THE ROLE OF PUBLIC MANAGEMENT IN ADDRESSING WORKFORCE DEVELOPMENT GAPS IN KAZAKHSTAN'S OIL & GAS SECTOR

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Abstract:

The "triple-helix" workforce development model, in which governments, private industry, and educational institutions collaborate to ensure the relevance of human capital investments, has long been a feature of advanced industrial economies. However, the model has been less frequently adopted in post-Soviet states, leading to significant gaps between educational outputs and industry needs. This paper reports the results of a study investigating factors leading to the improved competitiveness of Kazakhstan's oil & gas industry. More specifically, the paper reports the findings of stakeholder interviews and roundtable discussions held for the industry in Kazakhstan regarding the nature and challenges of workforce development in the country and provides a comparative case of successful workforce development practices in the industry. Limited coordination between the demands of industry and the supply of technical training by domestic educational institutions underlies the constraints to the competitiveness of the country's oil & gas industry. The paper finds that the state and public managers have an important role in redefining the parameters of educational training in the country by acting as an intermediary between industry and education to close the gaps between industry needs and current educational curricula.

Key Words: *workforce development; triple-helix model; emerging economies; oil and gas*

Introduction

Kazakhstan's Strategic Development Plan 2025, formally adopted by the government in 2018, identifies improved workforce skills and capabilities at the heart of the effort to transform the country's economy and achieve sustainable and inclusive economic growth. Achieving the goal will require the participation of all three sectors of the economy - public, private, and educational institutions - to develop a workforce that possesses the skills required to capture value in industries competing in a highly-integrated and technologically advancing global economy.

This paper investigates the role of workforce skills in constraining Kazakhstan's greater participation in one of Kazakhstan's most important industries, oil & gas. Oil & gas made up approximately 80% of the country's 2017 exports, the dominant source for Kazakhstan's foreign exchange; and it is a key aspect of Kazakhstan's global competitiveness. The industry is highly competitive, with global competition for foreign direct investment and participation in the industry, especially due to technology innovations making older oil and gas fields capable of revitalised production through enhanced oil recovery, slant drilling, and hydraulic fracturing. As a result, although Kazakhstan has natural resource endowments in petroleum and a favourable location for transportation, the country's ability to capture value relies heavily on the ability of its firms to conduct higher value activities in this global industry, which concomitantly requires a globally competitive workforce possessing the skills to complete these higher value-added activities. And yet, as is demonstrated in this paper, the position of Kazakhstan's companies and workers within the industry is routinely as a local service partner to multinational corporations for generally low to medium value-added activities, requiring only basic

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to moderate levels of skills to complete them. One factor critical to increasing the participation of Kazakhstan's companies and workers in higher value-added activities in this global industry is to improve the quality and relevance of training received in the country's vocational institutions and universities.

As a preview of the results, a recurring theme in our interviews and industry roundtables discussing factors affecting the competitiveness of the oil & gas industry in Kazakhstan was the gap between the competencies developed at institutions of higher learning and the needs of industry. To close this gap, better alignment between industry needs and the educational competencies developed in Kazakhstan's post-secondary education system is required. One effective pathway to achieving this goal is to adopt the "triple-helix" model (Etzkowitz and Leydesdorff, 2000) of workforce development, which consciously aligns the differing goals of education, government, and industry to create an improved innovation system (Lundvall, 1992; Nelson, 2013) meeting the needs of industry in a rapidly evolving global economy and capturing value for the regional economy and workers.

The purpose of this article is to identify the role of public management in addressing workforce development gaps in Kazakhstan's oil & gas sectors. To do so, it first provides an overview of the Global Value Chain (GVC) framework and methodology used to develop the insights in this paper. The second section explores the position of Kazakhstan's companies and workers within oil & gas. The finding is that Kazakhstan's companies and workers routinely occupy the lowest levels of value-adding activities in the industry, and concomitantly, are characterised by low levels of skills required to complete them, resulting in low wages. The third portion of the article reports the results of a series of roundtables and interviews conducted in 2016-2017 asking global and regional companies in the oil & gas industry to comment about the factors limiting the competitiveness of Kazakh companies and workers in higher value-added segments. Although a number of factors were identified, a recurring theme across interviews and roundtables was the gap between industry needs and the skills of students completing post-secondary education.

In the fourth section, the triple helix model of workforce development is introduced as a model for increasing the absorptive capacity of a regional innovation system by improving the coordination of activities between industry, education, and government. Applied to the oil & gas industry in Kazakhstan, the triple helix model provides a mechanism to coordinate the development of competencies by post-secondary institutions relevant to higher value-adding portions of global industries. In addition, the role of government and public administrators to develop a workforce development system meeting the needs of all three partners is essential. A comparative analysis of the role of government and public managers in alternative models of workforce development, such as apprenticeships which require a strong union presence, and "learning on the job" models which require investments by companies rather than post-secondary institutions to train workers is conducted.

In the final section, a summary of key findings and conclusions regarding the role of the public sector and public managers in improving the competitiveness of industries is provided. It argues that the state and public managers have an important role in redefining the parameters of educational training in the country by acting as an intermediary between industry and education to close the gaps between industry needs and current educational curricula and contribute to the global competitiveness of indigenous industries.

Methodology

The Global Value Chain (GVC) framework describes how industry governance affects the upgrading opportunities of countries in specific industries. GVC analysis, variously described by Kaplinsky and Morris (2000), McCormick and Schmitz (2001), Gereffi and Fernandez-Stark (2016), Taglioni and Winkler (2016), is a structured case study methodology detailing the input-output structure of an industry, the key corporate actors at each node of the value chain, and the supporting institutions and organisations required to foster a globally competitive industry. This study used GVC analysis to map the industry, understand competitive dynamics, examine the position of Kazakhstan's firms in the oil and gas industry, particularly to identify the workforce skills essential to economic upgrading, and to learn about the various roles government, education, and the private sector can take in the industry to develop a globally competitive workforce.

Value chain analysis is a mixed-methods approach (Creswell and Creswell, 2017) using both numeric and non-numeric data, key informant interviews, and secondary source materials. The methodological approach to value chain analysis is similar to an embedded case study design (Yin, 2009) guiding the researcher to collect and examine specific information regarding (i) the structure and make-up of an industry, (ii) the actors relevant to understanding the geography, governance and upgrading dynamics of an industry, and (iii) how supporting institutions and organisations contribute to the competitiveness of an industry. Value chain analysis has been used extensively to describe industries in both manufacturing and services sectors for both academic and policy purposes (Bair, 2005; Gibbon, Bair et al., 2008).

Value chain analysis has both structure and flexibility. From the outset of the development of value chain analysis is the perspective that "what you want to know determines the way you carry out your research" (McCormick and Schmitz, 2001). To quote two of the early developers of value chain analysis,

> [T]here is no mechanistic way of applying value chain methodology. Each chain will have particular characteristics, whose distinctiveness and wider relevance can only be effectively captured and analysed through an understanding of the broader issues which are involved (Kaplinsky and Morris, 2000).

Over time, certain aspects of analysis consistent with value chain research have been retained as necessary to conduct a professional analysis. In the most recent expression of what value chain analysis entails, Gereffi and Fernandez-Stark (2016) identify four key dimensions of the analysis: (1) the input-output structure of the industry linking producers with suppliers, distributors, and customers; (2) the geographic scope of production, identifying the placement of specific activities in the value chain in geographic space; (3) the governance of the value chain, identifying the type of relationship between local suppliers and lead firms in an industry; and (4) the institutional context of production. We briefly discuss below each of these aspects of value chain analysis.

The input-output structure consists of defining the most important pre-production, production, and post-production value-adding activities, including both goods and services. The input-output structure is illustrated in a sequential, linear set of activities on which additional information relevant to answering the specific research question may be added. Information provided may include the number of firms, employees, average wages, the names of firms active in each segment and subsegment of the chain, and the labour skills required in each segment of the value chain.

The geographic scope of production requires an understanding of the major firms in each segment of the value chain and how each region analysed contributes to global imports and exports. Understanding the shift over time in both the firms and the major exporting and importing counties can illustrate the dynamic change of industries over time. The evolution and industry market trends may also be examined.

Governance requires understanding the position of lead firms in the value chain. Although at a conceptual level lead firms could, across industries, be located in each major link of the chain, the global commodity chain literature (Gereffi and Korzeniewicz, 1994; Gereffi, 1996) bifurcates producer-driven and buyer-driven value chains. The GVC literature expands the global commodity chain literature's focus on "who" governs the value chain (i.e., buyers or producers) to "how" value chains are governed (i.e., market, modular, relational, captive, or hierarchical). Empirical evidence shows that value chain governance changes depending on the value chain segment, supply chain level, time or geography analysed. Many GVCs are also characterised by multiple and interacting governance structures, which can affect upgrading opportunities (Dolan and Humphrey, 2004; Gereffi, Lee et al., 2009).

Finally, the institutional context analyses the local, national, or international conditions and policies that shape the structure of competition in the chain. Specific areas of analysis may include the economic conditions of a region, the social context regarding the availability of labour and skills, and the institutional context regarding tax and labour subsidies, innovation, and education policies.

Although value chain analysis typically includes these four dimensions, the decision whether or not to include a dimension in the analysis or other "data layers" is left up to the individual researcher and the specific research question. For example, geography and trade statistics may be an important dimension for cross-national studies examining the role of domestic firms in the value chain, but emphasised less for some other research questions, including the present analysis.

Policy relevant insights are defined in GVC analysis as "upgrading" strategies. Upgrading improves the position of a firm or country in a value chain and can be of varying types (Humphrey and Schmitz, 2002)

- Entry into the value chain: the start of participation in a GVC;
- Process upgrading more efficient transformation of inputs into outputs by reorganising the production system or the introduction of improved technologies;
- Product upgrading: transition to more difficult manufacturing lines;
- Functional upgrading: acquisition of new functions to increase the general of skills of activity;
- Chain or intersectoral upgrading entry into a new chain due to the knowledge and skills received in the current chain;
- End-market upgrading entry into the market with higher value added, for which a geographical or a sectoral shift may be necessary.

In sum, value chain analysis is a flexible analytic tool which can be used to define industries, identify where and how value is added in an industry, identify market and technology trends relevant for governance and upgrading considerations within the chain, identify companies and actors in each phase and segment of an industry, understand how industry governance and public policies affect the upgrading opportunities of an industry, what opportunities exist to capture more value, the skills needed in the industry, and to identify key stakeholders.

This research study used GVC analysis to generate the workforce skills development insights for Kazakhstan's oil and gas industry. We conducted our analysis in four phases. In the first phase, we used existing studies to understand the structure of the industry, the competitive strategies of firms, and the location of Kazakhstan's firms within the international oil & gas industry. As part of this first phase of research, we reviewed reports and data produced by governmental and non-governmental sources to understand Kazakhstan's participation in the industry and to develop propositions about the importance of workforce skills in the successful upgrading trajectory of firms in the value chain. In the second phase, we interviewed firms across the oil & gas industry to develop a preliminary understanding of the value chain. The purpose of these first two phases was to better understand the oil & gas industry, the market and technology trends affecting competitiveness in the industry, and the actors in the production network of oil & gas services in Kazakhstan.

In the third phase of research, we conducted additional interviews with lead and local firms, experts in technology and finance, and regulatory agencies in Kazakhstan and countries similarly situated in the industry. The objective of this phase was to better understand specific technical or regulatory aspects not fully apparent at the second stage, to identify additional companies in the value chain nodes, to better understand the role of these companies in the production system, and to develop a detailed understanding of workforce requirements and constraints in Kazakhstan's industry. We relied on reports and data from international agencies, official U.S. and Kazakhstani statistics and reports, company interviews, and widely recognised and reputable third-party publications in the oil & gas energy field. While existing reports were important for understanding general trends in the industry, we found that our interviews with Kazakhstani companies provided a level of detail and perspective about regional dynamics that other sources could not provide. During this phase, our questions became specific and covered the full range of issues discussed in this article.

In the fourth phase of the research, Duke GVCC and NAC convened well-informed representatives of industry, government, and educational institutions to discuss, review, and comment on the findings of the value chain study and details regarding the workforce development challenges and paths forward to address the issues raised. We requested that they provide comments and corrections of either fact or interpretation. Revisions as a result of the external review process were made before final publication of the report underlying the narrative and results of this article.

Conducting value chain studies in this manner is time intensive but provides a level of detail and understanding of industries not replicable by a review of only secondary source materials or a quantitative analysis of economic impacts. A bottom-up, ground-level perspective offers insights into markets, technology trends, and the effective role for government action that would be difficult to achieve using other methods. Having described the methods used to develop the insights and recommendations, the paper now turns to the analysis of the oil and gas GVC and Kazakhstan's participation in the chain.

Kazakhstan's position in the oil & gas industry

The development of the oil and gas industry in Kazakhstan

Kazakhstan is the 16th largest oil producer in the world and the second largest producer in Eurasia after Russia. In terms of oil reserves, the country is in 12th place, just behind Nigeria, with proved oil reserves of 30 billion barrels as of December 2015 (BP, 2016). Although Kazakhstan's oil reserves are large, its gas reserves are relatively small—0.9 billion cubic meters or 0.5 percent of the world total reserves (BP, 2016). Oil is the most important export item. Its

share in the country's total export grew from 49 percent in 2000 to 59 percent in 2015, reaching almost 70 percent of exports at the peak price in 2014. Ironically, the country is a net importer of valuable light petroleum products, notably gasoline and jet fuel.

Kazakhstan became a large oil producer in the 1970s, and many of the current oil fields were discovered and developed at that time. As a part of the USSR, major crude oil pipelines connected Kazakhstan's oil fields with refineries in Russia. After the dissolution of USSR in 1991, Kazakhstan signed exploration contracts with international oil companies due to an inability to develop its subsoil reserves on its own. In 1993, Kazakhstan and Chevron signed "the contract of the century" and established a joint venture "Tengizchevroil" to extract hydrocarbons at the giant field. During the same year, the Government of Kazakhstan signed agreements on exploration in the Caspian shelf with international oil companies Agip, BP, Statoil, BG, Mobil, Total and Shell.

In 2002, the state-owned enterprise "KazMunaiGas" (KMG) was established through a merger of the national production and transportation companies. KMG is a vertically integrated oil and gas company comprised of 220 companies and present in all segments of the petroleum value chain. KMG's presence in Kazakhstan's oil sector is immense. KMG and its subsidiaries account for 28 percent of crude oil and other liquids production, 16 percent of natural and associated gas production. The group provides 65 percent of transportation pipeline services, 77 percent of sea transportation from Aktau port and 95 percent of gas pipeline transportation within Kazakhstan. It takes a lead position in refining, with 82 percent of total oil processing, and accounts for 17 percent of the refined products marketed in Kazakhstan.

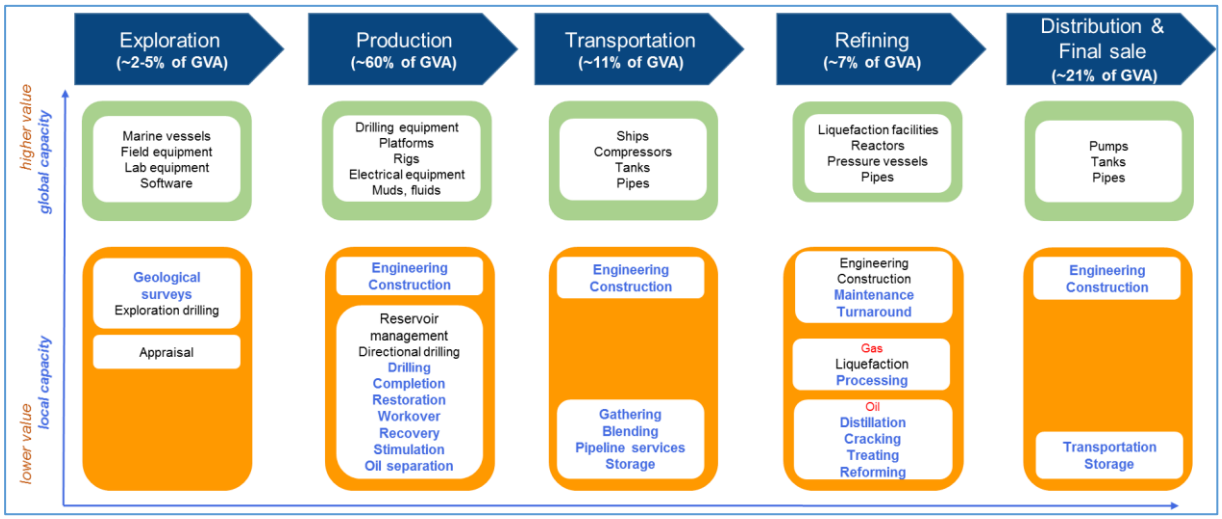
Although KMG possesses a substantial resource base estimated at over 1 billion tons, most of the company's operating oil fields are mature and past their production peak. Kazakh production in the future will, at best, remain level as production is expected to grow significantly only at the offshore Kashagan field. Although there are also a number of smaller fields discovered in the 2000s, they have not struck oil yet, and the cost of oil production in Kazakhstan is relatively high. For example, exploration and development of Kashagan oilfield, which is expected to be the main source of Kazakhstan's production growth, is already the world's most expensive project and was postponed for two years, from 2014 to 2016. Overall, production at existing fields is profitable at Brent crude oil price of US$40 per barrel or higher, which is a relatively high-cost production level. Other weaknesses of Kazakhstan's position in oil and gas are its reliance on Russia to transit its oil to world markets and its inability to be self-sufficient in refined petroleum products, which it imports from Russia, China, Azerbaijan, and Iran.[3]

Kazakhstan's current position in the oil and gas industry

Kazakhstan's indigenous footprint in the oil and gas production system is demonstrated in Figure 1.

[3] A refining modernisation programme is underway for KMG's refineries. After completion of the programme, the three refineries' production is expected to cover domestic demand after 2018.

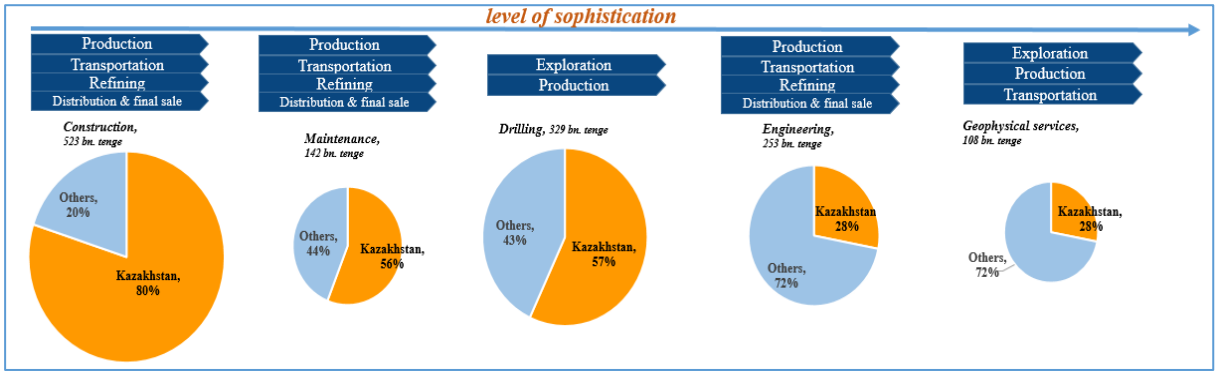
Figure 1: Kazakhstan's footprint in the domestic oil and gas value chain



Source: Authors

In general, the more complex the activity, the higher the share of foreign companies conducting the activity. Kazakhstan's one thousand companies with approximately 170,000 employees are generally represented in less technologically advanced segments; particularly, in construction, maintenance and (vertical) drilling operations (Figure 2). To put a finer point on the matter, while Kazakhstan's share of companies in lower-skilled construction services comprises 80% of the market, they only make up 28% of higher-skilled engineering and geophysical services spending in Kazakhstan.[4]

Figure 2: Participation of domestic firms in oil and gas services, by level of market sophistication



Source: Authors

Presented with this analysis, global lead firms and Kazakh companies were asked by the research team why domestic companies routinely captured lower shares of more sophisticated oil and gas services. The interviews identified multiple factors ranging from the nature of oil & gas services contracting, supply chain governance controlled by international firms, limited access to finance and state-of-the-art production equipment.

First, oil companies typically operate within supply chain governance systems (Gereffi, 2005; Gereffi, Humphrey et al., 2005) characterised by tightly coordinated networks of technologically-sophisticated and financially-powerful suppliers with a global reach. Supply chain networks characterised by this type of governance structure generally provides few opportunities

[4] Leading Kazakhstani service companies have demonstrated their international competitiveness by successfully operating in the regional markets of Russia, Turkmenistan, China, and India.

for local participation, particularly in developing countries, due to the inability of local suppliers to meet production and process standards of global firms, the ignorance of global firms about local firm capabilities, and the greater comfort of global firms to work with suppliers with whom they have worked before; therefore reducing the risk of supplier failure to perform on contracts due to technical abilities, financial resources, or knowledge of the global firm's processes.

Procurement processes of international oil companies are often driven by pre-existing networks and lack transparency. Historically, this has often limited the role of local firms to non-tradable and lower value operations. Over the past decade, procurement operations have become even more global, while modular development has resulted in previously non-traded services such as construction and fabrication being relocated to the most cost-efficient locations. This has further contributed to a decline in local participation. Today, new fields are developed by engineering firms based in key centres around the world, with little knowledge of local firms or their capabilities. Project requirements are defined by global standards, rather than those of the production sites, and suppliers must be certified to even pre-qualify for bidding. However, many local firms are not even aware of these standards, immediately excluding them from procurement processes.

Second, local companies often lack the required capacity, making local content rules contribute to an inefficient production system. Kazakhstan, among many other countries, pushed IOCs to source locally. The country has undertaken a quantitative approach to local content requirements, setting in 2014 percentage targets of goods, operational support and services purchased by oil and gas producers in the country. The law obligated oil and gas companies to source locally 72.5 percent of operational activities and services, and at least 16 percent of goods (e.g. equipment). This legislation was subsequently complemented by voluntary agreements on local spending for projects operating under production sharing agreements. Despite these measures, utilisation of local content remains far below the target, reaching 54 percent in 2014. While this was up from 45 percent in 2010 (Kazenergy, 2015), a significant portion of this spending is generated through KMG, which reported 72 percent of local content procurement in 2014 sourced primarily from its own subsidiaries. Meanwhile, independent service firms highlight that they are struggling to remain competitive, while buyers say that they cannot find capable local firms to hire (Field Research, 2016).

Third, the introduction of e-procurement processes and efforts by the government, through industry associations (KazService, KAZENERGY and PSA LLP) and the country's largest operators (TCO, KPO), to promote joint ventures and provide insights into market demand, have had limited success. Kazakhstan introduced an e-procurement system in 2013 with a goal to reduce information asymmetry, thereby ensuring local firms are informed of potential opportunities and compete in the tender process. However, the effort is undermined by the existence of separate rules and e-procurement systems for different groups of oil producers[5] resulting in market fragmentation that adds up to administrative costs for potential bidders.

Fourth, the operating environment for Kazakhstani companies is challenging. The challenges include, for instance, limited access to finance, exacerbated by exchange rate fluctuations. Having to import equipment and pay loans in local currency, Kazakh suppliers find themselves in

[5] There are currently three systems: contractors operating under PSA regime (own closed system), a group of KMG companies (Samruk-Kazyna procurement system) and private companies (operate within the NADLoc's system).

a disadvantaged position compared to foreign competitors. Many local companies are excluded from the largest projects of international oil companies because they are unable to provide sufficient financial guarantees from local banks.

Although companies we interviewed identified these challenges as important barriers to greater participation in higher value-added portions of the industry, almost all companies stated that the fundamental challenge was the lack of qualified human capital in the country. Insufficient business skills (management, finance, operations) and technical skills underlie the failure to meet safety, quality and technical standards requirements of international oil companies and participate in higher value adding portions of the value chain. For example, domestic companies with required technical capabilities are often barred at the pre-qualification stage due to a lack of knowledge about and/or inattention to the completion of applications in accordance with international oil company requirements. One production company we interviewed mentioned delays in project expansion because the company could not find enough workers with required technical specialisation in the market (Field Research, 2016).

Our interview findings are supported by official statistics. According to a study by the Ministry of Labour's Analytical Center, the job placement rates for the 2,000 to 3,000 annual graduates of petroleum-related degree programmes was just 7 percent in 2014, and new graduates accounted for just 3.1 percent of the workforce (Information Analytical Center, 2016). For a number of reasons—including poor teaching standards, professor qualifications, inadequate curricula and lack of opportunities for industrial placement—a majority of education institutes fail to serve the needs of the industry, resulting in low job placement among Kazakhstani graduates.

Unlike other oil-producing countries, Kazakhstan lacks a coherent human development strategy. Education of the workforce remains the purview of companies, and there are little incentives to invest in training for private actors. As a rule, large companies have training programmes within their networks for professional qualification enhancement, safety training, or customised training for developing specialised skills and rely on the Kazakh education system for basic skills training, such as English. Smaller local companies, precisely those service providers that could be partners for international oil companies have fewer resources to reach a comparable level of workforce development, thus exacerbating their competitive disadvantage. Local and foreign firms maintain that there is an acute shortage of qualified labour for key occupations, the quality of graduates is poor, and there are few opportunities or incentives for ongoing skills development. Overall, Kazakhstan's education system fails to address the needs of an industry that makes up the overwhelming majority of its global exports and source of foreign exchange.

Examining workforce practices of other oil producing countries

This section investigates the workforce development practices of oil and gas exporters, which have successfully overcome the human capital development challenge. Several key features emerge in well-performing workforce development systems: (a) a coherent workforce development strategy put together by all relevant stakeholders; (b) a demand-driven approach in response to industry needs at both the technical and professional levels; (c) high-quality teaching staff; (d) curriculum adherence to evolving dynamics of the global industry; and (e) an emphasis on practical experience for an optimal education.

Many oil-producing countries — the U.S., U.K., Australia — establish a specific industry strategy for the development of human capital in which all important stakeholders are involved. For example, in Alaska, the industry launched a five-year workforce development strategy for

2014-18. The plan was jointly developed by two committees, an industry steering committee with 11 representatives from the private sector, and a technical and education committee, comprised of representatives of the educational institutions at the university and TVET levels, labour unions, as well as key governmental departments: Labour, Education and the Commerce, Community and Economic Development (Alaska Workforce Development Plan, 2014). Western Australia prepared a similar workforce development strategy for its resources sector, including specific details on how the plan is to be implemented. The U.K. has also developed a workforce development strategy, mainly focused on talent retention and the identification of skills gaps, particularly at the TVET level (UK Government, 2016).

These strategies include an analysis of industry trends and the country's industrial development plans, detail job profiles, talent retention approaches, and an examination of the educational system's capacity to supply the right skills for both the short- and long-term. Due to information gaps, establishing an effective strategy requires the engagement of multiple stakeholders. Yet this can be challenging since formal communication channels between the private sector and educational institutions (public and private) are often weak or non-existent in many developing countries. Examples from developed countries show that educational institutions are generally more successful when they have a high degree of interaction with industry stakeholders. This interaction can take place through both formal and informal communication channels, with the government playing the role of facilitator to bring together the various actors.

Successful strategies are developed using a demand-driven approach; that is, developing human capital supply in response to the demands of industry for specific skills. Availability of qualified labour and agility of the workforce development become a competitive advantage. Participation in different stages of the oil and gas GVC requires different sets of skills; thus, it is critical to develop feedback mechanisms with industry to ensure the skills being taught at any one time are those appropriate for the current stage of the value chain, and not just the industry in general.

An industry-specific labour market survey is one widely-used mechanism to ensure that demand for workforce meets adequate response. The U.S. Department of Labour carries out an annual Occupational Employment Survey, from which it derives highly detailed information on current and projected employment numbers for a large range of job profiles in the industry, earnings by occupations, typical entry-level education, experience and on-the-job training requirements, and occupational health and safety concerns. This data is available publicly and is also linked to an online resource O*NET, which provides even further information about the daily tasks of each position (O*NET OnLine 2016). The U.K. provides a similar website (www.myoilandgascareer.com) to orient job seekers toward high-demand roles.

In North Carolina (U.S.) the community-college system uses this data-driven approach to ensure it is highly responsive to local business' requirements to shape its supply of training tools and education profiles according to the most up-to-date industrial needs (Little, 2016). Another instrument for directing students toward high-demand positions is to provide scholarships only for high-demand careers, and not those where supply already outstrips demand. This approach is also being used in the U.K. to drive entry into engineering degrees where there is an annual deficit of approximately 55,000 engineers. The U.K. provides scholarships of up to USD 53,000 per student pursuing these degrees (Launchpad Recruits, 2016).

Quality of the teaching staff is considered to be a critical element by both industry and educational institutions. In an industry such as oil and gas, practical industry experience is fundamental for teachers to adequately prepare students to enter the workforce. This is important

to ensure that the knowledge and skills of students are linked to the reality of the workplace, from applicable theories to the application of new technologies. In many instances, this is resolved by engaging the private sector to teach in the classroom, as well as providing opportunities for professors to work in the industry. For example, leading universities such as Texas A&M (Texas, U.S.) worked with oil and gas companies during the peak of the boom to allow experienced workers to take a "sabbatical" to teach for one to two years before returning to their jobs (Holeywell, 2014). At the TVET level, industry professionals teach in local community colleges; for instance, in North Carolina's community colleges, established practitioners teach classes at least two times a week. The reason why community-college education in North Carolina has been a success lies in the close cooperation of the private sector, local authorities and curriculum development at educational institutions. For example, the Advisory Board of the community-college system includes industry professionals among other stakeholders in government and education (Little, 2016).

Part of the challenge of retaining high-quality teaching staff is the cost of educational institutions, particularly during periods of high demand. Yet, when industry is engaged in a constructive dialogue, it can understand the longer-term benefits of maintaining teaching staff in place. For example, to help meet the needs of the sector in Russia, BP established a long-running programme through which they sponsored professors for up to USD 100,000 at leading Russian universities (ILO, 2012). In the current downturn, other schools have been able to utilise experienced staff members that are currently retiring from the industry.

The curriculum must change to meet the evolving needs of the global industry. The extractive sector is characterised by rapidly evolving technologies and is dominated by international companies that maintain strict standards with respect to technical protocols, safety and environmental impact. In order to graduate, job-ready workers and educational institutions must keep up with these requirements. Numerous developing countries have thus adopted international curricula to secure employment for local workers. For example, in the early 2010s, Saudi Arabia launched a massive project to establish local training programmes at the TVET level based on international standards, with two new schools, Saudi Petroleum Services Polytechnic (SPSP, a partnership with Saudi Arabia Chevron) and the National Industrial Training Institute (NITI). SPSP offers a two-year technical programme with courses in English, employability skills, and health and safety among others; the curriculum is accredited by the U.K.'s City & Guild and the International Association of Drilling Contractors. The government also contracted globally recognised Petrofac Training Services to operate and contract a to-scale drilling training center (Andrews and Playfoot, 2015). Likewise, BP contracted Petrofac together with Russian-based TTI International to establish a training school in Baku, Azerbaijan, to supply graduates for the needs of the Azeri-Chirag-Gunashli oil field and Shah Deniz gas fields. Graduates also receive City & Guild Level 2 accreditation (Petrofac, 2016). In Australia, petroleum engineers must be registered with the Society for Petroleum Engineers (SPE) in order to work in the industry. SPE Australia works with the International Society for Petroleum Engineers to ensure that only graduates who meet international standards can register (Engineers Australia, 2016).

Industry-relevant education must entail practical experience. This includes apprenticeship programmes, internships, and "real-model" training facilities. Several countries around the world have adopted programmes in which practical experience is an essential part of education for the industry, with specific qualifications attached. The different approaches taken vary by length, organisation, and incentives. Saudi Arabia's NITI requires a six- to 12-month job placement; Norway's apprenticeship programme is for 12 months; while the U.K. requires a

full two years for its apprenticeships. In terms of organisation, Norway and the U.K. apprenticeships for the industry are managed nationally through centralised offices that coordinate directly with firms to place students and ensure that firms dedicate sufficient time and qualified personnel to work with the apprentices (Andrews and Playfoot 2015). Statoil, Norway's oil and gas company, leads by example in this area and is the largest apprenticeship company in the country, thus encouraging other firms to follow suit (Statoil, 2016).

In addition, in some countries, these apprenticeships are incentivised by the government through subsidies. Nova Scotia, in Canada, offers a wage subsidy for employers hiring students and new graduates from Nova Scotia universities and community colleges (Nova Scotia Department of Energy, 2016). Malaysia offers a double tax deduction incentive for related expenses incurred during its internship programmes (TalentCorp Malaysia). Norway provides firms with a subsidy of approximately USD 12,000 per apprentice per year to encourage firms to take on more students (Andrews and Playfoot, 2015). An alternative model includes one in which the state, together with educational institutions, establishes true-to-scale training facilities to provide this hands-on experience. Singapore's Economic Development Board, for example, established the Chemicals Process Technology Centre with Nanyang Polytechnic to provide pre-employment training for 800 students per year for petrochemical operations. They also open the facilities for up to 8,000 employees in the petrochemical sector to receive additional instruction (Carpenter and Kiong Ng, 2013). Saudi Arabia has followed this example with the development of the Dhahran Training Centre with full-scale operations for training drillers for the sector (Arabian Drilling Company, 2016).

The role of government and public managers in workforce development

Kazakhstan is a newcomer in the oil and gas sector, and it has the opportunity to take advantage of the best practices developed by countries with decades of experience in the industry. Countries with a mature industry understand the cyclical nature of the sector, and that a downturn will eventually shift direction. They take advantage of downturns to prepare their human capital to be ready for the next wave of industry development. Likewise, Kazakhstan should take this opportunity to develop its workforce and catch up with the required skills of the leading companies on the field. In our view, limited coordination between the demands of industry and the supply of technical training by domestic educational institutions underlies the constraints to the competitiveness of the country's oil & gas industry.

One of the pathways to upgrading would be adopting a participatory approach to the development of the education and workforce training system. In Kazakhstan, the establishment of a comprehensive workforce development strategy could mitigate the challenges in the area of human capital. This mid-term strategy of human capital development, first and foremost, should be developed in close collaboration with oil and gas operators, oil-field service companies, education institutions (both higher education and TVET), the Ministry of Energy, Ministry of Education and the Ministry of Labour. There are several essential elements to the strategy:

1) ***An industry overview with detailed information on the existing workforce and its composition*** in Kazakhstan's oil and gas and oil-field industries. In particular, this section of analysis may contain the number of graduates by occupation over the past five years. The analysis should cover current labour requirements, detailed job profiles, and average wage by occupation.

2) ***Provide a detailed employment forecast as an important part of the strategy*** that should be published and available online as an up-to-date database. The Ministry of Labour,

which already produces regional employment forecasts, could administer these industry-specific analysis and forecasts based on industry surveys.

3) ***Making the information available to all interested parties is important for closing the gap between industry needs and the education system***. Creation of an industry-specific website with the current and forecast information on careers in the oil and gas industry containing the description of skills required, priority occupations, earnings and employment outlook (which can be fairly general , such as "weak, moderate, strong,") will allow the supply side (i.e., high school graduates, students, workers and education institutions) to make informed decisions regarding their professional paths, master their qualification and adjust curricula accordingly.

4) ***Identification of industry trends in all segments of the value chain, domestically and internationally***, will help universities and colleges tailor their study programmes and eventually raise the quality of teaching. Overall, it will align positions of state bodies and the private sector, and their vision of the industry for the future; thus, Kazakhstan can improve the responsiveness of its policies to the market needs. This section can be developed by professional associations and industry experts.

5) ***The core of the strategy will review the education system for oil and gas. The review will evaluate, by education levels — university, TVET, and professional training opportunities — relevant institutions and their potential*** (for instance, staff, technical base) and professional occupations taught in the institutions. Another indispensable element is the review of policies and incentives in attaining education or certain skills enhancement (grants, scholarships, tax credits) provided by the government and the private sector.

6) ***The workforce development strategy should entail a lifelong approach to education***. A part of the programme shall be dedicated to the review of existing opportunities for career enhancement, which so far have largely remained in the purview of individual companies.

7) ***The concluding section of the programme will contain policy actions and stakeholder collaboration schemes*** (e.g. quarterly meetings, conferences, industrial placement programmes, attracting professionals to teach in colleges and universities). The latter can be organised in following the example of North Carolina community colleges, where industry professionals come to teach a few hours a week at a local college, as part of their community service. In Kazakhstan, this practice can be tied to work permits for foreign workers, who can transfer their rich experience to Kazakhstani co-workers and students, or it can incentivise in other ways. Another mechanism to attract students to TVET is the provision of student loans that workers start repaying later in their careers when their salaries reach a certain level[6] and other measures to develop a high-quality labour force for oil and gas and oil-field service industries in Kazakhstan.

The role of government in leading these efforts to improve the quality of human capital and building strong linkages between industry and the education system in Kazakhstan cannot be underestimated. The role of the state to lead change varies in statist and laissez-faire economies (Etzkowitz and Leydesdorff, 2000; Etzkowitz and Ranga, 2015). In a statist (or "state cap-

[6] This practice called Advanced Learner Loans works in the U.K. https://www.gov.uk/guidance/24-advanced-learning-loans-an-overview

italism") model, the role of the state is essential to establishing and maintaining competitiveness. The state can act as convener and coordinator due to its dominant role in all three sectors: education, industry, and government. However, the challenge of statist models is that the state has few incentives to be as efficient a disruptor as in the more balanced tripartite role of these three sectors in laissez-faire systems.

One role government bodies could assume, in order to better support a workforce system consistent with innovation-systems thinking is to gather information regarding industry trends and plans, priority occupations and the demand for labour, and, more importantly, *effectively disseminate* that information. Thus, a government-run website, providing the results of the industry and Ministry of Energy surveys, will be a central tool to effectively boosting the workforce development strategy.

In developing and implementing this type of programme, it is crucial to make the measurement, monitoring, evaluation and programme revision an ongoing effort. Stakeholders should adopt an evidence-based approach to policymaking and implementation processes. To ensure a flexible yet transparent strategy, industry associations such as the energy producers' association KAZENERGY and the service providers' association KazService can take the lead in its development, implementation and monitoring, with the participation of all relevant stakeholders. The success of such a strategy may create a precedent for other key industries; for instance, agribusiness or mining sector, to follow suit.

Conclusion

The purpose of this paper was to identify the role of public management in overcoming obstacles to upgrading Kazakhstan's oil and gas sector, and how a system of workforce development can utilise the government, the education establishment, and the private sector to increase the competitiveness of the sector. The article reports the findings of stakeholder interviews in Kazakhstan regarding the nature and challenges of workforce development in the country and provides a comparative case of workforce development practices in these industries adopted by other countries that could be used to improve the participation of Kazakhstan's workforce in these industries.

The results of these stakeholder discussions identified that an important factor constraining future indigenous development and growth of these industries is due to the nature of workforce development in the country, which has limited coordination between the demands of industry and the supply of technical training and skills by domestic educational institutions. The public sector, due to its important funding role in higher education and the significant participation of state-owned enterprises (SOEs) in these industries, has an important convening power that can be used to better align the activities of educational institutions to meet the needs of these important industries to the Kazakh economy.

The paper finds that the state and public managers have an important role in redefining the parameters of educational training in the country by acting as intermediaries between industry and education to close the gaps between industry needs and current educational curricula.

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