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Managing innovation through co-production in interfirm partnering☆

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ABSTRACT

Innovation is a key source of knowledge-based competitive advantage. However, research on how firms' co-production enhances innovation is scarce. Thus, this study not only integrates the three dimensions of social capital and examines these dimensions' separate effects on co-production but also incorporates the roles of absorptive capacity and self-efficacy, analyzing their effect on innovation. This study uses a random sampling method to select 221 firms in Taiwan and employs structural equations modeling to test the relationships. The findings indicate that absorptive capacity and self-efficacy enhance innovation. Co-production positively affects innovation, absorptive capacity, and self-efficacy. The findings also support positive relationships between social capital and co-production. This study contributes to the little research that explores partnership co-production in innovation.

1. Introduction

Innovation in the era of knowledge economy becomes increasingly important for firms to sustain competitive advantage (Huarng, 2010; Subramaniam & Youndt, 2005). Innovation may come from outside the firms; such firms intensively develop partner relationships to increase new product development opportunity and improve innovation (Frost & Zhou, 2005; Lai & Chang, 2010; Paulin & Ferguson, 2010). Recent research emphasizes that co-production emerges from the reciprocal interaction processes in the inter-organizational context (Ballantyne & Varey, 2006). Specifically, co-production enhances the collaborative nature of value co-creation and shows the both parties' interest in collaborating effectively (Pires, Dean, & Rehman, 2015). Therefore, co-production becomes a key driver of innovation (Chen, Tsou, & Ching, 2011). However, empirical research on co-production activities in partner relationships remains scare (Payne, Storbacka, & Frow, 2008; Vargo, Maglio, & Akaka, 2008). This study contributes to filling this gap by addressing how firms integrate their partners as co-creators into the innovation process.

Co-production with partners can co-create value at a level that individual firms would struggle to achieve. In other words, co-production is a complex process that involves integrating resources from diverse networks (Vargo, 2009). This study proposes a framework for co-production that stems from social capital approaches to organization. Indeed, social capital is an important part of co-production in which firms discover new opportunities and obtain new knowledge. Thus, social capital, as a strategic resource, may affect the determinants of co-production.

Studies on collaborative innovation suggest that co-production enhances innovation (Chen et al., 2011). On the one hand, firms with an adequate level of absorptive capacity tend to be sensitive to technological opportunities in innovation and proactive in exploiting such opportunities (Nicholls-Nixon & Woo, 2003; Rothaermel & Hill, 2005). On the other hand, building self-efficacy is an important first step toward developing a skill (Bandura, 1997). Firms with high confidence in their ability to provide valuable knowledge are more likely to accomplish specific tasks (Chen, Greene, & Crick, 1998). Therefore, co-production may operate through absorptive capacity and self-efficacy to increase innovation. These two complementary indirect effects explain the additional variance of innovation.

Service-dominant (S-D) logic views alliance partnerships as value co-creation networks (Paulin & Ferguson, 2010; Vargo & Lusch, 2008). Following this stream of research, this study applies the conceptual S-D logic to analyze co-production in partnership. This study investigates, first, the effects of absorptive capacity and self-efficacy on innovation; second, the direct effects of co-production on innovation, absorptive capacity, and self-efficacy; and third, the direct effects of social capital on co-production. Accordingly, the findings enrich the literature by integrating the research streams on social capital and co-production in the development of a comprehensive model for Taiwanese firms and their alliance partners. In particular, this study explores unexamined roles of co-production, absorptive capacity, and self-efficacy as mediators

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between social capital and innovation. The structural equations modeling (SEM) results offer a comprehensive and complete explanation to understanding the relationships among the factors that enhance innovation.

The rest of this study proceeds as follows: Section 2, literature review and hypotheses; Section 3, method; Section 4, analysis and results; Section 5, discussion; and Section 6, conclusions and contributions.

2. Literature review and hypotheses

2.1. Innovation

Damanpour (1991) defines innovation as the adoption of an internally generated or purchased device, system, policy, program, process, product, or service that is new to the adopting organization. In this respect, innovation encompasses the generation of novel ideas for products and services, as well as business processes, technological capabilities, and manufacturing methods. In general, innovation consists of product, process, and administrative innovation (Subramanian & Nilakanta, 1996).

2.2. Absorptive capacity

Absorptive capacity refers to the ability to recognize the value of new information, assimilating and applying that information to commercial ends (Cohen & Levinthal, 1990). Zahra and George (2002) define absorptive capacity as the set of organizational routines and processes by which firms acquire, assimilate, transform, and exploit knowledge to produce a dynamic organizational capability.

Tsai (2001) finds that absorptive capacity affects both innovation and performance. Firms with a high level of absorptive capacity are likely to enhance innovation through the exploitation of partners' knowledge (Nicholls-Nixon & Woo, 2003; Rothaermel & Hill, 2005). Firms' absorptive capacity allows for the effective expansion of organizational and technological boundaries (Rothaermel & Alexandre, 2009). Through this expansion, firms develop successful innovation practices. In other words, firms with a high level of absorptive capacity have the ability to enhance innovation.

H1. Absorptive capacity positively affects innovation.

2.3. Self-efficacy

Self-efficacy refers to a firm's belief in the capability to perform a specific task (Bandura, 1997). Cervone and Peake (1986) describe self-efficacy as the product of dynamic cognitive processes by which a firm integrates diverse hints to consider the components of the overall activity. In general, self-efficacy affects how firms decide on the ability to perform tasks (Bandura, 1997). Firms with high self-efficacy are likely to show intrinsic interest in the tasks and persistence in the face of challenges, and do much effort in tasks (Chen et al., 1998).

Firms with high self-efficacy can set the goals and make an effort on task performance (Bandura, 1997; Beauregard, 2012). Thus, self-efficacy provides a theoretically sound context in which firms can analyze tacit and cognitive knowledge (Endres, Endres, Chowdhury, & Alam, 2007). As a result, firms with high self-efficacy present high confidence in knowledge transfer because firms can recognize new knowledge's value. Self-efficacy is an important determinant of creativity and innovation (Tierney & Farmer, 2011). Therefore, firms with a high level of self-efficacy tend to be creative and hence, highly innovative.

H2. Self-efficacy positively affects innovation.

2.4. Co-production

Co-production refers to the constructive participation in creation and delivery (Auh, Bell, McLeod, & Shih, 2007). Co-production enhances both parties' ability to share information and cooperate. Thus, co-production helps both parties increase coordination (Dyer & Singh, 1998). Muthusamy and White (2005) point out that co-production fosters a climate of openness and reciprocity, which leads to mutual understanding. Such mutual understanding results in positive outcomes (Auh et al., 2007). Most importantly, co-production creates a base for future integration of knowledge (Frost & Zhou, 2005).

External technical resources generally come from co-production and technology transfer. Particularly, innovation is a social process because innovation activities involve the implementation of ideas, and implementation relies heavily on people's involvement (Schilling & Phelps, 2007). Thus, collaboration positively affects innovation practices (Faems, Van Looy, & Debackere, 2005). The underlying rationale is that co-production provides access to new resources, abilities, and knowledge to achieving innovation (Chen et al., 2011; Malhotra, Gosain, & El Sawy, 2005; Wang, Bradford, Xu, & Weitz, 2008).

H3. Co-production positively affects innovation.

Coordination capability facilitates absorptive capacity (Jansen, Van Den Bosch, & Volberda, 2005). Coordination with partners frequently exposes the firm to new knowledge (Das & Kumar, 2007), which results in learning experiences that enhance absorptive capacity. In other words, co-production easily and effectively allows each partner to share strengths by exchanging different resources, ideas, and knowledge (Chen et al., 2011). As such, co-production expedites skills and experience development in knowledge transfer. Such knowledge integration during co-production assists in the development of absorptive capacity (Frost & Zhou, 2005).

H4. Co-production positively affects absorptive capacity.

Co-production facilitates good information and knowledge exchange between partners and consequently enhances the firms' self-efficacy. The underlying rationale is that the increased and broad competence and skills are likely to enhance confidence in behaviors such as providing suggestions for improvement and problem solving (Dong, Evans, & Zou, 2008). Co-production provides firms with resources and information. This provision affects the belief that firms can perform tasks effectively (Etgar, 2008).

H5. Co-production positively affects self-efficacy.

2.5. Social capital

The structural dimension of social capital includes social interactions; the relational dimension of social capital refers to assets rooting in these relationships such as trust; attributes like shared values embody social capital's cognitive dimension (Nahapiet & Ghoshal, 1998; Tsai & Ghoshal, 1998).

2.5.1. Social interactions

Social interactions are channels that allow information and resources flow and one party's access to the other party's resources (Tsai & Ghoshal, 1998). Hansen (1999) defines social interactions as regularly occurring contacts between groups of partners. In general, the key determinants of effective social interactions comprise closeness, frequent contacts, and communication (Becerra & Gupta, 2003).

Social interactions facilitate knowledge transfer between parties, thus establishing the foundation for coordination (Jones, Hesterly, & Borgatti, 1997). Similarly, Wagner and Bukó (2005) suggest that social interactions are crucial for the development of a stable and cooperative relationship in a knowledge-sharing network. Social interactions can increase connectivity, thus helping partners exchange resources and engage in mutual problem solving (Hoegl, Parboteeah, & Munson, 2003). Therefore, social interactions increase the incidence of co-production.

H6. Social interactions positively affect co-production.

2.5.2. Trust

Morgan and Hunt (1994) define trust as the integrity, honesty, and confidence that one party perceives in the other. According to Doney and Cannon (1997), trust in an organization is the confidence in the quality and reliability of products or services. Indeed, trust is a crucial element in the development of an interest in maintaining a long-term relationship (Morgan & Hunt, 1994).

Trust is a facilitator of cooperative behavior in collaborations (Dwyer, Schurr, & Oh, 1987). Marketing channel research empirically verifies the relationship between trust and cooperation (Lancastre & Lages, 2006; Payan & Svensson, 2007). Trust characterizes effective information exchange, interpretation, and integration during co-production. In this case, trust favors partners' participation in collective activities in which both parties all have a collective goal orientation (Leana & Van Buren, 1999). Thus, trust facilitates the motivation of co-production.

H7. Trust positively affects co-production.

2.5.3. Shared values

Shared values refer to a shared code or paradigm that facilitates a common understanding of the collective objectives and the proper behavior within a social system (Nahapiet & Ghoshal, 1998). Shared values also describe the consistency or compatibility of goals, policies, and beliefs of the exchange parties (Morgan & Hunt, 1994). In general, shared values can be a cue for expecting the other party to facilitate mutual goals.

To enjoy co-production synergies, both parties must share values (Saxton, 1997). The underlying rationale is that shared values foster connections, which in turn increase mutual understanding, and facilitate cooperation and collaboration (Emden, Calantone, & Droge, 2006). Shared values may tie a loosely coupled network system and promote co-creation in the inter-organizational context (Molina-Morales & Martínez-Fernández, 2010; Tsai & Ghoshal, 1998). Thus, shared values are likely to affect firms' involvement in co-production.

H8. Shared values positively affect co-production.

3. Method

3.1. Conceptual framework

Drawing from previous research hypotheses and discussions, this study develops a framework that links social capital, co-production, absorptive capacity, and self-efficacy to innovation (Fig. 1).

3.2. Data collection and sampling

The study uses a random sample from the top 5000 Taiwanese firms in the yearbook of the China Credit Information Service, Ltd. Taiwan is one of the leading computer producers in the world. Because these firms participate in the original design manufacturer (ODM) or electronics manufacturing service (EMS) networks, these firms co-produce with partners to enhance innovation. Therefore, 550 firms receive questionnaires and a cover page that explains the nature of the study. Out of the 258 surveys firms returned, 221 are complete in all predictor and dependent variables, resulting in a 40.2% response rate.

3.3. Constructs and variables

The literature review justifies variables selection. This study classifies variables according to a five-point Likert scale ranging from (1) strongly disagree to (5) strongly agree. In the final model, 28 items capture social capital, co-production, absorptive capacity, self-efficacy, and innovation. For the measurement of innovation, the five

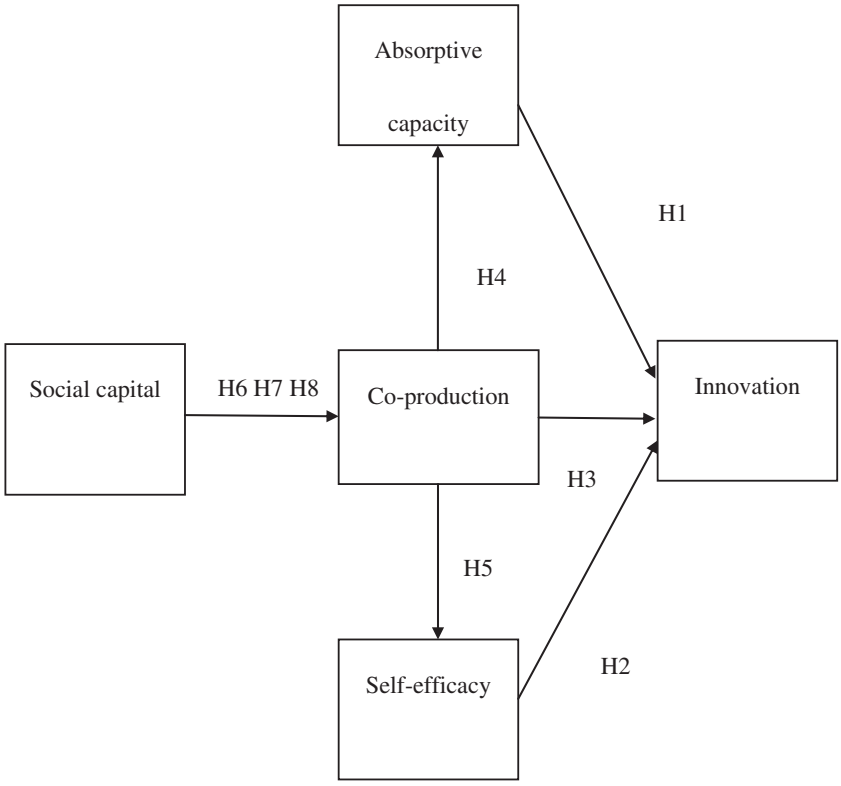

Fig. 1. Conceptual framework.

items that measure product, process, and administrative innovation come from Chen, Lin, and Chang (2009). The four items measuring co-production come from Auh et al. (2007) and Chan, Yim, and Lam (2010). The four items measuring social interactions come from Hansen (1999) and Doney and Cannon (1997). The five items measuring trust come from Doney and Cannon (1997). The three items measuring shared values come from Tsai and Ghoshal (1998) and Ko, Kirsch, and King (2005). The three items measuring self-efficacy come from Spreitzer (1995), and the four items that measure absorptive capacity come from Chang, Gong, and Peng (2012) and Jansen et al. (2005).

Regarding reliability, this study computes the composite reliability and the Cronbach's alpha for each construct. The Cronbach's alphas are all greater than 0.80, thus supporting the measurement's reliability. All composite reliability (CR) estimates are greater than 0.80 and all average variance extracted (AVE) estimates are greater than the recommended value of 0.50 (Fornell & Larcker, 1981). Regarding convergent validity evidence, all the items have significant loadings on their respective constructs (Anderson & Gerbing, 1988). This study assesses discriminant validity for two constructs by constraining the estimated correlation parameter between those two constructs to a value of 1.0, and then performing a chi-square difference test on the values for the constrained and unconstrained models (Anderson & Gerbing, 1988). The significantly lower χ^2 value for the unconstrained model indicates good discriminant validity. Table 1 shows the means, standard deviations, measurement properties, and correlations matrix for the constructs.

4. Analysis and results

4.1. Descriptive statistics

The sample characteristics are (1) industry type (manufacturing sector, 21.3%; high-tech sector, 78.7%), (2) firm age (≤5 years, 9.5%; 5–10 years, 29.9%; 10–15 years, 24%; 15–20 years, 24.8%; ≥20 years, 11.8%), (3) sales revenue (≤200 million, 3.7%; 200 million to 1 billion, 7.6%; 1–5 billion, 14.2%; 5–10 billion, 36.5%; ≥10 billion, 38%), and (4) number of employees (≤50 employees, 1.8%; 50–200 employees, 20.4%; 200–500 employees, 30.8%; 500–1000 employees, 38%; ≥1000 employees, 9%).

4.2. Hypothesis tests

This study applies SEM using LISREL 8.52 to examine the hypotheses. Table 2 reports the results of the SEM model. The fit of model is acceptable (chi-square (339) = 1102.71, p = 0.00, GFI = 0.82, NFI = 0.92, NNFI = 0.93, CFI = 0.94, PNFI = 0.81, RMR = 0.08, RMSEA = 0.09). Absorptive capacity positively affects innovation ($\beta = 0.20$, t = 3.29); therefore, H1 receives support. Self-efficacy positively affects innovation ($\beta = 0.18$, t = 2.61); therefore, H2 receives support. Table 2 shows co-production positively affects innovation ($\beta = 0.33$, t = 4.62); therefore, H3 receives support. Co-production positively affects absorptive capacity ($\beta = 0.44$, t = 6.53); therefore, H4 receives support. Co-production positively affects self-efficacy ($\beta = 0.39$, t = 5.21); therefore, H5 receives support. Social interactions positively affect co-production ($\gamma = 0.44$, t = 4.75); therefore, H6 receives support. Trust affects co-production positively ($\gamma = 0.22$, t = 2.51); therefore, H7 receives support. Shared values positively affect co-production ($\gamma = 0.15$, t = 2.25); therefore, H8 receives support.

Table 2
SEM results.

Proposed path	H	Coefficient	*t*-value
Absorptive capacity → innovation	H1	0.20*	3.29
Self-efficacy → innovation	H2	0.18*	2.61
Co-production → innovation	H3	0.33*	4.62
Co-production → absorptive capacity	H4	0.44*	6.53
Co-production → self-efficacy	H5	0.39*	5.21
Social Interactions → co-production	H6	0.44*	4.75
Trust → co-production	H7	0.22*	2.51
Shared values → co-production	H8	0.15*	2.25

* $p < 0.05$.

5. Discussion

5.1. Co-production and innovation: Direct effect and indirect effect

In accordance with Malhotra et al. (2005) and Wang et al. (2008), this study reports positive relationships between co-production and innovation. Specifically, co-production has both a direct effect on innovation and an indirect effect through two variables. First, co-production through absorptive capacity facilitates the development of skills and experience during knowledge transfer between parties (Frost & Zhou, 2005). Second, co-production fosters firms' self-efficacy and the ability to apply the new knowledge (Dong et al., 2008). In summary, co-production facilitates the development of absorptive capacity and self-efficacy, thus enhancing innovation. In this study, absorptive capacity and self-efficacy theoretically and empirically mediate between co-production and innovation.

5.2. Social capital and co-production

First, in line with Hoegl et al. (2003), social interactions positively affect co-production. Specifically, social interactions dissolve the boundaries between organizations (Songailiene, Winklhofer, & McKechnie, 2011). To this end, social interactions stimulate the formation of co-production and result in value co-creation. Second, trust induces co-production. Trust helps create the relational environment fundamental to cooperation (Dwyer et al., 1987). Third, consistent with Emden et al. (2006), this study reports that shared values positively affect co-production. Shared values allow crossing inter-organization boundaries and accessing partners' resources (Molina-Morales & Martínez-Fernández, 2010). This advantage favors firms' decision on co-production.

Table 1
Means, standard deviations, measurement properties, and correlations.

Variables	Mean	SD	CR	AVE	1	2	3	4	5	6	7
1. Social interactions	3.4	0.7	0.88	0.64	0.91						
2. Trust	3.5	0.7	0.92	0.71	0.55*	0.92					
3. Shared values	2.9	0.8	0.87	0.69	0.20*	0.23*	0.86				
4. Co-production	3.3	0.7	0.87	0.63	0.53*	0.45*	0.26*	0.86			
5. Absorptive capacity	3.5	0.8	0.91	0.72	0.20*	0.24*	0.11	0.41*	0.91		
6. Self-efficacy	3.4	0.8	0.89	0.74	0.17*	0.24*	0.16*	0.36*	0.21*	0.89	
7. Innovation	3.9	0.8	0.88	0.60	0.51*	0.43*	0.26*	0.52*	0.38*	0.36*	0.88

Values in the diagonal are the Cronbach's alpha.
* $p < 0.05$.

5.3. Managerial implications

Co-production is essential for achieving innovation. Firms must recognize the new approach's co-creationist value and responsibilities. Managers should see their partners as co-creators of a complementary links system (Paulin & Ferguson, 2010). First, firms need to set up a co-production platform. Through co-production, firms can create direct and indirect opportunities for accessing to partners' skills, thus increasing absorptive capacity, self-efficacy, and innovation. Second, understanding the role of each social capital in the formation of co-production helps managers build effective co-production. Managers can promote co-production by formulating social interactions, developing inter-organizational trust, and cultivating shared values. Finally, this study suggests that firms should include co-production in partnership management and that managers should develop co-production to encourage and enable collaborations that may develop innovation.

6. Conclusions and contributions

Knowledge intensiveness and technological complexity increase interdependence in terms of knowledge and resources. Therefore, this study develops and tests a model that defines the relationships between social capital, co-production, absorptive capacity, self-efficacy, and innovation. Most importantly, this study highlights the determinants of co-production and co-production's direct and indirect effects on innovation. The empirical results support all eight hypotheses relating to these constructs.

6.1. Research contributions

Regarding theoretical contributions, this study extends the research on co-production aiming at collaborative partnership innovation. Theoretically, the findings offer greater insights into co-production through which firms can capitalize on partners' strengths and, therefore, innovate more effectively. In addition, this study expands upon prior co-production research by providing links between key determinants of co-production partnerships. This study also analyses the individual roles of various social capital dimensions in motivating co-production. In sum, the use of this mediation framework adds to the literature and allows for a more complete understanding of social capital's effect on innovation.

6.2. Research limitations and future research

This study has several limitations. First, the use of cross-sectional and self-reported data may lead to the overestimation of the relationships. Some of the managerial and research implications would greatly benefit from a longitudinal investigation. Second, this study focuses on a specific geographic area. Thus, the context of this study limits the generalizability of the findings. Third, this study collects data from one side of the dyad relationship. Future research may explore the variables from both sides to confirm the findings and to generate additional insight into firms' dynamic interactions. Future studies could also explore organizational factors or strategic factors and consider the contingency view.

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