Contracting for Innovation: The difference in a case with fast-changing industrial background in China

Huayao Zhang[a], Jing Wen[b], Junjie Wu[c1], George Lodorfos[d]

[a.b.] College of Economics and Management, Zhejiang University of Technology, Hang Zhou China.

[c. d.] Leeds Business School, Leeds Beckett University, Leeds, UK

Author contact information	**Short biography**
Professor Huayao Zhang College of Economics and Management Zhejiang University of Technology Hangzhou, China Email: zhanghy@zjut.edu.cn	Huayao Zhang (zhanghy@zjut.edu.cn) is a Professor of College of Economics and Management at Zhejiang University of Technology. He received his Ph.D. from Xi'an Jiaotong University, China. His current research focuses on technological economics, with a particular interest in capability upgrading of enterprises in emerging economies.
MS Jing Wen College of Economics and Management Zhejiang University of Technology Hangzhou, China Email: wenjing83@zjut.edu.cn	Jing Wen (wenjing83@zjut.edu.cn) is a PhD candidate of College of Economics and Management at Zhejiang University of Technology. Her research interest focuses on market and institutional effects on enterprise technological innovations.
*Dr Junjie Wu (Corresponding author) Leeds Business School Leeds Beckett University Leeds, UK Email: J.Wu@leedsbeckett.ac.uk Tel. 0044 113 8124792	Junjie Wu (J.Wu@leedsbeckett.ac.uk) is a Reader at Leeds Business School, Leeds Beckett University, UK. Her broad research publications span the fields of Accounting, Finance, Economics and International Business. Her current research focuses include SME related issues and Social Responsibility Investment.
Dr George Lodorfos Leeds Business School Leeds Beckett University Leeds, UK Email: G.Lodorfos@leedsbeckett.ac.uk	George Lodorfos (G.Lodorfos@leedsbeckett.ac.uk) is a Professor, the Dean of Leeds Business School at Leeds Beckett University, UK. His broad research publications include papers in journals of management but also in journals of marketing with particular focus on, the impact of innovation on productivity performance, the impact of technology on the sustainable growth of businesses and the factors that influence consumers' e-purchasing behaviour.

[1] Corresponding author: Junjie Wu, Leeds Business School, Leeds Beckett University
Email: J.Wu@leedsbeckett.ac.uk
Tel. 0044 113 8124792

Contracting for Innovation: The difference in a case with fast-changing industrial background in China

Abstract

Conventional contracting nowadays has disadvantages for fast-changing high-tech industries due to technology and market uncertainty. Observations found that cooperation between firms often operates in more innovative ways which were defined by Gilson et al. (2009) as 'Contracting for Innovation'. However, their study was conducted in a developed market (i.e. the US) and thus the findings can hardly be used to explain what is observed in emerging markets which have significantly different industrial and market backgrounds. Using qualitative interviews from a case study, this paper aims to investigate contracting for innovation practices in a Chinese strategic alliance. Our findings suggest new functions compared to those in Gilson et al. (2009). This research has enriched 'Contracting for Innovation' theory against the background of emerging market with highly uncertain industrial environments.

Keywords

Contracting for innovation; strategic alliance; uncertainty; relation specific investment; hold-up problems.

1. Introduction

"We want to do something together but we don't know whether the partner to be capable. The contract just let us believe the partner has capabilities to do it."

"Contract is not important, what important is we have to work cooperatively."

Rapid technology developments force many companies in fast-changing high-technology industries to form strategic alliances (Hagedoorn, 1993; Powell and Walter, 1998; Gomes et al., 2016; Dattée et al., 2017) to rapidly acquire complementary resources and cope with highly uncertain industrial environments (Santangelo, 2000). Strategic alliances normally sign formal contracts at the start of their cooperation to set out formally enforceable obligations, including *ex ante* and *ex post* risk allocation provisions for parties involved. After that, contracting practice developments may vary depending on specific industrial and firm situations. For example, in a fast-changing high-tech industry, formal contracts could bring hold-up problems and high switching costs because the inflexibility would hinder alliances in adapting rapid changes in technology and market. As such, many high-tech strategic alliances practically use innovative approaches of contracting practices. This phenomenon was defined as 'Contracting for Innovation' by Gilson et al. (2009). The two quotes above are frequent messages we heard from our interviews carried out in China – proof of contracting innovation practice appearing in China. Investigation of these to enrich the 'Contracting for Innovation' theory became one of our motivations for conducting this study.

Conventional contracting (i.e. a formal contract) is traditionally used to bind partners of upstream and downstream firms in the supply chain. Despite its advantage of allowing both

parties freely investing in relation-specific assets based on transaction cost theory (Williamson, 1975), however both parties are inevitably being 'held-up': under some unexpected and/or imperfect situation, the formal contract may not be completed. In this circumstance, one party might take advantage of the contract (i.e. engage in opportunistic behaviors). The hold-up problem and opportunism would be intensified when environmental uncertainty is strong (Lafontaine and Slade, 2007). In other words, opportunistic behaviors and hold-up problems could be serious if no innovative contracting strategies and approaches are being operated in a fast-changing industry.

Thus in practice, many high-tech firms are using different forms of informal contracting to prevent or minimize opportunistic behaviors and resolve hold-up issues. As mentioned earlier, Gilson et al. (2009) undertook pioneering research in this field which observed three cases in the US and found that these new 'contracting for innovation' agreements contain no formal enforceable obligations on either party, rather informally emphasizing mutual dependencies and transparencies, information exchange, and learning from each other towards a long and on-going collaboration. In so doing, these firms are motivated by mutually shared benefits and a common understanding of market pressure. They create novel ways of collaborations following an iterative pattern to overcome continuing uncertainties and 'hold-up' problems. The results of Gilson et al. (2009) suggested that a formal contract normally serves as a platform for the parties involved to develop subsequent informal contracting practices over the process of their cooperation.

Although Gilson et al. (2009)'s study provided insights on contracting for innovation in the US, we argue that their findings are not best placed to explain the innovative contracting practices in China. As we found from interviewees, contracting may have different or added functions

in Chinese strategic alliances compared to those in the cases of Gilson et al. (2009), because the Chinese market has some different features to those found in a mature market such as in the US (Mockler et al., 1999; Fang et al., 2016). The different characteristics of emerging markets[2] may lead to different behavioral modes for partners in an alliance who consider contracting for innovation to grab market opportunities while avoiding or minimizing opportunistic risks and hold-up issues (Williamson, 1975; Lavie, 2006; Lafontaine and Slade, 2007;). We further argue that 'contracting for innovation' is created by people participating and therefore the role of trust between parties involved should not be overlooked. We therefore aim to investigate (via qualitative interviews) different practices of 'contracting for innovation' in high-tech strategic alliances operating in China and explain why they have some differences from the results of Gilson et al. (2009). We have initially examined one case. In this paper, we report the findings from this case and provide in-depth contextual discussion to help understand the differences. We see our research as a response to the call by Gilson et al. (2009) for more research to help prove their 'plausible' findings. We conclude with confidence that our research results do shed additional light on the complexities of this phenomenon.

The paper is organized as follows: in Section 2, we provide a critical literature review to serve as the theoretical foundation of this study. The introduction of the case and data collection are carried out in Section 3. In Section 4, the case analysis is facilitated by introducing the industrial status and specific technology involved (mobile phone lens technology) and the alliance. The data analysis and results are shown in Section 4. In Section 5, we compare our findings with these in Gilson et al. (2009). The conclusion, theoretical contributions etc. are summarized in Section 6.

[2] There is an argument that the Chinese market should be categorized as a "Transitional Market" (e.g. Roztocki and Weistroffer, 2011) because China is a formerly communist country. However, in this paper we still use the broader term, despite Chinese economic development now being quite distant from that of other countries with emerging markets.

2. Literature review

2.1 RBV and competitive advantage in strategic alliance

Resource-based View (RBV) is one of the most influential theories of strategic alliance in the last three decades. RBV aims to answer the question of why firms have different resources, and how to obtain them in order to have competitive advantages (Wernerfelt, 1984; Barney, 1991). According to RBV, firms are heterogeneous with regard to their resources/capabilities (Teece et al., 1997), but not enough to obtain or sustain all competitive advantages; however, competitive advantages can be gained through participating in a longtime, stable and mutual trust relationship with strategic alliances (Barney, 1991; Peteraf, 1993). Two widely-cited definitions of strategic alliance express it as:

> "… [an] independently initiated interfirm link that involves exchange, sharing or co-development" (Gulati, 1995, p.86); and

> "… [a] purposive strategic relationship between independent firms that share compatible goals, strive for mutual benefits, and acknowledge a high level of mutual dependence" (Mohr and Spekman, 1994, p.135).

These definitions emphasize that *value* (i.e. competitive advantage) can be created in alliances through investing in specific relationships to obtain resource complementarity, knowledge-sharing and effective governance (Adegbesan and Higgins, 2011).

Strategic alliances can generate greater profits for collaborating parties via their business

cooperation (Asanuma, 1989; Mohr and Spekman, 1994). The excess profits obtained from strategic cooperation are defined as relational rents (Schoemaker, 1990; Hagedoorn, 1993), i.e. competitive advantages which are created through cooperation. Resource complementarity is a fundamental channel for keeping competitive advantage. Resource complementarity refers to a set of differential resources jointly shared by the alliance partners in order to carry out technologic strategy cooperation, which creates value greater than the total value which alliance partners could create alone. Dyer and Singh (1998, p.662) defined it as 'a supernormal profit' which can only be 'created through the joint idiosyncratic contributions of the specific alliance partners'. Through resource complementarity, specific alliance partners can work effectively to gain unique relational rent jointly owned between them. The relational rent is difficult to imitate in other environments and therefore cannot be separated from its original owners. A higher ratio of complementary resources will lead to higher possibility of relational rents within a strategic alliance (Dyer, Singh, 1998).

Knowledge sharing is another important channel for keeping competitive advantages. Knowledge sharing means transferring and reorganising knowledge between cooperative companies, or a paradigm by which alliances can create specificity of knowledge through their interactions (Miles et al., 1999). Knowledge sharing can effectively standardise the behavior of technologic strategy partners and improve knowledge transfer efficiency (Dyer and Singh, 1998). As Dyer and Singh (1998) stressed, relational rent can be created between alliances through information communication and knowledge sharing. The more invested in knowledge sharing the alliances is, the higher the relational rents would be.

Another important channel for creating relational rent is relation-specific investment. In the process of alliance cooperation, partners need to invest in specific assets. The three types of

asset specificity that Williamson (1985) identified in inter-firm relationships are site specificity, physical specificity and human specificity, within which investing in human asset specificity through communication could be time-consuming but is a kind of material relation-specific investment (Gilson et al., 2009). According to assets specificity theory (Amit and Schoemaker, 1993; Dyer and Singh, 1998), the increase in relation-specific assets/investment can reduce the costs in the value chain, expand product differentiation, and accelerate the product development cycle. As a result, relational rents are created (Williamson and Oliver, 1991). More investment in relation-specific assets can increase the willingness for cooperation, which would increase relational rent (Lavie, 2006; Gulati et al., 2009). Relation-specific assets/ investment also relate to the duration of safeguards in governance: generally speaking, the longer the governance arrangement lasts (i.e. the length of the formal contract), the higher relation-specific assets/investment are (Dyer and Singh, 1998).

Effective governance can also lead to competitive advantages. Alliances normally sign a formal contract at the time of partnership established which provides "formal safeguards and determine the distribution of common benefits *ex ante*" (Lavie, 2006, p. 646). Although the formal contract is part of the alliance's governance arrangements, according to Dyer and Singh (1998) that effective governance should include the ability to implement self-enforcement governance, either in a formal or informal way without involvement of a third party. Effective alliance governance plays a key role in generating relational rents as it sets out good inter-firm routines which can facilitate knowledge sharing and effective communication (Lavie, 2006). Effective governance can reduce transitional costs and stimulate the value creation of an alliance (Williamson and Oliver, 1991). The failure of a strategic alliance may not result from lack of complementary resources, but a lack of effective governance (Wei and Long, 2011). As such, it is vital for alliances to have good corporate governance, to reduce transitional costs and

improve performance (Schoemaker, 1990). Dyer and Singh (1998) argued that with higher integration in terms of governance, the more relational rents would be generated. However, a signed formal contract is not able to cover all ongoing developments (Williamson, 1975, cited in Lavie, 2006); in this regard, informal safeguards and trust-building are found to be important in preventing opportunistic behavior from alliance partners (Dyer and Singh, 1998).

2.2 Dynamic capabilities and contracting for innovation in technological alliance

From the discussion above, one can see that RBV focuses on inter-firm relationships and emphasizes building competitive advantage through creating relational rents from scarce firm-specific resources. In addition, RBV also encourages firms to explore innovative strategies to develop new capabilities by exploiting firms' existing resources through external networks (Wernerfelt, 1984). Therefore, from a resource-based perspective, firms/alliances succeed not only just because they set out successful investment strategies but also because they can explore and implement innovative ways of cooperation to lower costs significantly without compromising the quality of products (Teece et al., 1997). This situation particularly applies in fast-changing, high-technology industries because some of their assets (e.g. tacit know-how and reputation) are "simply not readily tradeable" (Teece et al., 1997, p.514).

Along with rapid development of new and complex technologies in the last two decades, the high-tech industry has been very fragile, with incredible uncertainty and risks, and faces huge challenges in finding innovative ways to sustain itself. As such, scholars such as Leonard-Barton (1992) and Teece et al. (1997, p.516) used the term 'dynamic capabilities' to describe whether these industries/firms have the ability to "integrate, build, and reconfigure internal and external competences to address rapidly changing environments". In other words, firms or

alliances with *dynamic capabilities* would adapt novel strategies and approaches to maintain their competitive advantage amid furious global competition (Anand et al., 2010). For high-tech companies, to keep dynamic capabilities and their cutting-edge technologies means they must think proactively, do business innovatively and respond quickly to changing market demand.

Changes in behaviors and business models in the technology industry have challenged the conventional theory of vertical integration, which defines the boundary of upstream and downstream firms in the supply chain, and required changes from traditional practices of contracting to what Gilson et al. (2009) labelled 'contracting for innovation'. Observing three cases in the US (Deere-Stanadyne, Apple-SCI and Warner-Lambert-Ligand), Gilson et al. (2009, p.437) found that many previously in-house transactions are now outsourced through agreements between firms or even overseas alliances to avoid uncertainty in the market (Prado et al., 2009), and this kind of collaboration, on one hand, causes 'unavoidable mutual vulnerabilities' to alliance partners; however on the other hand, it motivates them to find novel ways of collaboration, including new contractual governance, to overcome continuing uncertainties and 'hold-up' problems. They named this phenomenon the *vertically disintegrated economy*.

According to Gilson et al. (2009), unlike conventional contracting, which explicitly sets out formally enforceable obligations including risk allocation provisions for parties involved, the new 'contracting for innovation' agreements contain no formal enforceable obligations on either party, rather informally emphasizing mutual dependencies and transparencies, information exchanges and learning from each other towards a long and ongoing collaboration. Three transaction characteristics with these new contracts are summarised by them as

(1) the contracted 'product' is a high-tech one that can hardly be specified beforehand/*ex ante*;

(2) none of the parties involved can develop this product alone or develop it cost-effectively;

(3) the transactions will be iterative, which requires continuing communication, co-design, mutual specification and development through monitoring and learning the partner's capabilities (Gilson et al. identified these as the relation-specific investments).

Gilson et al. (2009, p.449) argued that these iterative and cooperative contracts can play an important role in linking participants as a 'coordination cascade'- "an innovation by one party that requires coordination with a second party, whose response then requires adjustment by and further coordination with the first party". [3]

The Deere-Stanadyne case in Gilson et al. (2009) has similarities and differences with the case in this paper and these will be discussed later. In sum, their pioneering research highlighted three important elements in contracting for innovation in technologic alliance collaborations:

(1) formal contracting can be important to facilitate informal contracting structures which guides the participants' expectations for capability, cooperation, and trust;

(2) the structure of the innovative contracts mainly depends on whether there is foreseeable cooperation in the long run; if yes, then co-design of the prototypical design and adaptation has to address ongoing 'hold-up' problems associated with relation-specific investment;

[3] Mergel (2016) described this process in more detail in regards to a governmental project.

(3) in the process of project operation, the alliances must generally rely on informal arrangements to constrain opportunistic behaviors through value created by renegotiation. In short, both formal contracts with constraints on parties involved and informal agreements with no substantial constraints play important roles in safeguarding against opportunist behaviors and reducing hold-up risks in alliance collaborations.

3. Methodology

This research focuses on the effects of environmental uncertainty on innovative contracting behavior in technological alliances. After decades of dramatic development, China, especially its coastal area, is an ideal place for this kind of research because so many world-class large companies have come and worked with their local partners in the supply chain for years. In quite a few of these newly developed areas, such as smartphone parts manufacturing, Chinese companies working with manufacturing giants (e.g. Apple, Sony and Samsung) have earned competitive positions in the market to keep their cutting-edge technology. The contracting practices within this environment usually have two prominent characteristics:

1) all contracting parties are familiar with the fast development, and their contracts are more based on expectations than on realities;

2) the industrial supporting environment is convenient for iterated communications and more challenging contracts tend to be found. In other words, the contracting behavior observed under this circumstance may embody more environmental effects that are difficult to find elsewhere.

As the objective of this paper is to initially investigate the practice of ‘contracting for

innovation' in a Chinese high-tech strategic alliance, a single case study is an appropriate research design. By applying the case study method, the complexity of the strategic and practical decisions on the issues investigated can be explained (Ghauri, 2004); that is, the details of contracting, cooperation and trust building can be more effectively investigated by case study. The case study design is widely used in management research and has been developed by scholars such as Eisenhardt (1989) and Doz and Yves (1996) after Strauss (1987).

3.1 Case selection

Similar to the sample selection approach used in Wei et al. (2015), a 'multilevel approach' was used in the study. Level 1 is to consider the location. The Yangtze River Delta and Pearl River Delta are the two most developed coastal areas in China and have attracted thousands of large global companies to establish their strategy alliances there. The first author's affiliation is located in Yangtze River Delta and he has about 150 MBA students working in different companies/organizations in this area, which provided a convenience sample for the study.

Level 2 is to consider the industry. After a brief investigation of the 150 MBA students' companies/organizations, potential cases of contracting for innovation were found from various industries, such as auto parts, engine and ICT industries. Among them, the ICT industry seems to be the fastest-developing industry and faces the greatest uncertainty, e.g. smartphone upgrades in the last decade. The USA, Japan, Korea and more recently China play leading roles worldwide while leading brands such as Apple, Samsung and Sony produce parts in Chinese alliances. We thus targeted the ICT industry and five firms were selected in the first round. After screening their business activities and performance, as well as the background of collaborative partners, three alliances were shortlisted for more detailed investigations. In the

last stage the alliance between Sunny Optical Technology Co. (SOT) in China and Omni Vision (OV) in the USA was selected because their contracting practices are more traceable than in the other two cases. Specifically, SOT was chosen based on the theoretical sampling principle, as it conforms to the criteria for a polar case, which represents a theoretically fruitful and extreme situation (Eisenhardt, 1989).

SOT has about 5,000 employees, of whom 200 are full time R&D personnel and 260 are installation engineers. The core product of SOT is a mobile phone camera module (CM). SOT's parent company, Sunny Group, started to develop and produce lenses in 1991, mobile phone lenses in 2000 and whole lens modules in 2004. SOT was established in 2006 as a part of the Sunny Group's expansion strategy. Omni Vision (OV), the strategic alliance partner of SOT, which was established in 1995 and is headquartered in central Silicon Valley, exerts great influence on SOT. OV is the leader in developing high-quality sensors, and the largest sensor manufacturer, with a one-third share of the world market. The strategic cooperation between OV and SOT started in 2009. The alliance produces mobile phone CMs jointly: one side (OV) provides sensors and the other side (SOT) packages sensors with other parts.[4]

Figure 1 shows the growing trend (total sales, profit and loss) of SOT's parent company (Sunny Group) covering the period of our study, which was listed in Hong Kong stock market (Sunny Optical: HK2382). The sales are mainly composed of those from SOT and the sister company which produces lenses. The sales of SOT are growing almost at a fixed proportion of the sales

[4] A mobile phone camera module consists of a lens, sensor, backend integrated circuit (IC) and flexible printed circuit (FPC). The core component of a CM is the sensor (accounting for nearly half the cost). The technique of packaging the 4 parts together requires two methods: one is chip on board (COB) (installing silicon wafers and then protectively sealing them) and the other is chip scale package (CSP) (packaging the installed chips). The process of COB requires a stricter environment: the operation is performed directly on microchips and so the production line room/s must be under negative pressure and totally dust-free. The packaging requires the lens being closely aligned with the sensor, and only high-precision matching can ensure good quality of products.

of the listed parent company.

<Figure 1 insert here>

Alliance cooperation is prevalent amongst sensor-makers; SOT was selected by OV as its most important cooperator because of its production capacity. (SOT owned about 60% of the COB production lines in China as of 2010.) The competitive advantage of a module depends on matching effects between sensor and CSP, which in turn requires iterative cooperation between the sensor maker (OV) and the packager (SOT) as early as when the sensor is being designed. As such, the alliance between OV and SOT would offer us insights into their iterative cooperation and the details of contracting for innovation, because

(1) SOT serves the newly-developed smartphone industry in a hugely uncertain environment;

(2) OV is the world's leading chip producer; and

(3) the alliance supplies modules to world-leading brands such as Samsung, Sony and more Huawei.

Additionally, if OV intended to exert pressure on contracts for innovation on SOT, then how did SOT respond to this and how did both parties interact in the on-going process of cooperation to overcome what literature identified as hold-up issues? We therefore believe that the contracts between OV and SOT can enrich our understanding of the idea of ‘Contracting for Innovation’ raised by Gilson et al. (2009).

3.2 Data collection and analysis

The chief marketing manager of SOT (recently promoted to the position of vice general manager) is one of the MBA students supervised by the first author of this paper, and participates in all negotiations of contracts with OV. This vital contact allowed us to get access to rich information and key insights into the contracting and collaborating practices. The process of data collection and analysis can be summarized into five steps:

(1) Desk-based data collection

Before collecting primary data, we used the public search engines (Baidu and Google and other databases) to compile basic information on the ICT industry and mobile phone camera module (CM) technology. After this, we searched the websites of SOT about their strategies, values, business module, products, procedures, financial performance, marketing, R&D, suppliers and clients, international cooperation partners and events, comments from stakeholders, etc. We also accessed some hardcopy materials about OV and SOT during this stage. In total, the information collected would have filled more than 300 pages of A4 size paper in normal type. After a brief analysis of this information, we obtained an overall view of the ICT industry and technology of mobile phone CMs, and the background of OV and SOT. Based on this knowledge, an initial pilot interview outline was developed.

(2) Pilot interview

After forming an initial understanding of SOT's business, we carried out a pilot interview with two SOT managers separately, the marketing and R&D managers (both are chief managers in their departments). The main aim of the pilot interview was to understand more about SOT's cooperation journey with OV, in order to prepare revised semi-structured interview outlines for

our formal interviews. The time spent on the two interviews was 90 minutes each. We took them separately to ensure neither was influenced by the other. The focus in the interview with the chief marketing manager was on the issues relating to the market uncertainty of mobile phone CM industry; the intention of OV and SOT's strategic cooperation, the market positions of each side, the relational and institutional environments of SOT and the successes and problems of this cooperation in terms of marketing performance. At the interview with the chief R&D project manager, our interest was generally on the technologic strengths and weaknesses of each side; the impact of the cooperation relating to technologic development, the problems they encountered and the communication methods used to resolve these problems, and the extent of satisfaction as a result of these exchanges and communications on both sides. After this pilot interview, we had a clear understanding of the total journey of the OV-SOT alliance; the industrial environment of mobile phone CMs, and the dynamic capabilities of both OV and SOT. This understanding helped us pick out the problems requiring further focus in the formal interviews.

(3) Formal interviews and field observations

After finalizing the interview outlines, the formal interview was carried out in the form of a focus group. The interviewees included the General Manager of SOT, and the two managers in the pilot. The rationale for selecting these three was that they are key personnel in SOT, responsible for strategic issues (the General Manager), production (the R&D Chief Manager) and sales (the Marketing Chief Manager). From the pilot interview, we learned more in relation to technology and marketing aspects, but not at a strategic level. Two advantages of the focus group format are that the participants can inspire each other from conversing as a group, and that the researcher can collect rich data in one place (Denzin and Lincoln, 2008). The focus

discussion provided a whole picture of the OV-SOT alliance cooperation and event details for us to analyze. The focus interview lasted for two hours and was recorded with a recording pen. The first two authors also had an opportunity to visit the site, production lines and different departments, and were given some internal documents to help understand some of the issues discussed at the focus interview.

(4) Peer confirmation

After collecting data from SOT, we arranged two short interviews (each around 45 minutes) with two external peers (one is an independent director and another is a general manager) from other enterprises in the same (ICT) industry. The purpose of the external interviews was: (1) to understand the environmental and industrial atmosphere from other viewpoints and (2) to collect peers' perceptions on the OV-SOT cooperation, not only to achieve data triangulation but also to independently assess the value of the alliance. Satisfactorily, the peers' observations complemented the facts from the SOT data collection.

(5) Focused update interviews

We carried out focused update interviews recently during the stage of paper revision after receiving constructive comments from anonymous reviewers. During the period between 20 July and 15 August, 2017, the first author interviewed the general manager (same person as in the formal interview) and the vice general manager (previously market manager) of SOT by telephone. On the vice general manager's recommendation, we also contacted the market manager of OV by e-mail with a number of questions, and received prompt and satisfactory answers.

The focused update interviews concentrated on the issues around contracting and innovation in the OV-SOT alliance, covering the contents of the contracts, the relationship between formal and informal contracts and their substantial constrains and functions, the forms and contents of relation-specific investment for innovation purpose, the interviewees' personal perspectives on opportunism and hold-up affairs, and the effects influenced by environment and cooperation. The focused update interviews not only confirmed our perceptions but also provided us with much more details about their contracting practices which support and add value to the 'Contracting for Innovation' theory in Gilson et al. (2009). Before the interviews, we had been concerned some issues in relation to hold-up and opportunism might be sensitive; however, both parties were very open and frank to talk about these issues. This allows us to grasp the essence of their interactions on the matters. Table 1 specifies the process and contents in each step of data collection.

<Table1 insert here>

4. Results

4.1 Industrial environment and alliance of OV-SOT

The last decade has witnessed the explosive development of the world smartphone industry SOV is associated with, accompanying with large uncertainties. These uncertainties are mainly caused by unknown future technological development, and in some circumstances, today's technological advantages could quickly become tomorrow's technological burdens. One can understand this situation by looking at how some famous smartphone makers (e.g. Sony,

Samsung and Huawei) have had ups and downs in the world market. Generally, a fast and newly-developed industry would bring uncertainty to suppliers because production lines and supply chain need time to take shape. If product demands quickly fade out, the huge investments on equipment will become sunk costs. This kind of industrial uncertainty requires technological firms to working with innovative strategies.

Global industrial uncertainty alarms Chinese firms, even though the smartphone industry in China has been in a strong position in the last decade and is still expanding currently. Compared to its counterparts worldwide, China has invested much more in domestic companies in order to attract foreign investment and also provided the industrial supporting policies mentioned earlier. It is in this industrial environment that SOT and OV developed their strategic cooperation in 2009. Both parties want to establish a closer and flexible cooperation relationship, whereby SOT can obtain quantities of chips whenever they want from OV, of quality superior to other suppliers. It is SOT which takes the risks of market volatility.

Only when a lens from SOT is perfectly matched with the sensors from OV can the whole be used as a constructed CM. Complicated adjustment is thus needed after the lens and chips have been assembled, which requires close communications and coordination between SOT and OV: e.g., SOT needs to contact the chip manufacturers directly, discussing potential components in the design stage and identifying specific parameters. Thanks to the early market entry of SOT and OV's investment in the Chinese market, both sides have a good understanding of each other's businesses. Also, because the chip and the lens are two important parts in the lens module, the interaction and communications between SOT and OV are frequent and intensive, which helped smooth the strategic cooperation.

The alliance partnership with OV has brought SOT huge profits. The general manager of SOT regards the formation of the alliance with OV as "absolutely the right decision", which led SOT's business to develop rapidly. The marketing manager of SOT stressed:

> *"Environmental uncertainty brought OV and SOT together. Otherwise I don't think we need to form a strategic alliance with other companies, and I also knew OV would not choose us as their partner. The uncertainty also ties us firmly and we have to cooperate closely. In my opinion, the environmental uncertainty plays the fundamental role in acquiring competitive advantages for both sides."*

The remark of the marketing manager from SOT reflects the reality that environmental uncertainty is the vital factor in the forming of the OV-SOT alliance and the close cooperation relationship - a kind of relational rent as indicated in Dyer and Singh (1998) and Lavie (2006). In the process of forming the alliance and sequent cooperation, there has been a two-way communication mechanism in operation with which one can see the development of contracting for innovation in the alliance. The process also showed that relational investments and institutional resources stressed by theory of dynamic capabilities (e.g. Teece et al., 1997) demonstrate key roles in generating competitive advantage. In the following part, we will reveal the influence of environmental uncertainty on OV-SOT contracting practice for innovation with the consideration of contribution of RBV and dynamic capabilities.

4.2 Contracting for alliancing and innovation

(1) Motivation for forming strategic alliance

A fast-expanding market is a double-edged sword, especially for the ICT industry with its large investments on equipment. From SOT's perspective, the primary reason for forming the strategic alliance with OV is for fast development. "Without the cooperation with OV, we would not have developed so quickly," said the marketing manager. However, SOT knows clearly that market expansion also means potential risk. The SOT managers interviewed explained the investment dilemma in this industry: on one hand, the ICT industry has a long investment recovery period because of extensive investment; on the other hand, the volatility in the industry often causes turbulence in market demand and technique changes. Therefore, any investment in this sector faces high risks. Module suppliers often face a tough choice: though the market is expanding all the time, there is no way to be sure that their customers will stay loyal when better products available elsewhere. However, SOT believes that collaborating with OV would lower the risk thanks to OV's established international reputation in the sensor market (a core part for not only CMs but the whole mobile phone.)

From the viewpoint of OV, its venture in China depends on selecting the correct partner to maximize profits and minimize risks, and cooperating with SOT can help achieve this ambition. As SOT's general manager said, OV wanted to choose a Chinese enterprise which not only had a major market share, but also long-term development potential and competitive advantage. By contracting with SOT, OV can obtain the production capability and meanwhile avoid taking high risks on equipment investment. The general manager described the key driving force in the formation of strategic alliances as:

"Investing heavily in equipment may cause high market risks, which could lead to the investment being unrecoverable due to the quick technological development and fast

market change in the CM industry. This is the real reason for both OV and SOT choose alliancing to avoid investing into each other's domain."

As a result, SOT's choice of a strategic alliance with OV has mitigated market and investment risks. Two points support this claim: firstly, due to the explosive growth in smartphone demand, the demand for CM exceeds the supply. An insufficient supply of chips could cause a bottleneck in development, because of substantial investment in chip production lines. The formation of the strategic alliance can guarantee a stable supply. Secondly, the strategic alliance brought the assembler (SOT) and the chip manufacturer (OV) together, and as a result, SOT's reputation has been upgraded, which has helped to guarantee a more optimistic and stable demand. In short, in a fast-changing industrial environment, stabilising market demand through strategic alliance by sharing risks plays a key role in obtaining competitive advantage for the OV-SOT alliance.

To sum up, environmental uncertainty and high investment in equipment are the main driving forces for SOT and OV to form the strategic alliance in order to avoid high risks. The *binding effects* of sharing the other partner's reputation and production capability have effectively reduced environmental uncertainty through the contract arrangement. This contract arrangement has later proved to have the function of generating competitive advantages for both parties.

(2) Relation-specific investments and cooperative innovation

For both OV and SOT, alliancing offers a great opportunity to learn from each other through a stable relationship and supportive cooperation. This was particularly appreciated by the chief

R&D manager of SOT. As he noted, with the requirement for testing lenses and chips, the complicated assembly process requires a great deal of communication from both sides. As such, the formation of the alliance has provided a platform for close communication, which can benefit both sides greatly, not just in producing the best quality of modules, but also accumulating knowledge of business.

Solving the technique bottleneck of encapsulation requires timely communication between R&D departments on both sides. As modules are assembled in SOT, most communications and cooperation are also carried out there. During the cooperation, SOT received significant technical support. OV and SOT engineers' visiting each other has been routine for some time. As a result, productive communication with OV helped SOT greatly improve their assembly precision, which in turn boosted their profit as well as reputation, which in turn has made them the largest lens module producer in China and a good profitable company. In other words, SOT has gained satisfactory relational rents from the alliance partnership with OV, and the alliance achievements have also attracted others (e.g. Samsung and Sony) to develop strategic alliance relationships with SOT.

From OV’s perspective, the benefits from the alliance do not stop at the minimum of *ex ante* production risk but extend to product improvements. For example, chip designing in OV now requires communication with SOT before the design is finalised. In this way, OV can easily learn from the phone makers which are their preferred products. This is a very effective way for OV to learn the Chinese market, resulting a stable market share in China. The marketing manager of OV frankly expressed by email that the two-way learning process and iterative communications with SOT have brought a lot of benefits for OV.

Another benefit through routine communication is that mutual trust has been established between SOT and OV, both in the increase of inter-firm transactions and strength of personal relationships between key individuals. As the market manager of SOT stressed:

> *"Despite (formal) contracts legally put constrains on both sides, however if no established mutual trust, no one dare to put 'big bets' based on the 'legally effective' written paper and we still would maintain transaction volumes at a risk-controllable level. In contrast, because we trust each other and care about our relationship, verbal promises play more and more important roles. ……Except for purchase agreements, no other formal written contract is necessary. This is because we are in the (highly uncertain) industrial environment, informal oral agreements are more effective."*

The general manager of SOT also summarised: "*We started the collaboration with the motivation of sharing risks but surprisingly ended up achieving amazing mutual trust*". The cooperation of OV and SOT through extensive exchange of feedback on the market's uncertain conditions and mutual respect have enhanced competitive advantages on both sides. It has helped to make use of resources complementarily on both sides to meet the increasing demand and prevent opportunist behaviors. In other words, the cooperation has brought *technological effects* and reduced environmental uncertainty by strengthening the capabilities of the two partners and enabling them to face future challenges/risks. This finding supports the results found in Mount et al. (2015, p. 32) that there is "a strong relationship between recognitive capacity, network management and knowledge creation and exploration during later collaboration stages". The mechanisms and relative quotes related to market uncertainty and innovation are listed in Table 2.

<Table 2 insert here>

4.3 The role of contracts in safeguarding opportunism

(1) Contracts constitution

As we were informed by the marketing manager of SOT, there are at least three types of contracts signed between OV and SOT. The first signed is a '*Memorandum*' at the very beginning which only states the intention of cooperation as an alliance (or on-going relationships if satisfied) for the first two years, with no formally enforceable obligations. According to the manager, the memorandum is a 'soft' (implicit) document as it does not oblige either party to supply or to purchase anything from the other. The second type is the strategic '*Agreement*' (or '*Protocol*') which sets out mutual agreed terms and conditions for supply and purchase, including particular product quantities, discount prices and delivery times, for a period (e.g. one year). This agreement (contract) has 'hard' enforceable obligations on both parties specifying *ex ante* duties and possible *ex post* outcome, which assumes an efficient cooperation with good performance. The final type is the '*Purchase agreement*' which sets out more detailed purchase transactions for a short purchase circle (e.g. three months). By our understanding, the 'Contract' discussed in Lafontaine and Slade (2007) and Gilson et al. (2009) is similar to our strategic 'Agreement' in OV-SOT alliance; as such hereafter our discussion/analysis of formal contract refers to the second type contract mentioned (i.e. the 'Agreement'), however, describing the other two types of contracts will help readers understand the case.

With regards to informal contracts, although there seems to be no explicit statement in Gilson et al.'s study (2009), from reading relevant literature and conducting interviews, we can define it as a kind of promise occasionally agreed (either orally or in writing) to commit to some transactions/activities. Despite it being reached informally, without enforceable obligations, and possibly incomplete, however, on most occasions, informal agreements can be committed to as they are reached based on mutual trust on each other's behaviors/attitudes.

From the discussion above, one can see a formal contract serves as a proactive contract, which has the characteristics of imperfection, with consideration of contingent factors, and is open for future supplement. In our case, the formal contract between OV and SOT was initially only signed for one year. After the first year, OV and SOT came to discuss, revise and renew it for another year. The contract has never been renewed since, though the collaboration continues as usual to this day purely based on the agreed principles set in the contract. To quote the marketing manager, "*We trust each other so it is not necessary to sign a new contract*".

(2) Functions of contracts

How can the formal agreements enforce or constrain both sides? Let us discuss them further. The first agreement was signed shortly after the memorandum, after a number of exchanges and on-the-spot visits. OV believed that SOT would be their best partner in China and they shared the same judgments on market trend. In order to 'settle' the cooperation, the first agreement was signed, serving as a promised good plan to do business jointly. After the first year's cooperation, they learned more about each other's capabilities and characters and had strong confidence in one another; thus the second agreement was signed with larger purchasing intentions and more favourable pricing. In fact, the function of the second agreement can be

thought of as a much more ambitious 'blueprint' for a prosperous future. In the words of the marketing manager:

> *"We (OV and SOT) had strong feeling that we can do good business together, but we are not sure how much the other party can offer and their capabilities. So the first agreement is like a promise by declaring what can we offer and how can we do? After one year cooperation, both sides proved to be good partners with a lot of potential, and thus why don't we do something much more ambitious together?"*

The marketing manager of SOT further explained that the formal agreement indeed includes contents relating to constraints in the cooperation (e.g. testing equipment and mutual technique support). This is because both parties understand these constraints are necessary and help guarantee achieving the shared aims and purpose; thus the parties are willing to obey and invest in relation-specific investments (e.g. iterative communications and personnel training). On the other hand, the formal agreement leaves quite a big space on both sides to be flexible, i.e. to cooperate if favourable, or exit if not. The fact that the alliance continues their cooperation thus far as in the past and will obviously be continuing on even without a currently valid agreement reveals that the function of a formal contract between OV and SOT is not to constrainfor cooperation, but to inform of unperceived capabilities (the first round) and blueprint planning (both the first and second round).

The formal contract between OV and SOT also plays the role of trust fostering. An example given by the marketing manager can be a good illustration of this: though the agreement set out purchasing amounts and associated discount prices, at the early stage when trust had not been established, OV still proposed to charge market price rather than agreement price before

the agreed amounts were reached (and suggested paying back the difference after the amount was reached.). However, the proposal has never been actioned, as OV quickly learned the potential of SOT. After a market assessment, OV realized that there would be no problem in finishing the agreed amount, and thus charged only the agreement price even before the agreement amounts were reached. This example proved that though a formal contract was in place, it is up to the parties involved to implement the contract, and it might not become a constraint on the other party, if trust has been built between parties.

Along with trust building in the OV-SOT alliance and familiarity with the partner's capabilities and working character, more and more informal contracting appeared to help routine operations and transactions. Interestingly, these informal agreements normally have a specific purpose to achieve certain tasks. Following the normal logic, they should be in more formal forms as these have less uncertainty, but trust has gradually been fostered between the parties, thus more efficient informal contracts are enough. This reality shows that whether formal or informal contracts are applied depends on the level of trust. Once trust is fostered, informal contracts are more effective than formal ones. In other words, in our case an informal contract is not a supplement to formal ones, but rather are the different outcomes of different trust levels. Once mutual trust is fostered, *decision efficiency* based on informal contracts will be improved, which can be seen as one side of *governance effects* in reducing environmental uncertainty.

To sum up, the OV-SOT formal contracts served as a promise signal or positive gesture of cooperation when they wanted to cooperate with the other party. The purpose of contracting is not for constraining the parties, but establishing a common blueprint. Once mutual trust has been built and the cognitive uncertainty has been removed, more efficient informal contracts will be put in place. In contrast, the purchase agreements are in formal forms. This is because

purchase agreements are usually zero-sum transactions, not for mutual advantage. This difference hints that favourable expectations may be the proper environment for a proactive agreement.

(3) Opportunism safeguarding

Thanks to good industrial conditions, there has not been any default on the agreement so far. However, this does not stop SOT thinking of this as a possible problem. According to the general manager of SOT, the decision - whether SOT continues with the agreement obligation by bearing costs, or stops the obligation once market demand drops significantly - should be purely based on economic rather than legal considerations. "*No one wants to take your partner to court because even if you could win the lawsuit, you would lose reputation in the industry, [and] consequently some business.*" The OV marketing manager also agreed: *"the contract with SOT is to express our confidence in the market and the cooperation potential in the form of a formal document. The promises from both sides in the agreement have predictive features. It is normal and understandable if they are unable to deliver due to circumstance changing in the market. We all understand that nature. We can come to reflect and adjust them once that happens."*

From the development of OV-SOT contracting practice (the evolution from formal to informal agreements), one can see that contracting for innovation contains mechanisms for benefit allocation and opportunism safeguarding. This is because the contracting is a continuing and iterative process, and any unequal benefit allocations can be compensated or adjusted for in the next round. If mutual trust is established and both sides treat the other party as the best partner, the best option is to continue the relationship and find the right way to sort the dispute out via

communication, rather than ending the cooperation. In a similar way, hold-up problems can also be avoided. *"Nobody wants to spend years to find and build a relationship with another partner. The market would not allow you to do so*", added the SOT marketing manager. In short, iterative gaming during cooperation can help improve alliance cooperation. Non-cooperation would lead to high switching costs, because the investment in established trust and competitive advantages would turn into a sunk cost. In this way, the arrangement of *exit free* is the best solution for opportunism and hold-up problems. This can be seen as the other side of *governance effects* in reducing environmental uncertainty. Thus, we can summarise OV-SOT cooperative innovation and contracting mechanisms in Figure 2:

<Figure 2 insert here>

5. Comparison with the findings in Gilson et al. (2009)

Our results reveal similarities and differences with the findings of Gilson et al. (2009). Let us discuss them in more detail. The OV-SOT case is also an example of vertically disintegrated cooperation in the upstream and downstream of the supply chain through contracting for innovation. Specifically, the OV-SOT alliance is closest to the Deere-Stanadyne case in terms of contracting practices. For example, Deere-Stanadyne's contract "helps establish and maintain a long-term supply arrangement but does not obligate either party to supply or to purchase anything" (Gilson et al., 2009, p.458) and this (by our understanding) is similar to the "Memorandum" signed between OV and SOT; and even the formal "Agreement" of OV-SOT is implicit to some extent. Therefore, our case generally supports their findings, but we argue that our results have shown differences and added value to the pioneering research. Let us explain from three aspects:

(1) About the formal contract function

Gilson et al. (2009) concluded that formal contracting serves as a platform to develop subsequent informal contracting and associated mutual trust. In contrast, our findings confirmed the new functions of formal contracts: under conditions where industrial prosperity and market uncertainty exist simultaneously and information asymmetry is strong, formal contracting can play a role as a promise to the other party in order to reassure the other partner and act as a "blueprint" for future prosperity of cooperation, rather than constraining the opposite side.

(2) About governance mechanisms

Our case analysis disagrees with the suggestion by Gilson et al. (2009) that formal contracting is the premise for informal contracting. In our case, when mutual trust has not been established or not enough, the contract appears in the formal form; while when mutual trust is mature, informal contracts can replace formal ones. We believe that the forms of contracts applied are determined by mutual trust, which stresses the key role of trust in the governance mechanism. In other words, an informal contract is not a supplement to a formal contract in our case: rather, they play the same role under different trust conditions.

(3) About hold-up problems

According to Gilson et al. (2009), informal arrangements should serve to constrain opportunistic renegotiation (which may be an extension of the *supplement* role); however our

findings may suggest differences. The disclosed OV-SOT case is a successful cooperative alliance in the sense that both sides are very open on sensitive problems (as mentioned earlier), closely engaged in the whole process, communicate extensively, and they set out the possibility of free exit but have a strong willingness to continue the alliance cooperation. In this case, "hold-up" problems are not obvious (at least at the time of interviews), and there is no use of informal arrangements for purposes of safeguarding. We summarize these points in Table 3:

<Table 3 insert here>

Although the three points are drawn from a single case, they are consistently explained. Compared to the three cases in Gilson et al. (2009), our story represents successful cooperation in a strategy alliance in the current economically developing and uncertain mobile phone market in China. OV and SOT's positive collaboration has gained mutual trust, which brought *ex post* benefits and minimised risks on both sides. The contracting development cannot ignore this background. With the consideration of this background, we are therefore able to construct four propositions below:

P1: In a highly uncertain industrial environment, formal contracting can serve as a 'promise' of resource commitments to the strategic alliance from the parties involved.

P2: In a highly uncertain industrial environment, mutual trust and related informal arrangements are the foundation of a sustainable alliance cooperation.

P3: In a highly uncertain industrial environment, industrial prosperity would help foster mutual trust between the parties involved.

P4: In a highly uncertain industrial environment, iterated informal contacting and flexible exit can ensure a stable alliance relationship with no need to negotiate ex ante *for benefit distribution.*

6. Conclusions

Our case study reveals a story of proactive contracting for innovation. OV and SOT come from the emerging smartphone industry, with high uncertainty in technology and huge demands on industrial fixed-assets investment. Although good potential for market demand was visible, both parties opted to work in alliance to obtain complementary resources from the other party to achieve their strategic aims of maximizing profits, while minimizing costs and uncertainty. Through the alliance cooperation, SOT has stabilized product demand and market share by taking advantage of OV's world reputation as a supplier, while OV has entered into and stabilized business in the exciting Chinese market by contracting *ex ante* with SOT (the largest module producer in China) to mitigate new market risks. During the collaboration, both parties have experienced extensive information exchange and communication via both formal contracts and more informal promises and understandings. These innovative channels have helped build mutual trust between both parties and led to 'win-win' strategic cooperation, with highly tacit understandings of each other, no opportunistic behaviors committed and 'hold-up' problems minimized.

6.1 Theoretical contributions

(1) Extension of "contracting for innovation' theory to an emerging market like China

The 'contracting for innovation' theory initiated by Gilson et al. (2009) can be used to explain

alliance cooperation based on high mutual trust under the circumstance of no obvious opportunistic safeguarding. Their findings have addressed the deficiencies in explaining cooperative behaviors in other research, such as Williamson and Oliver (1991) and Lafontaine and Slade (2007). While Gilson et al.'s study was carried out in the US where the market is comparatively stable, their findings cannot be fully used to explain the phenomena we observed and argued in the introduction. Our study has found different functions of contracting and the conditions of cooperation exist in an emerging market where industrial prosperity and market uncertainty coexist. Our results indicate that 'Contracting for Innovation' can be more flexible and more innovative to best match with different environments. Therefore, our study has added explanatory power to the theory of 'Contracting for Innovation' in explaining strategic alliance cooperation between upstream and downstream firms in the supply chain.

(2) Development of understanding of offset effects of environmental uncertainty on strategic alliance

Many studies have carried out research on the environmental uncertainties around strategic alliances (examples see Dyer and Singh, 1998; Lavie, 2006). Our case provides detailed descriptions and explanations about the innovation and mechanism of a strategic alliance in a highly uncertain environment. These descriptions and explanations not only describe/explain how uncertain risks stimulate firms to create relational rents (i.e. mutual trust), but more importantly, how established mutual trust helps in turn reduce environmental risk (i.e. binding effects), and how technological effects and governance effects reduce environmental uncertainty.

(3) Enrich understandings of RBV and the motivation of strategic alliances

Many research on alliance innovations (e.g. Adegbesan and Higgins, 2011; Dyer and Singh, 1998; Gulati, 1995; Mohr and Spekman, 1994) generally followed views from traditional studies such as Barney (1991) and Peteraf (1993), though Teece et al. (1997)'s dynamic capabilities extended firms' resources to relational and institutional resources, etc. Our case indicates the basis of the OV-SOT cooperation is OV's reputation and SOT's product capabilities. These factors are rarely mentioned in other studies. As such, our research on one hand reveals institutional factors (reputation) can help the forming of, and innovation in, alliances; and on the other hand, production capabilities (rather than unique capabilities) commonly owned by many firms also can be advantages when forming an alliance. These new findings have enriched the theories of RBV and the motivation for strategic alliances, and inspired the understanding of emerging markets where there are distances between foreign and domestic firms in relation to institutional factors and product capabilities.

6.2 Practical implications

Our results perhaps have two managerial implications: (1) although resource complementarity, industrial environment and market conditions are important factors to be considered *ex ante* when establishing a strategic alliance, *ex post* contracting for innovation practices including effective communications, decision making and governance are also determinants of final success of the alliance. (2) As long as both parties have enough shared interests in the alliance, it might not be necessary to worry too much about *ex post* opportunistic problems and hold-up issues because generally speaking, both sides will work hard to find suitable ways of moving forward.

6.3 Limitations and future research

Although this study has made good contributions to theories and practices, it has three major limitations. Firstly, this case is located in an emerging and fast-changing industry with obvious characteristics relating to high uncertainty in technology, growing industrial prosperity and huge investment in fixed assets (e.g. technical facilities). These industrial and market constraints would limit our findings' applicability to other industries/cases. Secondly, the convenience sampling strategy and the biased data[5] would limit the representativeness of the findings. Thirdly, our case operated in China, with the special market conditions mentioned above; this could be good for our study to contribute to extant literature but it also means our study has geographical limitations. We think these limitations could motivate future research directions for the generalization of our findings, but need not compromise the value of our study.

Acknowledgment

This research is funded by the National Natural Science Foundation of China (Fund No. 71372178), the Key Research Centre of Philosophy and Social Science of Zhejiang Province, China (Zhejiang Technological Innovation and Enterprise Internationalization Research Centre), and Key Research Team funds of Zhejiang University of Technology. We are grateful for the critical and constructive comments from the journal editors and the anonymous reviewers.

References

[5] The majority of data is from SOT, with a minority from OV managers.

Adegbesan, J. A., & Higgins, M. J. (2011). The intra-alliance division of value created through collaboration. *Strategic Management Journal, 32*(2), 187-211.

Amit, R., & Schoemaker, P. J. (1993). Strategic assets and organizational rent. *Strategic Management Journal*, 14(1), 33-46.

Anand, J., Oriani, R., & Vassolo, R. S. (2010). Alliance activity as a dynamic capability in the face of a discontinuous technological change. *Organization Science*, 21(6), 1213-1232.

Asanuma, B. (1989). Manufacturer-supplier relationships in Japan and the concept of relation-specific skill. *Journal of the Japanese and international economies, 3*(1), 1-30.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99-120.

Dattée, B., Alexy, O., & Autio, E. (2017). Maneuvering in poor visibility: how firms play the ecosystem game when uncertainty is high. *Academy of Management Journal*, amj.2015.0869.

Denzin, N. K., & Lincoln, Y. S (2008). Collecting and Interpresting Qaulitative Materials. 3rd edition. Sage Publications.

Doz, & Yves, L. (1996). The Evolution of Cooperation in Strategic Alliances: Initial Conditions or Learning Processes? *Strategic management journal, 17*(S1), 55-83.

Dyer, J. H., & Singh, H. (1998). The relational view: cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review, 23*(4), 660-679.

Eisenhardt, K. M. (1989). Building Theories from Case Study Research. *Academy of Management Review, 14*(4), 532-550.

Fang, X., Lederer, A.L., & Benamati, J.S. (2016). The influence of national culture on information technology development, implementation, and support challenges in China and the United States. *Journal of Global Information Technology Management,* 19(1), 26-43.

Ghauri, P. (2004). Designing and conducting case studies in international business research. In Piekkar, R. and Welch, C. (eds), *Handbook of Qaulitative Research Methods for International Business*. Edward Elgar Publishing Ltd.

Gilson, R. J., Sabel, C. F., & Scott, R. E. (2009). Contracting for innovation: vertical disintegration and interfirm collaboration. Columbia Law Review, 109(3), 431-502.

Gomes, L. A. D. V., Facin, A. L. F., Salerno, M. S., & Ikenami, R. K. (2016). Unpacking the innovation ecosystem construct: evolution, gaps and trends. Technological Forecasting & Social Change., http://dx.doi.org/10.1016/ j.techfore.2016.11.009

Gulati, R. (1995). Does familiarity breed trust? the implications of repeated ties for contractual choice in alliances. *Academy of Management Journal, 38*(1), 85-112.

Gulati, R., Lavie, D., & Singh, H. (2009). The nature of partnering experience and the gains from alliances. *Strategic management journal, 30*(11), 1213-1233.

Gulati, R., & Singh, H. (1998). The Architecture of Cooperation: Managing Coordination Costs and Appropriation Concerns in Strategic Alliances. *Administrative science quarterly, 43*(4), págs. 781-814.

Hagedoorn, J. (1993). Understanding the rationale of strategic technology partnering: inter-organizational modes of cooperation and sectoral differences. *Strategic management journal, 14*(5), 371-385.

Lafontaine, F., & Slade, M. (2007). Vertical integration and firm boundaries: the evidence. Journal of Economic Literature, 45(3), 629-685.

Lavie, D. (2006). The competitive advantage of interconnected firms: An extension of the resource-based view. *Academy of Management Review, 31*(3), 638-658.

Leonard□Barton, D. (1992). Core capabilities and core rigidities: A paradox in managing new product development. Strategic management journal, 13(S1), 111-125.

Mergel, I. (2016). Agile innovation management in government: a research agenda. Government Information Quarterly, 33(3), 516-523.
Miles, G., Preece, S. B., & Baetz, M. (1999). Dangers of dependence: The impact of strategic alliance use by small technology-based firms. *Journal of Small Business Management, 37*(2), 20-29.
Mockler, R.J., Dologite, D.G., Chen, Y., & Fang, M.Q. (1999). Information technology diffusion in developing countries: A study of China. *Journal of Global Information Technology Management,* 2(4), 23-40.
Mohr, J., & Spekman, R. (1994). Characteristics of partnership success: Partnership attributes, communication behavior, and conflict resolution techniques. *Strategic management journal, 15*(2), 135-152.
Mount, M., Milewski, S., & Fernandes, K. (2015). Exploring the knowledge complexities of innovation intermediaries: the case of nanotechnology in the UK. *International Journal of Technology Management*, 69(1), 20-37.
Peteraf, M. A. (1993). The cornerstones of competitive advantage: A resource-based view. *Strategic management journal, 14*(3), 179-191.
Powell, & Walter, W. (1998). *Learning from Collaboration: Knowledge and Networksin the Biotechnology and Pharmaceutical Industries*: Blackwell Publishers Ltd.
Roztocki, N., & Weistroffer, H.R. (2011). From the special issue editors: Information Technology in transition economies. *Information Systems Management*, 28(3), 188-191.
Prado, E.P.V., de Souza, C.A., Takaoka, H., & Reinhard, N. (2009). Contracting outsourced information technology services in Brazil. *Journal of Global Information Technology Management*, 12(4), 52-71.
Santangelo, G. D. (2000). Corporate strategic technological partnerships in the European information and communications technology industry. *Research Policy, 29*(9), 1015–1031.
Schoemaker, P. J. H. (1990). Strategy, Complexity, and Economic Rent. *Management science, 36*(10), 1178-1192.
Strauss, A. L. (1987). *Qualitative analysis for social scientists*. Cambridge University Press,.
Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. Strategic management journal, 509-533.
Wei, L. I., & Long, Y. (2011). A Study on Choice Mode of Alliance Structure of Competitiveness Strategic Alliance. *Commercial Research*.
Wei, T., Clegg, J., Ma., L. 2015. The conscious and unconscious facilitating role of the Chinese government in shaping the internationalization of Chinese MNCs. International Business Review. 24 (2), 331–343.
Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic management journal, 5*(2), 171-180.
Williamson, O. E. (1975). *Markets and hierarchies, analysis and antitrust implications: A study in the economics of internal organization*. New York: Free Press.
Williamson, O. E. 1985. *The economic institutions of capitalism*. New York: Free Press.
Williamson, & Oliver, E. (1991). Strategizing, economizing, and economic organization. *Strategic management journal, 12*(S2), 75-94.

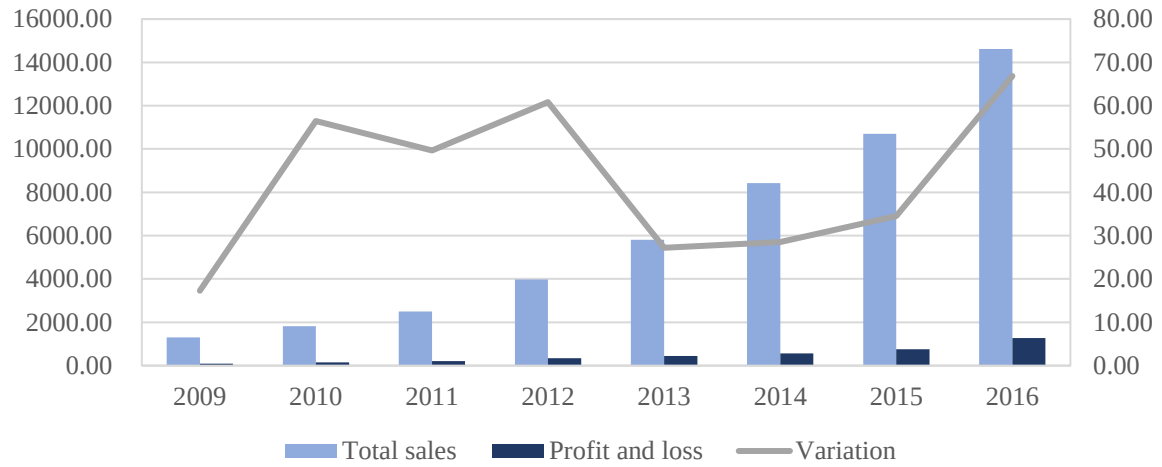

Figure 1 Total sales and profit of SOT's parent company (2009-2016, from SOT annual reports)

Notes: (1) Statistic unit: 1 million Chinese Yuan; (2) Principal axis: Total sales and profit; (3) Auxiliary axis: Variation (of annual total sales).

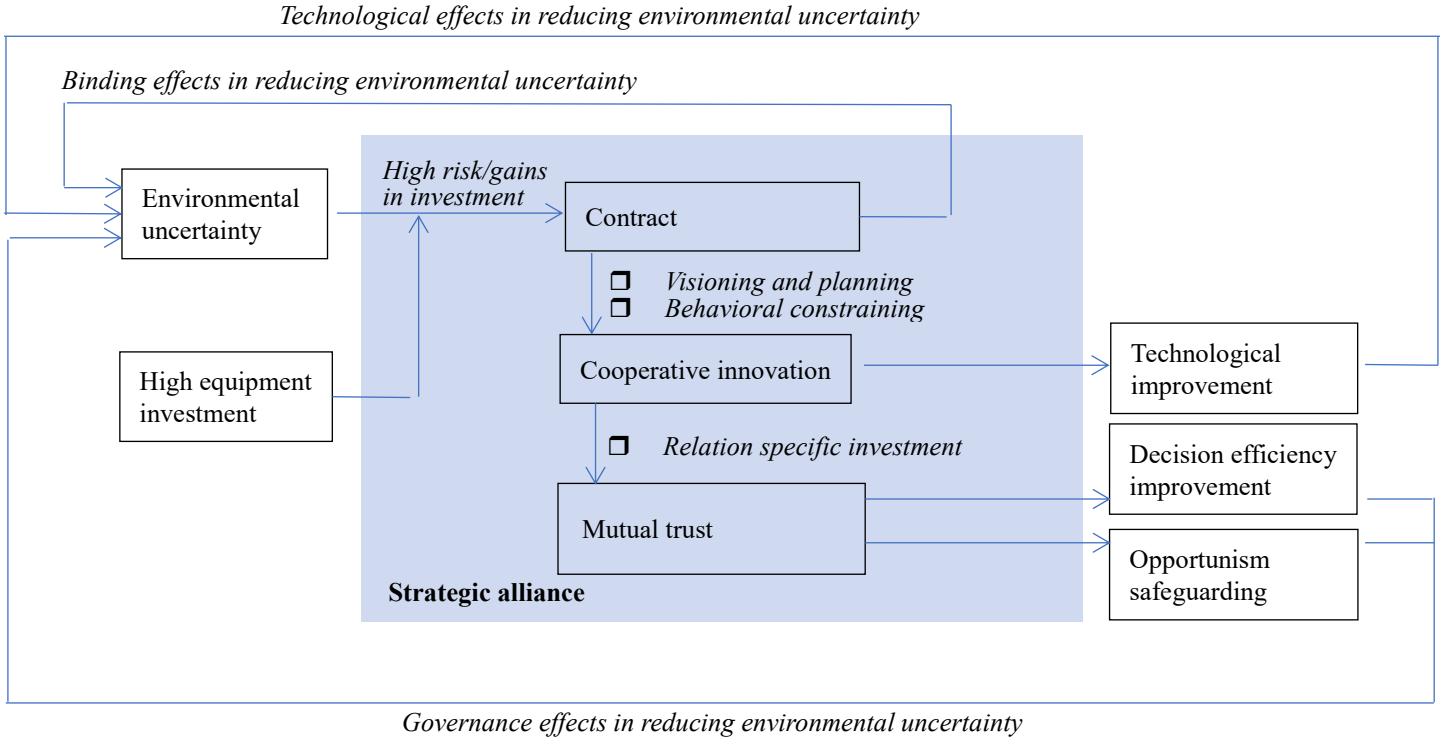

Figure 2 Cooperative innovation and contracting mechanisms reflected in OV-SOT alliance

Table 1 Data collection

Process	Sources	Data	Investigation focus
Desk based data collection (March-April,2015)	**Archival and published materials**: 1) Public search engines (i.e. Baidu, Google); 2) Professional database (e.g. China National Knowledge Infrastructure); 3) Company websites (i.e. SOT, SG and OV websites); 4) Hard copy materials obtained from SOT about both parties.	About 300 A4 pages in total	**Background knowledge** 1) Knowledge on ICT industry and technology of mobile phone CM; 2) Background of SOT and OV.
Pilot interview (April-May,2015)	**Open interview** (separately): 1) The chief marketing manager of SOT; 2) The chief R&D manager of SOT.	90 mins sound recording each	**Journey and key events/problems in SOT-OV alliance** 1) Whole journey of SOT-OV alliance cooperation; 2) Industrial environments; 3) Assets items (both in advantage and inferior position by SOT and OV separately) in forming dynamic capabilities.
Formal interview And field observation (May 2016)	**Semi structured interview** (aggregately): 1) A focus group consisting of the general manager, the chief marketing manager and the chief R&D manager of SOT; 2) Visiting production lines and different departments.	120 mins sound recording and notes taken by the 1st author	**Contracting and innovation process** 1) SOT-OV alliance strategy and key events/problems; 2) Contracting events and cooperation activities; 3) Confirming the truth of the cooperation through field observations.
Peer confirmation (June-July, 2016)	**External peers interview** (separately): Two external peers in the same industry;	45 mins sound recording each	**Peers' perceptions** 1) On environmental and industrial atmosphere; 2) On SOT-OV alliance cooperation.
Focused update interview and e-mail confirmation (July-August, 2017)	**Focused update interview** (separately): 1) The chief marketing manager of SOT (face to face); 2) The general manager of SOT (in telephone); 3) The marketing manager of OV (by e-mail).	(1) 45 mins sound recording; (2) 20 mins sound recording; (3) email confirmations on a number of key issues.	**Contracting and innovation process** 1) Contents about contracts; 2) The relationship between formal and informal contracts;* 3) The substantial constrains and functions of contracts;* 4) Forms and contents about investment in information; 5) Personal perspectives on the opportunist and hold-up problems;* 6) The effects of environment on contracts and cooperation.*

*: Issues confirmed with the OV marketing manager

Table 2 Environmental uncertainty and alliance collaboration effects

	Effects	Selected quotes
Contracting considerations	Seeking resource complementarities to avoid high risk in investment	*"Mobile industry changes too fast. If wait until we can have chip production capability, the market would not be there anymore." (Marketing Manager of SOT)* *"Chip and lens are two key parts in video camera. Both OV and SOT can solely produce the module (i.e. the combination of lens and chip), however in that scenario, each side has to bear high risk in heavy investment in special equipment. We chose the alliance to avoid the risks as OV has chip capability and we have lens technique." (R&D Manager of SOT)* *"Investing heavily in equipment may cause high market risks, which could lead to the investment being unrecoverable due to the quick technological development and fast market change in the CM industry. This was the main reason of OV and SOT working as an alliance to avoid investing into each other's fields." (Marketing Manager of SOT)*
Reducing uncertainty	Resource complementary reduces demand uncertainty	*"Chip manufacturers would influence more on customers. When customers choose the models, they concern the brand of chip. Our cooperation with OV allows us to share the market with higher certainty. The binding is helpful for both sides, especially for us….I think, firstly, OV cares about our production capability; secondly technological level for production capability plays an important role in reducing uncertainty in transforming technology into profit." (Marketing Manager of SOT)* *"We cannot afford stock out (unforeseeable short of supply). By contracting with OV, we can guarantee the supply of main part when it is out of stock…. For OV, the cooperation has reduced the risks because the quantities of products are ensured for big Chinese market demand. For us, we earn profits much higher than we could do by ourselves and also avoid risks on investing in equipment." (Marketing Manager of SOT)*
	Relation specific investment leads mutual trust which can reduce market uncertainty through improving decision efficiency and restraining opportunism.	*"Mutual trust means fewer rounds of communication and confirmation, thus improved efficiency of decision, and therefore, lower level of market uncertainty (because of earlier adjustments) and lower level of inter-organizational uncertainty (because of higher mutual trust)." (General Manager of SOT)* *"There should be no problem that SOT can drop out of the cooperation with OV at any time, and we also believe that OV also shares this idea. However we do not want losing the valuable investments in bilateral relationship. The investment not only raised our (SOT) assemble precision, more importantly, mutual trust. Without trust, we are unable to communicate so smooth and make timely decisions. This is the most treasured relationship in CM industry. It is the mutual understanding and trust rather than using a contract to restrain opportunism." (Marketing Manager of SOT)*

Table 3 Differences between the findings of Gilson et al.（2009）and of this research

	Findings in Gilson et al.（2009）	Findings in this research
Functions of formal Contract	**Formal contract plays as a platform of mutual cooperation** *"……formal contracting operates importantly to facilitate the development of informal contracting structures that police the parties' expectations of capability, cooperation, and trust（P472）."*	Under information asymmetry, formal contract serves as a 'promise' to the other party and a description of "blueprint" for future prosper of cooperation.
Governance mechanism	**Contract operates entirely as a governance structure** *"……the contract operates entirely as a governance structure that facilitates learning about the parties' capabilities(P477)."* *"……explicit mechanisms with respect to collaboration and dispute resolution（P479）."*	Mutual trust serves as governance structure while contracting is only the form and representativeness of mutual trust.
Hold-up problem	**Informal arrangement to constrain opportunistic renegotiation** *"The continued presence of uncertainty makes impossible the ex ante allocation of ex post decision power through assigning to one party options to take action like termination. For the project to work, the parties must rely on an informal arrangement to constrain opportunistic renegotiation of the division of the value created." (P474)*	Iterate informal contacting and flexible exit can ensure a stable alliance relationship with no need to negotiate *ex ante* for benefit distribution.