Value co-creation between foreign firms and indigenous small- and medium-sized enterprises (SMEs) in Kazakhstan's oil and gas industry: the role of information technology spillovers

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Value co-creation between foreign firms and indigenous small- and medium-sized enterprises (SMEs) in Kazakhstan's oil and gas industry: The role of information technology spillovers

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Abstract

Study related to the extractive sector still plays a limited role in the mainstream international business (IB) and management literature, with even less focus on ongoing liberalization and digitalization in the industry. This article was motivated by the question of how collaboration between foreign and indigenous oil and gas (O&G) companies can support small-sized and medium-sized indigenous technological development. The main contribution of this article is the development of a model that explains how different actors can cocreate value in the ecosystem of the O&G industry through digital technologies. A three-stage qualitative–interpretive method based on interviews with industry experts was adopted to build three vignette case studies. This article proposes what companies and the government could do to increase the competitiveness of the local economy, diversify from O&G into high technological industries, and support industrial development through information and communication technologies (ICT).

KEYWORDS
foreign and indigenous firms, ICT technology spillovers, industrial competitiveness, oil and gas industry, public-private partnership, value cocreation

1 | INTRODUCTION

Resource-rich countries[1] place great emphasis on oil and gas (O&G) industrial competitiveness because it is crucial to this sector of the economy in creating jobs and stimulating growth, as well as providing potential for diversification from the O&G industry into the growing service sector, namely the information and communication technologies (ICT)[2] industry, among others. Industrial competitiveness is associated with the "industry's ability to obtain and utilize resources to participate in competition" (Zhao & Wen, 2004). It also indicates the capacity of a country to support the development of businesses, and is especially important for small- and medium-sized enterprises (SMEs), the backbone of every economy (Hobohm, 2001). The development of SMEs is important in terms of job creation, especially for reducing urban poverty in developing countries, as they account for around 70% of employment, around 35% of exports, and the majority of national earnings in any economy (Navickas & Malakauskaite,

[1]Resource-rich countries: at least 20% of their total exports are natural resources, or at least 20% of their revenue are derived from the natural resource sector IMF (2007, 2012).

[2]Information and communication technologies (ICT) are primarily intended to fulfill or enable the function of information processing and communication by electronic means (UN, 2015). Digital technologies include; (a) advanced production equipment, robotics and factory automation, (b) new sources of data from mobile and ubiquitous Internet connectivity, (c) cloud computing, (d) big data analytics, and (e) artificial intelligence. These technologies and processes are based, in one way or another, on advanced ICT, so that the driver of the New Digital Economy is the continued exponential improvement in the cost-performance of ICT, mainly microelectronics (UNCTAD, 2017).

2009). SMEs are especially important for emerging resource-rich countries (ERRC) to move out of the middle-income trap (Radosevic & Yoruk, 2018), defined as the inability to sustain growth and transition from resource-driven growth, based on low-cost labor and capital, to productivity-driven growth (Khakas & Kohli, 2011). To boost industrial competitiveness, many resource-rich countries are, or have been, pursuing development policies aimed at maximizing the impact of natural resources on the whole economy (Ramdoo, 2015). These policies are focused on supporting domestic producers in expanding their activities, at least partially with domestic inputs, and gaining access to international technological and managerial expertise to enhance their competitiveness (Kalyuzhnova, Nygaard, Omarov, & Saparbayev, 2016). According to OECD (2013), business linkage[3] policies are an example of a public-private partnership (PPP), where development can enable increased interaction between local SMEs and international companies. It can incorporate a wide range of targets, including business development, boosting competitiveness, and diversification of the economy. Typically, these policies attempt to foster business between local companies and international companies, and have been used in many different countries and industries; for example, in high-tech industries in the Czech Republic, Costa Rica, and Ireland. No policy is, to some extent, context-independent: because the business setting is always changing, transferring practices from one country to another is difficult. Therefore, policies are always designed for a specific industry's characteristics, a specific country's characteristics, and time settings.

As such policies' designs differ substantially over time and geographic location, the literature gives contradictory views toward answering the question of how collaboration between foreign and indigenous O&G companies can support indigenous SME in their technological development, taking into consideration the ongoing digitalization[4] of the O&G industry. The fact that Kazakhstan has managed to attract significant foreign investments, predominantly in the natural resource sector, and, therefore, has built its O&G sector on foreign investments (Delevic & Heim, 2017). The collaboration between foreign and indigenous companies could play an important role in the transfer of international technological and managerial expertise to the indigenous SME in the O&G industry. Previous study in international business (IB), however, has also stressed foreign multinational enterprises (MNEs) tend not to agglomerate with local domestic companies, but are willing to agglomerate with other foreign MNEs (Mariotti, Piscitello, & Elia, 2009). This is, in large part, why governments of resource rich-countries pursue policies aiming to develop their domestic industrial capacity to support links with indigenous firms, and not only with other foreign MNEs. As such, further research is necessary to make such initiatives as successful as possible, accepting that our knowledge about them will continue to evolve (Tirole, 2017). In particular, the literature does not provide necessary multidimensional theoretical foundations for industrial development, as it is predominantly informed by economic and political theories (Shapiro, Hobdari, & Oh, 2018), and strategic management perspectives are virtually absent (Hansen, 2017). IB research has often excluded extractive industries and the service sector, claiming that they are likely to be subject to restrictions on the extent of foreign ownership in those businesses (Smarzynska-Javorchik & Wei, 2002).

This article aims to address this research gap, providing new theoretical insights into possible cooperation between local firms and MNEs in the O&G sector in Kazakhstan from the strategic perspective, taking into consideration recent trends such as liberalization of the extractive sector and convergence of the NDE.

The findings encourage policymakers, as well as indigenous SMEs, to take advantage of the digitalization of the O&G industry, including opportunities based on cooperation with foreign firms through facilitation of technology spillovers.[5]

2 | IMPACT OF FDI TECHNOLOGY SPILLOVERS ON LOCAL INDUSTRY

The literature on IB highlights the fact that foreign investments bring a package of capital, technology, and management skills to the host country, including those in the form of spillovers. For example, agglomeration spillovers refer to the vertical (buyer–supplier) and technological spillovers that arise from clusters and networks; these impacts can be intra-industry or interindustry (Dunning & Lundan, 2008). The empirical focus of research has been mostly on technological spillovers (Eden, 2009). Technological spillovers are informal, involuntary, nonmarket transfers (Eden, Levitas, & Martinez, 1997). An example of an agglomeration spillover is a knowledge spillover generated by geographically clustered high-tech firms in Silicon Valley (Almeida & Kogut, 1999). Technological spillovers represent differences between social and private impacts that are not reflected in market prices, and can, therefore, generate inefficiencies. As a result, public policy intervention may be needed for market prices to reflect social costs and benefits (Eden, 2009).

The extensive literature on horizontal foreign direct investments (FDI) spillovers (in the same industry) is inconclusive; the results show the presence of FDI seems more often than not to have no statistically significant productivity effects on domestic firms in the same (horizontal) industry (see, among others, Javorcik, 2004). FDI-induced performance (or productivity) spillovers take place when local firms learn about new technologies, marketing, or management techniques by: observing a foreign firm subsidiary (demonstration effects), hiring workers trained by the foreign firm subsidiary (labor market impacts), or using technologies shared by a foreign firm (technology-sharing impacts), thereby improving their performance. Competition may force a local firm to improve performance; however, competition may also negatively affect a local firm, reducing its revenue. For example, Aitken and Harrison (1999) and Javorcik (2004) demonstrated FDI may have negative effects on the productivity of domestic firms within the same industry. Positive effects have been found in

[3]Linkages refer to relationships created by companies with other actors, such as other companies, as well as academic and research institutions.

[4]Digitalization is a process of digital transformation to improve business performance.

[5]Technology (including ICT) spillovers (or externalities) are technological impacts on third parties not directly involved in an economic transaction (Pigou, 1920 in Eden, 2009).

upstream industries and as such, reflect supplier linkage effects rather than intra-industry technology transfer and learning effects. In general, the literature widely confirms the absence of positive effects within the same industries, as well as the presence of positive effects between industries (Altomonte & Pennings, 2009; Görg & Greenaway, 2004; Görg & Strobl, 2000, 2005; Javorcik & Spatareanu, 2008). In the O&G industry, production linkages can exist along the same value chain or in an intra-industry context, but they can also be inter-industry or horizontal (Narula, 2018). These latter linkages are essential for sustainable development. Interindustry linkages are important for the generation of new industries (industries supporting O&G, such as banks, transportation, logistic, and ICT companies), or industries outside of O&G that initiate new value chains in other, nonextractive sectors (Kaplinsky, Morris, & Kaplan, 2011). As such, returns from extractive sectors (often referred to as "rents") have the potential to create the basis for further economic activity in other (renewable) industries, therefore acting as a driver for sustainable development.

3 | LITERATURE REVIEW AND THEORETICAL MODEL

3.1 | Value cocreation process between foreign and indigenous firms

Value cocreation is a paradigm in the management literature that emerged from the service management field, innovation management studies, and marketing and consumer research (Galvagno & Dalli, 2014; Prahalad & Ramaswamy, 2000; Vargo & Lusch, 2004). In the early 2000s, Dyer and Singh (1998) and Dyer (2000) proposed a firm's resources may cross over firm boundaries and be shared with other firms. Later, the idea that companies and customers are able to create value through interaction pervaded the literature (Galvagno & Dalli, 2014; Grover & Kohli, 2012). Barrett, Velu, Kohli, Salge, and Simoes Brown (2011) demonstrated firms are increasingly looking to other firms to collaborate and cocreate ICT-enabled[6] products and services. Recent research also demonstrates the importance of the collaborative process of value cocreation in the context of knowledge-intensive business services (Aarikka-Stenroos & Jaakkola, 2012; Gummesson & Mele, 2010; Jaakkola & Hakanen, 2013; Vargo & Lusch, 2011). This approach has challenged the view that value is usually determined before a market exchange takes place (Prahalad & Ramaswamy, 2000, 2004, 2013; Vargo & Lusch, 2004).

The cocreation view states suppliers and customers interact with each other for the development of new business opportunities. There is an ongoing debate in the literature about the differences between cocreation and coproduction (Galvagno & Dalli, 2014; Grönroos & Voima, 2013). The marketing perspective considers value cocreation as a network of interactions between actors, evaluating the available and potential resources to understand what they have and what they can do (Mele, Russo-Spena, & Colurcio, 2010). According to the innovation and technology management perspective, the interaction between customers and companies, which technological platforms often mediate, leads to innovation, customer participation, and improved customer services (Galvagno & Dalli, 2014). Grover and Kohli (2012) demonstrate there are four components that determine value cocreation: relationship-specific assets, knowledge-sharing routines, complementary resources and capabilities, and effective governance. The value cocreation view has been previously applied to the settings of an MNE subsidiary in a knowledge-intensive industry (Heim, Tian, & Ghobadian, 2018). In this research, we focus on the foreign and indigenous actors in the O&G industry, value cocreation, and taking advantage of foreign ICT resources[7] for indigenous firms.

Based on the value cocreation perspective, we suggest: *Value cocreation from ICT spillovers in a multiple-stakeholder environment refers to the benefits resulting from the interaction of public and private partners, such as business organizations, governments, banks, research and educational institutions, and foreign ICT providers[8] of international O&G company (IOC). This value cocreation leads to the development of indigenous industry.*

Built on the review of the literature (Gomez, Baron, & Fiore-Silfvast, 2012; Gummesson & Mele, 2010; Jaakkola & Hakanen, 2013; Okonkwo, 2018; Vargo & Lusch, 2011) and the guiding theories of the value cocreation, we develop a value cocreation model at the network level for the O&G industry, which describes the process of inter-company alignment in the ecosystem of public and private organizations (Figure 1). Our research questions stand as follows:

1. To what extent is ICT adopted in the energy sector of Kazakhstan, and how is it used by private and public stakeholders to cocreate value within each organization, as well as between organizations and sectors?
2. How can the adoption of ICT in a multiple-stakeholders environment facilitate industrial development through value cocreation between private and public stakeholders in the O&G sector?

> We argue the deployment of ICT contributes to each layer of value cocreation, and the competitiveness of the O&G industry can be improved by further adoption of ICT and value cocreation in collaborative public-private networks.

3.2 | Model derivation

Based on our analysis of how previous studies have modeled ICT-enabled value creation in a single organization, we conclude the locus value cocreation in an environment of multiple stake-holders' in the O&G industry is the ICT provider, which can be a subsidiary of an international O&G company (model constructs are given in Table 1). The ICT

[6]ICT-enabled products and services are business opportunities emerging from the use of ICT.

[7]ICT resources are physical and intellectual assets related to ICT.

[8]ICT provider is a department or an entity, supporting companies with ICT, including technologies and services.

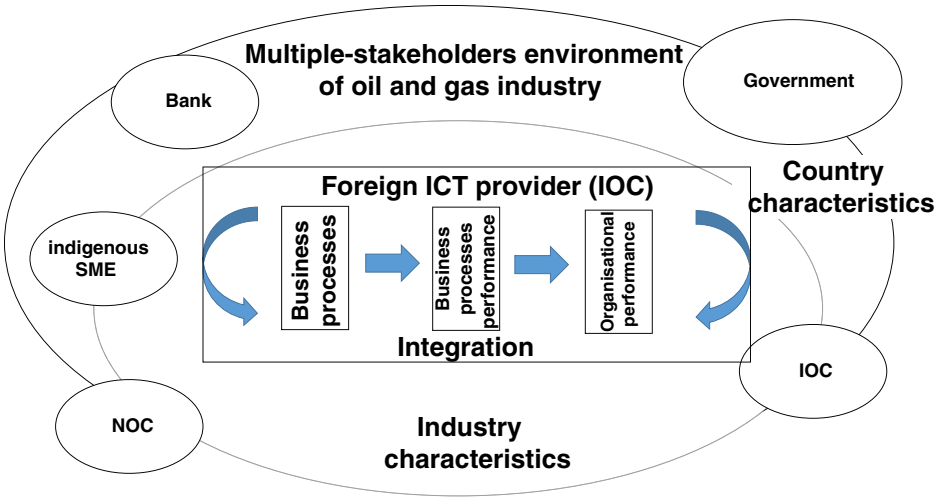

FIGURE 1 Value cocreation model at the network level for the oil and gas (O&G) industry [Color figure can be viewed at wileyonlinelibrary.com]

provider invests in and deploys ICT resources. Indigenous firms can take better advantage of the underused resource. External factors also play a role in shaping the extent to which ICT business value can be generated and captured (Melville, Kraemer, & Gurbaxani, 2004).

The Business–ICT Value Cocreation model (Figure 1) consists of three domains:

- the foreign ICT provider
- the competitive environment, including industry characteristics and multiple stakeholders, such as national O&G companies (NOC), international IOCs, local SMEs, and banks
- the macro-environment, including government.

TABLE 1 Model constructs

Domain	Main characteristics
ICT provider (IOC)	Financial resources
	ICT and related investments
	ICT skills and processes
	Managerial skills, business–ICT strategic alignment, and performance
Industry (NOC, SMEs)	Competitiveness
	Industrial regulation (local content policies in O&G and ICT sectors)
	Level of the local industry development
	Available local and foreign specialists
Country (government, banks)	Infrastructure (roads, buildings, airports, optic cables etc.)
	Educational institutions
	Research and development investments
	Business culture
	Regulation (tax subsidies, law on public–private partnership)

Abbreviations: ICT, information and communication technologies; IOC, international O&G company; NOC, national oil company, O&G, oil and gas; SME, small- and medium-sized enterprise.
Source: Authors.

The first domain is the ICT provider, which generates ICT business value through the deployment of ICT resources and sharing of digital platforms with multiple stakeholders of the second domain. This domain also includes regulation at the industry level, such as government promotion and regulation of technology development. It also includes industrial policies; for instance, local content for the ICT and O&G sectors. ICT increasingly diffuses organizational boundaries, linking multiple firms via electronic networks and software applications, and melding their business processes (Basu & Blanning, 2003; Hammer, 2001; Mukhopadhyay & Kerke, 2002; Straub & Watson, 2001). The application of ICT and complementary organizational resources by an ICT provider may result in the improvement of business processes and impact performance in the multiple stakeholder environment. The third domain is the macro-environment, which includes regulation at the country level, such as laws on PPPs, special economic zones and tax subsidies, the availability of ICT specialists, and finally, the information infrastructure. We included country characteristics in the model to emphasize the increasing role of public policies in shaping ICT business value in developing countries, where local organizations, such as SMEs, may face constraints in their application of information technologies.

Value cocreation also occurs at three inter-related levels (Jaakkola & Hakanen, 2013): the individual level (one actor), the relationship level (two actors), and the network level (Figures 2a,b and 1, respectively). Value creation at the network level involves value processes within individual organizations as well as within the network of actors in the O&G industry.

4 | METHODOLOGY AND THE EMPIRICAL STUDY

Our study focuses on the underinvestigated process of value cocreation in the ecosystem of PPPs with a foreign ICT provider and indigenous O&G firms. We adopt a multiple case study research methodology because it is the most appropriate for such exploratory research—especially when the boundaries between phenomena and context are not clearly evident (Eisenhardt, 1989). In the international

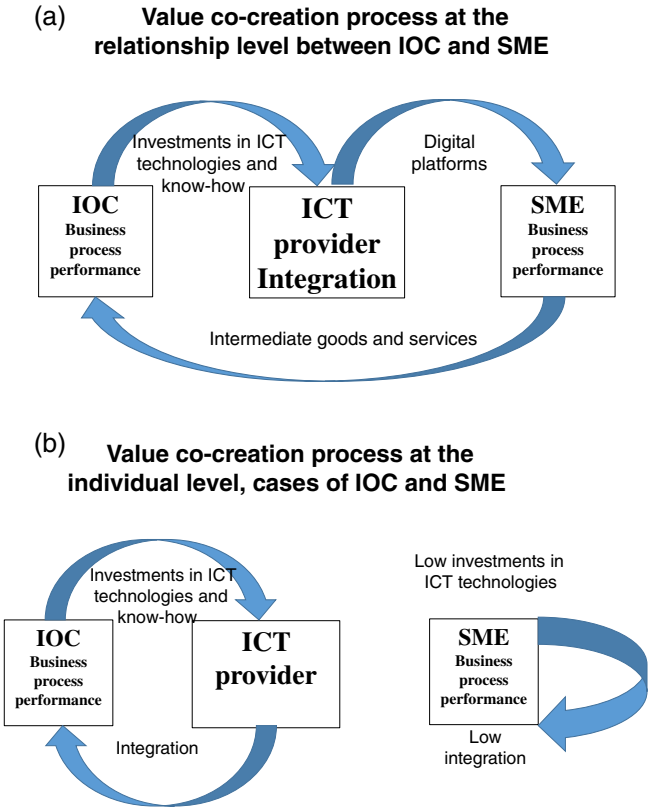

FIGURE 2 (a) Value co-creation model at the individual level for the cases of international O&G company (IOC) and small- and medium-sized enterprise (SME). (b) Value co-creation model at the relationship level for the case of IOC and SME [Color figure can be viewed at wileyonlinelibrary.com]

business (IB) field, the research is categorized as a case study if they meet the definition proposed by Piekkari, Welch & Paavilainen (2009, p. 569): "a research strategy that examines, through the use of a variety of data sources, a phenomenon in its naturalistic context, with the purpose of 'confronting' theory with the empirical world." Yin (1994, 2014) argued an industry may be investigated using a case study design. Pauwels and Matthyssens (2004) concluded, in many IB studies, theoretical sampling for multiple case studies is complicated by its intrinsic multilevel character. Furthermore, while the multinational firms have to be sampled, cases within those firms' business units, foreign subsidiaries, and even individual managers or other actors also have to be selected. Lee and Baskerville (2003) demonstrated it is possible to generalize from empirical evidence, even from a single case study, to wider theoretical constructs and structures. As an instrument to stricture the information from case studies based on interviews we use vignettes; systematically elaborated short descriptions of concrete social situations that contain precise references to what are thought to be the most important factors in the decision-making processes of respondents (Alexander & Becker, 1978). Qualitative vignettes are particularly useful for exploring "actions in context" (Barter & Renold, 1999). Recent examples of studies include public services (Rice, 2017). In IB research, use of qualitative illustrations, such as vignettes, to illustrate and emphasize the key elements and relationships in the theory makes its communication to the management audience easier (Doz, 2011).

As the focus of this study is on collaboration between foreign and indigenous companies in the ecosystem of the O&G industry, we have focused on firm-level (primary) cases, such as: international companies or MNEs, state-owned national oil companies (NOCs[9]), and SMEs. The selection of cases in the O&G industry is very limited; although the Kazakhstani O&G sector is open for foreign investments, and almost all of the largest global international O&G companies are operating there,[10] the number of companies is limited due to an oligopolistic market structure. Overseas state-owned NOCs (so-called SOEs) act as international firms, as they have to comply with the host country's legislative requirements. Although SOEs' strategies can be led by noncommercial motives, this is out of the interest of this research, and, therefore, not included in the scope of this study. Overall, international O&G companies demonstrate understanding that they need to look beyond the narrow generation of profit and paying taxes and royalties in their activities. However, while European laws directly prescribe certain social duties to business, American discourse reflects obligations that companies accept voluntarily. US O&G companies' social responsibility is embodied in their funding of programs in education, healthcare, and labor safety. In particular, oil giants give

[9]NOC—National Oil Company, a major, often state-owned, company operating only in the domestic market (KazMunayGas, Kazakhstan), IOC—international oil company, global company operating in international markets (China).

[10]Major international O&G companies operating in Kazakhstan are Eni, Chevron, Lukoil, Exxon-Mobil, CNPC, Royal Dutch Shell, Total and INPEX.

priority to the development of science, technology, engineering and mathematics (STEM)-disciplines.[11] Such expenditures are not based on pure altruism, as they facilitate the creation of a favorable climate for business operations. Such corporate programs represent successful examples of private-public partnerships in social areas (Pichkov, 2013).

We attempt to find a way to turn these strategies into advantages for the host-country economy. To address this methodological issue, we used triangulation to integrate multiple data sources. For this purpose, we conducted interviews with industry experts and studied secondary cases, such as educational, research, and industry institutions (see Appendix), as well as consulted extensive secondary and web-data sources and described our vignette case studies.

From the theoretical perspective, we use the existing theory of the value cocreation framework. The rationale for choosing this approach is that ICT can be used as an enabler for value creation by companies with different levels of ICT adoption in one industry, while companies that are more advanced in terms of ICT adoption can share their ICT resources with companies of lower levels of adoption. The latter would use ICT for the improvement of business processes, which would lead to better overall organizational performance. As both companies are interconnected in the O&G value chain, as are their customers and suppliers, this would allow them to cocreate value within their industry. To meet the aims of the research, while recognizing the fact that there is no established theoretical model applicable for a value cocreation process using ICT in the O&G industry, we use a three-stage qualitative–interpretive research method (Klein & Myers, 1999).

We explore how information systems influence value cocreation in the context of the O&G industry, and how industry influences the adoption of the information systems. First, we conduct a literature review to identify relevant theories, which will be used as an initial guide to inform the topics of research and data collection (Walsham, 1995). Second, we adopt the theory to the circumstances of the O&G industry to identify key domains for interviewing. This leads to the inductive development of the business-ICT value cocreation model at the network level for the O&G industry (Figure 1). This model, the result of the preliminary stage of theorizing, is the construction of an initial theoretical lens using the constructs and propositions from an appropriate theory meant as a "sensitizing device" to guide subsequent data collection and analysis (Pan & Tan, 2011). It was developed by the authors as a theoretical framework for testing in the circumstances of the O&G industry in Kazakhstan. Third, the lead author conducted semistructured interviews (Appendix) and examined the data from secondary sources, such as policies and the companies' websites. To limit bias, we used an approach proposed by Eisenhardt and Graebner (2007), and have selected highly knowledgeable informants who view the focal phenomena from diverse perspectives.

The methodology is depicted in Figure 3. Interviews were negotiated through one of the authors, who is a reputable academic and researcher on Kazakhstan's energy sectors. These credentials granted the researchers immediate legitimacy and credibility (Patton, 1990). This stage involves deductive advancement through in-depth interviews to identify the level of ICT adoption in Kazakhstan's O&G sector, and constructs a model for each type of O&G organization.

Three vignettes described cases that were different from each other in terms of company ownership and size, private local SME, state-owned NOCs, and international O&G companies; however, we acknowledge the quasi-state ownership of the selected enterprise. The aim of the present vignette study is to generate first outcomes in the form of a model of ICT-based collaboration for each case and for the O&G cluster. The three vignette case studies each had a similar structure (see Table 2). They started with a brief paragraph about the company. The story continued with more information about the company's main characteristics of ICT adoption, skills available, and investments in ICT. These capabilities are critical for the decision to collaborate. Finally, information about ICT-based collaboration is presented in the form of visual models (Figure 4 and Figure 5).

Criteria for the vignette case study selection were the following: for the local private company, we wanted to select a large enterprise, defined by the World Bank (WB) (2015) as having more than 100 employees but less than 250 employees, operating in the O&G industry for a minimum of 20 years, and covering all regions at the national level. For the national O&G company (operating predominantly in one country), we selected a major state-owned enterprise (SOE) operating in the O&G industry. For the international O&G company (operating in more than one country), we selected a subsidiary of a foreign-owned major international O&G Company with more than 10 years of business experience in Kazakhstan. This likely allows the company to overcome the competitive disadvantages of operating in a foreign environment, as the organizational learning processes of emerging economies may take a minimum of 5 years (i.e., Wei & Clegg, 2015).

Finally, we develop a framework of ICT collaboration in the O&G industry cluster (Figure 6).

5 | DATA ANALYSIS AND RESULTS

An overview of findings from three typical case studies in the O&G industry—indigenous SME, national O&G company (NOC), and IOC—are presented in Table 2. The case of the IOC will be discussed in detail later, as it gives information about technologies available to such companies and the ways indigenous firms can collaborate.

5.1 | Case study

We identified three main cases within the O&G industry through theoretical sampling (Eisenhardt & Graebner, 2007; Silverman, 2006): a privately owned SME, a NOC, and an IOC. The main characteristics of ICT adoption for these three case studies are summarized in Table 2.

5.1.1 | Vignette study 1: Privately-owned SME

Our findings demonstrate ICT technology is relatively undeveloped in Kazakhstan, especially in SMEs, in which the level of adoption is

[11] *STEM disciplines are*: Science, Technology, Engineering, and Mathematics.

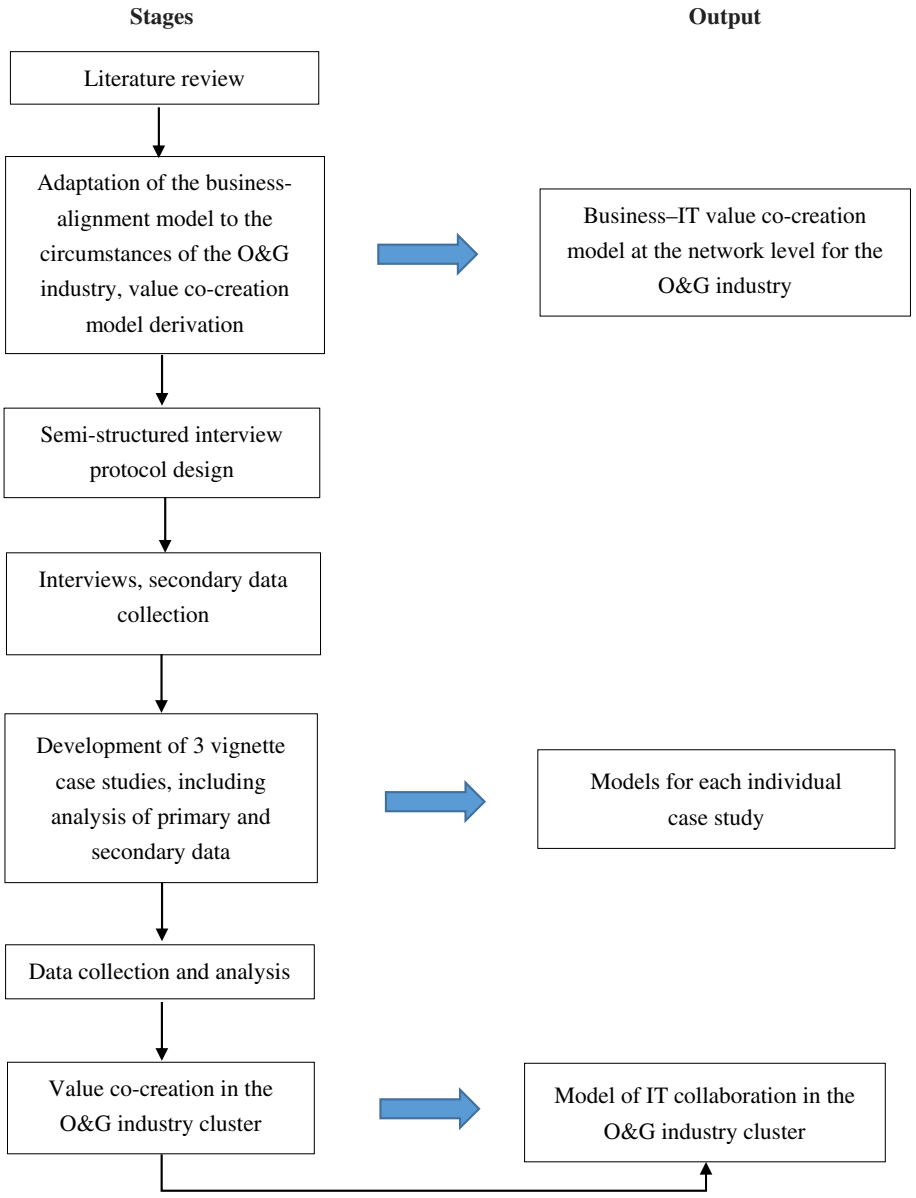

FIGURE 3 The research methodology. *Source*: Authors [Color figure can be viewed at wileyonlinelibrary.com]

very low (level one). The main gaps are the lack of financial resources for investments in ICT equipment and services, which leads to a lack of modern technologies, as well as skills gaps. The reason why SMEs often cannot access financial resources is their inability to provide evidence of long-term financial stability and ability to pay the loan back. For example, one of the interviewees was recently working as a managing director for a national (in terms of geographical coverage) machinery building plant, which had been producing equipment for the O&G industry in Kazakhstan for more than 20 years. The company is one of the 10 leading machinery plants in Kazakhstan, and currently employs about 200 people, but does not have any employees responsible for ICT.

In particular, he said the following:

> The main initiative in the company is regulatory compliance, namely product certification according to international standards. The organization has no informal or formal ICT or digitalization strategy. ICT is not used to increase efficiency, reliability, or keep costs low (no enterprise resource planning (ERP) systems). Nor is it used in customer services or product innovation (no customer relationships management (CRM) solutions system). The only ICT available are hardware (computers with installed applications such as operating system), office solutions (the company sometimes uses illegal copies of programmes), and a basic accounting programme. There are no plans to implement new technologies, nor any strategic plans. New technologies such as cloud and mobile are not available. The reason is that there is limited availability of such services even from major national telecom companies, namely Kazakhtelecom.

TABLE 2 Summary of findings by cases

Case	Main characteristics of ICT adoption
SME	Lack of financial resources
	No evidence of long-term financial stability can be provided
	Lack of modern technologies
	ICT investments are mostly available in the form of hardware
	Skills gap, no ICT manager
	No business–ICT strategy alignment in place
	ICT is not used for efficiency, reliability, or cost-saving improvements
	Low innovativeness
	No strategic orientation toward partnership and joint venturing
	No platform building toward ecosystems and digitalization of core business
NOC	Financial resources are available
	Government guarantee long-term financial stability
	Modern technologies are partly available
	ICT investments in enterprise systems, hardware, and services. The share of local content is high in services but very low in hardware and software.
	Skills gap in some ICT areas, CIO has been recently appointed
	A project on business–ICT alignment transformation has recently started
	Innovativeness in the form of business processes transformation and digitalization of some business processes
	No strategic orientation toward partnership and joint venturing
	No platform building toward ecosystems
IOC	Financial resources are available upon approval from the headquarters
	Long-term financial stability is guaranteed by the headquarters
	When taking decisions on budget, in most of cases the ICT department act as a driver of innovations
	A subsidiary in Kazakhstan can use technologies that are available at international level, such as single-enterprise ("private") cloud data center in Asia, as well as facilities in China and Dubai
	ICT investments in ERP systems, cloud computing, infrastructure, provides services, construction plans, consulting, support, and technical service business for the petroleum industry and large enterprises and public institutions, ICT solutions developed by the headquarters in China
	Local skill gaps in some ICT areas, expatriate specialists as well as headquarters transfer knowledge to local employees
	Innovativeness, investments in the digital infrastructure, platform building within toward ecosystem of CNPC's network of organizations in Kazakhstan
	Strategic orientation toward partnership and joint venturing within the O&G industry

Abbreviations: CNPC, China National Petroleum Corporation; ICT, information and communication technologies; IOC, international O&G company; NOC, national oil company, O&G, oil and gas; SME, small- and medium-sized enterprise.
Source: Authors.

Level of ICT development

The overall level of ICT adoption in the organization corresponds to the lowest level on the five-tier scale, as activities and processes are not defined by individual managers, but by one person who has a personal passion to ICT and management procedures, and controls are not established.

The main gaps are a lack of the financial resources needed for investment in ICT equipment and services, which leads to a lack of modern technologies; and a gap in skills. The reason that SMEs cannot access financial resources is that they are unable to provide evidence of their long-term financial stability and their ability to repay loans. For example, one of the interviewees, recently working as a managing director, explained that the main initiative in the company is regulatory compliance, namely product certification according to international standards, but there are no financial resources to develop ICT further.

Skills available

ICT skills in the O&G SMEs in Kazakhstan are underdeveloped. Organizations often report a number of gaps between the skills they require and the skills available on the job market or through their employees. The major gaps include a culture of communications, formal ICT qualifications, problem-solving skills, communication and learning skills, initiative, and leadership skills. Often there is no individual or team responsible for ICT in SME organizations.

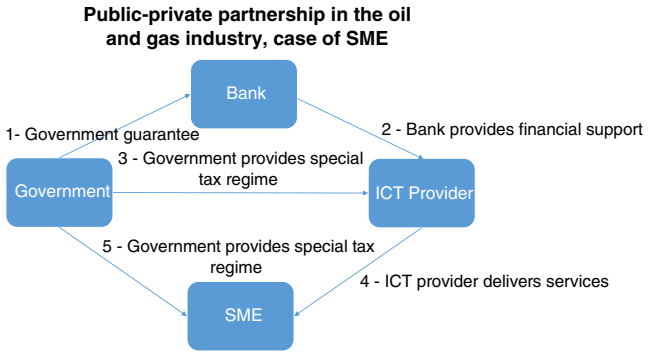

FIGURE 4 Information and communication technologies (ICT) collaboration in the oil and gas (O&G) industry: Case of a single SME [Color figure can be viewed at wileyonlinelibrary.com]

Structure of ICT investments

The organization has no informal or formal ICT or digitalization strategy. ICT is not used to increase efficiency, reliability, or to keep costs low (there is no enterprise research planning or ERP); ICT is not used in customer services or product innovation (there is no customer relationship management [CRM] system). The only ICT available is in the form of hardware (computers installed with applications such as an operating system), office solutions (the company sometimes uses illegal copies of programs), and a basic accounting program. There are no plans to implement new technologies and there are no strategic plans. New technologies, such as cloud and mobile, are not available because there is limited availability of such services, even from major national telecom companies, such as *Kazakhtelecom*. The overall level of ICT adoption in the organization corresponds to the lowest level ICT adoption model: "efficiency of processes is chosen by individual managers who do just anything to get the job done, without systematic methods of selection. Individual managers, but individual members of staff do not define activities and processes, often when ICT development is not even included in their job descriptions."

Development of Kazakhstan's O&G SMEs would benefit its economy directly through new job creation, but also indirectly through growth in productivity and attraction of FDI. Adoption of ICT by local O&G SMEs in Kazakhstan would also affect the economy in an indirect way through increased labor productivity, capital investment in ICT infrastructure and equipment, and overall competitiveness of the O&G sector.

The aforementioned empirical findings can be summarized in the framework (Figure 6), which shows how an SME can benefit from the PPP in the O&G industry.

5.1.2 | Vignette study 2: National O&G company (SOE)

In the case of a national O&G company (*KazMunayGas* or *NOC KMG*), the level of ICT adoption can be described as in the middle, between the SME discussed in the previous section, and an MNE, which will be discussed in the next section. Kazakhstan's NOC KMG is owned by *the National Welfare Fund Samruk-Kazyna* (*NWF Samruk-Kazyna*), which is a group of state-owned companies, a sovereign wealth fund, and a joint stock company in Kazakhstan. NWF Samruk-Kazyna also owns, either in whole or in part, many major companies in the country, including the national rail and postal service, the telecommunication company *Kazakhtelecom*, the state uranium company *Kazatomprom*, and *Air Astana*, as well as numerous financial groups. The state is the sole shareholder of the fund.

A deputy general manager of strategy and development at KMG Solutions B.V. stated:

> The common problem of all developing countries is under-investment in ICT, and particularly in ICT in O&G industry in Kazakhstan and particularly in KazMunayGas. Now we need to invest much more in order to achieve an acceptable level of digitalization…

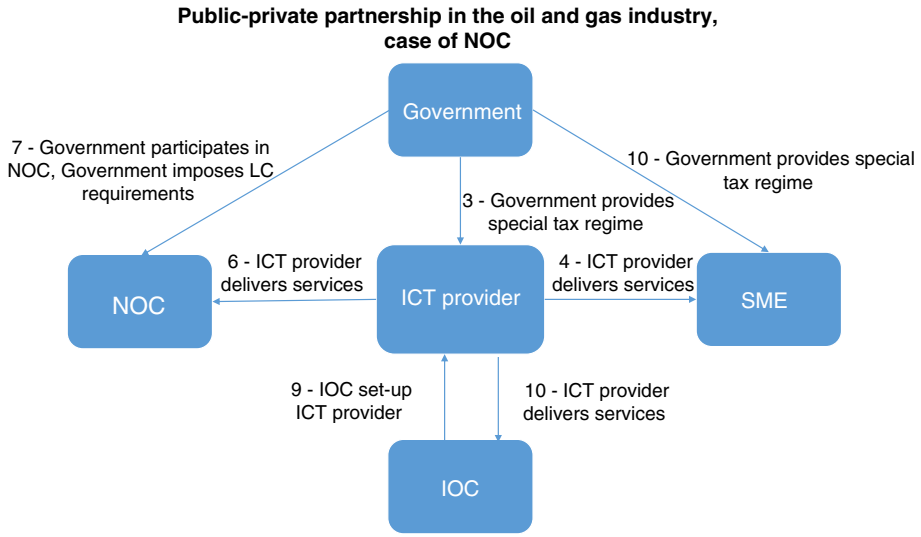

FIGURE 5 Information and communication technologies (ICT) collaboration in the oil and gas (O&G) industry: Case of a NOC [Color figure can be viewed at wileyonlinelibrary.com]

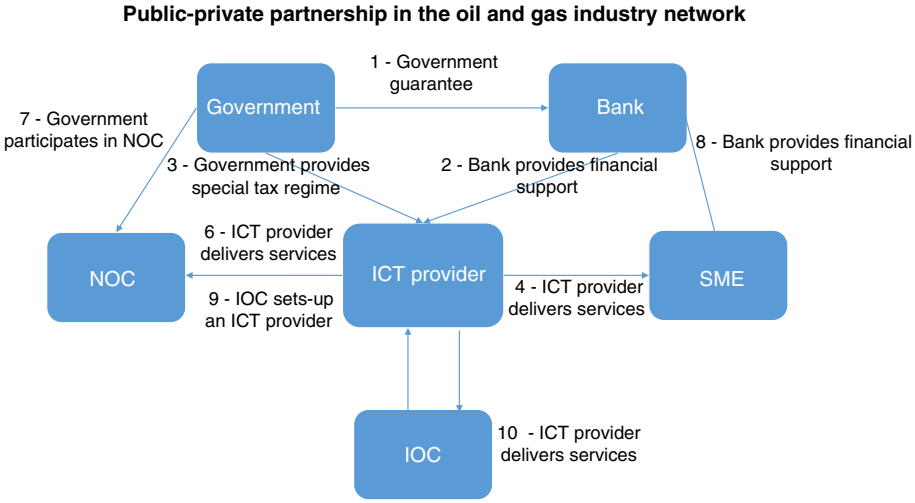

FIGURE 6 Public–private information and communication technologies (ICT)-enabled collaboration in the oil and gas (O&G) industry [Color figure can be viewed at wileyonlinelibrary.com]

> Second, is the problem of local ICT industrial development. The slogan of local producer protection is not a factor of development, but the factor of protectionism, which leads to the deterioration in quality, increase in prices and does not lead to the expected development of labor force… the solution is not to substitute… you know import substitution… but to complement import with local development.

Level of ICT development

The ICT services for NOC KMG are centrally provided by NWF Samruk-Kazyna to the group of companies they own. In 2015, NWF Samruk-Kazyna started a project on business and IT transformation, and in 2016, launched KazMunayGas, a project on a shared service center (SSC) creation. The main idea behind the project is to redesign business processes, to align the ICT strategy and the business strategy, and to transform the ICT of the organization from a service provider to a partner. At the moment, the level of ICT does not allow a business to develop its full potential, that is, not only to save costs but also to generate income and develop new businesses. The reason is that managers view ICT as a cost-generating service. Management still does not pay enough attention to ICT, innovation, or digitalization. For example, until recently, there was no position of Chief Information Offices in the C-teams of group companies (apart from *Kazakhtelecom* and *Air Astana*), i.e., there was no chief information officer (CIO) position in NOC KMG (he was only appointed in March 2014). If there is no representative of the ICT department at the C-level, it is very difficult for ICT to become a business partner. Previously, there was an IT director position, responsible for IT operations. In contrast, a CIO is responsible for ICT as a strategy, developing innovations, digitalization, and ICT as a driver of a business.

Skills available

The IT Transformation Team (TT) in NWF Samruk-Kazyna includes the following departments: business processes, IT, change management, and project management. In KMG, it accounts for more than 100 people and is built from the best representatives of the operational departments to transform a business from the inside. Since their appointment, members of the TT work only on transformation, and not on operational tasks. In NWF Samruk-Kazyna, there was no IT architect job, but now in the TT, a minimum of five architect jobs have been created: application architect, data architect, infrastructure and security architect, processes architect, and a head of IT as chief architect. The problem here is that there are no specialists in the areas of data governance or master data management in Kazakhstan. NWF Samruk-Kazyna has hired specialists from Russia, who transfer knowledge from previous projects, such as Lukoil and Gazprom, in the Russian O&G industry. NWF Samruk-Kazyna has also established an IT academy where specialists can fill gaps in the knowledge of processes, corporate governance, project management, data management, and business architecture management. Unfortunately, an IT academy cannot solve all problems. The main challenge is that universities in Kazakhstan educate IT specialists with no focus on business needs. According to our interviewee, an ICT specialist who is currently working for a major international O&G company who had an internship at her future employer, "the internship was too short, only 1 month and in this period of time [she] could not get sufficient practical information but only general knowledge about [her] potential working place." She suggested such internships should be a minimum of 6 months to gain more professionally focused knowledge. NWF Samruk-Kazyna has contacted major Kazakhstani universities with proposals on how to adjust their educational programs to suit business needs. Thirty students took on 3-month summer positions in six TTs in NWF Samruk-Kazyna in 2015. Professional development standards have been created to carve out a career path for IT specialists, that is, how the IT staff can progress in their career by outlining which training and certification have to be undertaken at which career stages. The TT in "Samruk-Kazyna" also organizes workshops on business and IT strategy alignment, as well as IT courses in the IT Academy in its corporate "university."

TABLE 3 Plan of IT procurement of national oil and gas company (*KazMunayGas*) (NOC KMG)

Year	Goods, thousands Tenge	LC (%)	Services,[a] thousands Tenge	LC (%)	IT programmes, thousands Tenge	LC (%)
2015	309,906	1	1,581,034	96	117,354	0
2014	2,189,805	0	1,904,774	93	575,960	0
2013	157,314	0	963,468	84	314,730	0
2012	103,679	1	1,668,169	83	2,260,453	12

[a]Prices are not available for all positions.
Source: Authors calculations from www.kmg.kz/procurement. Prices are not available for all positions.

Structure of ICT investments

We analyzed the IT expenditure of the NOC KMG. From Table 3, it is evident that KMG creates expenses rather than drives value, because the company procures mostly hardware, while less is spent on the implementation of ERP, CRM, and BI[12] systems. Such systems have been in existence as technology for decades, and are now using new technologies such as cloud, mobile, and big data, which can really have a great impact on business. The problem is that KMG still does not understand how these newer technologies can be integrated into its business models, and, therefore, also does not grasp the effects that it can provide. From our point of view, the situation described here corresponds to the middle stages of ICT adoption: basic management processes and controls are in the process of establishment and transformation.

The data in Table 3 show that the local value added in IT goods and programs is very low, with services achieving nearly full localization.

The aforementioned empirical findings can be summarized in the framework (Figure 6), showing the PPP for a NOC cooperating on projects with an indigenous SME in the O&G industry:

5.1.3 | Vignette study 3: International O&G company (MNE)

International O&G companies operating in Kazakhstan have the most highly developed levels of ICT in the O&G value network in the country. The ICT services are centrally provided by the ICT service company, which delivers them to the network of organizations using digital technologies. We interviewed an executive from *Richfit International*, an ICT provider, and a wholly owned subsidiary of the *China National Petroleum Corporation* (CNPC) in Kazakhstan. The subsidiary provides ICT services, mainly for CNPC International, which ranks among the top five on the list of global oil companies. CNPC's network of organizations in Kazakhstan consists of 12 companies, including operators of the O&G fields, as well as different companies from O&G value chain, such as major energy and chemicals companies (nine companies in Kazakhstan), and downstream operations (mostly focused on Kazakhstan and Central Asia).

According to the managing director:

> integration and sharing of ICT digital resources allowed the company to save significant financial resources and improve the competitiveness of the group companies. We are also ready to deliver our services to any external companies from the O&G industry. Our headquarters in their home market in China delivers about 30% of services to the companies which do not belong to the group. This allows to co-create value within the O&G industry between companies of different sizes and parts of the O&G value chain.

Level of ICT development

Some of the companies in the O&G industry are advanced from the ICT development standpoint; however, there are others in which ICT does not exist, only basic technologies.

According to the managing director:

> customers have different levels of ICT adoption. The level of adoption depends on the history of the organization. Through the deployment of modern digital solutions within the network of our organizations, we improve the availability of ICT. For example, we implemented cloud ERP in the down-stream company and improved its performance.

Often customers do not even know what ICT services they do have—and so they have no idea about what and how to further implement them. In the more advanced companies, the focus is on ERP systems from the Kazakhstani perspective, but even ERPs do not exist in all the companies. There is also an interest in rig maintenance and repair automation, as well as industrial automatization of rigs and timely data transmission. The aim is real-time data transmission, but if there is no automatization of this process, companies must transmit data manually, often on a daily basis, but sometimes, in extreme cases, only on a weekly basis.

Another expert expressed an opinion that about 30% of O&G companies in Kazakhstan have a relatively high level of ICT adoption. About 60%, however, still have a low level, and 10% have a very low level. O&G companies in Kazakhstan used to spend only 1.5% of their revenue on ICT; since the downturn in oil prices, this has decreased to 1% or less. In most companies, the ICT function reports to the chief financial officer (CFO), so there is no CIO position at the C-level. In CNPC, about 20% of the ICT budget is spent on innovations and 80% is spent on maintenance.

[12]Enterprise resource planning (ERP), customer relationships management (CRM) and business intelligence (BI).

Skills available

Richfit International also participates in some ICT projects in Africa, Venezuela, and Russia, but Kazakhstan is one of the priority markets for CNPC, as it is the closest geographically, and is where it owns the highest number of foreign entities. The provider supplies information construction plans, consulting, support, and technical services for the petroleum industry, large enterprises, and public institutions. The total number of ICT employees in headquarters is 3,000, and Richfit International in Kazakhstan accounts for about 50 employees. The company has carried out its business activities in Kazakhstan for 3 years. Business activities include outsourcing and implementation of ERP systems, outsourcing of ICT services, infrastructure outsourcing, and implementation of ICT solutions developed by the headquarters in the home country (e.g., office automation systems, digital control systems, and production of temperature and pressure sensors for these systems). The company employs local specialists as well as expatriates who transfer the knowledge available at the corporate level to local employees; however, as one of the top managers explained:

> there is a shortage of ICT specialists in Kazakhstan, which is why expatriate specialists would be very helpful as local staff report skills gaps in some ICT areas; however, the local content requirements for the share of local labor are very high, and obtaining a working permit is extremely expensive. This makes the transfer of knowledge difficult; however, headquarters supports ITC Ltd with the knowledge available at the corporate level.

Structure of ICT investments

When making decisions on budget, the ICT department acts as a driver of innovation in most cases. Technologies such as the industrial internet or internet of things (IoT) and cloud computing are being adopted by the company. For example, CNPC has recently built the largest single-enterprise ("private") cloud data center in Asia. The reason for this was that the operating environment, which included hundreds of ICT applications, had become too complex and lacked the ability to perform its critical functions, so it was necessary to integrate the architectures to enable the company to centrally manage its services. ITC Ltd can also use cloud facilities from headquarters, and there are already customers in Kazakhstan who use CNPC's cloud.

According to the managing director of the company:

> Only 10% of energy companies in Kazakhstan use new ICT such as the Cloud and Internet of Things. ITC Ltd can offer to customers in Kazakhstan its cloud facilities in the home country and Dubai. The data of our customers will be safe - the MIPC, as with many other private and government organizations, is paying close attention to cybersecurity and has decided not to use vendor solutions for its cloud services but to build its own. However, constraints on the use of modern technologies for other companies include a generally low level of ICT adoption in Kazakhstan, and also legislation that restricts the storage of personal and some other data outside of Kazakhstan.

6 | DISCUSSION

Through the data analysis, we have noticed the level of ICT adoption in Kazakhstan's energy sector and the method of value cocreation varies depending on the type of O&G organization (i.e., SMEs, national companies, and multi-international companies). There is a very low level of adoption by SMEs, a medium level by national companies, and the highest level by international companies operating in the Kazakhstani energy sector. This is a predictable result when technology transfer within MNEs from technologically advanced countries such as the United States, China, and the UK is taken into consideration. Russian MNEs are also more technologically developed than local Kazakhstani O&G companies due to the historical origin of the Kazakhstani energy sector as part of the former Soviet O&G industry, with a center of competence in the Russian Federation. The NOC KMG has recently started an ambitious ICT and business processes transformation project, which is financed by the Kazakhstani state. However, the share of domestically produced value-added in ICT products and services procured by NOC KMG remains very low, and it does not fully exploit the potential that could be created by the Kazakhstani energy sector to enhance the ICT sector. SMEs do not get enough attention or resources from the state or from policymakers to be able to develop their levels of ICT. Where can such companies seek knowledge and resources to develop their ICT adoption? How can policymakers use the potential of MNEs to strengthen the domestic SME sector?

In our previous research (Li, Liu, Belitski, Ghobadian, & O'Regan, 2016) we concluded that leadership mediated by digital technology is critical for SMEs performance. The constructs of this leadership, in particular, include human capital development, strategic orientation toward partnerships and joint venturing, disruption and innovativeness, platform building toward ecosystems, and digitalization of core business. This study confirms strategic alignment of SMEs with NOCs and IOCs, as well as the other actors in the ecosystem of the O&G industry is crucial for their value creation, performance, and growth. The value-creation process in such ecosystems also involves different stakeholders. They form a network through which resources are integrated by technology (Gummesson & Mele, 2010; Jaakkola & Hakanen, 2013; Vargo & Lusch, 2011). Therefore, our policy advice to the Kazakhstani government is to engage the international O&G companies in the development of the local O&G industry and incentivize them to undertake such activities by creating special ICT–O&G linkages through PPPs between IOCs, SMEs, and the government, including state-owned companies and other stakeholders.

Our analysis suggests the options how ICT may be used as a source for long-term competitiveness in the multiple-stakeholder environment of the O&G industry. Furthermore, the results of our study can be applied to any other vertically integrated industries. This

research has both managerial and theoretical implications, as well as suggestions for helping policymakers to formulate more collaborative policies when aiming to support indigenous development and link the indigenous O&G sector with foreign ICT to facilitate technological spillovers. This study extends our empirical knowledge of how organizations can cooperate to cocreate value from ICT spillovers in the O&G industry. The proposed conceptual model contributes to prior theory and expands it by combining business ICT alignment in multiple-stakeholder and value cocreation theory. This creates the basis for further research on the topic.

Practical implications of the findings, however, will require the development of a proper public-private institutional framework. According to UNCTAD (2010), business linkages represent one of the best ways for SMEs to enhance their competitiveness and acquire critical assets, such as access to international markets, finance, technology, management skills, and specialized knowledge. Our recommendations to policymakers in Kazakhstan are to consider the possibility of seeding an interindustrial O&G–ICT cluster that will focus activity on the transfer of technological expertise from international O&G companies to the local economy, and in addition foster ICT education and product development in the form of collaboration between the IOC, the local O&G industry, and the ICT sector. Initial endowments could be given by international O&G companies operating in Kazakhstan and the government. To incentivize O&G companies, the government may choose to consider a tax incentive for endowments to the PPP company. The location of such partnership companies is a critical success factor—it should provide easy access to qualified personnel, as ICT is a knowledge-intensive industry. This type of collaboration includes relationships between the ICT provider, NOCs, IOCs, and SMEs, as well as the government (as an initiator of new technology implementation), and banks (as guarantors of funding).

The process of ensuring theory–data–model alignment in this study involved recursively iterating between existing guiding theories. These theories include value cocreation in networks, the PPP developmental model, empirical data, and the emergent conceptual model to ensure all dimensions were aligned (Eisenhardt & Graebner, 2007). The aforementioned empirical findings form the basis for the conceptual framework, showing PPP linkages in the O&G cluster presented in Figure 6 and summarized in Table 4 later.

7 | CONCLUSIONS AND FUTURE WORK

The ICT industry plays a crucial role in the development of any state. The advantage of digital technologies, for example, cloud computing, is that they allow the implementation of standard services in a number of companies in a short period of time, and make it possible to react to business strategy changes in a timely manner. In developing resource-

TABLE 4 Public–private partnership linkages in the O&G cluster (see Figure 6)

Linkage	Main characteristics	Indicative literature
1	The *government* provides guarantees to the SME or the ICT provider. The current research results confirm the inability of SMEs to prove their long-term financial stability and their ability to repay a loan.	Marchese and Potter (2011)
2 and 8	The current research results demonstrate a lack of financial resources for investments in ICT equipment and services. The *bank* provides financial support to the ICT provider for infrastructure investment and operational needs.	Marchese and Potter (2011)
3	The *government* provides a special tax regime for the ICT provider. To set up knowledge clusters, appropriate incentives would have to be coordinated, financed, and provided.	Meller (2008)
4, 6 and 10	The *ICT provider* delivers services to the different companies of the O&G cluster: SMEs, IOCs, and NOCs. The current research results demonstrate that the share of local content in ICT goods and software procured by the NOC is too low, whereas it is high in services. This means that local service providers are linked to the NOC but not to the local oil SMEs. The value of ICT to users may rise due to network externalities from a community of users. Thus, one firm's ICT investment could increase the productivity of others, and this demonstrates a classic spillover effect.	Lee and Guo (2004)
5	The *government* provides a special tax regime for the SME.	
7	The *government* participates in the NOC. State participation in the O&G sector via the NOC provides the government with better control along the value chain. The presence of the NOC benefits the overall efficiency levels in the industry and thus improves value creation.	Tordo (2011)
9	The *IOC* sets up the ICT provider and transfers knowledge and know-how. Acquiring ICT through foreign investments is another opportunity to develop technology	Meller (2008)
11	The *government* imposes local content requirements	Government of Kazakhstan (2010); Kalyuzhnova et al. (2016)

Abbreviations: ICT, information and communication technologies; IOC, international O&G company; NOC, national oil company, O&G, oil and gas; SME, small- and medium-sized enterprise.
Source: Authors.

rich countries, using the wealth created by the energy sector to boost the domestic industry is highly important (Kalyuzhnova, 2008). The key challenge is that many of those countries have no financial or technological resources of their own to invest in the domestic industry, so they need to attract FDI to develop their O&G reserves. Due to the fact that international O&G companies tend to use global procurement opportunities, including for ICT procurement, these expenditures create low knowledge spillovers in the national economy, and, therefore, create inequalities in the distribution of O&G wealth between the host and home countries. That is why facilitating efforts from the state are necessary to develop the local industry.

This study helps to understand how ICT can create value in the O&G industry and offers insights into the value cocreation process in PPPs. Existing studies do not offer a vigorous model or guidelines on how to create business value from ICT through a cocreation process within a network of public and private organizations. This is particularly pertinent to the O&G industry as it starts to experience the convergence of new emerging technologies and the consequences of digital disruption. The main contribution of this article is the theoretical development of the model, which explains the role of ICT in the value cocreation process in a network of foreign and indigenous SMEs, as well as other actors. This value cocreation process leads to the development of the local industry through the facilitation of technological spillovers. This research addresses the gap in our understanding of how multiple participants in the ecosystem of the O&G industry align different ICT resources to cocreate value. We move the focus of the role of ICT from one company only, to a network of organizations, explaining the nature of collaboration with the external environment. To the best of our knowledge, this is the first model that attempts to explain how ICT can cocreate value in a network of organizations in the O&G industry.

We adapt the value cocreation approach to construct our models of PPPs, advancing the current theoretical understanding of the business-ICT value cocreation process. The inductive part of our research was augmented by deductive empirical testing. Because the proposed models help them to understand how ICT-enabled value cocreation process leads to development, both practitioners and academics will benefit.

We contribute to the literature by developing a theoretical foundation for ICT-led development, drawing on a widely accepted new paradigm in the management literature, namely the value cocreation framework. Moreover, we extend this perspective by linking it with the strategic use of ICT and draw possible advantages for the local industry through the development of local capabilities via integration with international O&G companies. Furthermore, apart from the general theoretical contribution, our research identifies detailed constructs of the value cocreation process that are strongly supported by empirical evidence. This is the first time that these constructs have been incorporated with a strong empirical grounding in a value cocreation model in the O&G industry. It demonstrates how ICT can integrate different public and private actors in the network to cocreate value and how local industry gains the competitive advantages necessary for long-term survival and development. We maintain that our research will help practitioners as well as policymakers to adapt their businesses in the digital age. Practitioners such as managers and SME leaders will benefit from this model by guiding their enterprises toward business competitiveness.

This study is not without limitations. We acknowledge our study is confined to one industry in one country and our results must be tested on a larger sample. We believe, however, the model we developed offers a promising basis for future research on the role of ICT in industrial development. To improve the generalizability of our findings, we will test our framework in a setting of other O&G-rich countries. As the data are available, we recommend conducting quantitative research based on this model. We believe the network value cocreation model may be appropriate for any highly integrated industries; therefore, future research can also include an expansion of this model to other industries. Further research may also more deeply explore the differences in adoption patterns more deeply by relating the differences to more organizational dimensions that go beyond the size of the organization and its form of ownership to encompass aspects such as innovativeness, strategic orientation, an incidence of joint venturing, exposure to global commerce, etc. Through such an approach, the manner in which ICT adoption occurs at different types of firms can be explored in more detail, explaining the ways in which positive spillovers occur, and the approaches that provide the positive results wider adoption of ICT can bring.

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APPENDIX: LIST OF INTERVIEWS

N	Interviewee's role	Company type	Interviewee type
1	Director	Kazakh institute of oil and gas	Industry expert
2	Dean, faculty of IT	Kazakh-British Technical University	Industry expert
3	Managing director	Local oil and gas (O&G) machinery small- and medium-sized enterprise (SME)	O&G local SME
4	Director	Major international information and communication technologies (ICT) company	Industry expert
5	Managing director	China National Petroleum Corporation, Richfit international	O&G international
6	Director, IT consulting	Major international consulting company	Industry expert
7	ICT engineer	International O&G consortium	O&G international
8	Local content manager	KPI Inc.	O&G international
9	Budget and reporting specialist	International O&G consortium	O&G international
10	Head of corporate training Center	National oil company (NOC) KazMunayGas, Kazakh-British Technical University	Industry expert
11	Researcher on innovations and IT	National research university	Industry expert
12	Dean, faculty of IT	National O&G university	Industry expert
13	Deputy managing director	LINA ltd	O&G local SME
14	Managing director	LLP KazTechOil services	O&G local SME
15	Managing director of IT	MH industries	O&G local
16	Deputy head of legal department	MH industries	O&G local
17	Head of shared services Center	NOC KazMunayGas	O&G national
18	Vice-president ICT	NOC KazMunayGas	O&G national
19	Head of metrology department	Atyrau refinery LLP (NOC KazMunayGas group)	O&G national
20	Head of ICT department	Atyrau refinery LLP (NOC KazMunayGas group)	O&G national
21	Managing director	International law company	Industry expert
22	Head of ICT Center	China national petroleum corporation, Richfit international	O&G international
23	Government advisor	National development agency	Industry expert