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KAZAKHSTAN'S MACROECONOMIC OUTLOOK & INVESTMENT OPPORTUNITIES IN DIGITALIZATION

APRIL 2018

CONTENTS

Kazakhstan's macroeconomic outlook and investment opportunities in digitalization

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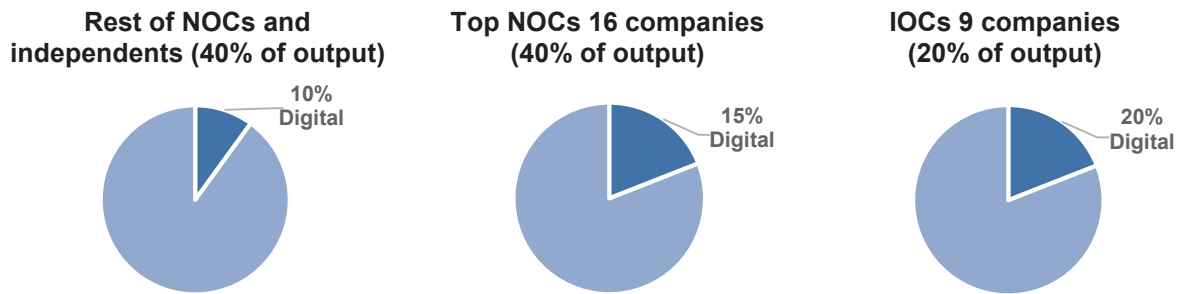
Section 1.0 Executive Summary

- Kazakhstan's economic growth accelerated to 4.0% in 2017 on the back of a balanced and broad-based expansion across all economic sectors. For 2018, GDP growth is expected to range between 3.5% and 4.0%, supported by higher global oil prices, moderate increase in oil production, continued fiscal stimulus and improved global economic conditions. Medium-term GDP growth outlook is anticipated at 3.7% p.a. during 2018-2022.

- Current monetary policy stance bodes well for domestic demand, business investments and the general economic activities. Inflationary expectations are well-anchored and inflation is projected to ease further to 5%-7% in 2018 (2017: 7.1%).

- The tenge strengthened by 3.6% in the fourth quarter of 2017 after touching last year's low of 345.11 on 5 October, closing at 332.85 as at 29 December. Year-to-date, tenge rose further by 4.2% to 318.73 as at 30 March 2018 (2017: 326.32 average).

GDP Growth vs. Brent Price (2005-2018f)
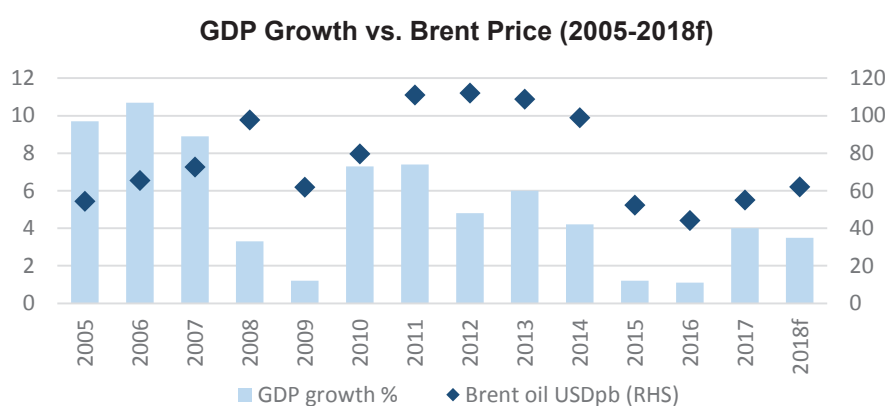
Source: Ministry of National Economy, Bloomberg, Samruk-Kazyna

- Kazakhstan's economy is highly reliant on natural resources and extractive industries, and the constant change in global economic dynamics has made it more challenging for the country to stay competitive. Now is the time for Kazakhstan to explore new opportunities and venture into new growth areas, especially through the modernization and application of technology in key economic sectors. This will result in enhanced sector value add to GDP contribution as well as economic diversification in the longer-term – one of the key priorities for economic transformation under Modernization 3.0.

- In line with expectations of volatile global oil prices moving forward, improving the level of digitalization is one of the ways for the oil & gas industry to stay competitive. Currently, the share of integrated/connected oil & gas equipment amounts to only 3%-5%, while the share of utilized data to make decisions is at about 1%. This implies that oil & gas companies have significant potential to optimize asset and operations using digital technologies. Out of 93mln bpd of oil output, only 9-18mln bpd come from oil fields that are digitally enabled. Top national oil companies, which are responsible for 40% of world oil output, produce only 15% of output using digital technology. Oil & gas companies in Kazakhstan lag behind its international peers in terms of the level of digitalization. The implementation of such projects requires substantial investments, and thus a revision of investment programs, which were recently cut down due to low oil prices. We recommend to start by deploying digital in areas where technology can affect the cost curve in the short-term and deliver immediate results.

- Digital technology creates value within the oil and gas context by enabling better and faster operational decisions, leading to greater asset utilization, reduced operating costs and increasing efficiency. It can simplify and synchronize processes and accelerate integrated decision-making. Smarter decisions lead to faster incident correction and prevention, as well as greater insight into operations and collaboration. The oil & gas industry is expected to generate USD1.1tln in digital value at stake from 2015-2024.

Rest of NOCs and independents (40% of output)   **Top NOCs 16 companies (40% of output)**   **IOCs 9 companies (20% of output)**

10% Digital   *15% Digital*   *20% Digital*

* NOCs – national oil companies, IOCs – international oil companies
Source: Ernst & Young "How ready are your assets to perform in the digital world?"

- The transportation sector is currently undergoing significant transformation. R&D investments in digital railways, intelligent streets and next-generation vehicles are expected to change the way companies do business, generating opportunities for additional revenue growth or operating expenses optimization.

- In Kazakhstan, the national railway operator has already started the integration of digital technologies in customer services and traffic management, introducing online ticketing and electronic freight tracking. Passengers are now able to purchase domestic and international railway tickets from various internet platforms without the need to wait in queues. In addition, freight forwarders will have an opportunity to place and track their orders online through an electronic document and contracting system using a computer or a smartphone, which will lead to the reduction in the overall transaction costs and will further enhance operational efficiency. Meanwhile on aviation sector front, Kazakhstan's national airline operator has already adopted state-of-the-art digital technologies in order to enhance service quality and optimize operating performance. The company is currently utilizing special automated revenue management system, allowing it to dynamically adjust pricing based on load factors and capacity on routes.
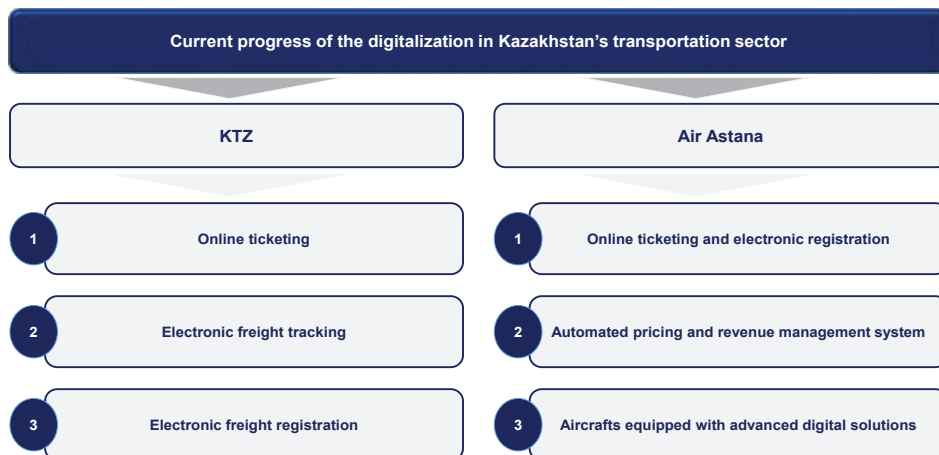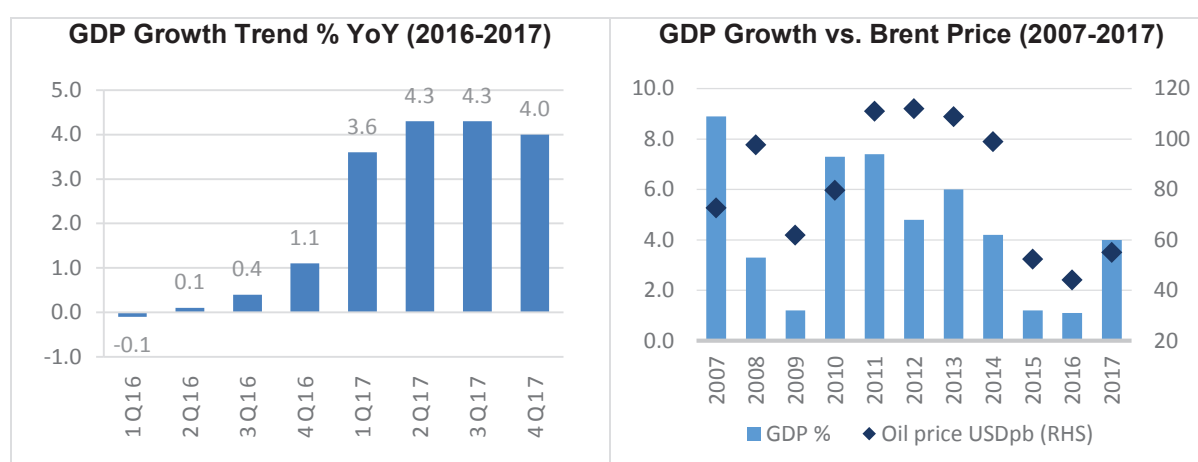

Source: Samruk-Kazyna

Section 2.0 Kazakhstan's Macroeconomic Outlook

GDP Growth: Review of 2017 and 2018-2022 Outlook

2017 GDP review. Kazakhstan's economy remains resilient; it has withstood shocks from low oil prices, devaluation of the tenge and growth slowdown in key trading partners. The economy is gradually adapting to the "new normal" environment. Growth momentum picked up significantly with GDP growth of 4.0% in 2017, driven primarily by mining, manufacturing and transportation sectors. Favorable external environment, including higher-than-expected growth in key trading partners and recovery in commodity prices, provided further support to the domestic economy. Concurrently, the Government continued fiscal stimulus by implementing several development programs such as Nurly Zhol and State Program of Industrial-Innovative Development (SPIID), aimed at enhancing transport infrastructure, transit potential and diversification of the economy.

Source: Ministry of National Economy, Bloomberg, Samruk-Kazyna

Economic expansion was balanced and broad-based across all sectors, supported by a gradual recovery of domestic and external demand. Mining (9.3%), manufacturing (5.1%), utilities (4.9%) and transportation (4.8%) sectors were the largest growth contributors, while overall industrial production expanded by 7.1%. Short-term economic indicator, which is a gauge for change in production indexes of base industries, rose by 5.2%.

On mining front, crude oil output rose by 10.5% in 2017, supported by significant increase in oil prices and the launch of Kashagan production, while natural gas output expanded by 10.1%. Coal and lignite production growth stood at 6%, while iron ore and non-ferrous metal ores output gained 6.9% and 8.2% respectively, resulting in overall mining sector growth of 9.3%.
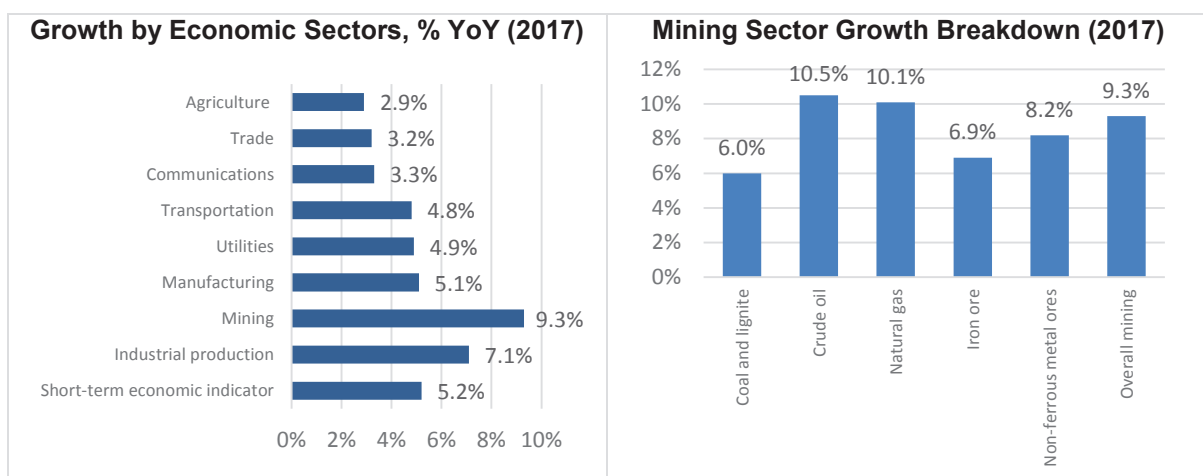
On manufacturing sector, pharmaceuticals production increased by 41.8% in 2017, while light industry gained 7.3%, driven by the growth in textile (11.2%) and leather products (8.4%). Chemical industry rose by 7.2%, while metallurgy sector gained 5.9%, with ferrous and non-ferrous subsectors increasing by 6.6% and 5.5% respectively. Machinery output growth stood at 5.6%, with electronics production (26.5%), automobiles (39%) and other vehicle manufacturing (37.7%) being primary contributors to machinery output increase.

Similarly, the transportation sector demonstrated significant growth dynamics in 2017, with the total freight turnover rising by 7.9%. Rail freight turnover gained 10.6%, supported by implementation of One

Belt & One Road initiative and increase in transit freight traffic. Meanwhile, the growth of road and pipeline freight turnover stood at 0.6% and 13% respectively.

Meanwhile, information and communications sector recorded a growth rate of 3.3% in 2017. Overall trade rose by 3.2%, with retail and wholesale trade gaining 6.3% and 1.5% respectively. Agriculture sector output grew by 2.9%, driven by the increase in livestock (3.9%) and crops (2.2%).

Investment dynamics are gradually improving as the volume of fixed investments expanded by 5.5% YoY in 2017, driven by mining, manufacturing, transportation and infrastructure investments facilitated by the continued implementation of the Nurly Zhol program. Thus, infrastructure marked a significant increase in capital expenditures with investments in the water supply and sewage systems growing by 23.8% YoY, while those into electricity supply increased by 6.5% YoY.

Growth by Economic Sectors, % YoY (2017)

Sector	Growth
Agriculture	2.9%
Trade	3.2%
Communications	3.3%
Transportation	4.8%
Utilities	4.9%
Manufacturing	5.1%
Mining	9.3%
Industrial production	7.1%
Short-term economic indicator	5.2%

Mining Sector Growth Breakdown (2017)

Category	Growth
Coal and lignite	6.0%
Crude oil	10.5%
Natural gas	10.1%
Iron ore	6.9%
Non-ferrous metal ores	8.2%
Overall mining	9.3%

Source: Ministry of National Economy, Samruk-Kazyna

2018-2022 GDP outlook. Looking forward, **economic expansion is expected to sustain between 3.5% and 4.0% in 2018** as (1) oil production continues to increase driven by Kashagan, (2) commodity markets rebalance on the back of growing global demand, (3) continued infrastructure development produces a multiplier effect on the economy, and (4) stronger growth among Kazakhstan's key trading partners facilitates trade and investment flows.

For 2018-2022, GDP growth is forecasted to average at 3.7% per annum. As traditional sectors of Kazakhstan's economy reach their full growth potential, alternative sectors such as transportation, construction and manufacturing will emerge as drivers of future growth. This will require measures to stimulate productivity growth across all sectors of the economy. While the Government plans to reduce total expenditures, it remains committed to **implement reforms aimed at digitalization of the economy, advancing human capital development and enhancing infrastructure. Total spending on development programs alone is estimated at KZT2.1tln in 2018-2020.** Other measures include creating a robust investment and business climate to stimulate the development of small-and-medium-sized enterprises.

Samruk-Kazyna plays a pivotal role in Kazakhstan's economic development, acting as a vehicle in attracting investments, introducing and implementing advanced technologies and knowledge in driving operational efficiency of its portfolio companies. In addition, privatization of key portfolio companies in 2018-2020 will form strategic growth factors that will be key drivers for

sustainable growth and economic value creation for Kazakhstan in the next four years up to 2022.

On the global economic front, continued recovery in the Central Asia region and sustainable growth in China should provide **positive spillover effects through increased trade, investments and transit volumes**. As a result, transportation, transit and logistics industries are expected to become one of the fastest growing sectors in Kazakhstan's economy. In addition, stronger growth in regional economies will be **driving demand and stabilize prices for key commodities** in the global markets, contributing to sustainable expansion in the traditional commodity sectors.

Risks and challenges remain, which include (1) volatility in the global commodity markets, (2) economic performance of key trading partners which could affect trade and freight turnover, (3) geopolitical tension in the region may have adverse effects on Kazakhstan (volatility of commodity prices, investment flows and exchange rate fluctuations).

Box 1: Kazakhstan's macroeconomic dynamics vs. CIS peers

Kazakhstan's economy is the largest in Central Asia and the second largest after Russia in the Commonwealth Independent States (CIS). Nominal GDP is estimated at USD156.4bln as at 2017, contributing to 56% of Central Asia's GDP.

Central Asia's GDP breakdown by country, USD bln (2017e)
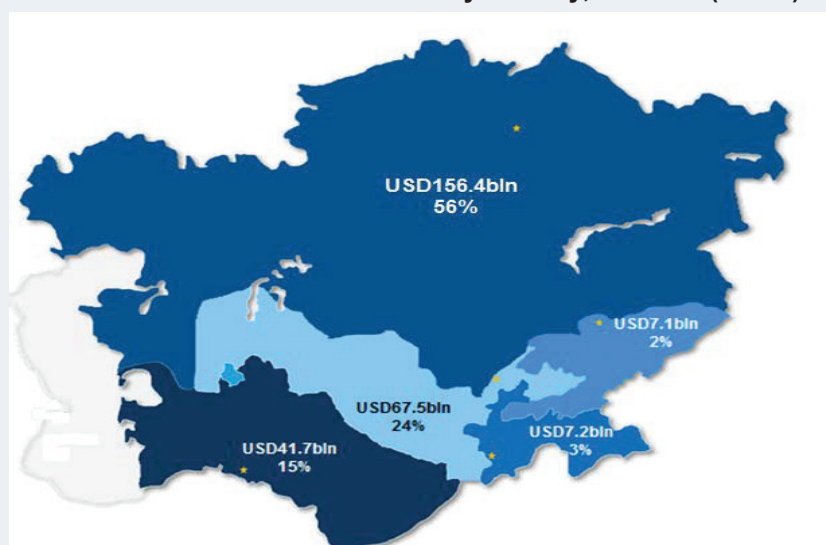
Source: IMF World Economic Outlook Database October 2017, MNE's Forecast of Socio-Economic Development as at August 2017, Samruk-Kazyna

Consequently, Kazakhstan's GDP per capita was the highest in the region at USD8,708.6 in 2017, slightly below Russia's USD10,248.24. Other countries of the region, Turkmenistan, Uzbekistan, Kyrgyz Republic and Tajikistan, have significantly smaller GDP per capita of USD7,522, USD2,128, USD1,140 and USD819 respectively. GDP per capita by PPP in Kazakhstan (estimated at USD26,072) is almost 1.5 times higher than in Turkmenistan, 3.5 times higher than in Uzbekistan, 7 times higher than in Kyrgyz Republic and 8 times higher than in Tajikistan.

Nominal GDP and GDP per capita (2017e)
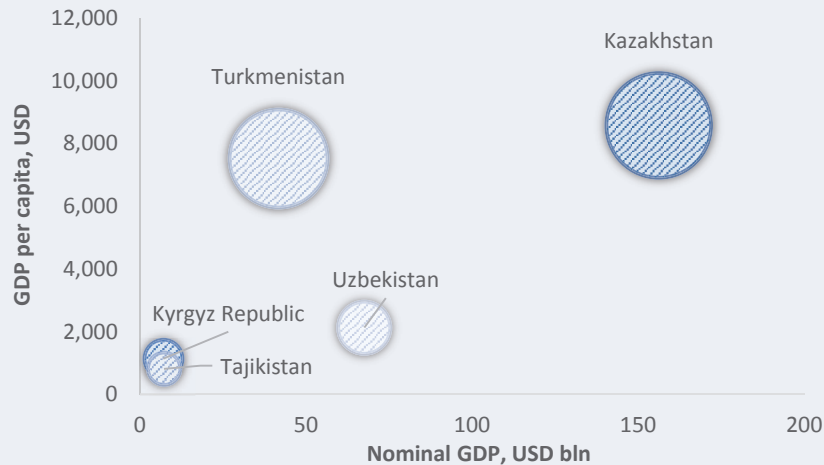
Source: IMF, Samruk-Kazyna

Kazakhstan's GDP growth remains positive and relatively high, averaging at 6.8% per annum between 2000 and 2017. While growth was lower than in some other Central Asian economies, Kazakh economy performed commendably well considering its relative size and the level of development. The only other comparable country, Russia experienced significantly lower GDP growth of 3.9% per annum over the same period.

GDP growth, % (2010-2018f)
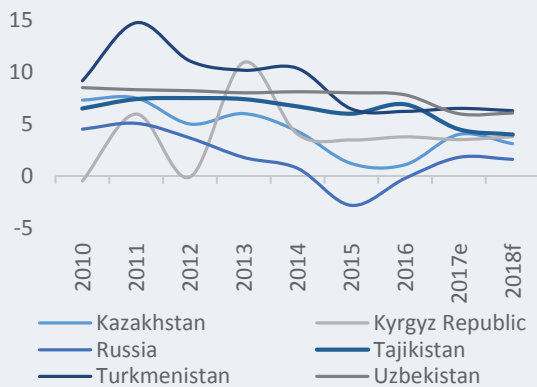
**Average GDP growth, % (2000-2017e)**
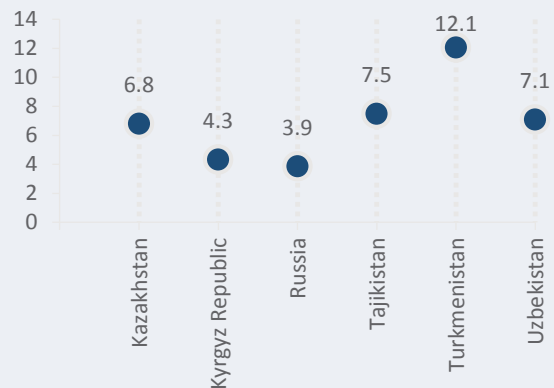
Source: IMF, Samruk-Kazyna

Kazakhstan is the largest player in the region's external trade, accounting for 54.7% of total trade turnover including mutual trade as at 2016. In terms of trading partners, Russia, China and EU are key trading partners for all Central Asian economies to some extent. As such, China's trade turnover with Central Asian countries reached USD30bln in 2016, including USD13.1bln with Kazakhstan, USD5.9bln with Turkmenistan and USD5.7bln with Kyrgyzstan. The EU's trade turnover stood at USD21.7bln in 2016, including USD17.8bln with Kazakhstan. Russia's trade turnover totaled USD18.6bln, including USD13bln with Kazakhstan.

Kazakhstan is the only country in the region, except Russia, that holds a large and consistent trade surplus. Peer countries are more import-dependent and have external trade deficits with the exception of Turkmenistan, which recorded a surplus of USD5.6bln in 2016. Simultaneously, Kazakhstan is by far the largest exports source and imports destination for China, the EU and Russia.

China, the EU and Russia's trade turnover with Central Asia, USD bln (2016)
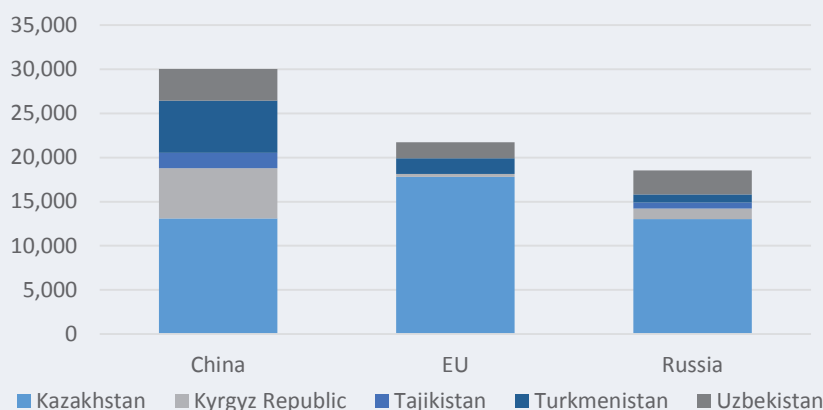
Source: National Bureau of Statistics of China, Eurostat, Federal State Statistics Service of Russia, Samruk-Kazyna

Kazakhstan's total trade turnover is estimated at USD81.1bln, or 52% of GDP in 2017. According to estimates, Kazakhstan's exports rose to USD49.3bln, while imports grew to USD31.8bln. Thus, Kazakhstan's trade turnover exceeded the trade turnover of Kyrgyz Republic, Tajikistan, Turkmenistan and Uzbekistan combined.

Exports, Imports and balance of trade, % of GDP (2017e)
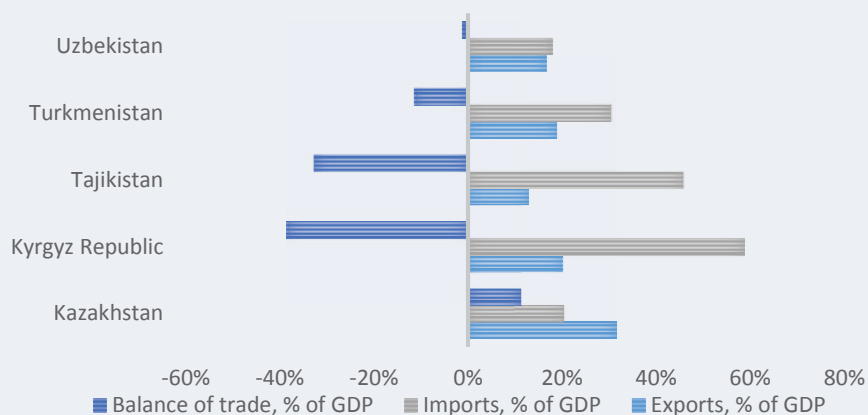
Source: National Bank of Kazakhstan, Statistics committees of Kazakhstan, Kyrgyz Republic, Russia, Tajikistan, Turkmenistan, Uzbekistan, UNCTAD, Samruk-Kazyna

Kazakhstan has attracted more than USD255bln in gross foreign investments since 2005, leading other CIS countries. As such, Kazakhstan ranks first in the region in terms of its FDI stock per capita and FDI stock to GDP ratio. Despite volatile global investment climate, which reduced foreign investment into emerging markets and transitional economies, Kazakhstan maintained its attractiveness for foreign investors. Consequently, FDI stock as at 3Q17 amounted to USD160.9bln. Total investment stock, which includes portfolio and other investments, amounted to USD225.9bln.

Netherlands remains by far the largest investor in Kazakhstan, other major investors include the US, the UK, China and France. Government policy has been encouraging foreign investment with measures such as reduction and, in some cases, waiver of taxes for five years, state subsidies, partial or total exemption from duties and taxes on equipment and other materials.
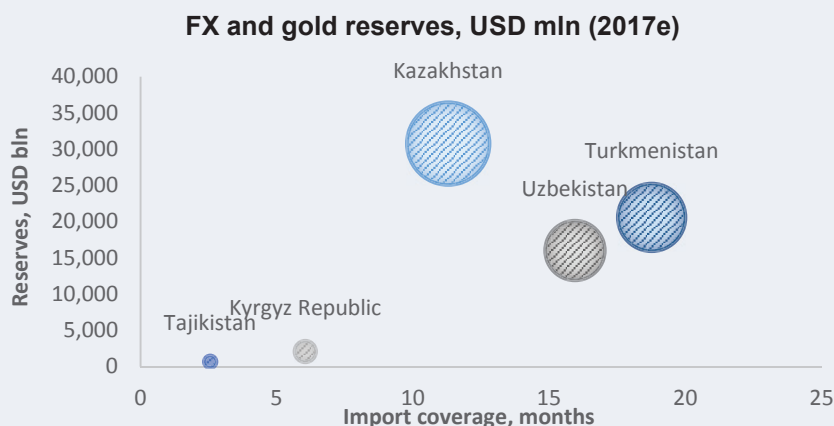
FDI stock per capita and FDI stock to GDP ratio (2017e*)
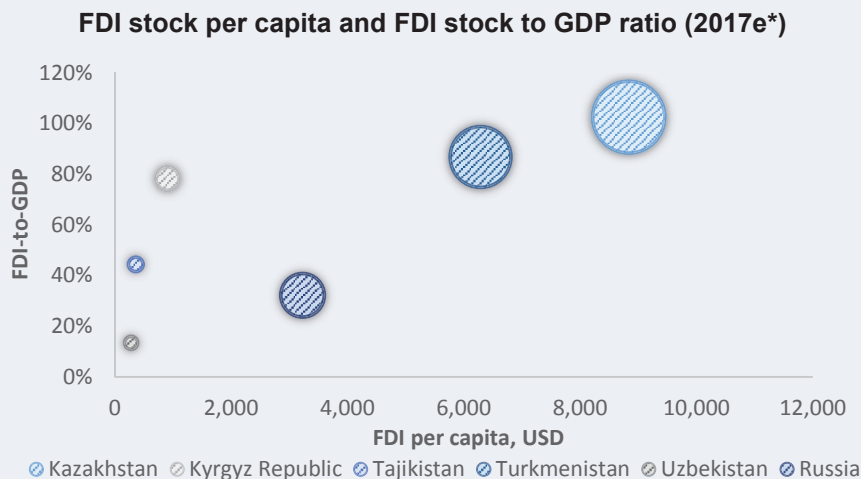
Source: Central banks of Kazakhstan, Kyrgyz Republic, Russia, Tajikistan, Turkmenistan, Uzbekistan, UNCTAD, Samruk-Kazyna
* Note: Statistics are based on official sources as at 3Q17 (Kazakhstan) and 1H17 (Russia, Kyrgyz Republic, Tajikistan) as well as 2016 estimates (Turkmenistan, Uzbekistan)

Kazakhstan is one of the primary recipients of China's FDI under One Belt One Road economic initiative, receiving an inflow of USD751mln in 3Q17 or more than 5.2% of China's total FDI into 59 countries covered by the B&R initiative in 2017.

Due to its geographical location and existing economic ties, Central Asia plays a key role in the success of this program. Chinese companies already hold a large FDI portfolio, especially in extractive industries in Kazakhstan and Turkmenistan. However, new projects are aimed at developing infrastructure and enhancing industrial and agriculture capacities. For example, Chinese companies are in negotiation with local partners to invest USD1.9bln in Kazakhstan's agriculture.

Kazakhstan also holds the largest amount of reserves. Reserves have been growing throughout 2017 to reach USD30.7bln by end-2017, as rising oil prices supported the stabilization of tenge. According to Guidotti-Greenspan rule, reserves should be sufficient to cover all short-term external obligations. For Kazakhstan, reserves to short-term debt ratio is 4.07 as of 3Q17. Another measure of reserves adequacy is import coverage. Kazakhstan's reserves are sufficient to cover approximately 11.6 months of imports. Kazakhstan's import coverage is significantly higher than in Kyrgyz Republic (6.1 months), Tajikistan (2.5 months), but smaller, compared to relatively secluded economies of Turkmenistan (18.8 months) and Uzbekistan (15.9 months).

FX and gold reserves, USD mln (2017e)

Source: National banks of Kazakhstan, Kyrgyz Republic, Russia, Tajikistan, Turkmenistan, Uzbekistan, UNCTAD, Samruk-Kazyna

Kazakhstan's fiscal and external positions are relatively stable compared to its peers. Government debt remains low and current account deficit is minimal. Other countries in the region, excluding Russia and Uzbekistan, have higher levels of government debt. Gross government debt in the Kyrgyz Republic reached 56.9% of GDP, while its current account deficit amounted to 11.6% of GDP.

Gross debt and current account balance, % of GDP (2017e)
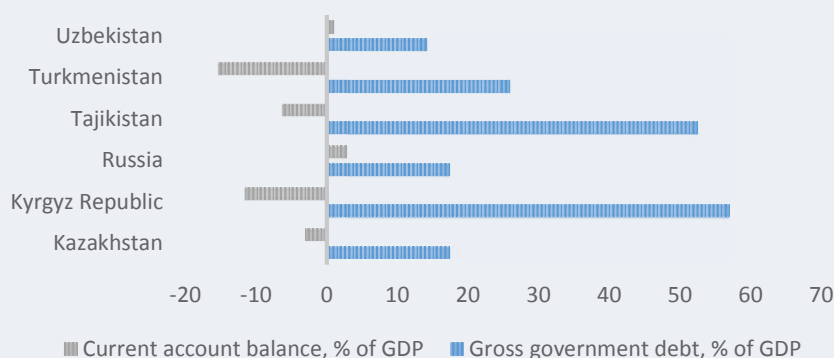
Source: National Bank of Kazakhstan, IMF, Samruk-Kazyna

Since its independence, Kazakhstan has actively pursued programs of economic reform designed to establish a free market economy. For much of the past 15 years, Kazakhstan was deemed as having one of the best investment climates in the region. In 2002, Kazakhstan became the first sovereign among CIS countries to receive an investment-grade credit rating from an international rating agency Standard & Poor's. The country's strong fiscal position is reflected in international rankings.

Sovereign Ratings Comparison, as at 3 February 2018

Country	S&P	Moody's	Fitch
Kazakhstan	BBB-/Stable	Baa3/Stable	BBB/Stable
Kyrgyz Republic	N/A	B2/Stable	N/A
Russia	BB+/Positive	Ba1/Positive	BBB-/Positive
Tajikistan	B-/Stable	B3/Stable	N/A

Source: S&P, Moody's, Fitch

The World Bank's Doing Business 2018 ranks Kazakhstan in the 1st place in Central Asia in terms of ease of doing business, and the 5th place within Europe and Central Asia. Globally, Kazakhstan holds the 1st place in protecting minority investors and 6th in enforcing contracts as well as 17th place in registering property. Meanwhile, index of transaction transparency and index of manager's responsibility are well above the average for Eastern Europe and Central Asia. The government has implemented a number of pro-business reforms that have been recognized by various international organizations.

Ease of Doing Business rankings (2018)
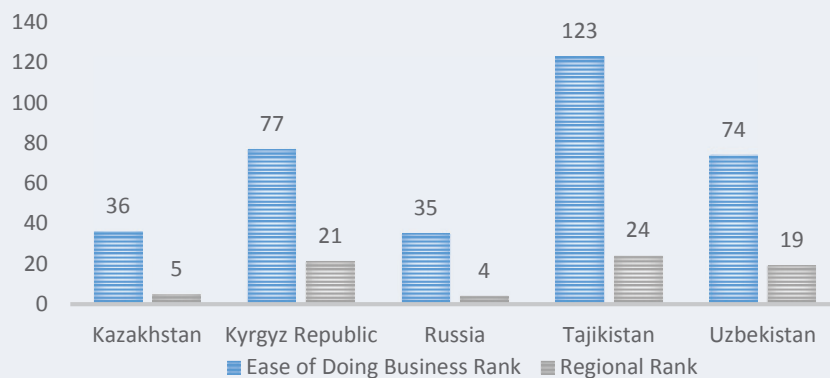
Source: World Bank Doing Business 2018, Samruk-Kazyna

Kazakhstan is the only country in the region that has a positive government effectiveness index, calculated by the World Bank. Kazakhstan also outperforms its peers in terms of control of corruption, government effectiveness, regulatory quality and rule of law. Investors in Kazakhstan note economic, political and social stability as one of the most attractive factors for investment.

Governance indicators (2016)
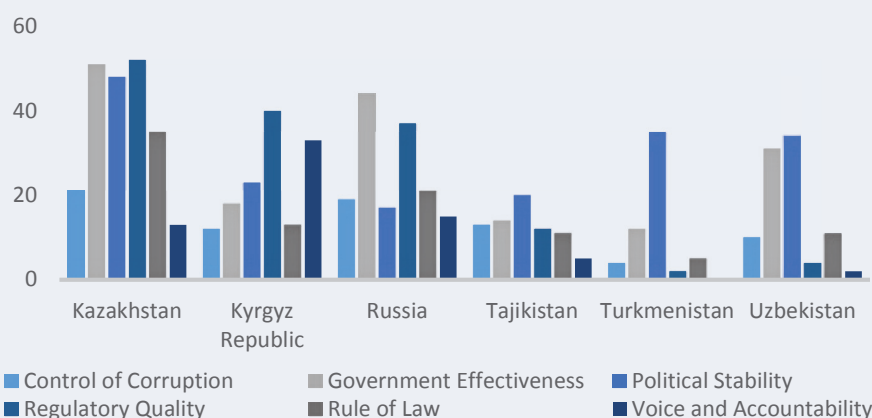
Source: *World Bank Group, Samruk-Kazyna*

Kazakhstan has a more inclusive growth, compared to its peers. Revenues are more-or-less evenly distributed among the population. In this regard, Kazakhstan's Gini index, which measures income inequality, is the smallest in the region and one of the lowest in the world. In addition, Kazakhstan has one of the highest levels of labor productivity in the region due to a developed education system and robust human capital.
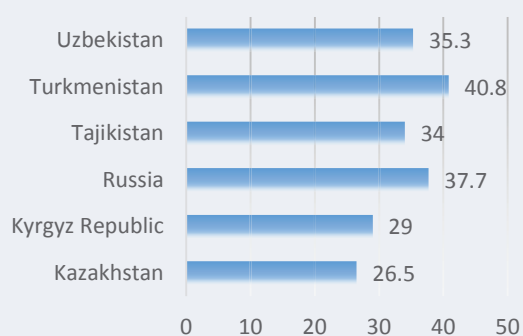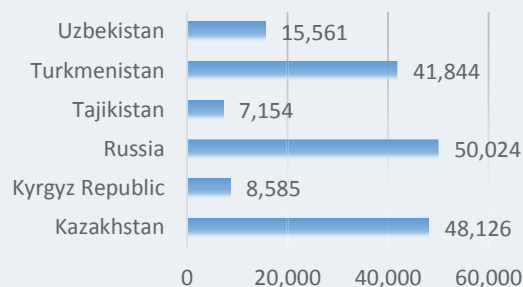
Gini index

Uzbekistan	35.3
Turkmenistan	40.8
Tajikistan	34
Russia	37.7
Kyrgyz Republic	29
Kazakhstan	26.5

GDP per person employed, USD constant 2011 by PPP (2017e)

Uzbekistan	15,561
Turkmenistan	41,844
Tajikistan	7,154
Russia	50,024
Kyrgyz Republic	8,585
Kazakhstan	48,126

Source: *CIA Factbook, World Bank, Samruk-Kazyna*

Fiscal policy

Kazakhstan's fiscal policy has been accommodative and focused on creating long-term growth factors with increased investments into infrastructure and human capital. The main priorities of the Government's spending are the development of agriculture, industrialization and development of small-and-medium-sized enterprises, digitization of the economy and development of transport and social infrastructure. Consolidated budget expenditures for 2017 are estimated at KZT12.93tln, while revenues are expected at KZT9.20tln. Consequently, consolidated budget deficit in 2017 is estimated at KZT3.73tln or -7.2% of GDP.

Improved economic conditions in 2018 and beyond should provide additional oil and tax revenues, which are expected to improve Kazakhstan's fiscal position. Thus, budget revenues in 2018 are projected at KZT9.7tln, while expenditures are expected to decrease to KZT10.9tln. Despite decreased

spending, the Government allocated KZT243.3bln on the Nurly Zhol program, KZT195bln on agriculture development, KZT76.1 under the SPAIID and KZT292.6bln on the development of transport infrastructure. Consequently, consolidated budget deficit is projected at KZT1.19tln or -2.1% of GDP in 2018.

Looking forward, the Government will continue to improve the efficiency of fiscal spending, while positive and sustainable economic growth are expected to support the growth of tax revenues. As a result, consolidated fiscal deficit is expected to decrease to KZT0.69tln or -1.1% of GDP by 2020.

Consolidated Budget Position, KZT bln
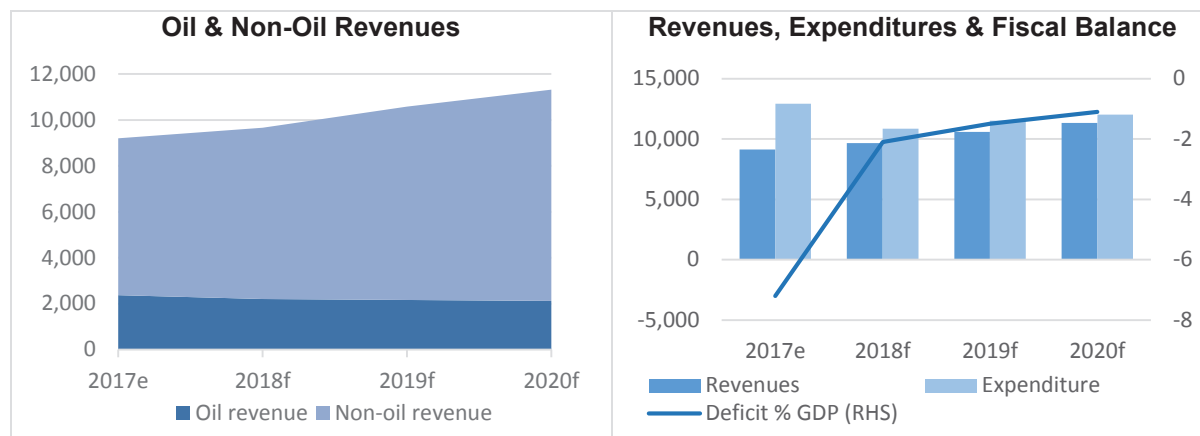
Source: Ministry of National Economy projections as at August 2017, Samruk-Kazyna

Kazakhstan's fiscal position remains strong, supported by budgetary surpluses accumulated during the years of commodity boom, allowing the government to continue with key infrastructure programs. According to official estimates, with oil price at a conservative level of USD50pb, National Fund assets are expected to remain robust at USD63.42bln or 38.6% of GDP as at end-2018. **Reflecting the country's strong balance sheet and relatively robust economic activity anticipated over the period to 2020, in September 2017, Standard & Poor's affirmed Kazakhstan's sovereign ratings at BBB-, with the rating outlook lifted to stable** from negative previously.

Inflation and monetary policy

The National of Kazakhstan (NBK) continues with monetary policy stimulus in line with easing inflation, cutting the base rate three times from 12% in early 2017 to 10.25% as at August 2017. In 2018, the key interest rate was reduced two times from 10.25% to 9.50% as at March 2018. The decisions on the base rate were taken premised on the following factors:

- Actual inflation rate continues to ease within the target range. Inflation stood at 7.1% annually in 2017, significantly lower than NBK's expectations of 7.5%-7.7%. Lower inflationary pressures were due to stabilization in prices of non-food products (petrol and durable goods). Well-anchored and lower inflation expectations also contributed to further interest rate cuts in 2018, whereby one-year inflation expectations fell to 6.0% according to the survey conducted in February 2018 vs. a high of 7.7% in November 2017. Based on current inflation trends, there is likelihood of CPI reaching the lower bound of 5.0%-7.0% target for 2018 in fourth quarter of this year. In the medium term, inflation is projected to stay within official target of 4.0%-6.0% in 2019 and potentially reach 4.0% by 2020.

- Stabilization of the USDKZT exchange rate in 4Q17 and 1Q18 also contributed to driving down the general price level. The tenge has strengthened gradually reflecting the combination of improved external and domestic conditions, whereby the recovery in global oil prices since October 2017 and accelerated growth momentum provided the added support needed by the tenge. These positive developments contributed to the conversion of foreign currency denominated assets to tenge-denominated assets on both the foreign exchange cash market and the bank deposit market.

- Tenge deposits grew by 11.2% to KZT9.16tln in 2017, while FX deposits fell by 15.9% to KZT8.35tln. The rebound in tenge deposits since early 2016 was supported by depositors' improved confidence on the back of recovery in global oil prices, positive domestic growth dynamics and the changes in interest rates in favor of local currency deposits. The proportion of tenge deposits improved further to 54.8% of total deposits as at February 2018, up from 45.4% as at end-2016.
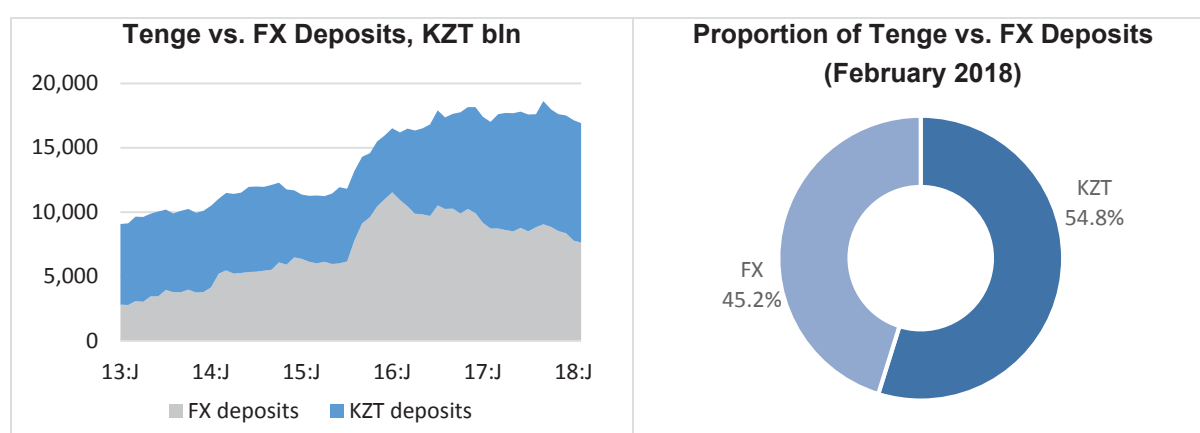
Source: National Bank of Kazakhstan, Samruk-Kazyna

- The domestic money market has been experiencing structural liquidity surplus condition, with NBK continues to actively conduct operations to absorb excess liquidity since March 2016. The net volume of tenge liquidity injected into the financial system amounted to KZT1,278bln in December 2015 and KZT1,438bln in January 2016, before declining to KZT849bln in February 2016. This was followed by excess tenge liquidity leading to an absorption of KZT2,519bln in December 2016 and rising to KZT2,450bln in December 2017. NBK absorbs liquidity from the market through notes, repo auctions and deposits.

Open position of NBK's operations, KZT bln (December 2015- 30 March 2018)
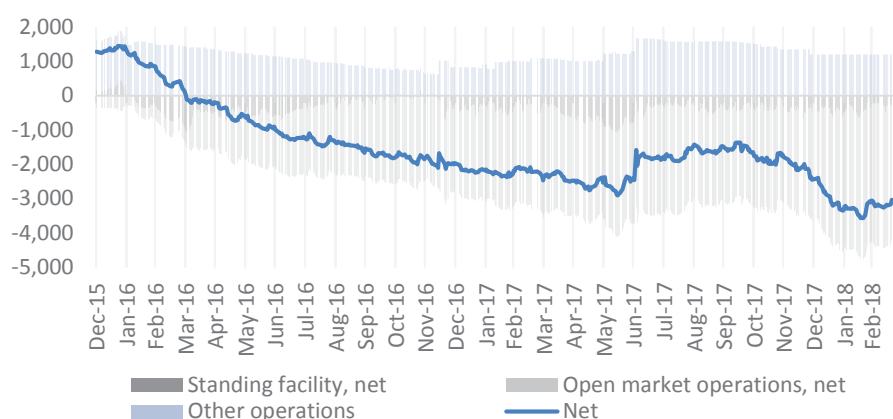
Source: National Bank of Kazakhstan, Samruk-Kazyna

Despite this, excess liquidity has yet to translate into healthy credit growth. The ongoing restructuring and recapitalization of the banking sector limit banks from expanding loans to businesses and individuals. On a monthly basis, the amount of tenge-denominated credit has been growing gradually since March 2017. Total credit to the economy grew by a marginal 0.5% to KZT12.71tln in 2017, as the increase in consumers loans (+12.4%) cushioned the impact of the decline in business loans (-5.8%). Credits are mostly concentrated in sectors such as trade, industry, construction and agriculture. Implementation of NBK program aimed at increasing the financial sustainability of the banking sector is expected to support gradual recovery of credit activities in the medium-term.
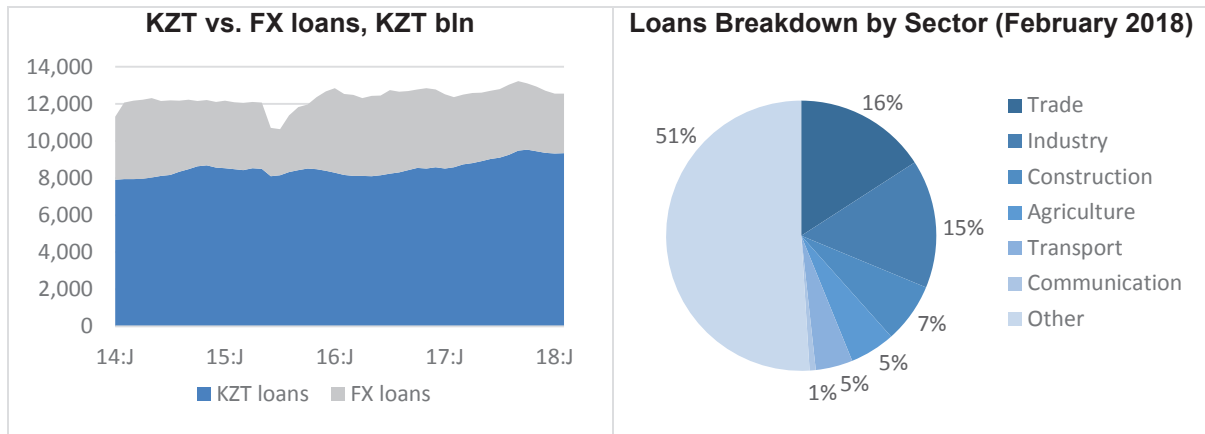
Source: National Bank of Kazakhstan, Samruk-Kazyna

Monetary policy stance moving forward would depend on (1) stability of the national currency, (2) inflationary expectations, (3) liquidity in the money market, (4) credit growth, and (5) the pace of de-dollarization in the banking sector.

Overall, we welcome NBK's move in cutting the base rate which bodes well for domestic demand, business investments and the general economic activities. The index of business sentiment, based on the survey of top management of real sector enterprises, moved into positive territory, signaling continued recovery in economic activity. The cuts in the base rate stimulated banks to lower market rates (to businesses) since July 2016, which will be crucial in lifting the demand for resources and the expansion of credit activities moving forward.
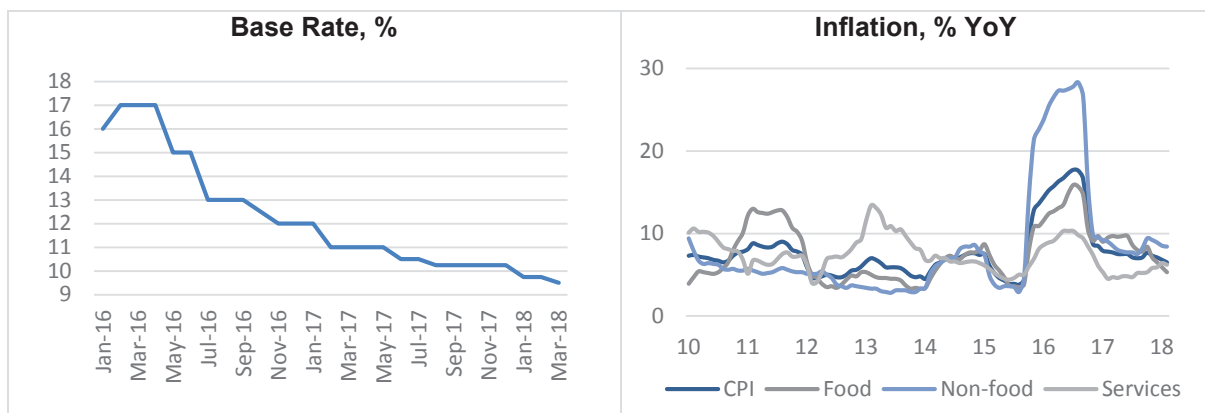
*Source: National Bank of Kazakhstan, Bloomberg, Samruk-Kazyna*

In a move to liberalize the domestic capital markets, NBK announced recently that it targets to launch direct trading of state debt and short-term central bank notes on the domestic equity market by end-1H18. This would give foreign investors direct access to Kazakhstan's state debt and central bank notes estimated at USD28bln. This initiative is expected to expand the long-term sources of funding, reduce the borrowing or the government as well as to support the formation of a normal yield curve and further develop the country's capital markets.

USDKZT exchange rate
The USDKZT exchange rate strengthened in 1H17, reaching 310.40 in May 2017, supported by the recovery in commodity prices. Nevertheless, the tenge weakened in 3Q17 following the decline of global oil prices to below USD45pb in June 2017. Speculative factors on the external front and seasonal demand-supply dynamics for FX contributed further to the weakening of the tenge, to last year's low of 345.11 on 5 October 2017.

After a nine-month pause, NBK resumed intervention in the FX market to smooth out significant fluctuations on the tenge in four separate months of June, August, September and October 2017 (at amounts of USD101mln, USD70mln, USD69.7mln and USD379.8mln respectively). As at 29 December 2017, the USDKZT exchange rate closed at 332.85, strengthening by 3.6% since 5 October 2017, partly attributed to the recovery in oil prices.

The tenge is expected to remain stable in 2018, barring external factors potentially affecting the local currency (2017: 326.32). As at 30 March 2018, tenge close at 318.73, an increase of 4.2% year-to-date.

USDKZT vs. Brent Oil Trends (January 2016 – 30 March 2017)
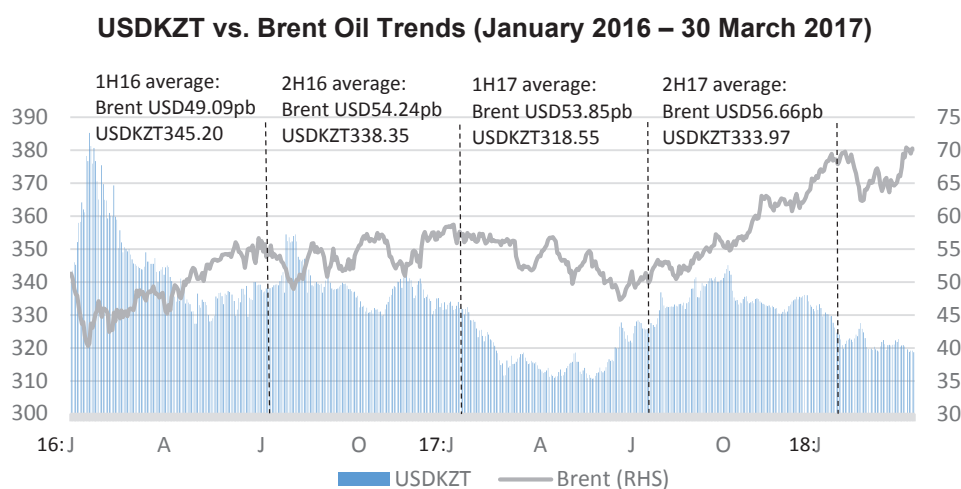
Source: Bloomberg, Samruk-Kazyna

Apart from global oil prices, movement in the currencies of major trading partners may also impact the tenge. Since the shift to a free-floating regime in August 2015, the USDKZT exchange rate has closely mirrored that of the USDRUB exchange rate. Russia is one of Kazakhstan's most important trade partners and hence it is important to maintain exchange rate stability to ensure trade competitiveness.

USDKZT vs. USDRUB Exchange Rate Trends (2015 – 26 March 2018)
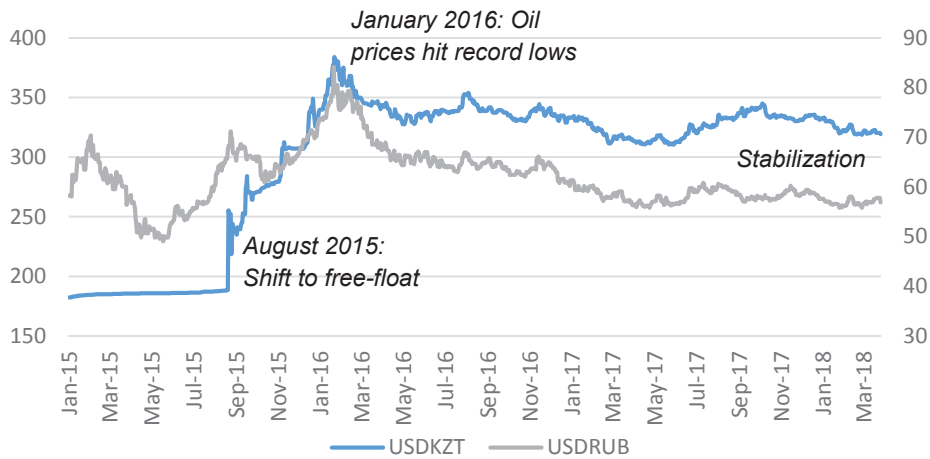
Source: National Bank of Kazakhstan, Bank of Russia, Samruk-Kazyna

External positions

Kazakhstan's external trade turnover increased by 24.0% YoY to USD81.01bln in 2017. Exports expanded by 32.2% YoY to USD49.25bln, supported by higher oil prices and volumes as well as improved external demand. Exports of oil and gas condensate increased by 37.8% in 2017, while exports of ferrous and non-ferrous metals rose by 51.6% and 27.1% respectively. Concurrently, imports grew by 13.1% YoY to USD31.76bln. Growth in exports saw trade surplus increased by almost twofold to reach USD17.49bln in 2017. As such, current account deficit was significantly lower at USD4.67bln in 2017, almost halved the amount recorded in the previous year.

Kazakhstan's total trade turnover is projected to increase moderately in the medium-term, potentially exceeding USD100bln by 2022. Following this, current account balance is expected to improve gradually to -3.2% of GDP in 2022.
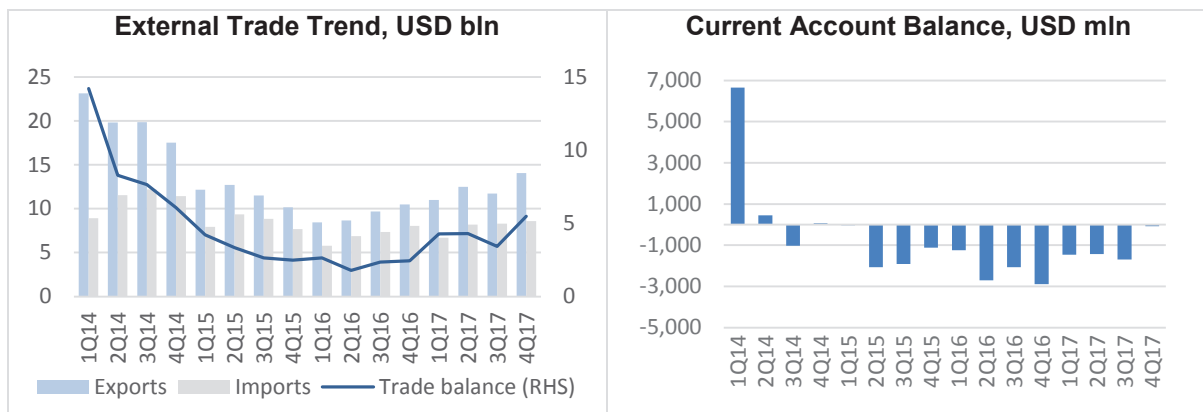
Source: National Bank of Kazakhstan, Bloomberg, Samruk-Kazyna

Further development of Kazakhstan's regional connectivity and transport infrastructure under the Nurly Zhol program and the China's One Belt One Road initiative is expected to contribute significantly to the growth of Kazakhstan's external trade and transit volumes. As at December 2017, total infrastructure investments in Kazakhstan exceeded USD20bln, including approximately USD2bln direct financing from China's investors. In addition, China is expected to provide more than USD250bln to fund infrastructure projects in Asia region, with Kazakhstan being one of the primary beneficiaries. As a

result, transit traffic volume is forecasted to increase two-fold by 2020, providing impetus to the development of logistics, transportation and tourism industries.

On reserves, Kazakhstan's official international reserves comprise of foreign exchange assets at the NBK and in the National Oil Fund. Total international reserves stood at USD90.80bln as at February 2018. This amount comprised of FX reserves of USD31.43bln at the NBK and USD59.37bln at the National Oil Fund. The National Fund assets are expected to remain robust at 38.6% of GDP in 2018, reflecting ample fiscal space and flexibility for the country to absorb economic shocks, if the need arises.
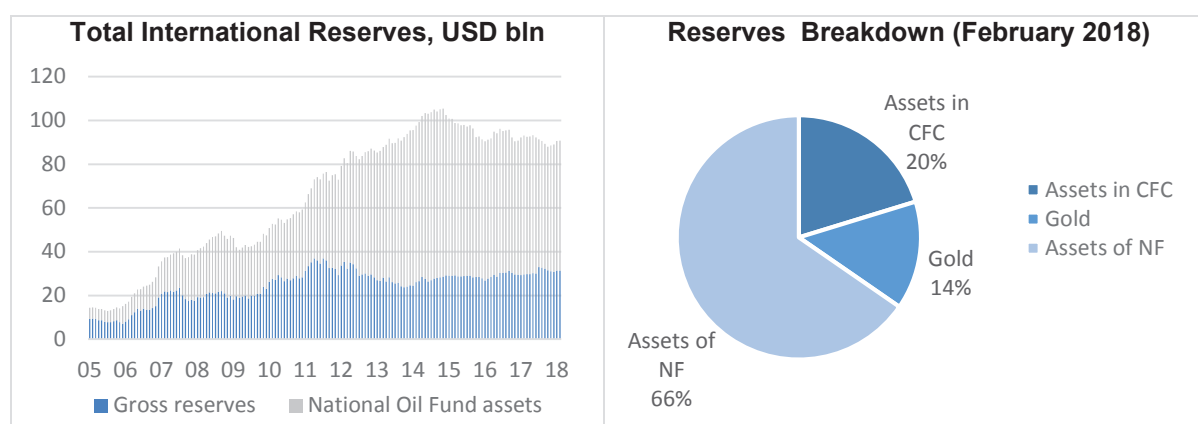
Source: National Bank of Kazakhstan, Samruk-Kazyna

Foreign direct investment

Gross inflows of FDI picked up momentum in 2016, amounted to USD20.64bln, USD5.89bln or 39.9% higher than in 2015. In the first nine months of 2017, FDI inflows amounted to USD15.75bln, translating into an annualized rate of USD21bln for 2017. Since independence, Kazakhstan attracted cumulative FDI of more than USD255bln.

Inflow of investments went to traditional sectors, such as mining with total investments of USD73.78bln or 28.6% (mainly in the extraction of crude petroleum and natural gas), as well as investments into professional, scientific and technical activities at USD87.14bln or 33.8% (majority relates to geological exploration and prospecting activities). The oil and gas, natural resources and extractive industries continue to remain the most attractive sectors for investments, comprising more than half of Kazakhstan's accumulated FDI inflows to-date. Nonetheless, the manufacturing, wholesale and retail trade, financial services, and construction attracted commendable investments of USD33.76bln (13.1%), USD23.96bln (9.3%), USD12.49bln (4.8%) and USD8.52bln (3.3%) respectively, reflecting relative success of Kazakhstan's efforts to diversify the economy.

Gross Inflows of FDI, USD bln

FDI averaged at 7% of GDP per annum in the past 10 years, peaking at USD28.88bln in 2012
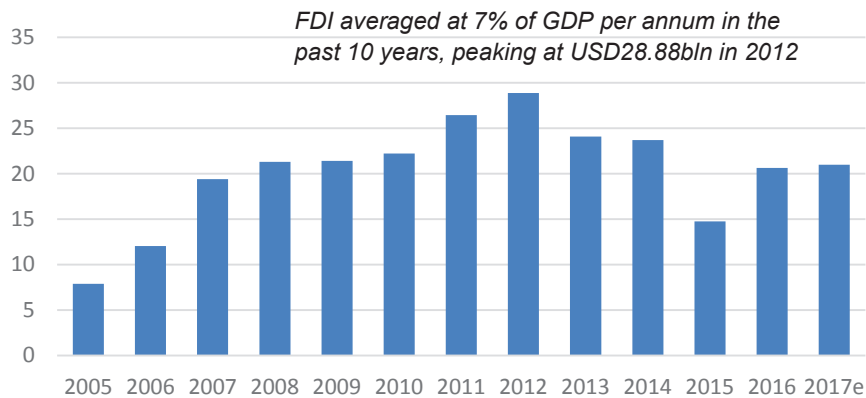
Source: National Bank of Kazakhstan, Samruk-Kazyna

Netherlands remains the largest investor (domiciled by country) in Kazakhstan with investments amounted to USD76.10bln, while the US has USD24.90bln investments in the country. Other major investors include Switzerland, China, France, UK and Russia. Kazakhstan has increasingly been receiving FDI from China namely within the One Belt One Road initiative.

New Asian partners such as China, India and even Iran are replacing Kazakhstan's traditional investment partners. However, they have not been able to fully substitute Russia and western investors, many of which have been deterred by lower oil prices, weakened domestic and regional economic cycles in the past two years.

Kazakhstan ranks 1st place globally in protecting foreign investors and minority shareholders, according to the World Bank Doing Business 2018 report, up from 3rd place in 2017. Index of transaction transparency, index of manager's responsibility and index of investment protection are well above the average for Eastern Europe and Central Asia. Government policy has been encouraging foreign investment with measures such as reduction and in some cases waiver of taxes for five years, state subsidies, partial or total exemption from duties and taxes on equipment and other materials.
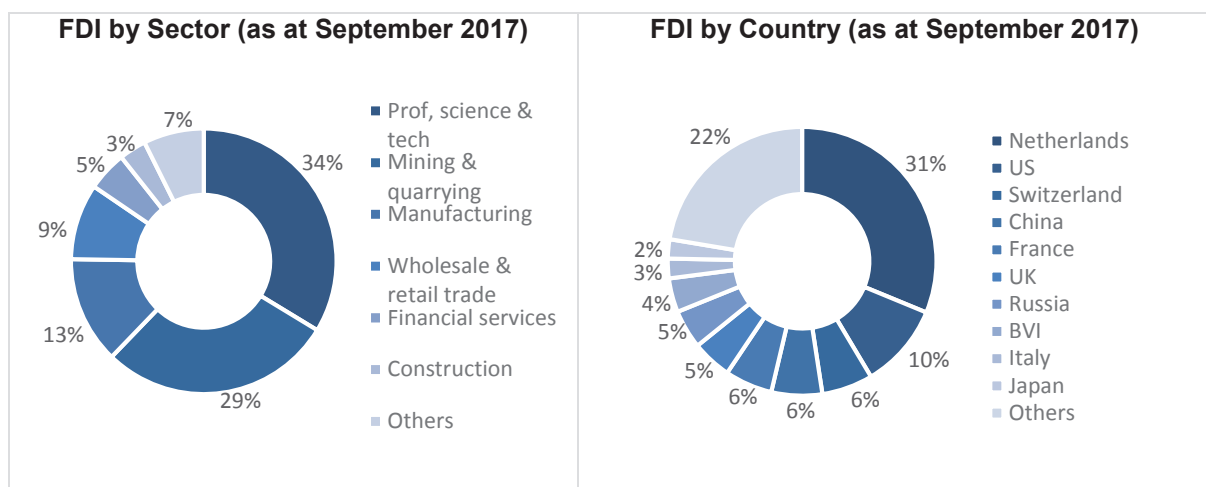
Source: National Bank of Kazakhstan, Samruk-Kazyna

Box 2: Kazakhstan's One Belt & One Road proposition

Kazakhstan has been one of the biggest recipients of Chinese FDI in Central Asia, with the total FDI stock amounting to USD14.9bln as at end of 3Q17. Transportation, finance, mining, and manufacturing were the main beneficiaries of China's investments.

China's FDI stock distribution

Source: Committee on Statistics of the Republic of Kazakhstan, Samruk-Kazyna

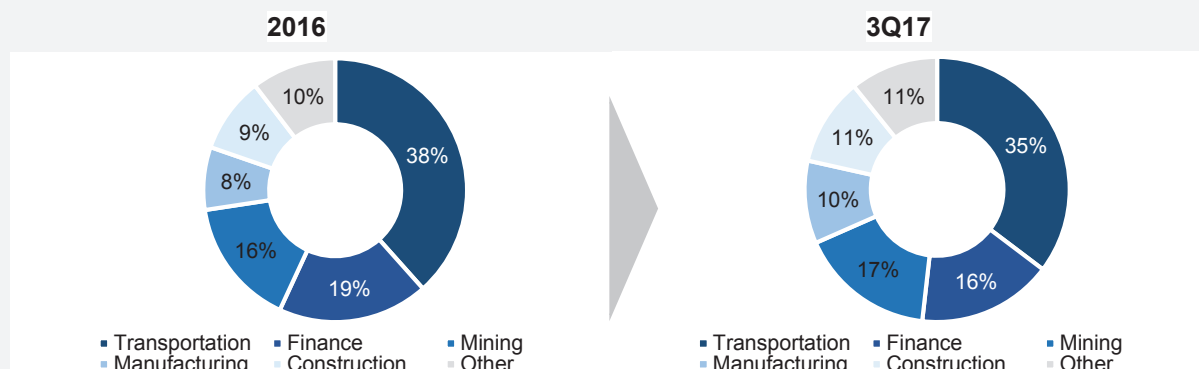B&R program implementation in Kazakhstan is expected to be faster than in other participating countries due to substantial synergies with Nurly Zhol program and optimized legal and regulatory framework. The majority of Nurly Zhol projects may be considered as a part of a broader B&R framework, as they directly contribute to the improvement of Kazakhstan's infrastructure and EU-Asia transit potential.

In particular, Khorgos Gateway, a dry port on the China-Kazakhstan border, currently represents a key logistics hub on the New Silk Road. The facility, which was specifically designed to process containerized cargo, is expected to considerably increase Kazakhstan's transit capacity, with the total project cost to date amounting to over USD220mln. Khorgos may process more than 16,000 containers daily, offering a range of logistics solutions, including freight reloading, the formation of container trains and documentary support. In May 2017, as a part of B&R program implementation, China's investors, COSCO Shipping and Lianyungang port, agreed to further develop Khorgos' infrastructure base, acquiring 49% stake in the terminal.

Main projects, considered as a part of B&R initiative in Kazakhstan

№	Project	Cost, USD mln	Development period
1	Khorgos terminal	222	2014-2020
2	Kuryk port in Mangistau region	261	2015-2018
3	Zhezkazgan-Beineu railway	1,131	2012-2017
4	Arkalyk-Shubarkol railway	242	2012-2017
5	Almaty1-Shu railway	102	2015-2017
6	New railway hub in Astana, including train station	561	2013-2017
7	Logistic terminal in Shymkent (Southern Kazakhstan region)	43	2014-2017
8	Logistic terminal in Astana	82	2014-2016
9	Modernization of Aktau port	112	2014-2017

Source: KTZ, Samruk-Kazyna

Another key logistics project, Kuryk seaport, which is located in Mangistau region, was constructed in order to increase Kazakhstan's marine transit capacity. Enabling direct reloading from trains and trucks to ferries, the port is expected to stimulate freight shipments to Europe and the Middle East via Azerbaijan and Iran. Construction of the first project's phase was completed in December 2016, with the total of 44 logistics facilities commencing their operations. In October 2017, Kuryk has already processed more than 1,000,000 tons of cargo, meeting its 2017 target in advance.

In October 2017, Astana LRT, an entity established to develop Astana's transport and logistics infrastructure, received approximately USD1.6bln from the China Development Bank to finance the construction of light rail system in the city, reinforcing China's strong B&R commitment. The project, incorporating 22.4 kilometers of track, 18 stations, and a depot, is currently at the feasibility study stage. It is planned to be constructed using Chinese technical specifications and the rolling stock, with 19 vehicles delivered from China. Other main infrastructure projects in Kazakhstan, which could be attributable to B&R, include several railways (Zhezkazgan – Beineu, Arkalyk – Shubarkol, Almaty – Shu) and logistics hubs in Astana and Shymkent.

In addition, China's authorities plan to relocate 51 production facilities to Kazakhstan, with a total of investments amounting to USD27bln in sectors such as metallurgy, chemicals, construction materials and vehicle manufacturing. Three projects, including polypropylene production in Pavlodar, automobile manufacturing in Kostanay and vegetable oil production in the North Kazakhstan region, are already transferred to Kazakhstan, with another six projects being in the process of reallocation.

Kazakhstan's B&R transit potential

2,000,000 TEU
Market potential (2020)

Implied growth of more than 1,799,000 TEU

201,000 TEU – Existing transit volume (2017)
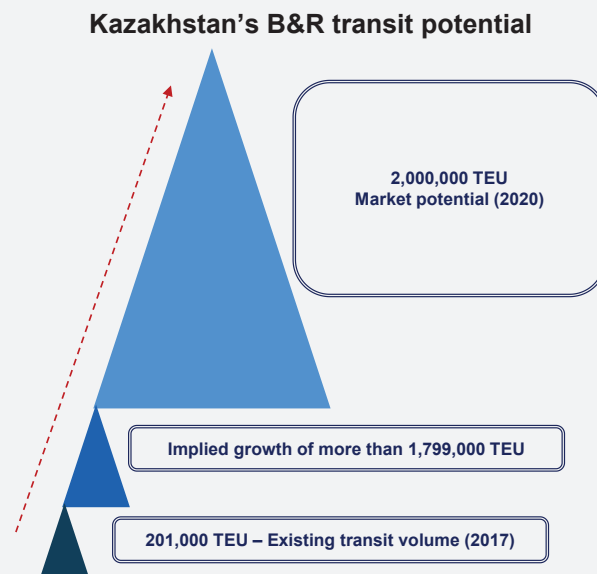
Source: KTZ, Samruk-Kazyna

In the latest address to the nation, **Kazakhstan's Head of State announced key goals to increase revenue from transit freight transportation to USD5bln by 2020 and integrate the latest digital technologies**, including blockchain and internet of things, to optimize and improve the efficiency of Kazakhstan's transportation and logistics sectors.

In January 2017, the first container train from China arrived in London, covering a distance of 7,500 miles. It moved via territories of Kazakhstan, Russia, Belarus, Poland, Germany, Belgium, and France,

crossing under the English Channel in the UK. The total duration of the trip amounted to 18 days, implying almost two times faster cargo delivery time, compared to the marine transportation.

Estimated cargo delivery time from Yiwu (China) to London

Land route via Kazakhstan	18 days
Sea route	36 days
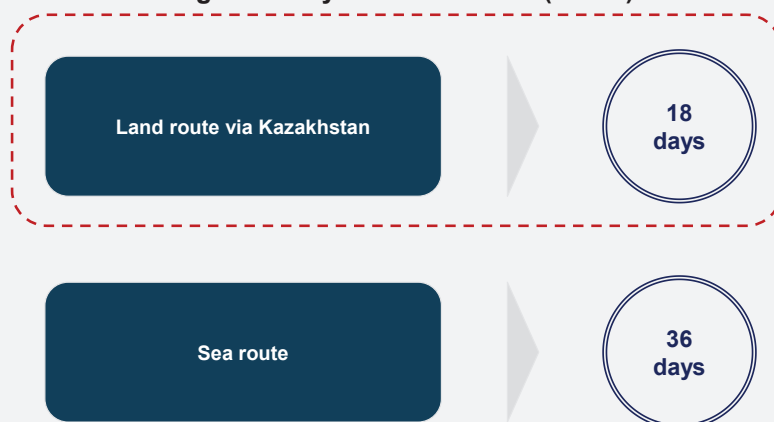
Source: KTZ, Samruk-Kazyna

Meanwhile, in November 2017, another container train going from Kokshetau to Turkish city Mersin commenced its regular operations on Baku-Tbilisi-Kars railway. The train consisting of 30 containers loaded with grain traveled more than 5,000 kilometers, reaching destination point in 10 days. The route included transshipment at a recently constructed Kuryk seaport, which contributed to the faster delivery of freight. The total annual capacity of the new route is estimated at 10 mln tons of cargo, with continuous improvement of logistics infrastructure within B&R program expected to further increase transportation capacity.

Consequently, industries which are primarily engaged in transportation or processing of containerized cargo, are expected to outperform overall Kazakhstan's economy over the medium term, with the growth exceeding GDP growth. These industries comprise rail and road transportation, logistics and marine, rail and road infrastructure.

B&R potential spillover effects on Kazakhstan

Potential spillover effects on Kazakhstan

USD7bln of estimated infrastructure investments over the next 5 years	**4.5%-7.0%** contribution to domestic GDP growth by 2021	Over **200,000 jobs** created by 2021
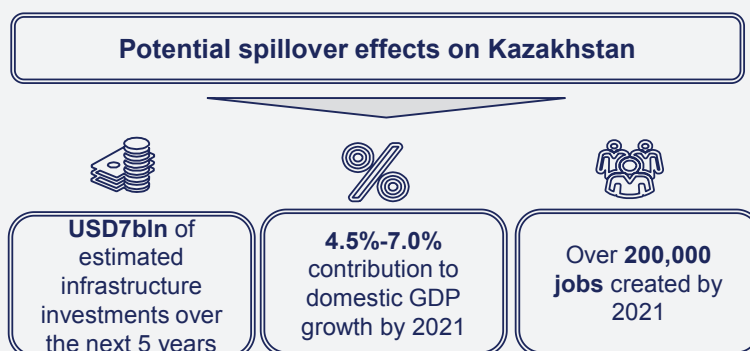
Source: KTZ, Samruk-Kazyna

B&R is forecasted to contribute additional 4.5%-7.0% to Kazakhstan's GDP growth by 2021, creating over 200,000 new jobs. In addition, the country's economy will considerably benefit from ongoing infrastructure improvements, with total investments size reaching more than USD7bln over next five years.

Global commodity markets

In 2Q17, global oil prices reversed the rally seen in 1Q17 post the OPEC and non-OPEC production cut announced in December 2016. The downward trend observed in the second quarter was due to significant bearish sentiment given excess oil supply and high oil stocks. Oil prices touched the year's low at USD45pb in June 2017. Nevertheless oil prices staged a strong recovery in 3Q17, breaching the USD60pb-level towards end-October 2017, its highest level in more than two years, driven by (i) the deal extension of OPEC and non-OPEC to limit production in 2018, (ii) improving market fundamentals with expectations of growing demand in the OECD region and China, (iii) high adherence of OPEC and non-OPEC producers to the deal cut requirements, (iv) rising geopolitical risks in northern Iraq potentially threaten exports from this region, and (v) declining OECD commercial oil stocks. As at 29 December 2017, WTI spot closed at USD60.42pb, rising by 12.5% YoY, while Brent for May 2018 settlement traded at USD66.09pb, an increase of 13.0% YoY.

Brent Price Trends (November 2016-30 March 2018)

Source: Bloomberg, Samruk-Kazyna

The main support to oil prices in 2018 will come from demand growth underpinned by improved global economic conditions. From supply side, there is still upside risk to supply disruptions, as Iran, Iraq, Libya, Nigeria, and Venezuela pose a high risk to short-term oil supply. Oil prices are expected to remain volatile in the near-term, restrained by growing US crude production and rig counts. The US oil producers are extremely flexible and adapted to lower oil prices by reducing drilling costs and increasing production efficiency. Based on current market dynamics, we expect oil prices to be higher at USD64-65pb average in 1H18 vs. USD55.3pb average in 2017. Medium-term expectations for oil price stand at USD60pb average by 2022.

In 2017, the average daily production in Kazakhstan amounted to 1.73mln bpd or 86.2mln tons (+10.5% YoY). The increase in production was due to ramp-up of production in Kashagan, the output amounted to 61mln barrels or 8.3mln tons for 2017 or 9.5% of total national output. The country's total output is forecasted at 638mln barrels or 87mln tons in 2018 (+0.9% YoY), with Kashagan oilfield contributing 12% of total output. Crude production from Kashagan field should reach 370,000 bpd in 2018 from 250,000 bpd at end-2017. The crude production is forecasted to grow at 0.6% CAGR during 2018-2022.

Meanwhile on uranium, the market continued to experience low prices and significant oversupply in 2017. This has led to output cuts by the largest uranium producers, which were the key trend observed last year. The impact of the first announcement by the largest producer to reduce output by 10% back in January 2017 was short lived, with uranium price rising to USD26lb in Feb 2017 and declining to USD19-21lb in 3Q17. The second announcement was made in early Dec 2017, as a result of which prices surged to USD26lb. In 2018, uranium prices are forecast to increase based on market expectations due to combination of decrease in oversupply and higher demand. In the long-term, very few mines will be developed at today's low prices level, which can lead to the shortages of supply. This, combined with a significant new nuclear power generation capacity being constructed in China and India, may support uranium prices.

Regional economies

Taking cue from the growth expansion observed in 2H16, global economic activity accelerated further in 2017, driven by major advanced economies (Japan, euro area), emerging Asia (China) and Russia where growth results were better-than-anticipated. Combination of stronger domestic demand (consumption and investment) and improved external demand in line with stronger global conditions supported overall growth momentum. Nevertheless, global economic recovery is uneven, whereby inflation remains below official targets in advanced economies (US, euro area) while some commodity exporters (Latin America and part of CIS) remain hard hit by moderate global commodity prices and lower FX earnings. Against the backdrop of a more balanced risks in the short-term, the International Monetary Fund projects global GDP growth of 3.9% in 2018, 0.2% higher than previous forecast. Meanwhile, the World Bank maintains a more moderate outlook on global growth at 3.1% for 2018.

GDP Growth of Selected Countries, % (2016-2018f)
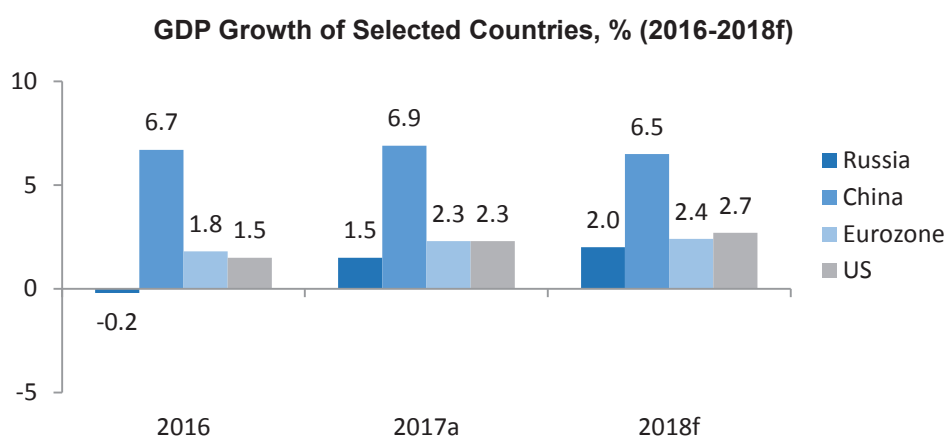
Source: Central Banks' official forecasts, market consensus, Samruk Kazyna

Being Kazakhstan's largest oil export market, Europe showed positive surprises in economic activity in late-2016 and 2017. Growth was above expectations for Germany, France, Italy and Spain. Solid readings on purchasing managers' indices indicated continued growth momentum and stronger domestic demand than previously anticipated. Upside surprises in GDP data was in line with faster-than-expected decline in unemployment rate, favorable business and consumer sentiment as well as lower interest rates. As such, the region's GDP growth touched a post-crisis peak of 2.3% for 2017, and the European Central Bank projects 2018 growth of 2.4%.

China, being Kazakhstan's largest export market for oil and metal products, saw GDP growth beat market expectations, coming in at 6.9% in 2017. This was first growth acceleration for China since 2010 and above official target of 6.5%. Growth acceleration was supported by robust household consumption,

which saw the economy created more than 10mln new jobs in the urban cities and saw retail sales volume expanded above 9% during the year. Meanwhile, fixed asset investment held steady, boosted by double-digit growth in infrastructure spending. December statistics point to a moderate yet sustained growth momentum in 2018, with GDP growth of between 6.2% and 6.5% over the medium-term as the economy rebalances and reforms and optimization are being implemented in targeted areas.

Russia's growth momentum accelerated as higher oil prices lifted real wages growth and consumer confidence, and reduced fiscal pressure. GDP growth came in at 1.5% in 2017, below official forecast of 1.7%-2.2%, dragged down by a weaker fourth quarter due to seasonality factors. Inflation is significantly below the central bank's target of 4%, allowing the regulator to further reduce the key interest rate, provided a boost to consumption and aggregate demand. Positive growth is expected to continue into 2018, with GDP growth forecast of up to 2.0%.

Positive economic performance of China, Russia and Europe will have spillover effects to Kazakhstan through trade, commodity prices and investment flows, as well as through the degree of confidence and stability in financial markets. China and Russia account for 12% and 9% respectively of the country's total exports, while European countries collectively account for ~50% of total exports.
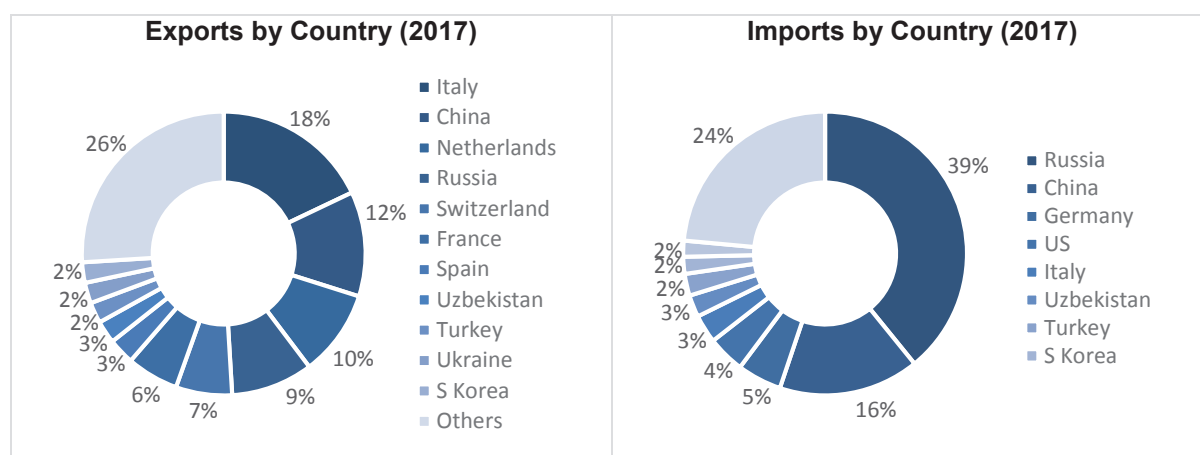
Source: Statistics Committee, Samruk-Kazyna

Macroeconomic indicators of Kazakhstan's key trading partners

Indicator	Eurozone	Russia	China	Kazakhstan
GDP growth 2018f	2.3%	2.0%	6.5%	**3.5%-4.0%**
Unemployment rate %, February 2018	8.6%^	5.0%	3.90%*	**4.9%**
Inflation % YoY, February 2018	1.2%	2.2%	2.9%	**6.5%**
Benchmark interest rate %, as at March 2018	0.00%	7.25%	4.35%	**9.50%**
PMI Manufacturing, February 2018	58.6	50.2	50.3	N.A.
PMI Services, February 2018	56.2	56.5	54.4	N.A.

Source: Central Banks, Eurostat, Russian Federation Statistics Service, National Bureau of Statistics of China, Ministry of National Economy, Bloomberg

* data as at 4Q17, ^ data as at January 2018

2018 outlook

In summary, Kazakhstan's economy remains resilient and is gradually adapting to the "new normal" environment. Growth momentum picked up significantly in 2017, with GDP expanded by 4.0%, driven by domestic demand, fiscal and monetary stimulus as well as favorable external conditions.

Looking forward, **economic expansion is expected between 3.5% and 4.0% in 2018** underpinned by (1) continued increase in oil production driven by Kashagan, (2) commodity markets rebalance on the back of growing global demand, (3) continued infrastructure development produces a multiplier effect on the economy, and (4) stronger growth among Kazakhstan's key trading partners facilitates trade and investment flows. **Reflecting the country's strong balance sheet and relatively robust economic activity anticipated over the period to 2020, in September 2017, Standard & Poor's affirmed Kazakhstan's sovereign ratings at BBB-, with the rating outlook lifted to stable** from negative previously.

The central bank continues with monetary policy stimulus in line with easing inflation, cutting the base rate further (by two times) in 2018 from 10.25% to 9.50% as at March 2018. **Monetary policy stance moving forward would depend on (1) stability of the national currency, (2) inflationary expectations, (3) liquidity in the money market, (4) credit growth, and (5) the pace of de-dollarization in the banking sector**.

Overall, we welcome NBK's move in cutting the base rate which bodes well for domestic demand, business investments and the general economic activities. Inflation trends have corresponded to the expectations of NBK, with CPI easing to 6.5% as at February 2018 vs. 7.1% as at end-2017. In the absence of negative shocks, **inflation is expected at 5.0%-7.0% in 2018**. In the medium term, inflation is projected to stay within official target of 4.0%-6.0% in 2019 and potentially reach 4.0% by 2020

On currency, the USDKZT exchange rate strengthened since 4Q17, where it closed 3.6% higher at 332.85 as at 29 December, after touching last year's low of 345.11 on 5 October. **The tenge is expected to remain stable in 2018**, barring external factors potentially affecting the local currency (2017: 326.32). As at 30 March 2018, tenge close at 318.73, an increase of 4.2% year-to-date.

On global oil market, the main support to oil prices in 2018 will come from demand growth underpinned by improved global economic conditions. From supply side, there is still upside risk to supply disruptions, as Iran, Iraq, Libya, Nigeria, and Venezuela pose a high risk to short-term oil supply. Oil prices are expected to remain volatile in the near-term, restrained by growing US crude production and rig counts. The US oil producers are extremely flexible and adapted to lower oil prices by reducing drilling costs and increasing production efficiency. Based on current market dynamics, we expect oil prices to be higher at **USD64-65pb average in 1H18** vs. USD55.3pb average in 2017. Medium-term expectations for oil price stand at USD60pb average by 2022.

On regional economies, Russia's growth momentum accelerated as higher oil prices lifted real wages growth and consumer confidence, and reduced fiscal pressure. GDP growth came in at 1.5% in 2017. Inflation is significantly below the central bank's target of 4%, allowing the regulator to further reduce the key interest rate, provided a boost to consumption and aggregate demand. Positive growth is expected to continue into 2018, with GDP growth forecast of up to 2.0%. China, being Kazakhstan's largest export market for oil and metal products, saw GDP growth beat market expectations, coming in

at 6.9% in 2017. This was first growth acceleration for China since 2010 and above official target of 6.5%, supported by robust household consumption and fixed asset investment. December statistics point to a moderate yet sustained growth momentum in 2018, with GDP growth of between 6.2% and 6.5% over the medium-term as the economy rebalances and reforms and optimization are being implemented in targeted areas. Similarly, Europe showed positive surprises in economic activity in late-2016 and 2017. Growth was above expectations for Germany, France, Italy and Spain. Solid readings on purchasing managers' indices in the third quarter indicated continued growth momentum and stronger domestic demand than previously anticipated. As such, the region's GDP growth touched a post-crisis peak of 2.3% for 2017, and the European Central Bank projects 2018 growth of 2.4%.

Kazakhstan's economy is highly reliant on natural resources and extractive industries, and the constant change in global economic dynamics has made it more challenging for the country to stay competitive. Now is the time for Kazakhstan to explore new opportunities and venture into new growth areas, especially through the modernization and application of technology in key economic sectors. This will result in economic diversification and enhance sector value add to GDP contribution in the longer-term – one of the key priorities for economic transformation under Modernization 3.0.

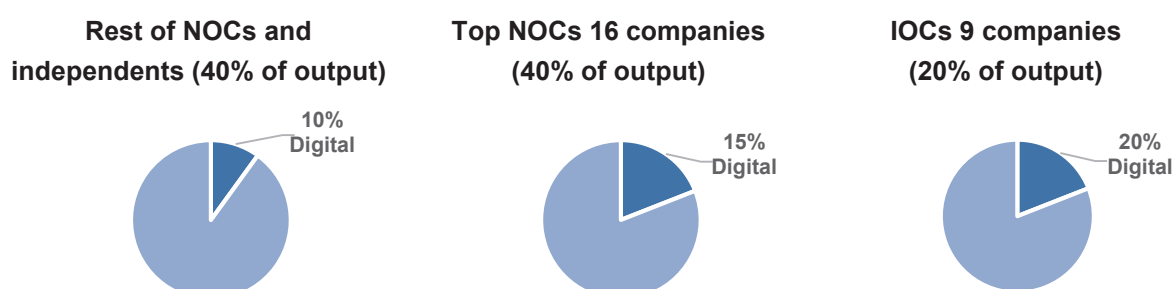**Kazakhstan: Charting Growth**
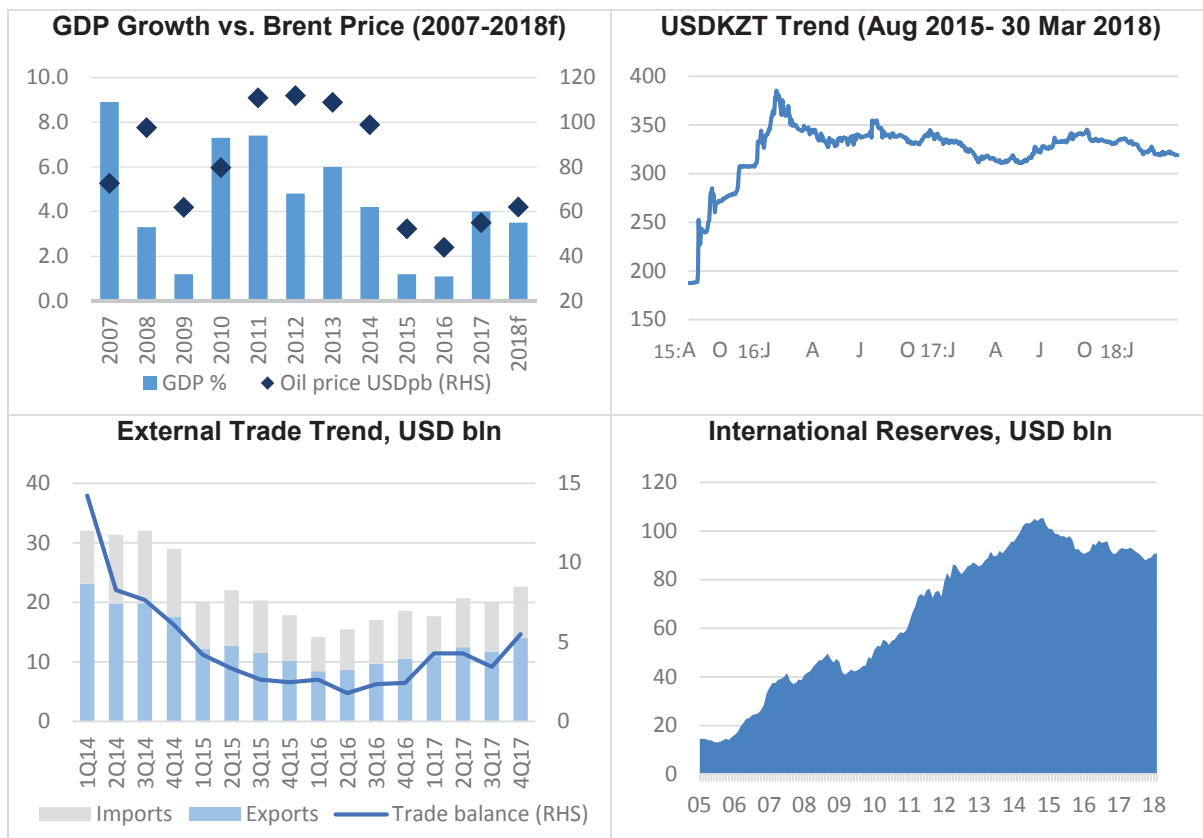
Source: Ministry of National Economy, National Bank of Kazakhstan, Bloomberg, Samruk-Kazyna

Section 3.0 Investment Opportunities in Digitalization

3.1 Digitalization in oil & gas industry

Oil & gas industry has not fully experienced the effects of digital technology compared to other industries such as media and retail. Improving the level of digitalization is one of the ways that the oil and gas industry can stay competitive. Nowadays, relying on higher oil prices to drive growth and returns is risky, and investments in digital technologies allow the industry to improve efficiency and safety, and reduce costs.

Rest of NOCs and independents (40% of output)	Top NOCs 16 companies (40% of output)	IOCs 9 companies (20% of output)
10% Digital	15% Digital	20% Digital

* NOCs – national oil companies, IOCs – international oil companies
Source: Ernst & Young "How ready are your assets to perform in the digital world?"

Currently, the share of integrated/connected oil & gas equipment amounts only 3-5%, while the share of utilized data to make decisions is at about 1%. Therefore, there is a huge potential for oil & gas companies in optimization of operating expenses and increasing production efficiency using digital technology in the era of weak oil prices. Out of 93mln bpd, only 9-18mln bpd are produced using digital technology. Top national oil companies, which are responsible for 40% of world oil output, produce only 15% of output using digital technology (EY, 2016). It is a time for energy companies to increase their investment in the digital technology, as technology cost continues to decline.

WTI spot price vs. technology costs
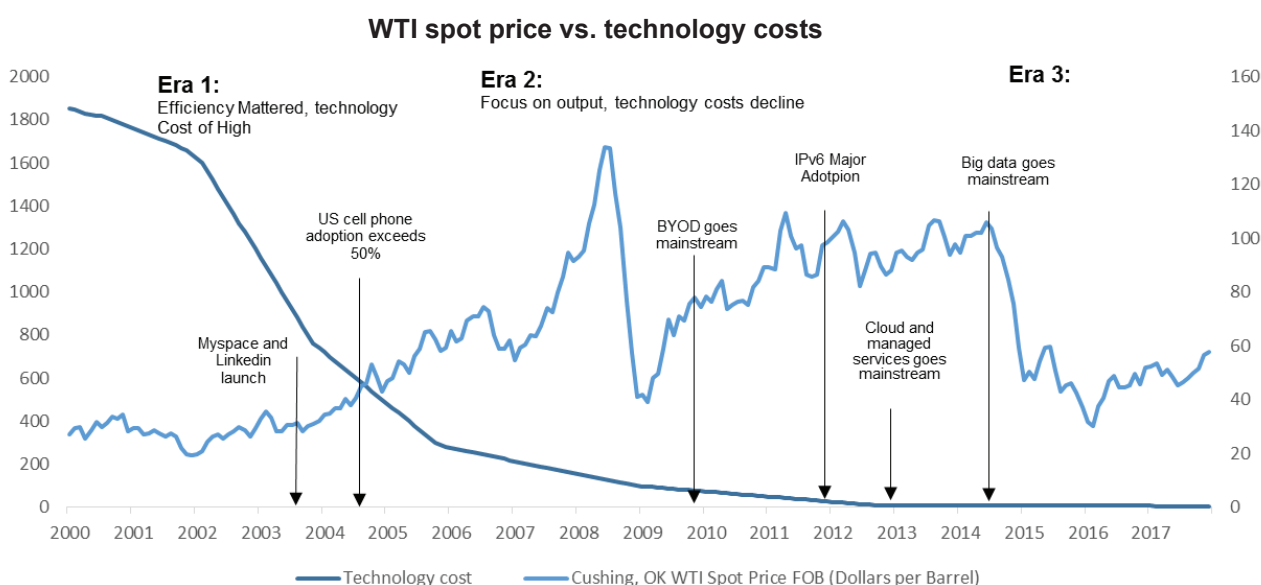
Source: E&Y

Digital (smart) well and oilfield

In the low-oil price environment, the need to reduce the cost of oil production has led to the improvement in technologies that optimize the production process through the wells. Digital oil field technologies allow companies to manage wells remotely, to reduce visit of operators to well pads and receive data from wells, which can be analyzed in real-time. These smart oil fields allow to manage production process and assets based on automation, integrate between processes with financial indicators and other indicators. It is worth noting that there is no ideal smart field globally, each company develops and implements those elements of digital and intellectual technology, which are most appropriate for the field.

Schematic description of a smart well
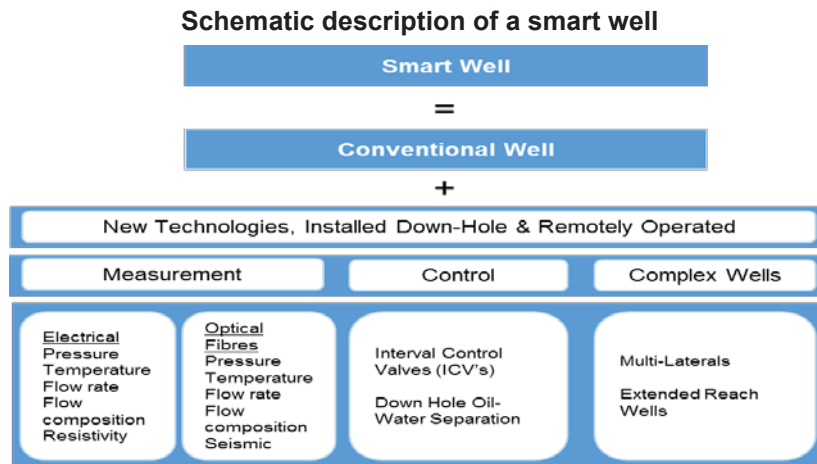
Source: Research paper "Dynamic water flood optimization with smart wells using optimal control theory"

The first smart field abroad was activated in 2001, while in Russia in 2008. Shell and BP are leading companies in terms of introduction of smart field technology. As of January 2015, the number of smart fields globally has reached 240, while 27 of them were in Russia, including 10 at Rosneft, 7 at Gazprom, 5 at Lukoil, and one at Tatneft. The global smart oilfield market is expected to grow at a CAGR of more than 4% by 2020. Total investments in digitalization and intellectualization of oil & gas industry in Russia may reach USD0.5-2.0bln annually during the next 5-15 years.

Oil fields with elements of digital and intellectual technology (Smart Field) in Russia

Gazprom: 7, 8 – Piltun-Astokhskoye, Lunskoye (Sakhalin II); 9 – Kirinskoye – unmanned (Sakhalin III); 1 – Prirazlomnoye – Pechora Sea; 21 – Z.Salimskoye; 24 – V. Salimskoye; 25 – Vadelipskoye; Rosneft: 5, 6 – Chaivo, Odoptu (Sakhalin I); 13 – Vankorskoye; 14 – Priobskoye; 15, 16 – Uvatskaya field group – Urnenskoye and Kamennoye; 17 – Samotlorskoye; 18 – Vanyeganskoye; 22 – Verkhnechonskoye; 23 – Yurubcheno-Tokhomskoye; Lukoil: 3 – Kravtsovskoye – Baltic Sea; 10, 11 – Yu. Korchagina, Filanofskogo – Caspian Sea; 19, 27 – Arkhangelskogo and Sukhareva (North of Perm region); Novatec 2 – Yurkharovckoye – Tazovskaya guba, 20 – Severbo-Khancheiskoye GCF – deserted; Tatneft: 12 – Romashinskoye; JSC "Ritech": 26 – Kotovskoye; Zarubezhneft: 4 – Khryaginskoye.

Source: Russian Oil & Gas Institute

Digitalization in oil & gas industry in Kazakhstan

Nowadays, in Kazakhstan the trend of introduction of smart field technology is slow, but positive. Currently, oil & gas companies in Kazakhstan lag behind its Russian peers in terms of the level of digitalization. Kazmunaigas EP (KMG EP) is now adopting technology of smart fields, optimizing logistics processes and equipment maintenance at its subsidiary companies. In addition, the company approved the project in increase of the efficiency of oil production at some fields. Successful implementation of these projects will be scaled to whole KMG EP.

Smart fields at Embamunaigas

In 2015, KMG EP has started implementation of "smart field" project at its subsidiary, Embamunaigas's Uaz field, which was a pilot project. At all stages of oil production at the Uaz field, equipment has been installed that takes readings and delivers them in real time to the control center. The whole cycle of oil production and processing at Uaz field is equipped with complex remote touch and control system with technological parameters in online mode. The well parameters are broadcast to the control center. Simultaneously, all the data recorded is submitted to the Center of visualization of production processes at Embamunaigas (EMBA), where it is analyzed and based on which long-term planning is being introduced.

Installation of Smart control system at EMBA

Source: Danfoss

The project allows to promptly identify the location of oil leak, to improve the quality of identifying the reasons of oil leakage, to control production equipment, to boost the effectiveness of producing and

injection well stock, and to reduce operating expenses and costs. According to the preliminary forecast, production at the Uaz field could be increased by about 3% thanks to the smart field project, the time required to repair wells will be cut by 15-20%.

The implementation of "smart field" at Uaz allowed to reduce the electricity consumption by 32%, to increase active well utilization rate and consequently, to reduce the number of well remedial maintenance operations. Currently, records of oil extracted are kept for each field. For a detailed assessment of the effectiveness of the project a considerable time period is required.

In 2017, it was planned to extend the implementation of this project at other fields of the group of companies of EP Kazmunaigas, such as Prorvinksiy group of oilfields, Akshabulak, and in 2018 at Uzen and Karazhanbas.

EMBA performed a pilot test using Sensorless Artificial Lift Technology (SALT). This technology is a well automation and control system that minimizes energy consumption, helps reduce mechanical failures, maximizes or optimizes production, and is cost effective; a control system that automatically makes intuitive adjustments to match the well's productivity, prevents loading violations, and minimizes costly shutdowns; an automation system that helps mitigate well intervention, minimizes energy consumption, and provides a more favorable return on investment.

Smart control system at Ozenmunaigas
In 1H14, Ozenmunaigas introduced a smart control system as a part of the modernization project of 300 wells in 12 oilfields. There are more than 3,000 wells at the company. Supervisory control system (SCM) "Smart control system for sucker-rod pumping unit" is provided for supervisory control and telemetering, optimizing operating modes of the sucker-rod pumping units of oil rigs. This is a distributed system which consists of two main levels. The lowest level implements the function of smart control station of sucker-rod pumping units. The highest level consists of SCM server and operators' automated workstations (AWS). The data between SCM server and control station is exchanged via GSM communication.

The main benefits of SCM are a decrease of electricity expenses, operating expenses, improvement of working conditions and efficiency of oil production. Improving efficiency of oil production is achieved by increasing filling of the plunger with formation water to the maximum level by automatically forming optimum pattern of change of the pumping frequency within the time base. The most important point is that the operation visibility of the sucker-rod pumping unit allows to diagnose preaccidental situations or accidents in the ground and underground downhole equipment. This helps to extend the life span of mechanical downhole equipment. The selection of the most optimal operating modes for the sucker-rod pumping unit allows to reduce electricity consumption due to an increase of total KPI of SRPU by increasing pump filling rate and by using frequency controlled drive with recovery function.

Supervisory control system structure
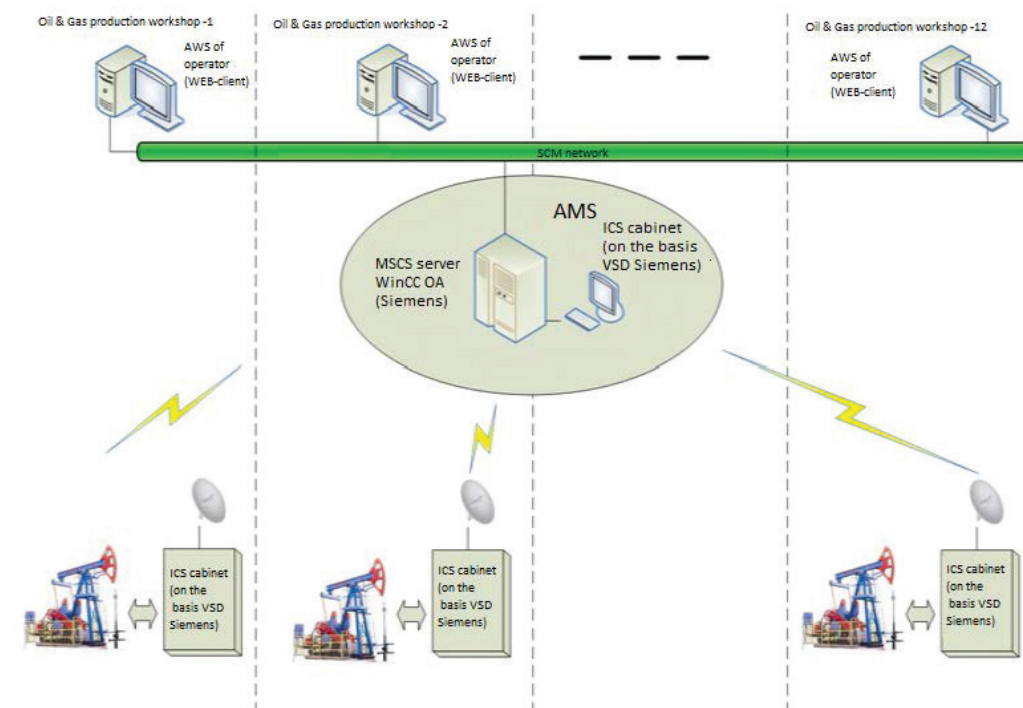
Source: Siemens

State program on "Digital Kazakhstan"

Industrial sector has a high level of equipment deterioration (49% on average), low level capacity utilization (61%) which imply low labor productivity, poor and obsolete technical level of equipment. This requires a gradual modernization and inauguration of new information and IoT systems.

Within the framework of the state program on "Digital Kazakhstan", the "national database" of mineral resources is planned to be established as a foundation for the information and communications technology (ICT) infrastructure. This will help to protect data on resources, collected from current subsoil users and to attract new investments by providing this data for potential investors. This will also allow to improve transparency in governance of mineral resource complex due to automation of the process of granting right o subsoil use. Moreover, the creation of the "national database" will allow to introduce monitoring and accounting treatment system of mineral database in real-time.

Currently, the government has only an access to the data on oil pumped to the custody transfer metering station, taking into account losses estimated based on the approved standards. Mineral extraction tax (MET) is calculated based on the oil volume at the oil metering station. We do not rule out that there may be losses and theft while transporting oil from field to the oil metering station, which might reach 10-12%. Therefore, the improvement of hydrocarbon accounting system and the creation of the state accounting information system is important.

Why invest in digital technology?

According to Gartner, leveraging digital technologies to improve business performance remains a top priority for oil and gas chief information officers. Chairman and chief analyst of Wood Mackenzie stated that digital technology has a major part to play in the next stage of structural cost reduction. PWC claims

that digital is a critical capability to accelerate operational efficiency and drive margins in oil & gas. According to the IEA estimates, the extensive use of digital technologies by oil & gas companies could lead to production costs reduction by 10-20%, an increase of recoverable oil & gas resources by around 5%. According to chief executive of GE oil & gas, digital technology can help to improve oil & gas productivity by 5pp. Digital technology creates value within the oil and gas context by enabling better and faster operational decisions, leading to greater asset utilization, reduced operating costs and increasing efficiency. It is also estimated that the oil & gas industry will generate USD1.1tln in Digital Value at Stake from 2015-2024.

The main benefits are optimization of expenses, minimization of losses, and maximization of oil output.
1) Integrated model helps to accurately estimate and forecast oil output and oil recovery rate, reduce operating and capex expenses.
2) It becomes possible to adapt flexibly to conditions and to modify the production planning in real time.
3) Digital oil production makes leading oil & gas companies more flexible and responsive to volatility of the oil market.
4) The average oil recovery rate could be increased by 30-50% as a result of using digital technology due to a substantial decline of operating costs and relevant reserves growth.

The journey to value for oil & gas companies
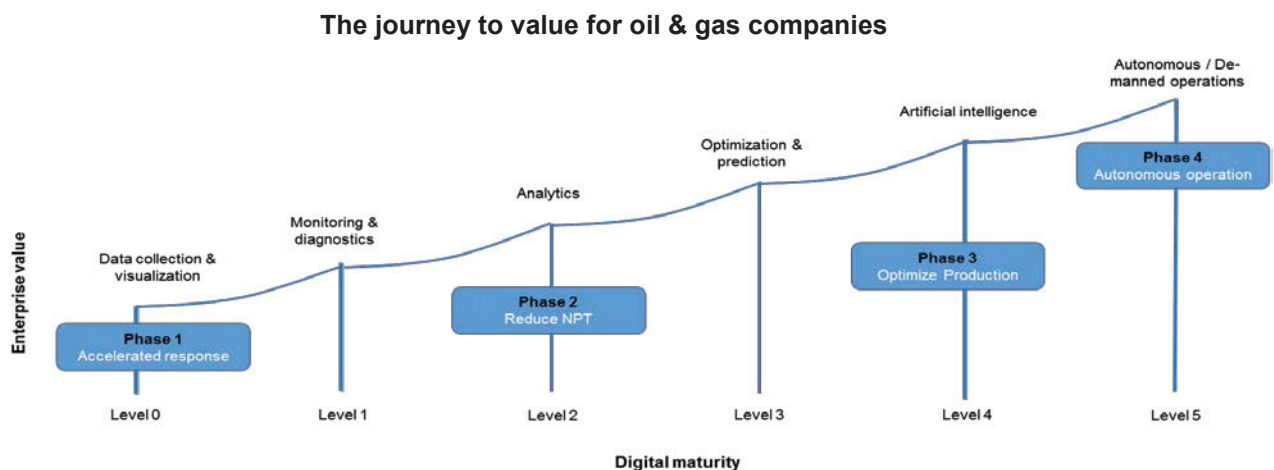
NPT means non-productive time[1]
Source: GE oil & gas

Top areas of digitalization where oil & gas companies should focus on:
- **Recovery efficiency:** This include permanent reservoir monitoring and 4D seismic data analysis.
- **Lifting-process automation**: The production process is automated and managed remotely through accurate estimation of significant field parameters (pressure, flow rate, and temperature) in near-real-time.
- **Remote monitoring**: This will help to identify and quickly react to issues such as leakages, theft, and rig downtime. A specific failure code is detected to accelerate problem solving before sending maintenance worker.

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[1] The Non-Production Times is a very high cost item for exploring and producing hydrocarbons. They are reduced thanks to real-time data analysis and the adaptation of technical means deployed, hunting unexpected variations in pressure gradients, which are still accountable for nearly 40% on NPT nowadays.

- **Drilling optimization**: Data management and Big Data analytics drive efficiencies through standardization and simplification. This reduces non-productive learning time and helps to accelerate well execution.
- **Project planning**: By using Big Data analytics to improve project outlay estimates, firms can prevent cost escalations.

Six areas of digitalization exist for significant value creation in upstream operations
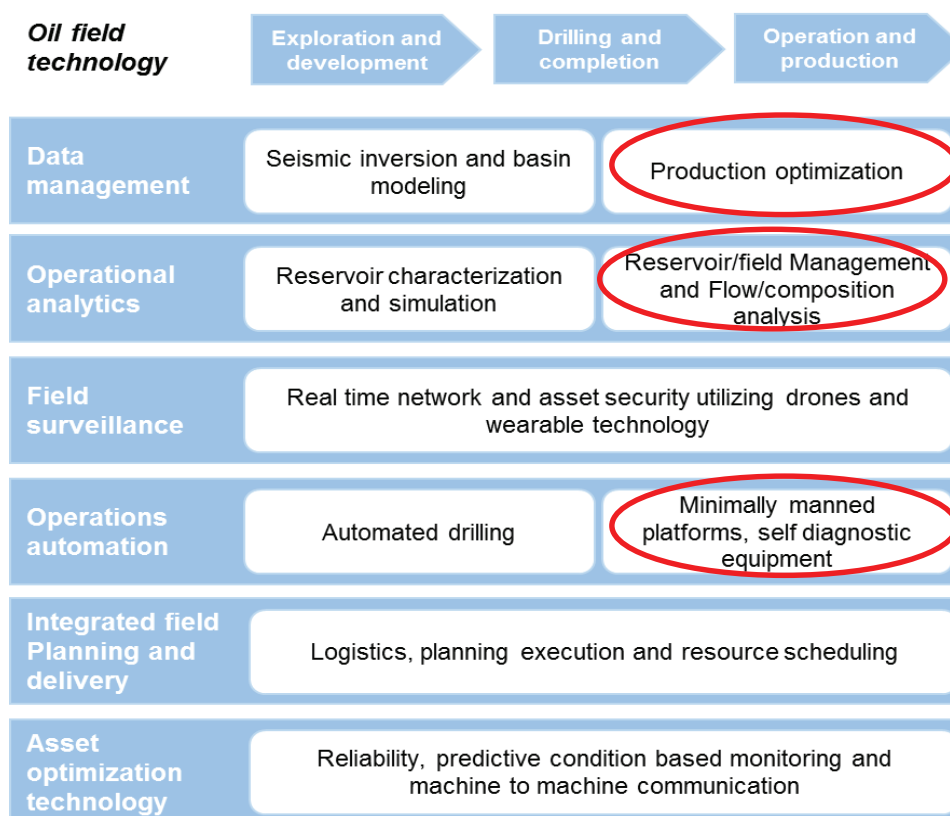
The chosen digital solution will affect the production growth rate, thus its economic efficiency should be evaluated based on methodological approach. There is a set of technologies that are used widely by oil & gas companies:

- Remote Real-Time Facility Monitoring and Control;
- Real-Time Drilling;
- Real-Time Production Surveillance;
- Intelligent Wells;
- 4-D Visualization and Modeling;
- Remote Communications Technology;
- Integrated Asset Models;
- Workflow and Knowledge Management Systems;
- Production Volume Management Systems.

Key challenges

1) Digitalization challenges increase substantially with the age of oil field and level of reserves.

2) Lack of highly qualified human resources affects the intellectualization process of oilfields. This can be resolved by hiring foreign specialists or by forming corporate (governmental) competency building and development system on integrated modelling and integrated operations.

3) Technical readiness of Kazakh oil & gas companies to introduce digital technologies is high. Moreover, some of them are implementing pilot projects. The implementation of such projects requires substantial investments, and thus a revision of investment programs, which were recently cut down due to low oil prices. The key obstacles to allocating funds on digital projects are uncertainties associated with achieving positive effects, while the examples of successful stories in implemented projects by international peers are insufficient substantiation.

International practices - digital oil field programs

Company	Program	Results
Shell	In 1998, Shell and WellDynamics introduced the concept of smart wells by installing a series of remote-controlled downhole control valve devices and monitoring production in real time.	Increased oil output by 15%, reduction in capex at USD800mln, smart field value on analysis of 50 assets through 2009 estimated at USD5bln
Chevron	In 2005, Chevron started its I-field program, which included remote collaboration, visualization, and standardization.	98% reduction in engineer's NPT, HSE benefits, increases in output and reductions in operating costs by 2-8%
BP	In 2000, BP introduced Field of future program, where the company invested in fiber communications with monitoring centers onshore that enabled experts to work directly with offshore operations.	Delivery of 30-50mln boepd
Statoil Hydro, OLF	In 1996, integrated operations program was developed by Statoil to achieve zero environmental accidents, minimize human intervention and exposure high-risk and remote areas.	3-5% increased production, 20-40% reduction in production losses, 15-30% reduction in operating and maintenance costs
Conoco Phillips	In 2006-2011, the company initiated its Integrated operations program focused on operations, an engineering toolkit, and data management.	Annual spending on plunger lift operations, intervention processes was reduced by 39% and 29%, respectively
Kuwait Oil company	In 2010, the company launched the Kuwait intelligent digital field, using state-of-the-art communications, sensor devices, collaboration centers, automated engineering workflows.	Oil production gain by 8% per day per well, by increasing water injection by 30%
Saudi Aramco	In 2006, the company started the first use of intelligent field program to enhancing HSE through remote monitoring and intervention; reduce operation costs by minimizing manual supervision and intervention.	Reduced planned downtime and deferral for water injection process and preinjection requirements by 14% from planned volume, reduced well interventions four fold, optimized operating costs, field performance, and safety records.

Salym Petroleum Development	In 2009-2010, the Salym group of oilfields has started its project on smart field technology. The company was able to optimize its oil production, improve oil recovery, and reduce operating costs due to the introduction of Smart Fields technology systems.	The production was improved by 2–2.5% per year on average, the number of visits to well pads by operators was reduced and the quantity of serviced wells increased from 15-20 wells to 30-40 wells, as the data is transferred from wells to the control unit in the real-time.

Source: Introduction to digital oil and gas field systems, 2017

Conclusion

Digital technology has a major part to play in the next stage of structural cost reduction. Currently, the share of integrated/connected oil & gas equipment amounts only 3-5%, while the share of utilized data is at about 1% to make decisions. This implies that oil & gas companies have significant potential to optimize asset and operations using digital technologies.

The global smart oilfield market is expected to grow at a CAGR of more than 4% by 2020. Smart oilfield services are forecasted to increase the NPV of an oilfield by 25% by reducing exploration and production costs and shortening schedules, increasing productivity, and reducing downtime. Furthermore, smart oilfield services also improve worker safety and health and extend the lifetime of brownfield, which in turn will impel the growth prospects for this market segment until end-2020.

Nowadays, in Kazakhstan the trend of introduction of smart field technology is slow, but positive. Currently, oil & gas companies in Kazakhstan lag behind its Russian peers in terms of the level of digitalization. The implementation of "smart field" at some fields will reduce the electricity consumption by 32%, increase active well utilization rate and consequently, reduce the number of well remedial maintenance operations. The most important is that it allows to diagnose preaccidental situations or accidents in the ground and underground downhole equipment.

Technical readiness of Kazakh oil & gas companies to introduce digital technologies is high. The implementation of such projects requires substantial investments, and thus a revision of investment programs, which were recently cut down due to low oil prices. The key obstacles to allocating funds on digital projects are uncertainties associated with achieving positive effects, while the examples of successful stories in implemented projects by international peers are insufficient substantiation.

There are still challenges in introducing digital technologies in Kazakhstan in relation to highly qualified human resources. This can be resolved by hiring foreign specialists or by forming corporate (governmental) competency building and development system on integrated modelling and integrated operations. Digitalization and intellectualization challenges increase substantially with the age of oil field and level of reserves.

The introduction of such technologies is impossible without integrating people, technology and business processes. The application of "smart" and integrated technologies allows the specialists to exchange the knowledge more effectively, which finds its reflection in the productivity of the operations and makes it possible to take considered and accurate decisions ensuring the largest profits.

3.2 Digitalization in transportation industry

The transportation sector is currently undergoing significant transformation. R&D investments in digital railways, intelligent streets, and next-generation vehicles are expected to change the way companies do business, generating opportunities for additional revenue growth or operating expenses optimization. As the proportion of the global population living in cities is rising faster than transportation sector's capacity, this excess infrastructure demand facilitates a considerable capital spending, aimed to develop technologies that will improve the overall efficiency of passenger and freight transportation.

Today, due to advances in automation, data processing, and analysis, passengers have an access to open traffic data, real-time planning, and social services via smartphones. This disruptive change allows customers to choose among different carriers based on travel time, comparable pricing and other factors, leading to more rational buying decisions and driving competition among transportation service providers.

Consequently, the digital transformation started to affect consumer experience in all sectors, creating potential inflection points that may sharply change transportation demand composition. In industries, including retail, media, and marketing, innovations led to disruptive shifts in business and operating models while the pace of technological modernization in the transportation industry varies across segments. In particular, the aviation sector managed to successfully utilize benefits of latest digital technologies, creating new value-adding services and improving operating margins. Meanwhile, railway industry and automobile transportation still remain in a transitory stage, adopting technologies, which are expected to increase efficiency and safety of services using intelligent networks and automated vehicles.
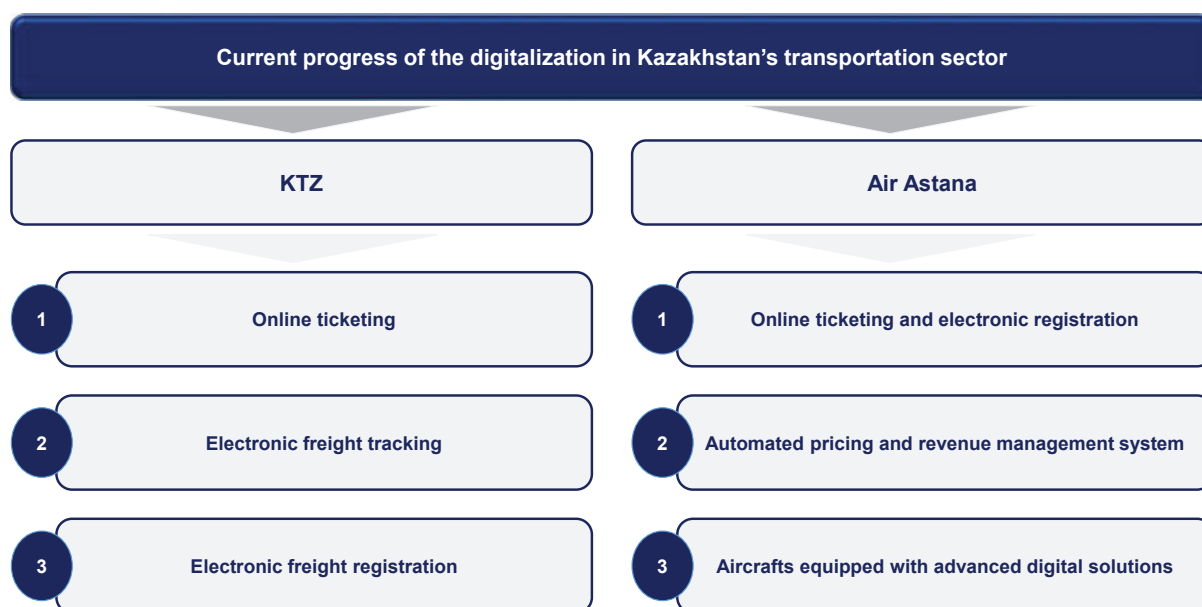
Transportation sector plays an important role in Kazakhstan's economy because of its commodity-based orientation, and the country's immense territory. Water transport accounts for only a minor part of the total freight turnover due to the country's continental location while automobile transport is not an ideal choice for long distances due to high cost. Meanwhile, Kazakhstan's aviation sector remains in the emerging stage, mainly attributable to the affordability of air travel, which results in the preference for cheaper options of rail and automobile transport.

Since Kazakhstan's economy is still significantly correlated with commodity markets, which are demonstrating high volatility, the country needs to implement a proactive approach and transform its industries to remain competitive. Digitalization has the potential to facilitate the transformation of the country's main sectors, enhancing the effectiveness of operations, unlocking value potential and shaping industries' composition. Consequently, Kazakhstan is expected to benefit from upcoming efficiency improvements, with the digital transformation spearheading overall diversification of the domestic economy and stimulating entrepreneurial activity across all sectors.

On the railway sector front, Kazakhstan Temir Zholy (KTZ), the national railway operator, already started the integration of digital technologies in customer services and traffic management, introducing online ticketing and electronic freight tracking. Passengers are now able to purchase domestic and international railway tickets from various internet platforms without the need to wait in queues. In addition, freight forwarders will have an opportunity to place and track their orders online through an electronic document and contracting system using a computer or a smartphone, which will lead to the

reduction in the overall transaction costs and will further enhance operational efficiency. All locomotives will be equipped with sensors, enabling real-time location tracking via satellite and fiber optic communication lines.

Based on the availability of customer data and real-time order information, KTZ will be able to integrate demand forecasting and planning solutions for freight and passenger segments, optimizing the use of the network and rolling stock. Meanwhile, the potential introduction of digital analytical capabilities, aimed to complement traditional asset performance measurement tools, may improve service planning processes, increasing the affordability of railway transportation and reducing delays and interruptions in services.
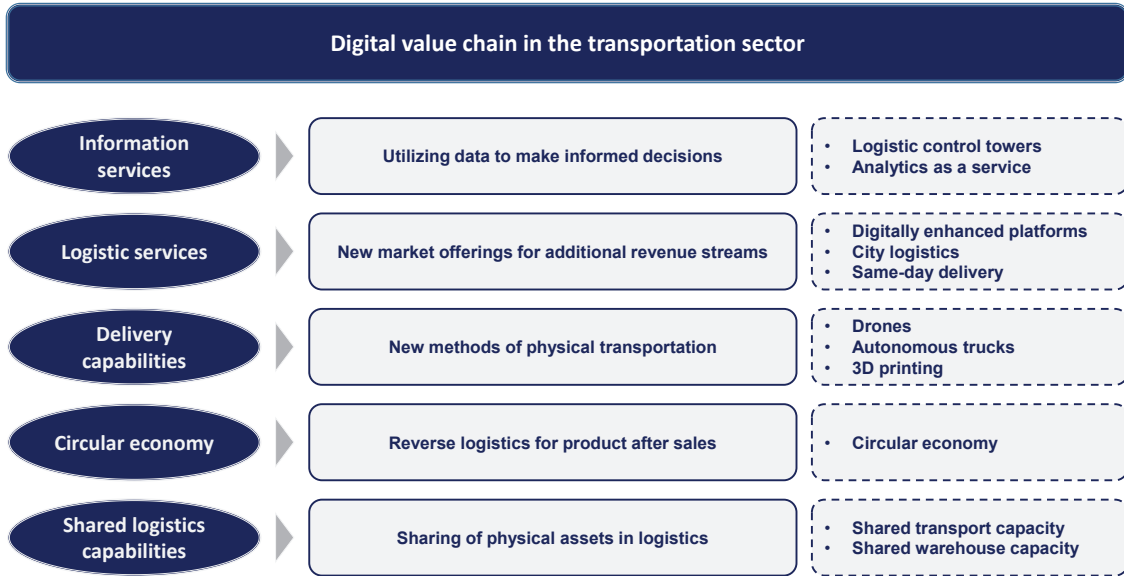
Current progress of the digitalization in Kazakhstan's transportation sector

KTZ

1 Online ticketing

2 Electronic freight tracking

3 Electronic freight registration

Air Astana

1 Online ticketing and electronic registration

2 Automated pricing and revenue management system

3 Aircrafts equipped with advanced digital solutions

Source: Samruk-Kazyna

Meanwhile, on aviation sector front, JSC Air Astana, a leading Kazakhstan's airline operator, has already adopted state-of-the-art digital technologies in order to enhance service quality and optimize operating performance. The company is currently utilizing special automated revenue management system, allowing Air Astana to dynamically adjust pricing based on load factors and capacity on routes. In addition, all the company's aircrafts are equipped with interactive digital solutions, allowing customers to view movies and TV shows during flights. Air Astana was the first operator, which introduced online ticketing and electronic registration on all its flights, reducing transaction costs and improving customer experience.

Kazakhstan's road transportation sector is also equipped with modern digital technologies, supporting the efficient operations of carriers. Solutions, based on specialized software, provide the opportunities to monitor technical conditions of vehicles, track vehicle traffic and fuel consumption, increasing profitability and quality of services.

The integration of predictive maintenance analytical tools, which include sophisticated solutions based on data integration, sensor and communication technologies, will lead to a higher cost efficiency and more effective asset utilization for transportation companies. Meanwhile, the introduction of freight

exchange platforms may allow connecting freight carriers with shippers and forwarders, making pricing more efficient.

Digital value chain in the transportation sector

Information services →	Utilizing data to make informed decisions	• Logistic control towers • Analytics as a service
Logistic services →	New market offerings for additional revenue streams	• Digitally enhanced platforms • City logistics • Same-day delivery
Delivery capabilities →	New methods of physical transportation	• Drones • Autonomous trucks • 3D printing
Circular economy →	Reverse logistics for product after sales	• Circular economy
Shared logistics capabilities →	Sharing of physical assets in logistics	• Shared transport capacity • Shared warehouse capacity

Source: World Economic Forum, Samruk-Kazyna

Compared to other developed and emerging countries, Kazakhstan managed to stay in line with CIS peers, with the degree of digital penetration in Russia's transportation sector being mostly the same as in Kazakhstan. As mentioned earlier, in a bid to improve profitability, the country's transportation industry players in all sub-sectors have already started to adopt digital infrastructure, aimed to collect and analyze traffic, route and customer-related data. However, emerging countries still need to develop appropriate legal and infrastructure framework to successfully incorporate technologies, including enhanced delivery capabilities (drones, self-driving vehicles, and 3D printing), circular economy and shared logistic assets, which are currently present in developed markets like the US.

Digitalization progress across countries

|	US	China	Russia	Kazakhstan
• Logistic control towers • Analytics as a service	✓	✓	✓	✓
• Digitally enhanced platforms • City logistics • Same-day delivery	✓	✓	✗	✗
• Drones • Autonomous trucks • 3D printing	✓	✗	✗	✗
• Circular economy	✓	✗	✗	✗
• Shared transport capacity • Shared warehouse capacity	✓	✗	✗	✗

Source: World Economic Forum, Samruk-Kazyna

Internet of Things (IoT)

As logistic supply chain is cardinally transforming, in the future, transportation will become more convenient, efficient, faster and independently planned. Technological innovations, fundamentally shaping the logistics industry, will have spillover effects on other sectors, creating potential value synergies and providing benefits for the society. Consequently, the transportation sector can be considered as a natural starting point for a full-scale digital transformation in Kazakhstan under the framework of the Industry 4.0 initiative.

Digitalization changes and destabilizes almost all industries. New innovations, such as 3D printing, can affect the transportation of goods in much the same way as the introduction of emails influenced and shaped an entire postal sector. Some goods will no longer be produced in large manufacturing facilities and delivered around the world. Instead, the product schematics will be digitized and forwarded to small factories, located closer to the customer, where they will be manufactured using 3D printing, leading to a "single" serial production and new concepts of logistics services.

IoT is expected to affect transportation and logistics sectors, connecting almost any device to the Internet and promoting data-based logistic solutions. This will form a completely new view of processes, transforming storage, monitoring, and maintenance operations. In particular, IoT will be directed to the monitoring of assets throughout the supply chain via a variety of technologies and tools, processing a huge number of generated data sets and using these data in ideas for finding new solutions. The technology's advantages can be observed throughout the whole logistic value creation chain, including warehousing, cargo transportation and the "last mile" delivery and impacting areas such as operational efficiency, security, customer service quality. In addition, automation of business processes will provide an opportunity to eliminate the need for interference by operators, improving quality and predictability and allowing to coordinate joint activities of people, systems, and resources.

Future horizons of digital initiatives
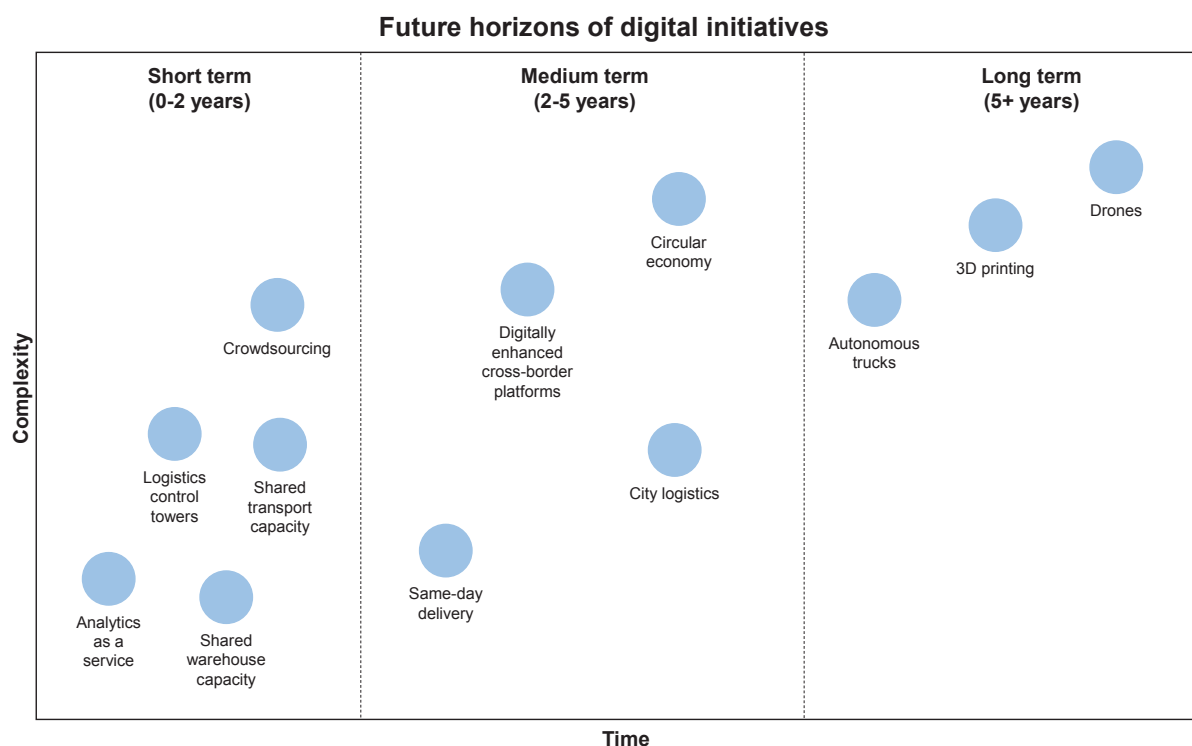
Source: World Economic Forum, Samruk-Kazyna

Internet of Things provides much more opportunities for freight transportation than just tracking and monitoring. Suppliers of logistics services will get a clear idea of the movement of goods, as well as the ability to monitor the state of products, which will ensure the arrival of goods at the right time, in the right place and in the right condition. The information sensors for trucks and the multi-touch tags for goods convey information about location, condition (reaching thresholds) and facts of opening parcels (to detect possible theft). To date, many of the existing solutions are autonomous and do not relate to each other, implying that new platforms must be created, combining various existing hardware and software solutions to control the integrity of the entire supply chain.

On fleet and asset management front, sensors can monitor how often a truck, container, or goods picking device is used or idle, and transmit this data for optimal utilization analysis. Today, many logistics vehicles are already equipped with numerous sensors, embedded processors, and wireless communications. Sensors measuring the volume of each load can provide additional information regarding the reserve capacity of vehicles on certain routes, with IoT-supporting devices providing solutions, focused on determining reserve capacities on the main routes.

In addition, it is possible to increase fleet efficiency, save fuel and reduce distances traveled by vehicles without cargo, which accounted for up to 10% of the routes. A joint management of a fleet can also lead to predictive management of the assets life cycle, using analytics to predict failures in the operations and automatically plan technical condition checks.

On warehousing front, the introduction of goods identification using inexpensive flexible devices will allow shifting toward the smart inventory management in the warehouse operations, leading to wireless reading and collection of data transmitted from each pallet when they are moved to a warehouse. Such data can include product information, such as volume and size, which can be subsequently compiled and sent to the warehouse management system for further processing, eliminating the need for manual counting and processing. Cameras attached to locks can be used to scan pallets for potential damage or defects. Once the pallets are moved to the desired location, the chips will transmit the signals to the warehouse management system, enabling visibility of the stock level in real time, and preventing the costly shortage situations in a warehouse. If any goods have been moved, the sensors notify the control system, which can track the exact location of the goods, taking the necessary measures.

For quality control purposes, sensors may monitor the condition of goods and notify warehouse managers if temperature or humidity values are close to the critical level. This allows the warehouse staff to take corrective measures, ensuring a high level of quality and greater customer confidence. During the outbound delivery, the pallets are scanned through the output gateway to ensure the correct dispatch of the desired goods. Later, the inventory level is automatically updated in the warehouse management system for a more efficient inventory management.

However, the application of the Internet of Things technology will be successful only when there is a synergy as a result of the combined use of various IoT devices. A car, which cannot connect to another vehicle or an intelligent parking lot, will be less efficient, while a smart pallet that can be used to manage inventories in a warehouse, but not in a retail store, will provide only limited benefits. Consequently, IoT will require creation and management of an intelligent network of assets connected to various vertical and horizontal elements of the supply chain.

Self-driving vehicles

Self-driving vehicles are vehicles that can operate with a significant degree of autonomy, implying that a driver doesn't need to constantly monitor the road when driving in autopilot mode. While at the current stage of the digital technology, a human's oversight is still required for monitoring and safety purposes, over the medium term, autonomous technologies will be ready to perform all the necessary functions to transport safely from one location to another. However, in order for a vehicle to be self-managing, artificial intelligence should have the capacity to execute the four basic interdependent procedures, including navigation, situational analysis, traffic planning and trajectory management.

Daily impact of self-driving vehicles in the US

Lives saved from crashes	Costs of crashes	Savings on potential traffic violations	Less daily fuel consumption, barrels	Annual traffic signal savings
42	USD576mln	USD14mln	420,000	USD2.4mln

Source: AUVSI, Samruk-Kazyna

The transportation industry is expected to be a primary beneficiary of the self-driving technology implementation, with potential spillover effects to manufacturing, mining, and other sectors. However, in the first stage, autonomous vehicles will only be used in the freight transportation sub-sector as cargo delivery carries less potential litigation risks than the passenger segment. Self-driving trucks may transport goods inside some secured and controlled areas, such as private warehouses. Meanwhile, the integration of self-driving technologies outside warehouse operations in the external environment, including public streets, long-distance transportation and the "last mile" delivery is the next evolving step, unlocking substantial cost optimization and revenue enhancing synergies.

Autonomous technologies can improve response time to potentially hazardous situations on roads and calculate the fastest maneuver, taking into account the current state of the truck and the driving conditions. Since this can dramatically reduce the number and severity of accidents, self-managed transport has the potential to play a crucial role in reducing driver errors and avoiding accidents. A truck equipped with such an assistance system will stick to the strip automatically, keeping a safe distance from the cars in front and respecting the maximum truck speed and prescribed high-speed limits on the road. The driver will still have to perform tasks such as pouring into the traffic, overtaking and leaving the motorway, but, in the future, these functions will also be automated. Nevertheless, with this system, a driver must be available and be ready to resume manual control at any time if situation and conditions require so.

Over the long term, the transportation fleet can be reinforced with trucks capable of covering most of the way without driver's intervention or even managing the entire journey without a driver on board. For long-range shipments, a driver may not accompany the truck at all, driving it manually just to the entrance of the motorway. After that, a vehicle will automatically move non-stop until it reaches its destination, where another driver would wait and then drive the truck under the manual mode to the destination in the city.

Another potentially useful application for autonomous driving is a convoy, in which a driver of the first truck retains control over all functions and sets the pace, with following trucks and other vehicles moving without manual assistance. Autonomous trucking convoys are expected to provide significant fuel-efficiency gains to the transportation industry, saving approximately 12% of the fuel consumed by traditional trucks. In addition, automated convoys may optimize labor costs, as three or four trucks can
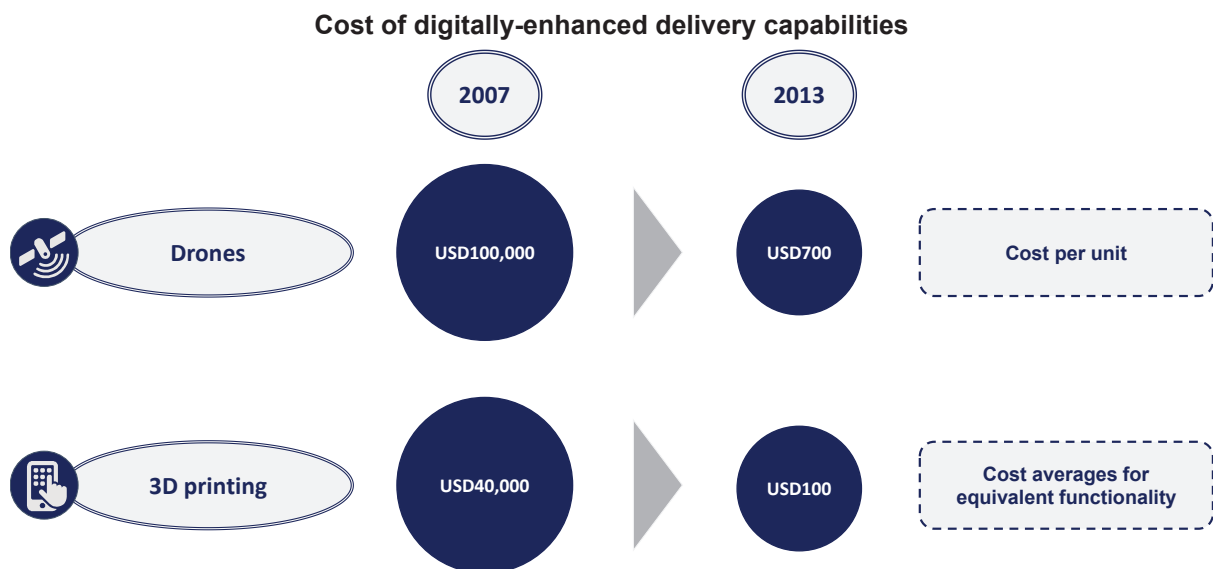
be controlled by just one driver. Consequently, combined with 14% maintenance costs reduction potential, it is estimated that approximately USD30bln of value may be unlocked from the integration of self-driving technologies, leading to the reduction of 25 mln metric tons in emissions, and preventing up to 400 deaths from road accidents. These forecasts are based on assumptions that autonomous trucks will be offered for commercial use starting from 2020, reaching a market penetration of 5% in developed markets by 2025.

Drones

On aviation front, unmanned aerial vehicles (UAVs) or drones still require more time for large-scale implementation, as the commercial use of UAVs is comprehensively regulated in most countries. However, the first tests indicated the considerable potential of drones, especially in scenarios of delivery to rural regions. For the transportation industry, short-distance delivery by electric multi-copters seems to be the best practical application field. However, there are four possible additional applications, including first and last mile urban delivery, rural delivery, infrastructure inspection and in-house logistics.

The UAVs can play an extremely important role in in-house logistics. Considering the automotive industry's mass production sites, the "strictly on time" operational processes and substantial costs of idle production lines, drones may offer in-house transportation, as well as urgent delivery from a supplier to a plant, replacing helicopters.

The mining sector may also benefit from express delivery of goods, which are critical for operations maintenance. Drones can be relocated easily, and they can follow a given flight path, eliminating a need for specially trained personnel to start and operate them. If operations are limited to a private area, organizations will have to deal with minimal regulatory restrictions and confidentiality considerations, with load capacity being the most significant limitation.

Cost of digitally-enhanced delivery capabilities

	2007		2013	
Drones	USD100,000	▶	USD700	Cost per unit
3D printing	USD40,000	▶	USD100	Cost averages for equivalent functionality

Source: Accenture, Samruk-Kazyna

Similar to self-driving vehicles, drones may also be used in warehouse operations, reducing operating costs of a multi-story warehouse. Sensors will enable the system to independently observe and analyze the warehouse environment, navigating drones inside the warehouse, finding logistic objects and

executing inventory operations. Collected information can then be transferred to third-party systems through intelligent interfaces and services, allowing for the direct transmission of selected contextual information.

Drones will provide faster, cost-efficient and lower emission deliveries, attributable to off-road movement, the use of battery power and near-autonomous operations, with a group of UAVs may be controlled by just a single drone minder. Drones today perform less than 0.5% of all logistics deliveries globally. However, with the evolution of digital technologies and the adoption of appropriate regulations, transportation companies will be fully positioned to benefit from premiums for faster/same-day deliveries, offered by UAVs.

Amazon is currently developing a ninth-generation drone prototype, which will have the potential to transport payloads of up to 2.3 kilograms at 80 kph speed. In addition, these UAVs will eventually be able to locate the recipient of a delivery using data from their smartphone, having capacity perform approximately 400 mln deliveries per year. Meanwhile, DHL is utilizing autonomous quadcopters to deliver small packages to the sandbar island of Juist, located 12 kilometers off the German coast in the North Sea, while SF Express deployed a 1,000 drone's fleet to transport 500 packages per day across China. Swiss Post established a joint-entity with Matternet, a Silicon Valley-based drone producer, to assess the economic feasibility of up to 1-kilogram parcel deliveries by drones across distances of up to 10 kilometers. The integration of UAVs is also expected to benefit the society, leading to a reduction of 15 mln metric tons in emissions, and preventing up to 4,000 deaths from road accidents.

3D printing
3D printing, also called additive layer manufacturing (ALM), creates three-dimensional solid objects from digital blueprint files, with objects being formed by integrating successive layers of material, each of which is a thinly sliced horizontal cross-section of the final object.

Applied to aircraft manufacturing, ALM is expected to reduce waste during the manufacturing process and lighten the final weight of a plane, reducing fuel costs and carbon emissions during its use by end clients. Compared to typical machining techniques that create a part by cutting away a solid block of material, ALM eliminates the problem of 5-10% material waste during the printing process.

With costs and supply lead times for tooling dropping by 70%, the workload of 3D printers is expected to increase, especially applied to spare parts markets, which can be produced on demand, eliminating the need for long-period storage in large spaces. This is technology creates a considerable risk for the transportation sector, as customers can print required intermediate goods somewhere close to their own location, reducing freight transportation demand. However, a proactive logistics service provider may still benefit substantially using 3D printing as an opportunity to extend the range of value-added services, with a blueprint file arriving from a manufacturer that a single logistics service provider then prints and ships, perhaps even installing the final object at the customer's location.

Consequently, ALM technology carriers both the revenue-enhancing potential and a demand disruption risk. Despite 3D printing may result in the reduction of operating profits by USD1bln due to decline in demand, this technology may allow transportation companies to upgrade their services, supporting asset turnover and profitability.

Transportation sector's digitalization value at stake
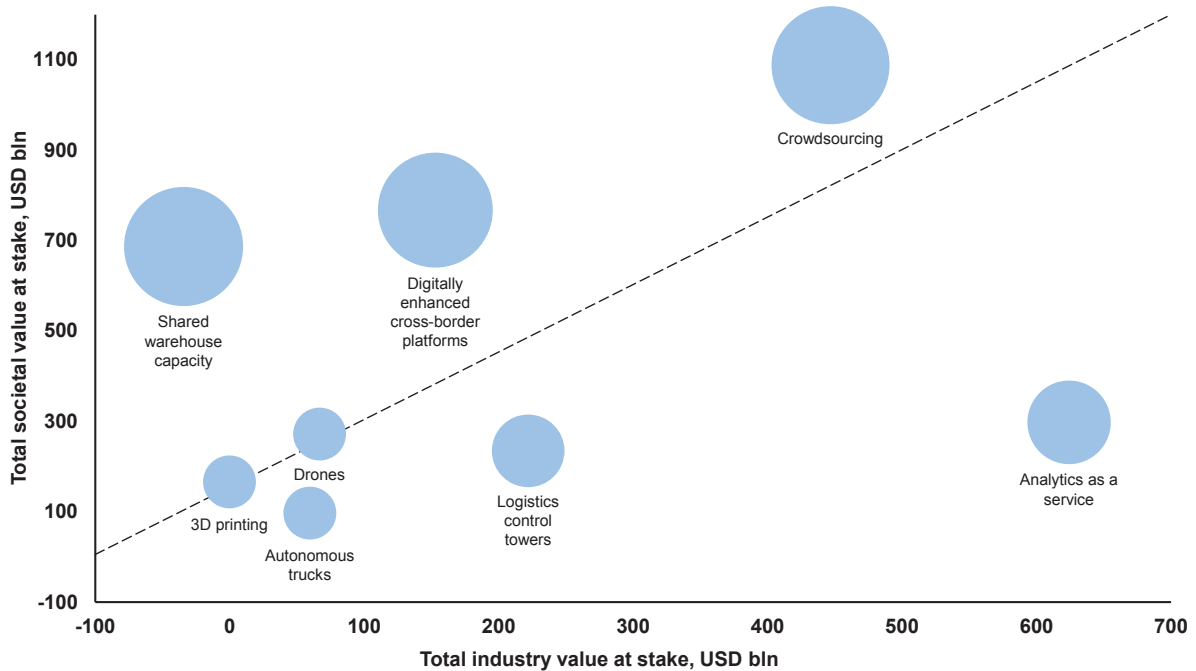
Source: World Economic Forum, Samruk-Kazyna

Conclusion

Digitalization has the potential to facilitate transformation of all Kazakhstan's industries, with the digital revolution spearheading overall diversification of the country's economy and stimulating entrepreneurial activity. Compared to other developed and emerging countries, Kazakhstan managed to stay in line with CIS peers, with the degree of digital penetration in Russia's transportation sector being mostly the same as in Kazakhstan.

In a bid to improve profitability, Kazakhstan's transportation industry players in all sub-sectors have already started to adopt digital infrastructure, aimed to collect and analyze traffic, route and customer-related data. However, most emerging countries still need to develop appropriate legal and infrastructure framework to incorporate technologies, including enhanced delivery capabilities (drones, self-driving vehicles and 3D printing), circular economy and shared logistic assets, which are currently present in developed markets such as the US.

Appendix: Kazakhstan's Key Indicators

Kazakhstan: GDP Composition (2016-2018f)

Key indicator	2016	2017e	2018f
GDP			
GDP growth, % YoY	1.1	4.0	3.5-4.0*
GDP per capita, USD	7,714.8	8,708.6	9,005.9
Agriculture, % YoY	5.4	2.9	3.6
Industry, % YoY	-0.4	7.1	2.1
Mining & quarrying, % YoY	-2.2	9.3	1.7
Manufacturing, % YoY	1.8	5.1	2.9
Construction, % YoY	7.4	1.9	3.6
Oil price, USDpb	44	55.3	62-63 for 2Q^
Indicators of monetary policy			
Inflation (year-end), % YoY	8.5	7.1	5.0-7.0
Credit to the economy, KZT bln end of period	12,859	12,705	13,510
Deposit of residents, KZT bln end of period	18,164	17,510	21,444
Money supply, KZT bln end of period	19,913	19,456	23,505
USDKZT (average)	342.2	326.32	330-340
Current account balance			
Export, USD mln	37,301.2	49,252.0	47,509.5
Import, USD mln	27,869.3	31,758.4	34,033.5
Trade balance, USD mln	9,431.9	17,493.6	13,476.0
Current account balance, USD mln	-8,517.8	-4,672.2	-8,727.6
% of GDP	-6.4	-3.0	-5.4
Consolidated budget			
Revenue, KZT bln	7,517.3	9,199.3	9,666.9
% of GDP	16.0	17.7	17.3
Oil revenue, KZT bln	1,736.8	2,375.3	2,208.3
Non-oil revenue, KZT bln	5,780.5	6,823.9	7,458.7
Expenditure, KZT bln	10,143.8	12,932.1	10,858.4
% of GDP	21.6	24.9	19.4
Consolidated budget, KZT bln	-2,626.5	-3,732.8	-1,191.5
% of GDP	-5.6	-7.2	-2.1
Non-oil balance, KZT bln	-4,363.3	-6,108.1	-3,399.7
% of GDP	-9.3	-11.8	-6.1

Source: Statistics Committee, Ministry of National Economy socioeconomic indicators as at August 2017,

National Bank of Kazakhstan, Samruk-Kazyna

* As stated by the Minister of National Economy in March 2018

^ in-house expectations for 2Q18 as at 30 March 2018

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