Accordingly, we first assessed the reliability and validity of the constructs. Convergent validity ensures that the statements of the questions given to the firm managers are sufficiently correlated with the expected latent variable. In a second step, we assessed discriminant validity which as an indicator for, or lack of, correlation between the respective latent variables. The results of our measurement model are in line with the general conventions in the field. For instance, average variance extracted is well above the 0.5 cut-off point. Discriminant validity is

Table 1.
Sample characteristics

	Freq.	%
<i>Position of the 'key informant'</i>		
General Manager	10	10
HR Director/Manager	49	48
Other Director/Manager	18	18
Expert	11	11
Others (Board Member, Spokesperson, etc.)	14	14
Total	102	100
<i>Industry</i>		
Manufacturing	60	59
Service	42	41
Total	102	100

	Convergent validity	Composite reliability	Cronbach's Alpha	AVE
<i>Innovation performance (INNOPER)</i>				
Compared to its competitors, how successfully has your company managed to create innovations/new operating methods in the following areas over the past year? (1 = very poorly, 5 = very well)				
Products and services for customers	0.825	0.909	0.875	0.667
Production methods and processes	0.838			
Management practices	0.793			
Marketing practices	0.815			
Business models	0.812			
<i>Internal relational capital (InternalC)</i>				
To what extent do the following statements on internal cooperation apply to your company? (1 = completely disagree, 5 = completely agree)				
Different units and functions within our company – such as R&D, marketing and production – understand each other well	0.925	0.937	0.899	0.831
Our employees frequently collaborate to solve problems	0.902			
Internal cooperation in our company runs smoothly	0.908			
<i>External relational capital (ExternalC)</i>				
To what extent do the following statements on external cooperation apply to your company? (1 = completely disagree, 5 = completely agree)				
Our company and its external stakeholders – such as customers, suppliers and partners – understand each other well	0.835	0.906	0.844	0.763
Our company and its external stakeholders frequently collaborate to solve problems	0.887			
Cooperation between our company and its external stakeholders runs smoothly	0.898			
<i>Trust Capital (TrustC)</i>				
To what extent do the following statements on trust apply to your company? (1 = completely disagree, 5 = completely agree)				
The way our company operates is characterised by an atmosphere of trust	0.808	0.942	0.922	0.764
We keep our promises and agreements	0.908			
Our company seeks to take the interests of its stakeholders into account in its operations	0.886			
The expertise of our company inspires trust in stakeholders	0.934			
The image and reputation of our company inspire trust in stakeholders	0.828			
<i>IT practices (ITP)</i>				
To what extent do the following statements on IT management practices apply to your company? (1 = completely disagree, 5 = completely agree)				
Our company uses information technology to enable efficient information search and discovery	0.821	0.936	0.916	0.71
Our company uses information technology in internal communication throughout the organization	0.886			

IT practices in
relational and
trust capital

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Table 2.
The measurement
(continued) model and constructs

Table 2.

	Convergent validity	Composite reliability	Cronbach's Alpha	AVE
Our company uses information technology to communicate with external stakeholders	0.903			
Our company uses information technology to analyse knowledge in order to make better decisions	0.893			
Our company uses information technology to collect business knowledge related to its competitors, customers and operating environment, for example	0.842			
Our company uses information technology to develop new products and services with external stakeholders	0.690			

confirmed by the square root of all the average variance extracted is higher than the correlation between the constructs (Fornell and Larcker, 1981).

The full results are presented in Tables 2 and 3. Table 2 shows the measurements model and full constructs. It provided information about the convergent validity of the constructs as well as composite reliability, Cronbach's alpha values and the average variance extracted. We did not drop items from initial constructs, because all the factor loadings in Table 2 are well above the threshold for significant factor loading of 0.5 (Hair et al., 2012). Composite reliability and Cronbach's alpha for all items are above the required 0.7 threshold (Hair et al., 2012). Composite reliability values reach from 0.906 for external relational capital to 0.942 for trust capital.

Table 3 shows the discriminant validity of the latent constructs as well as the descriptive statistics. Diagonals in italic are the square roots of the average variance extracted and off-diagonal are the bivariate correlations between the constructs. All correlation coefficients between variables in Table 3 are positive with the strongest positive relationship between internal and external relational capital and trust capital (0.764 and 0.748 respectively) and moderate positive correlation between internal and external relational capital and IT practices (0.588 and 0.591 respectively). The results in Table 3 also confirm that IC dimensions enhance organizational performance mostly through their combinations and interactions (Inkinen, 2015). Given that all the measures are in line with commonly applied thresholds, we decided to proceed with the structural model analysis.

3.2.3 *Structural model.* The structural model is used to test the hypothesised relationships. The overall model indicators were largely sufficient for the purpose of our analysis. For instance, the Tenenhaus goodness-of-fit index (GoF) was 0.451 and the average block variance inflation factors as well as average full collinearity variance inflation factors were well below the threshold of 5.

Table 3.

Discriminant validity and descriptive statistics

	Mean	SD	1	2	3	4	5
1 Innoper	3.75	0.77	<i>0.817</i>				
2 InternalC	3.73	0.85	0.679**	<i>0.912</i>			
3 External	3.82	0.78	0.631**	0.691**	<i>0.874</i>		
4 TrustC	4.06	0.83	0.674**	0.764**	0.748**	<i>0.874</i>	
5 ITP	3.79	0.84	0.657**	0.588**	0.591**	0.686**	<i>0.843</i>

Note(s): Diagonals in italic are the square roots of the average variance extracted and off-diagonal are the bivariate correlations between the constructs. **. Correlation is significant at the 0.01 level (2-tailed). AVE in italic shown on diagonal

The R -squared for the innovation performance was 0.28. Overall, we found support for most of our hypothesis. We found that internal relational capital was positively associated with innovation performance ($\beta = 0.407$, $p < 0.001$), hence, confirmed [hypothesis 1](#). Trust capital was positively association with innovation performance ($\beta = 0.258$, $p = 0.003$) and hence supports [hypothesis 3](#). However, the association between external relational capital and innovation performance was only marginal significant with a path coefficient of 0.146 and a P value of 0.064.

We also conformed all the moderating effects from IT practices, hence finding support for [hypothesis 4a](#), [4b](#), and [4c](#). The full results can be found in [Table 4](#).

We also included industry and firm size as a control variable. However, the inclusion did not change any of the associations or the overall model structure and are therefore not reported here.

3.3 Fuzzy set qualitative comparative analysis

Fuzzy set qualitative comparative analysis (fsQCA) is still a relatively recent addition to the broader management and innovation performance literatures ([Ragin, 2008](#); [Fiss, 2011](#); [Greckhamer et al., 2018](#)). The key advantage as a complementary tool to traditional symmetric methods such as SEM-PLS is that it allows researchers to investigate alternative multidimensional solutions without *a priori* assumptions of their nature ([Woodside, 2013](#)). This has also led to a growing interest in the method in the field of innovation and knowledge management (e.g. [Nguyen et al., 2019](#); [Castro et al., 2013](#)).

In a first step, the variables need to be transformed into conditions, a process referred to as calibration. In our case, we follow [Ordanini and Maglio \(2009\)](#), and [Pappas et al. \(2016\)](#) and use the scales as cut off points. In particular, we chose as full membership the value of 5, the crossover point was 3, and full non-membership was 1. That seemed appropriate given that previous studies do not necessarily hint towards differing interpretations of the scales neither empirically nor theoretically.

After the calibration, a necessary condition analysis is being conducted. This is done in order to identify conditions which might be necessary, as compared to only sufficient on their own to explain the outcome. The full results are presented in [Table 5](#). We can derive from it that none of the conditions reaches the consistency value of greater than 0.9, either in its presence or absence. We can therefore conclude that none of the single conditions is necessary to reach the outcome of high innovation performance. Full results are provided in [Table 5](#).

	Path coefficient	p -value	Hypothesis supported
H1 : Internal relational capital is positively related to innovation performance	0.407	$p < 0.001$	Yes
H2 : External relational capital is positively related to innovation performance	0.146	$p = 0.064$	No
H3 : Trust capital is positively related to innovation performance	0.258	$p = 0.003$	Yes
H4a : IT practices positively moderate the relationship between internal relational capital and innovation performance	0.405	$p < 0.001$	Yes
H4b : IT practices positively moderate the relationship between external relational capital and innovation performance	0.158	$p = 0.050$	Yes
H4c : IT practices positively moderate the relationship between trust capital and innovation performance	0.280	$p = 0.001$	Yes

Table 4.
PLS test results

Table 5.
Necessary condition
analysis results

Conditions	Innovation performance Consistency	Coverage
InternalC	0.6694	0.8125
~InternalC	0.4306	0.4189
ExternalC	0.7351	0.7635
~ExternalC	0.3589	0.4037
TrustC	0.7480	0.7723
~TrustC	0.3553	0.4023
ITPractise	0.7024	0.7861
~ITPractise	0.3951	0.4123
Note(s): ~ stands for 'NOT'		

Following the necessary condition analysis, we analyse sufficient conditions. In order to do so, fsQCA provides causal combinations of the outcomes in the form of truth tables. Following [Fiss \(2011\)](#) and [Castro *et al.* \(2013\)](#) we chose a consistency level of 0.75 and a frequency threshold of 1.

After that, we focus our attention on the intermediate solutions that emerge from the Boolean algorithm. The truth table as well as the parsimonious solution are provided in [Table A2](#) for completeness. The full results are presented in [Table 6](#), however, of greatest interest are those configurations that have the highest raw coverage, which might be seen as the fsQCA equivalent to R in traditional regression analysis. The signs are interpreted as follows, ⊗ means the condition is absent, ● means the condition is present, and blank space means that the condition is not relevant to achieve the outcome. Solutions 1 to 4 show configurations that lead to high innovation outcomes. Solutions 5 and 6 show configurations that lead to the absence of high innovation outcomes.

Solution 1 shows that high external relational capital and high trust capital lead to high innovation outcomes. This highlights the importance of open innovation (external orientated) strategies that often include broad range of external stakeholders based on mutual trust and reciprocity.

Condition Solution	Configurations for high innovation performance				Configurations for low innovation performance	
	1	2	3	4	5	6
InternalC		●	●			⊗
ExternalC	●		●	⊗	⊗	⊗
TrustC	●			⊗	⊗	⊗
ITP		●		●	⊗	●
Raw coverage	0.653	0.545	0.582	0.194	0.596	0.149
Unique coverage	0.094	0.033	0.012	0.061	0.515	0.069
Consistency	0.813	0.884	0.870	0.772	0.858	0.750
Overall solution consistency			0.807			0.841
Overall solution coverage			0.825			0.665
Consistency cut-off			0.757			0.750
Frequency cut-off			1			1

Table 6.
fsQCA results

Note(s): ⊗ = absent, ● = present, blank space = 'do not care'. Consistency reflects the sample supports the solution, coverage reflects the power of the solution, as the 'R' in regression method

Solution 2 shows that high internal relational capital and high IT practises drive high innovation outcomes. This indicates that in the case of internal oriented innovation strategies (closed approach to innovation), strong internal relationships should be combined with IT practises to develop high innovation performance.

Solution 3 suggests that high internal and external relational capital in combination can also lead to high innovation performance outcomes. This suggests that innovation in such firms is driven by their ability to successfully combine multiple network and internal and external knowledge.

Solution 4 suggests that in the absence of external relational capital and trust capital, high IT practise can also drive high innovation performance. However, this only applies to a relatively small set of firms in our sample as indicated by the relatively low consistency score of 0.194.

Overall, the high innovation performance outcome configurations reveal that IT practise appears to matter most for firms that are more inward oriented. IT practise seem to matter to a lesser extend for those firms that drive innovation performance through external relational capital.

Lastly, we also tested for low performance outcomes. That is because we want to understand if the absence of certain conditions also leads to the absence of the desired outcome, in our case high innovation performance. Although, the resulting solutions provide a mixed picture, which indicates that it is not the absence of a certain condition that also leads to the absence of high innovation performance outcomes, we can argue that lack of external relationships, trust and adequate technology to support knowledge processes will most likely lead to low innovation performance.

In order to test for the robustness of our fsQCA results, we followed [Fiss \(2011\)](#) and changed the consistency level from 0.75 to the more conservative 0.8. The results overall lend support to our initial ones and indicate a dichotomy between inward and outward oriented innovation strategies. The full results of the robustness test are presented in [Table A1](#).

4. Discussion

Based on direct links between relational (internal and external) capital and trust capital, and innovation performance, our findings indicate that intra-organizational networks of firm's social relations and trust embedded in internal and external relationships were positively related to innovation performance. However, external relational capital was found to be only marginal significant for innovation performance. Our findings suggest that internal collaboration and relations in Taiwanese companies are more important for innovation processes and outcomes than relations with different external stakeholders, which is in line with [Cabrilo et al. \(2018a\)](#) who found the same results in Serbian business environment. Having in mind that external relational capital does not affect innovation performance, it can be concluded that Taiwanese companies still mostly follow a closed approach to innovation, integrating mostly internal ideas and knowledge in the innovation process. This result does not coincide with the argument of a number of authors who ascertain that openness and access to external networks, and collaboration with external stakeholders are essential for effective innovation process ([Chesbrough, 2003](#); [Maklan et al., 2008](#); [Rass et al., 2013](#)). Advocates of open innovation warn that the company that is focused only on internal interactions does not succeed in innovation; it is necessary to look outward, incorporate knowledge and ideas from various external sources in order to be responsive at the wider market and stay competitive and successful. Our findings are not consistent with studies that explore internal and external relational capital separately ([Hsu and Fang, 2009](#); [Castro et al., 2013](#); [Inkinen et al., 2014](#); [Delgado-Verde et al., 2011](#)), as they found the same positive influence from both, internal and external relational capital, on innovation performance in Finnish and Spanish companies.

The positive influence of trust capital on innovation performance is due to efficiency and effectiveness of knowledge creation and sharing processes generated from a knowledge friendly environment induced by trust in intra and inter-firm relationships (Blomqvist, 2002). The finding confirms that more trust embedded in a firm's internal and external firm's relationships facilitates knowledge flows within and across the boundaries of organizations and exploitation of both, the internal knowledge and external ideas in innovation process, which positively impacts innovation performance. This finding reveals that trust capital improves innovation capability, as trust improves socialization (Lawson *et al.*, 2009), knowledge sharing (Nahapiet and Ghoshal, 1998), intra- and inter-firm learning (Rebolledo and Nollet, 2011), R&D collaboration and new product development projects (Bstieler, 2006).

Concerning the moderation effects of IT practices, we find that IT practices positively moderate the relationship between all selected IC components (internal relational capital, external relational capital and trust capital) and innovation performance. Our evidence reveals that the more technology a company uses in managing knowledge, the better it helps to leverage the potential innovation performance effects of intra- and inter-firm networks and relationships over time. This result is consistent with most of previous studies (Carayannis, 1999; Alavi and Leidner, 2001; Inkpen and Dinur, 1998; Kale *et al.*, 2000; Pagani and Pardo, 2017; Adamides and Karacapilidis, 2018; Majchrzak and Malhotra, 2013). Furthermore, in line with Li *et al.* (2008), Qureshi and Evans (2013b), and Adamides and Karacapilidis (2017), we found that IT is important for companies in Taiwanese business environment to capitalize on trust in networks (either internal or external, or both) for innovation. When trust is complemented with knowledge supportive technology, firms can facilitate knowledge sharing and knowledge transfer, enhance organizational learning and better leverage knowledge-based resources in innovation processes (Andreeva and Kianto, 2012; Kianto *et al.*, 2014; Qureshi and Evans, 2013b; Adamides and Karacapilidis, 2017).

From the configurational analysis, we point out that there are at least three paths through which selected IC components with or without IT practices lead to increased innovation performance in companies. Hence, equifinality is present. This analysis confirms that an innovation strategy relates to a firm's choice of internal know-how development and external sourcing at the firm level (Cassiman and Veugeliers, 2006). The solutions reveal that high innovation performance requires either strong relations full of trust with external stakeholders such as customers, suppliers, or competitors, or strong intra-firm relationships complemented with strong inter-firm networks or IT practices. These findings reveal that Taiwanese companies implementing open innovation strategies in order to benefit from external sources of knowledge, have to build trustful external networks with or without support of advanced technology. The use of technology in knowledge processes enhances innovation capability only if there is a strong internal network. This finding reveals that Taiwanese companies report better innovation performance when IT practices are aimed to facilitate internal communication, collaboration, 'in-house' knowledge sharing, internal R&D projects and innovation processes. Finally, the third solution discloses that complex interplay between intra- and inter-organizational network relationships may help Taiwanese companies to achieve high innovation performance (Nagy *et al.*, 2018; Najafi-Tavani *et al.*, 2018; Delgado-Márquez *et al.*, 2018), which have so far mostly been investigated in isolation of each other. Our findings hence go beyond traditional symmetric studies which explored the association between multidimensional IC and innovation performance (e.g. Cabello-Medina *et al.*, 2011; Delgado-Verde *et al.*, 2011; Inkinen *et al.*, 2014; Cabrilo *et al.*, 2018a). In particular, we provide initial empirical evidence for the combinatory nature of intangible assets as suggested in the wider literature (e.g. Milgrom and Roberts, 1995; Roberts, 2007).

5. Conclusions

This study investigates whether IT practices moderate the effects of internal and external relational capital, and trust capital, on innovation performance and fills the gap on the role of technological proficiency in increasing organizational capacity to generate superior innovation performance from relationships with stakeholders and trust embedded in these relationships. The research was motivated by adjacent studies which allude that specific constellations of certain IC dimensions (rather than all IC dimensions) and certain knowledge-based managerial activities (such as IT practices) affect organizational innovation performance (e.g. Bounfour, 2003; Kianto *et al.*, 2014; Cabrilo *et al.*, 2018b).

Our findings provide important theoretical, empirical and practical contributions. Theoretically, we use a framework which combines the technological perspective of knowledge management and IC which has so far been overlooked in the existing conceptual and empirical discussions. This framework has been tested to examine the applicability of several theories in the emerging economy of Taiwan where IT is well established. By using a combination of symmetric and asymmetric statistical methods, we gain more detailed insights into equifinality in the context of networks, trust, IT practices, and innovation performance and identify configurations of intangible resources and technological capabilities that enhance innovation performance. Testing our hypothesis by applying fsQCA, we also provide new ground for methodological discussions in the field of innovation. From a managerial perspective, this study provides new knowledge about IT utilization which practitioners may use to capitalize on knowledge assets and facilitate innovation performance.

Our research has three major limitations. First, we applied the key informant approach to data collection assuming that employees in specific positions are knowledgeable to provide relevant responses. However, for relationships, especially external ones, it would have been of interest to consider an external view of network actors. Second, results were based on subjective measures of innovation performance collected through the survey. Third, the study was limited to Taiwanese companies with at least 200 employees. It might well be that the economically significant small business sector has distinct networking and trust building in internal and external relationships, and that innovation performance depends on other macroeconomic effects.

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Table A1.
Robustness test
results fsQCA

Configurations for high innovation performance			
Condition Solution	1		2
InternalC	●		●
External			●
TrustC			●
ITP	●		
Raw coverage	0.545		0.539
Unique coverage	0.099		0.093
Consistency	0.884		0.874
Overall solution consistency		0.876	
Overall solution coverage		0.639	
Consistency cut-off		0.840	
Frequency cut-off		1.000	

Table A2.
Truth table and
parsimonious solution
for high innovation
performance outcomes

Truth table and ideal solutions						
Case	InternalC	External	TrustC	ITP	Frequency	Raw consist.
1	0	0	0	0	23	0.28
2	1	1	1	1	20	0.88
3	0	1	1	1	7	0.77
4	1	1	1	0	3	0.84
5	0	0	0	1	3	0.76
6	1	1	0	1	2	0.85
7	1	0	1	1	2	0.84
8	0	1	1	0	2	0.79
9	1	0	0	1	1	0.87
10	1	1	0	0	1	0.79
11	1	0	0	0	1	0.67
12	0	1	0	1	1	0.67
13	0	1	0	0	1	0.64
14	0	0	1	0	0	0
15	1	0	1	0	0	0
16	0	0	1	1	0	0

Note(s): Attributes are labelled as follows: 1 = membership in set; 0 = no membership in the set

Condition Solution	Parsimonious solution high innovation performance			IT practices in relational and trust capital
	1	2	3	
InternalC			●	779
External		⊗	●	
TrustC	●			
ITP		●		
Raw coverage	0.748	0.261	0.582	
Unique coverage	0.138	0.076	0.038	
Consistency	0.772	0.794	0.870	
Overall solution consistency		0.773		
Overall solution coverage		0.866		
Consistency cut-off		0.757		
Frequency cut-off		1.000		

Table A3.

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