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Social, environmental and economic sustainability of Kazakhstan: a long-term perspective

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This paper explores the evolution of Kazakhstan's development through an analysis of population trends, infant mortality, air emissions, water management, oil production, income, cost of living and average salary. The longitudinal data analysis demonstrates that the development of Kazakhstan during the Soviet period was far from sustainable in terms of uncontrolled environmental pollution. Time-series analysis illustrates that the 1990s transition to the market economy temporarily eased environmental degradation but also brought about initial socio-economic disarray and decline in living standards. Further support for rural areas and economic diversification is needed to move away from Kazakhstan's heavy reliance on mineral resource extraction to a more sustainable path of development.

Keywords: Kazakhstan; sustainability; population; emissions; water; income; oil

Introduction

Sustainable development (SD) has grown in importance for both public bodies and the business community since the 1970s. One of the most important early attempts at modelling future potential future was the book *Limits to Growth* (1972), which used 12 probable scenarios of resource use, population growth and economic development from 1972 to 2100 (Meadows et al. 1972). The major conclusion was that growth in the human footprint (associated with growing pollution and resource use) can exceed the planetary limits, unless emissions and resource use rates are reduced (Randers 2010). However, *Limits to Growth* did not account for some parameters, such as change of technology and use of renewable energy. If resource consumption is slowed down and energy efficiency, recycling and effective use of raw materials are increased, then a sustainable future looks more realistic.

SD is a contested and vague concept, meaning different things to different people (Robinson 2004).[1] There is no common philosophy of sustainable development-ism, in contrast to the schools of neo-liberalism or socialism (Pearce, Markandya, and Barbier 1989; Giddings, Hopwood, and O'Brien 2002). Diverse interest groups approach SD according to their objectives. The confusion over SD can also be observed in transitional countries. In the 1990s the concept of SD was widely supported in Russia; however, two decades later, environmentalists were struggling to promote its case (Henry 2009). The major drawback was that the Russian administration often used the phrases 'economic development' and 'sustainable development' interchangeably, which slowed down understanding of sustainability principles and pursuing its goals.

Another major drawback of SD is that it does not encompass ethical, cultural and philosophical issues. In Kazakhstan, despite many historical changes, the nomadic lifestyle of ancient

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Kazakhs had exerted a strong influence on sustainable living and surviving as a nation (Kaldybay et al. 2013). Based on seasonal climatic conditions, the Kazakh *auls* (mobile villages) rotated to different areas – *kokteu*, *zhailau*, *kuzdeu* and *kystau* – i.e., spring, summer, autumn and winter pastures. The environmentally sustainable husbandry and pastoralism protected the existence of several generations of Kazakh tribes. Therefore, local understanding of sustainability plays an important role in implementing SD approaches of various nations, shifting away from the top-down one-size-fits-all approach.

Studies have been conducted for developing and transitional countries in the areas of energy pricing, corporate social responsibility, sustainable energy development, quantitative policy analysis in water-stressed regions, and sustainable rural development (Dahl and Kuralbayeva 2001; Verbitskaya, Nosova, and Rodina 2002; Kojima 2005; Sarkeyeva 2007; Streimikiene, Simanaviciene, and Kovaliov 2009; Pasakarnis and Maliene 2010). However, there is limited research on SD issues in Kazakhstan and Russia to date. These analyses focused either on a certain type of indicator (e.g., energy or higher education; Verbitskaya, Nosova, and Rodina 2002; Sarkeyeva 2007; Streimikiene, Simanaviciene, and Kovaliov 2009) or on a separate geographical area of development (e.g., rural areas in Central and Eastern Europe (CEE); Pasakarnis and Maliene 2010). An interesting investigation of sustainability with a focus on financial support for SD was carried out for Ukraine (Vahovitch 2008). Although the list of indicators was quite comprehensive, the SD analysis for Ukrainian regions was limited from the intergenerational equity viewpoint because it was done primarily for the periods of 1990–2000 and 2000–05. Another relevant study on SD perspectives was done for 12 countries of South-East Europe (SEE) (Ivanovic et al. 2009). The results showed the mutual sensitivity of economic and ecological indicators. Using energy indicators in the Baltic States, Streimikiene, Simanaviciene, and Kovaliov (2009) offered recommendations for developing a sustainable energy policy for the accession of Baltic States to the European Union.

These two studies on the Ukraine and the SEE covered different areas of development. The investigation of SD in the SEE countries (Ivanovic et al. 2009) considered national aggregate data without a deeper analysis of the various regions within a country (Vahovitch 2008). The study on SD indicators in the SEE was also partial as it analysed the status of sustainability rather than the course of development.

Based on this analysis, this paper argues that it is important to look at both the bigger picture on an extended time scale and the local context of regional development for a comprehensive analysis of intergenerational sustainability. It develops an analysis of Kazakhstan's SD path through a multi-measure investigation that takes inter-generational and intra-regional contexts into account.

Kazakhstan (which is the world's ninth biggest country and the largest landlocked country) has a vast territory, huge natural resources and a multi-ethnic population. In addition, its location between Europe and Asia makes it a historically multicultural region with both eastern and western characteristics (Bendas 2003). Due to substantial energy resources (especially oil and gas), Kazakhstan is an important player in socio-economic, geopolitical and environmental development in Central Asia.[2] These specific features served as a primary call for the application of SD theory to this country. Kazakhstan's progress (or lack of it) towards sustainable socio-economic welfare improvements and environmental protection can be a role model for other neighbouring countries and influences the development of the whole region of Eurasia.

Sustainable development indicators

Many attempts to define sustainability and characterize SD have been made at local, national and global levels by governmental bodies, academics and various institutions. The definition of

sustainability and SD, as argued above, is not straightforward. Many researchers have agreed that it is not possible to define a single indicator for SD, or to capture the whole range of significant aspects of SD (Bossel 2001). Thus, the selection of SD indicators is a complex and context-driven process.

The human development index (HDI), which consists of life expectancy, education and income indices, is a useful tool, first launched and promoted by the United Nations Development Programme (UNDP) in 1990, and based on Amartya Sen and Mahbub ul Haq's works (UNDP 1990; Stanton 2007). It did not, however, account for crime, environmental pollution and unemployment, which often accompany development. Using these indicators may be problematic, as income may incorporate costs of pollution control measures (Redclift 1987).

Another contribution to SD indicators was made at the World's Economic Forum where an environmental sustainability index (ESI) for 148 countries based on 68 indicators was developed. To some extent, this scheme was similar to the wellbeing index (WI), which was developed by the World Conservation Union in 2001 as a set of 88 indicators for 180 countries (Prescott-Allen 2001).[3]

Population has been used as an indicator in many studies by various institutions. From a sustainability point of view, the size of the population is important as it allows appraisal of resources needed to provide food, access to water, sanitation and housing to satisfy basic human needs. Another useful social sustainability indicator is infant mortality rate (IMR),[4] used by the Organisation for Economic Co-operation and Development (OECD 2008). IMR is an important indicator of public health because it reflects the health of women and the overall health situation (curative and preventive).

Air emissions analysis is another measure for human health and wildlife. Air emissions from stationary sources were chosen for this analysis both because they are often the main contributors to air emissions and as they are fixed they are easier to tackle. All the major pollutants were considered, including sulphur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOCs) and heavy metals.

Freshwater quality and quantity affects human health, especially the health of children and women of reproductive age. Freshwater withdrawal was included in the OECD (2008), World Bank (WB) (2012) and United Nations (UN) indicators (UN 2007); and domestic water consumption was included in the UK SD indicators (DEFRA 2011). Due to data limitations, water abstraction from natural sources was used in this study. Water abstraction is a broader withdrawal of water, whereas freshwater consumption reflects on withdrawals from freshwater sources only.

Although oil production could be considered as an economic indicator, oil is a finite natural resource demonstrating depletion of fossil fuels. In addition, oil extraction, transportation and processing cause pressure on wildlife, release of air pollution and oil spills. Crude oil production, as an indicator, was used by the OECD (2008).

As for economic sustainability indicators, salaries are important for SD as they stimulate work efficiency and increase human satisfaction, leading to a mutually beneficial situation for both society and the economy. A similar indicator, price and wages, was used by the European Bank for Reconstruction and Development (EBRD) (2013).

Gross national income (GNI) per capita and income per household were included as indicators in the studies by the OECD (2008), Ukraine (Vahovitch 2008), WB (2012) and UN (2007). This paper uses income per capita that comes from formal and informal employment, property, sales and social transfers (pensions, social benefits, scholarships and loans).

Income growth is closely linked to inflation (which is based on consumer price index – CPI); and high inflation negatively influences people on low incomes. Nominal income is presented in current prices and does not account for inflation. Real income is calculated as nominal income divided by CPI, thus real income is a better indicator as it reflects goods and services that can

be purchased. To understand income distribution, Gini coefficient data were used. The Gini coefficient is expressed between 0 and 1 (the higher the number – the more unequal is income distribution).

Research methods

The selected SD indicators (population, infant mortality, air emissions, water abstraction, oil production, average salary and income per capita) were examined using time-series analysis. The main data sources for the pre-transitional period come from annual reports of the Union of the Soviet Socialist Republics (USSR) national economy (1956–91) and annual reports of the Kazakh Soviet Socialist Republic (1958–1990), stored in the Russian State Library, Moscow. The main sources for the post-transitional period were the annual statistical reports of the Republic of Kazakhstan (RoK) (1992–2012), accessible through the state libraries and official website of the RoK statistical agency.[5] It was difficult to verify the state statistics. The cross-checking allowed verification of the state statistics to avoid human error arising from the manual transcription of the data from the Soviet reports into Excel spreadsheets.

There are several advantages of using state statistics. First, governmental statistics provided an extensive dataset on various social, economic, industrial and agricultural systems. Second, it would not have been possible to obtain such general data on Kazakhstan for the pre-transitional period without the Soviet reporting style. Although there were gaps in the datasets, official statistical sources provided feasible and sufficient ground for understanding and exploring the trends.

There are, however, limitations of the Soviet statistical reports. First, the Soviet statistics were politically motivated and data were often adjusted to fit into official propaganda, for example, classified population census in 1937 (Davies 1994). The second limitation of Soviet data was that many data tables were provided in percentages rather than in absolute units. Third, the Soviet statistics selectively omitted some data in their calculations, for example, salaries did not include military industry, and estimates of deaths did not cover victims of repression (Bergson 1947; Ellman 2002). During Mikhail Gorbachev's '*perestroika*', reliability and quality of the state statistics slightly improved (Treml 1988).

The regular data collection in Kazakhstan started with the first population census of the Russian Empire in 1897. During the Soviet period, Kazakhstan had to report (like many other FSU republics) to the Central Statistical Board in Moscow. After gaining independence in 1991, Kazakhstan began developing its own monitoring system. Following an audit in 2008, the RoK Statistical Agency was granted a certificate of compliance with ISO 9001:2008 requirements, which validates the document management system, including timely update for legitimate research.

As of January 2015, there were 16 administrative units in Kazakhstan: 14 '*oblasts*' (regions) and two state-cities: Almaty and Astana. The latest available regional data were plotted on maps to help a reader visualize the various regions of Kazakhstan.

Analysis of social sustainability indicators

Population

Allegedly tribes living on the territory of modern Kazakhstan had a traditionally nomadic lifestyle since the first millennium BCE, grazing their livestock on the common pastoral lands (Olcott 1995). Before the inception of the USSR, rich owners of livestock (*bais*) granted some part of their livestock to the poorer herdsmen, who grazed and looked after the animals in exchange for their milk and wool (Pianciola 2004).

Although the Russian presence in Kazakhstan began in the 16th century, large-scale Russian resettlements took place in the 19th century with the construction of forts and the use of fertile land in northern and eastern areas of the Kazakh steppe (Figure 1). With the establishment of Soviet power in the 1920s, especially after the introduction of the collectivization campaign in 1929–30, the Kazakhs were forced to settle to make them easier to administer. This broke down sensible ecological adaptations in the process. The state-enforced top-down collectivization and confiscation of livestock from *bais* posed a massive risk to the whole subsistence of Kazakh *auls* (Pianciola 2001).

Many Kazakhs were forced to emigrate to neighbouring countries, including China and Mongolia, or chose to kill their livestock rather than hand them over to the Soviet authorities. As a result, there was a loss of 12 million (80%) of sheep and cattle and more than 1.8 million human deaths due to famine and starvation (Alekseyenko 2000). Among other Soviet republics, Kazakhstan was the worst affected state with population losses of 38% of the Kazakh ethnic group, the highest among other national groups (Pianciola 2001).

Another large-scale loss of human life occurred during the 1941–45 Great Patriotic War between the USSR and Nazi Germany, when an estimated 27 million Soviet people (mostly civilians) died (Overy 2011). Besides the direct human losses, the war also adversely affected marriage and fertility (Brainerd 2007). Nearly 3.3 million people were deported from Russia to Siberia and to the Central Asian republics between 1941 and 1949, but around 43% of the resettled population died of disease and malnutrition (Shubnaya 2011). Deportations of entire nationalities (including Soviet Koreans, Germans, Crimean Tatars, Chechens, Kurds and Greeks), resettlements of 'anti-Soviet' people, and large-scale labour force transfers took place during and after the war (Kim 2009).

Between 1954 and 1962, about 2 million people, mainly Russians, moved voluntarily to Kazakhstan during Nikita Khrushchev's publicly advertised campaign to develop *tselina* or 'Virgin Land', which made the number of ethnic Russians in Kazakhstan to increase rapidly,

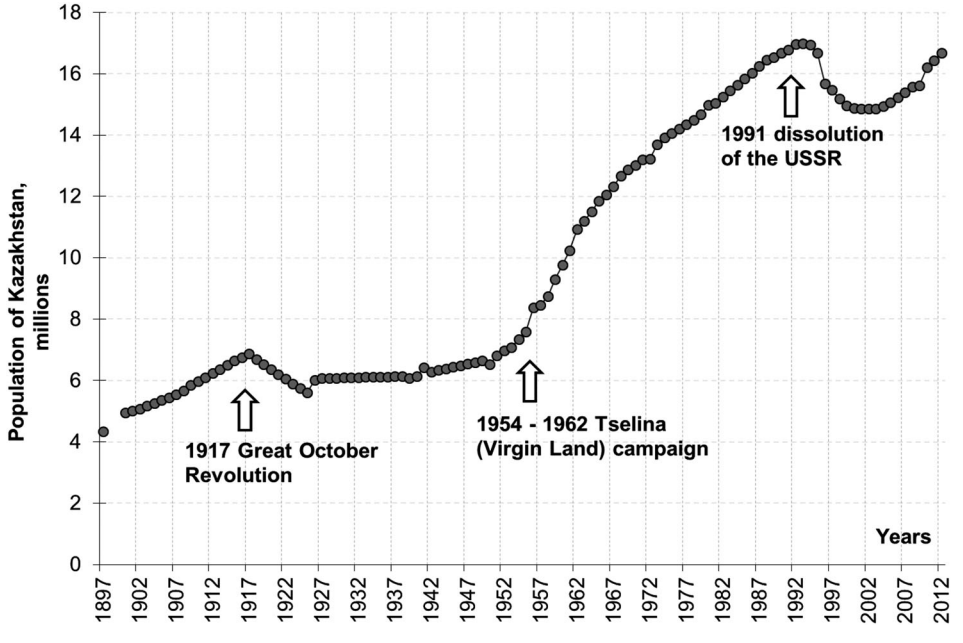

Figure 1. Population.

reaching 43% by 1959 (Minorities at Risk 2006). Ethnic Kazakhs became a minority comprising only 30% of the total population, and Kazakh ethnic identity was largely distorted through strong assimilation to Russian culture and language, especially among urban Kazakhs (Ramazanova 2011).

Figure 1 demonstrates that there were two peaks in the population of Kazakhstan: in 1917 and 1993. Although Kazakhstan's population was adversely affected by collectivization in the 1930s, the famine and the Great Patriotic War in the 1940s, the total population size is seen as not hugely altered, probably due to ethnic relocations and labour transfers from other Soviet republics and most likely due to exaggeration of the population figures for political reasons during the Soviet period.

The last demographic shock in Kazakhstan was experienced in the 1990s (Figure 1). Following market liberalization after the dissolution of the USSR in 1991, inflation and income inequality increased and the number of people living below the poverty line grew. The population of Kazakhstan began to decline, mainly due to falling life expectancy and a decline in fertility rates (Thomas 2015) (Figure 1). The relocation of people took place again, with Germans, Russians, Greeks and Ukrainians emigrating from Kazakhstan. However, between 1991 and 2005, over 1.1 million *oralmans* (returnees) arrived in Kazakhstan from China, Mongolia and other countries.

The introduction of state policies for protection of women's health positively contributed to population recovery since the 2000s (Figure 1). In addition, in line with the state development strategy for Kazakhstan until 2030, programmes to combat unemployment and poverty reduction were also adopted. These helped low-income families to access benefits, which improved living standards. The Russian population declined to 30% due to migration to the Russian Federation, while the growth in proportion of ethnic Kazakhs continued (Shustov 2010).

During the Soviet period, most of the towns were small and medium size (fewer than 100,000 people) and only one city, Almaty, had a population of more than 1 million. New towns were founded (and expanded rapidly) next to industrial centres, coal mining and metal manufacturing areas (e.g., Karaganda and Temirtau).

Generally, the rural population dominates in the south-east and north of Kazakhstan (Figure 2). This distribution has been driven mostly by the mild climate in the south and the heritage of the Soviet *tselina* campaign in the north. The highest urban population is in the coal-mining Karaganda *oblast*, which had the highest number of towns (11) due to mining and metallurgy centres (Figure 2).

The highest population density was in Almaty city (Figure 3), while the population density of Astana city has grown rapidly since it became a capital city in 1998. Apart from the two state cities, South Kazakhstan *oblast* is the highest populated area (Figure 3).

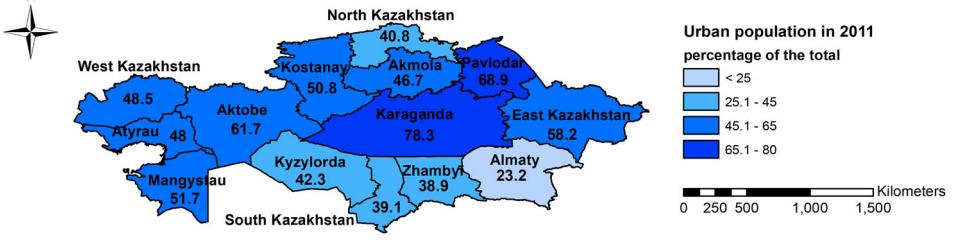

Figure 2. Percentage of the urban population.

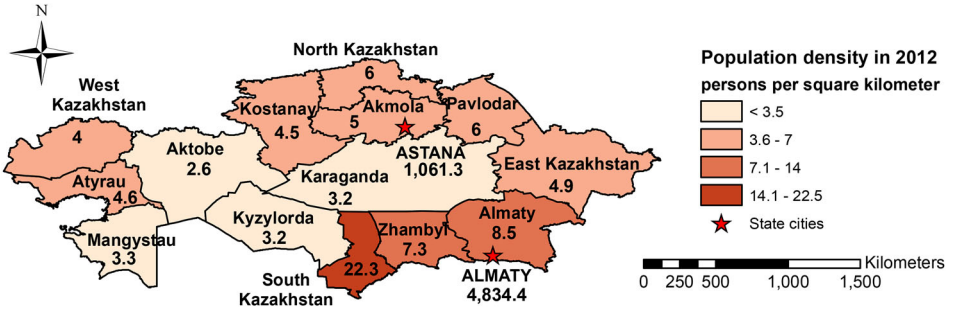

Figure 3. Population density.

In south and south-east of Kazakhstan, warmer winters and longer summers created favourable conditions for living and farming. Additionally, these areas had mountain-fed water resources and were located along the Great Silk Road route, which over time promoted development of market towns. Almaty city, as the capital of Kazakhstan for 68 years (1929–97), has been a major cultural, political and socio-economic centre, attracting people in search of employment. Since the move of the capital in 1998, there has been a similar effect in Astana, and its population has been constantly rising. This allowed a certain regional balance between south and north of the country.

Infant mortality rate (IMR)

In pre-Soviet Kazakhstan, some medical practices, especially those applied during childbirth, were traditionally performed by *shamans* (i.e., tribal healers) (Jones and Grupp 1983; Michaels 2000). Significant improvements in infant mortality happened between 1917 and 1925 with the establishment of the Maternity and Child Welfare Department in the USSR. Soon after the Great Patriotic War, infant mortality in the USSR declined as new medicines introduced during the war (including penicillin) were applied (Jones and Grupp 1983). Additionally, since the majority of people with weak health or chronic diseases were no longer alive, a more robust generation emerged. As a result, IMRs in the USSR declined steadily (Dutton 1979).

In the 1970s, however, IMR in the USSR went up again as a result of the deteriorating healthcare infrastructure caused by stagnation and militarization, and improved recording in the Central Asian republics (Jones and Grupp 1983). In addition, the IMR growth in the 1970s was linked to the increase in death rates from diarrhoea and respiratory and infectious diseases (Velkoff and Miller 1995). This was especially true for the rural areas in Central Asian republics where home-births were widely practised (Anderson and Silver 1986).

IMRs in Central Asia remained high during the transition, particularly in rural areas (Buckley 1998). This high IMR in the region was associated with unsustainable agricultural practices (such as Aral Sea desiccation in Kazakhstan), long-term exposure to pesticides and chemicals resulting in their accumulation in mothers' and their children's bodies, and shortage of access to safe water and sanitation, which caused low weight, anaemia and digestive diseases in children (Franz and FitzRoy 2006). In a number of Soviet republics infant mortality was misreported, which was not a result of governmental instructions but rather due to differences in live birth and death definitions (Aleshina and Redmond 2005).

In Kazakhstan, IMR declined from 37.4 deaths in 1961 to 23.7 deaths in 1971 (Figure 4). A particularly sharp increase happened in the early 1970s (from 23.7 deaths in 1971 to 39.5 deaths in 1976, i.e., 67% growth) due to poor environmental conditions, anaemia in mothers and their

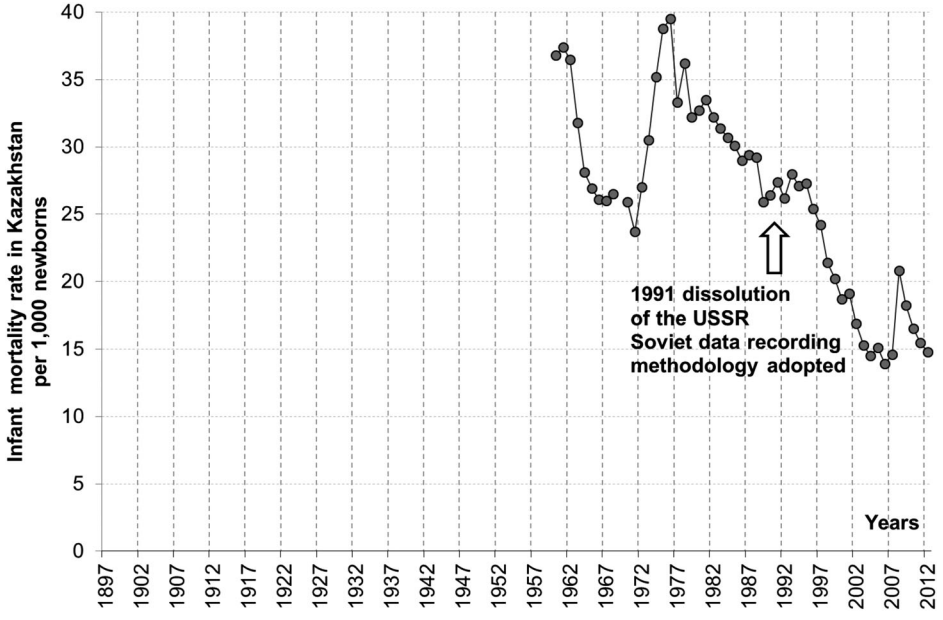

Figure 4. Infant mortality rate (IMR).

newborn children, and deteriorating healthcare infrastructure (due to militarization). Since the 1980s, IMR in Kazakhstan has declined (due to stimulation of childbirth by the state, improved perinatal healthcare and reduced maternal mortality), until the early 1990s when it was negatively affected by intensive migration and socio-economic instability (Figure 4).

Different methods of reporting IMR (World Health Organization (WHO) versus the previously used Soviet method) could change the numbers considerably. If IMRs in Kazakhstan were calculated using the WHO methodology, the rates might have been considerably higher (Anthopolos and Becker 2010).

Among the five Central Asian republics, Kazakhstan had the lowest IMR (Buckley 1998). Overall, the higher rates were at the beginning of the transition during the early 1990s due to economic recession, lack of medical supplies, decline in living standards and increased poverty. Since the late 1990s, IMRs in regions of Kazakhstan have fluctuated, but, overall, were in decline. A low IMR tended to be in *oblast*s with lower content of urban population, for example, Almaty *oblast*, so a higher IMR was often linked to urbanization (Figures 2 and 5) with the exception of Kyzylorda *oblast*, which is explained below.

Figure 5 illustrates that Kyzylorda *oblast* had the highest IMR. Around one-third of infants' deaths in Aral Sea area in Kyzylorda *oblast* were caused by perinatal complications: respiratory diseases, diarrhoea and nutrition deficiency (Kiessling 1998). Desiccation of the Aral Sea uncovered huge salt deposits contaminated with industrial and agricultural chemical residues, which were applied against boll weevils (i.e., severe agricultural pest) during the Soviet period (Spoor 2002). Continuous exposure to the insecticide DDT (dichlorodiphenyltricholroethane) contributed to the higher infant mortality in Kyzylorda *oblast*.

Other regions with high IMRs were East Kazakhstan and Mangystau *oblast*s (Figure 5). Mangystau *oblast* also had the highest maternal mortality of 115.1 deaths per 100,000 live births. Numerous uranium mines caused a high level of oncology diseases in Mangystau *oblast* that contributed to higher IMRs (Grid-Arendal 2012). East Kazakhstan *oblast* has remains of the

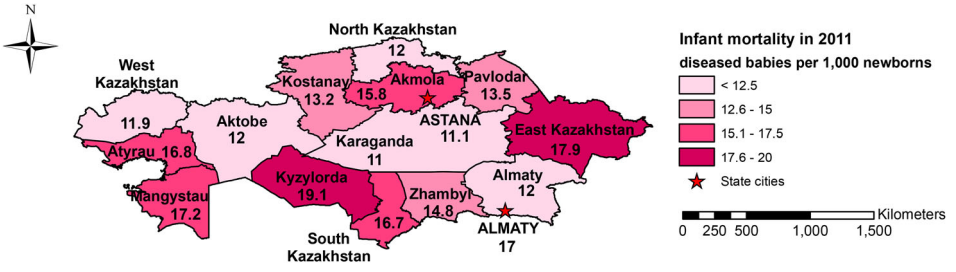

Figure 5. Infant mortality rate (IMR) in 2011.

Semipalatinsk nuclear testing site (active between 1949 and 1989), where previous radioactive explosions resulted in acute birth defects, genetic illnesses, leukaemia and other cancer types, mutations and severe chromosomal abnormalities in several generations.

Analysis of environmental sustainability indicators

Air emissions

To satisfy growing industrial and municipal needs during the 1920s, an 'electrification' plan that prioritized construction of large-scale thermal power stations/units and hydropower stations in a very short time period was developed in the USSR. Emissions from power stations were notorious for excessive sulphur dioxide, nitrates and acid sulphates pollution (Jedrychowski 1999). During the Great Patriotic War many plants were evacuated to Siberia and Kazakhstan and new factories with no pollution control were built rapidly (Josephson 2007). The nuclear testing site in Semipalatinsk also contributed radioactive pollutants causing cancer and leukaemia.

From the 1960s, the Soviet economy experienced long-term industrial decline (Easterly and Fischer 1995). Further economic recession and falling industrial production in the 1990s helped to improve the environmental situation in Kazakhstan and was positive from a sustainability perspective. Whilst this industrial decline would be welcomed by proponents of the de-growth concept, it was not intentional (Martinez-Alier et al. 2010).

Air emission volumes in Kazakhstan went down following the transition to a market economy (Figure 6). Among stationary sources, the biggest polluter was the energy sector (especially coal-based heat and power production) – 50% of all the emissions were from stationary sources in 1990 and 40% in 1995. The high air emissions were associated with energy production in the 1980s and fell sharply after the USSR collapsed (EBRD 2011) (Figure 6).

There might, however, be other reasons behind the decline in air pollution in the 1990s (Figure 6). Reporting of air pollution changed during the transition, making primarily big enterprises accountable, thus underestimating pollution levels (Oldfield 1999). Moreover, to cut costs during the transition, some enterprises simply switched off their pollution control equipment and cut the number of air-monitoring stations.

Various international treaties may have contributed to this decline as well. Kazakhstan joined the Montreal Protocol on ozone layer-destroying substances in 1997, ratified the Kyoto Protocol in 2009 and developed national programmes to reduce greenhouse gas emissions.

Figure 7 demonstrates that the main polluters of air emissions were Pavlodar and Karaganda *oblast*s. About 96% of all coal production in Kazakhstan came from just three cities: Ekibastuz (Pavlodar *oblast*), Karaganda and Temirtau (both in Karaganda *oblast*) (Dahl and Kuralbayeva 2001). Kazakhstan coal has a high ash content (39% in Karaganda coal and 55% in Pavlodar coal).[6]

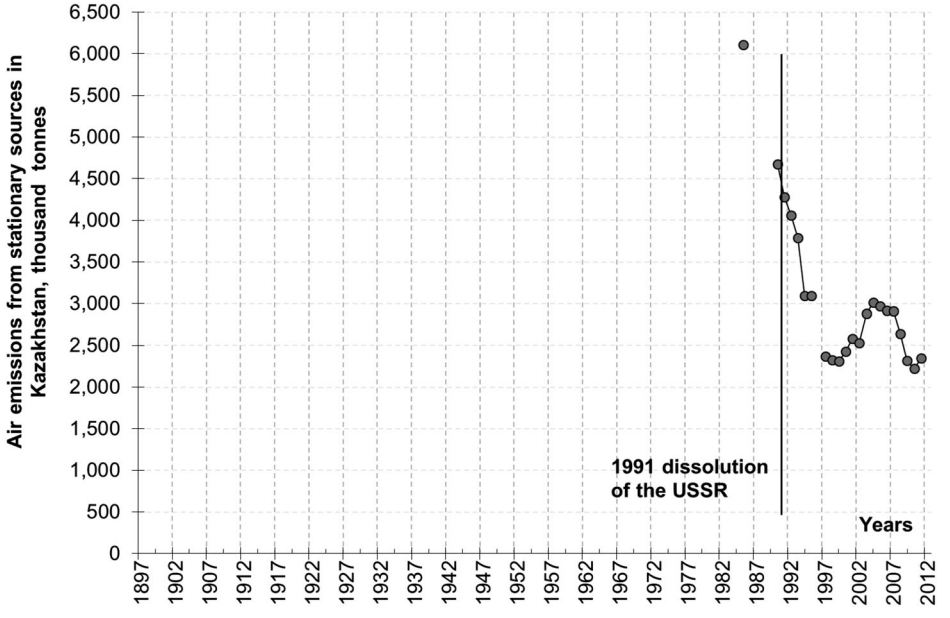

Figure 6. Air emissions.

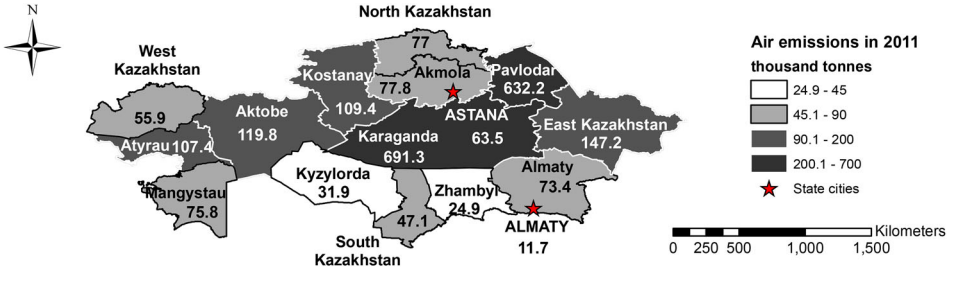

Figure 7. Air emissions in 2011.

Karaganda and Pavlodar *oblast*s were the most urbanized and had a high output of coal, power, ferrous and non-ferrous metals (Figure 2) (Dahl and Kuralbayeva 2001). Pavlodar aluminium plant had high air emissions of manganese and vanadium metals, while steel and metallurgy complexes in Temirtau (Karaganda *oblast*) emitted phenols, dust, ammonia, carbon monoxide and nitric oxides (Simonenkov et al. 2010).

Water management

Water in the USSR was considered a free resource. Water consumption was not restricted, which caused its wasteful usage due to lack of maintenance, recycling and treatment facilities. The biggest disaster with water management in Kazakhstan began in the 1960s, when the Soviet government decided to turn Central Asia into the world's greatest cotton region. This significantly limited inflow of water from the Syr-Darya and Amu-Darya rivers that feed the Aral Sea (Czarra 2003). As a result, the Aral Sea lost 75% of its volume, causing severe damage to the local fishing economy, environment and human health (*New Scientist* 1989).

Water in Kazakhstan is mostly consumed by the agricultural sector. From 1992 to 2001, water consumption for regular irrigation and industrial needs has fallen by 65% and 40% respectively (UNDP 2004). Moreover, previously shared water resources were spread among the FSU states, causing political bargaining and conflict over water. Among Central Asian states, Kazakhstan is the least water-sufficient republic, as it has no major rivers originating on its territory and experiences water stress due to limitations of the freshwater supplies and upstream water pollution (Zhylkybayev, Bondarenko, and Tsun-sin 2012). Therefore, different tools to retain water and promote its sustainable use were introduced after the 1990s, including efficient water consumption, fines for water pollution and excessive freshwater use, and ratification of international treaties (e.g., the Helsinki Convention on prevention and control of transboundary water pollution) (Kirsanov and Kim 2007). Efforts to recover the Aral Sea were undertaken in the early 2000s by Kazakhstan and the WB, which brought some improvements in fishing, local weather and ecosystems.

Figure 8 shows that freshwater consumption in Kazakhstan was in decline, and fell especially sharply during the early 1990s mainly due to reduced industrial and agricultural production. This illustrates short-term environmental benefits caused by de-growth.

A slight increase in freshwater consumption happened in the mid-2000s (Figure 8). This was associated with increase in water abstraction in two regions: Kyzylorda and South Kazakhstan *oblast*s, which are more sufficient in water than central and western regions (Figure 9). At the same time, significant volumes of water (up to 65%) are often lost through inefficient irrigation and old infrastructure. Kazakhstan might face an acute water deficit by 2030 if water wastage is not resolved (Pavlovskaya 2013). The problem might become even more severe in view of the expected growth in droughts, 20% decline of the major water basins and 20% fall in grain yield in Kazakhstan (Severskiy 2004).

Figure 9 shows that the southern Kazakhstan regions had higher water abstraction than their northern counterparts. The highest water abstraction in Kyzylorda *oblast* is disproportionate to its

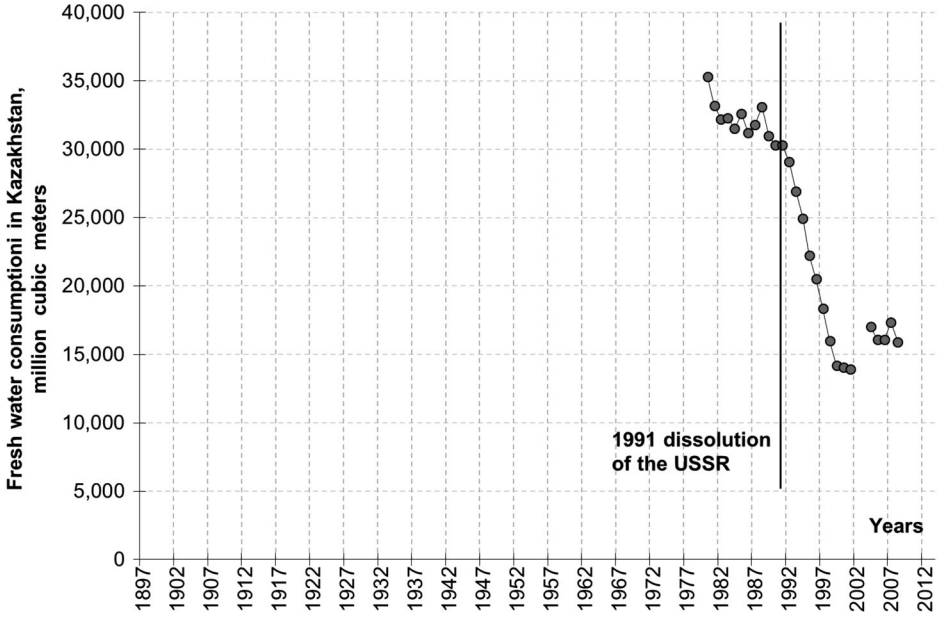

Figure 8. Fresh water consumption in Kazakhstan.

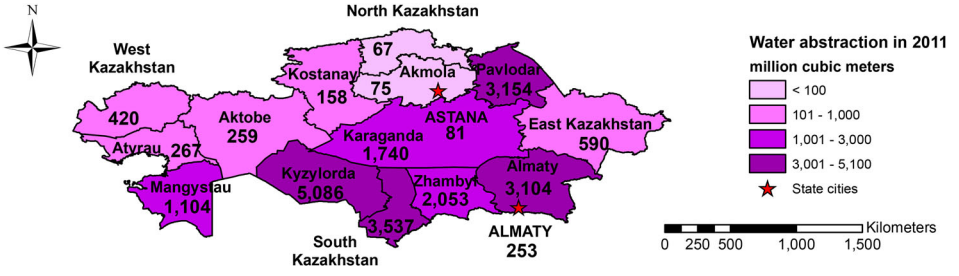

Figure 9. Water abstraction in 2011.

low population density, and is related instead to agriculture (Figure 3). Water in Kyzylorda *oblast* was used for water-intensive irrigation of rice fields, as precipitation in the arid southern regions is very low and the region supplies more than 80% of all rice production in the country (Beurs and Henebry 2004).

Almaty *oblast* is the most water-sufficient area due to its location in the Zhety-su (seven rivers) region. However, one of the main freshwater rivers in Almaty *oblast*, Ili River, originates in China and carries considerable wastewater pollutants (Greenberg 2007). The Ili River flow into Kazakhstan is likely to decline and salinity of Balkhash Lake to rise as the Chinese government plans to relocate about 40 million people from its central regions to the north-west.

Oil production

Oil production in Kazakhstan began in 1899; however, rapid growth started in the 1960s with the discovery of several oilfields in the western part of the country. In order to attract more workers into the oil industry, the USSR set up extra privileges, including longer vacation, the highest salaries and an earlier pension for prolonged service (*za vyslugu let*). However, the oil industry generated high volumes of air and water pollution and posed threats to biodiversity and ecosystems.

Environmental pollution from the oil industry continued after Kazakhstan gained independence and had a destructive impact on the health of oil workers and the population (Granovsky 2003). As oil production and air pollution increased, so did the number of people with respiratory diseases, diseases of digestive organs and infections.

Between 1992 and 2010 Kazakhstan exported on average 73% of its oil production, 70% of its gas and 31% of its coal output, making it very dependent on energy exports (Oskenbayev, Yilmaz, and Abdulla 2013). Tengiz and Kashagan oilfields were discovered in the 1990s and attracted considerable foreign investments from both Western (United States and Europe) and Eastern (China) countries (Ipek 2007), so joint ventures (JVs) with foreign oil companies were created. Subsequently, Kazakhstan built two oil pipelines to China; in addition, oil is also transported through the Caspian Sea by tankers to Baku (Azerbaijan) and distributed through railways or pipelines.

Recent years have seen increased unrest amongst those working in the oilfields. For example, in Zhanaozen (Mangystau *oblast*) local oil workers demanded better pay for harsh working conditions in 2011, but their protests were deemed ‘illegitimate’ by the government. The deeper reasons for the conflict seemed to rest in their frustration over poverty, as western regions remain among the poorest in the country despite being rich in oil reserves (Pomfret 2006).

Additionally, enormous oil and gas resource development resulted in low economic diversification, and a strong autocratic political system (Franke et al. 2009; Özcan 2010). This paradox is not a new phenomenon and similar cases of ‘resource curse’ could be found around the globe, including Nigeria, Angola and Venezuela (Sachs and Warner 1995; Neumayer 2004). Jones

Luong and Weinthal (2010) believe that the ownership structure and weak institutions are the 'curse' as they hinder development of the resource-rich countries.

Figure 10 illustrates that Kazakhstan increased its oil production volumes since the 1960s. After initial decline in the early 1990s, oil production in Kazakhstan increased enormously: from 26 million tonnes in 1998 to its peak of 80 million in 2011, or on average 15% every year in 1999–2004 (Figure 10).

Regionally, most of the oil production in Kazakhstan is concentrated in its western *oblast*s, especially Atyrau and Mangystau (Figure 11). There are 15 large fields in Kazakhstan, including Tengiz, Uzen, Kashagan and Karachaganak. In the late 2000s, Tengiz oilfield (Atyrau *oblast*) was expanded with a new method of sour gas injection and a new refinery plant. This increased oil production from 310,000 barrels a day to 540,000 barrels a day, i.e., 1.7 times (Kazmunaygas 2010).

High oil production levels in Atyrau and Mangystau *oblast*s cause a negative impact on the unique marine environment of the Caspian Sea through the introduction of invasive species by oil tankers, pollution from oil extraction, processing and transportation of oil, and sulphur dioxide and hydrogen sulphide emissions from the oil refineries (Kalb et al. 2004; Kaiser and Pulsipher 2007).

Being an isolated water body, the Caspian Sea has a large number of endemic species, for example, the Caspian seal and the Caspian sturgeon. Offshore oil and gas projects disrupt seal habitats, while pipeline construction disturbs sturgeon habitats (Raloff 2006). The Caspian seal is now listed by the International Union for the Conservation of Nature (IUCN) as endangered, as its population has declined by 90% in the last 100 years (and from 500,000 in the 1960s to 111,000 in 2005) due to loss of habitats, by-catch in fisheries (i.e. unintentional catching of fish and/or sea mammals), over-hunting and construction of artificial islands (IUCN 2013).

At the same time, rapid extraction of the oil and gas industry contributed to social conflicts, such as the 2011 Zhanaozen uprising, which left at least 14 people dead. While the average salary

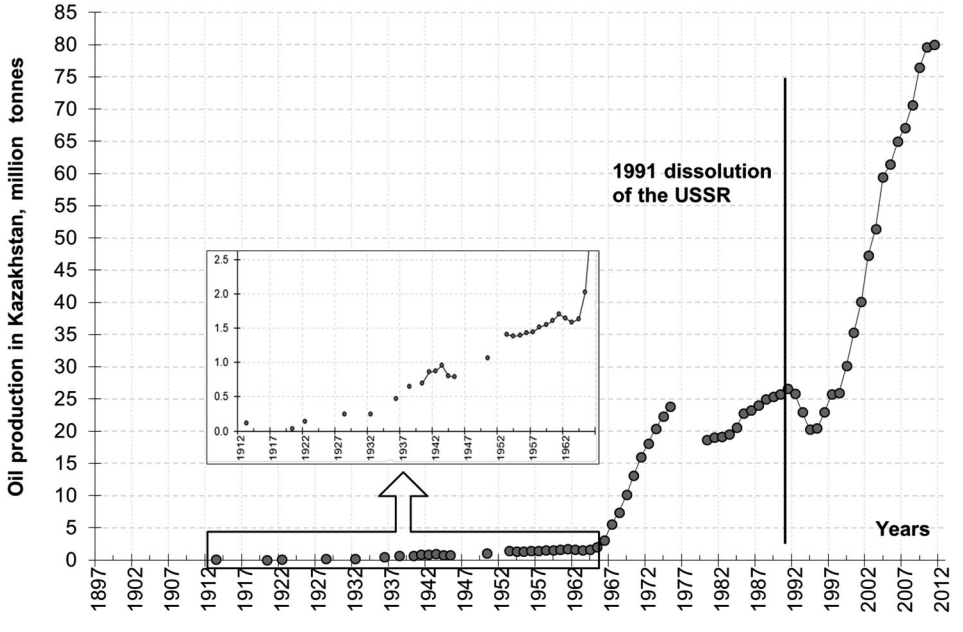

Figure 10. Oil production in Kazakhstan.

Figure 11. Oil production in 2011.

in western Kazakhstan was higher than in other regions, the cost of living was also high (Figures 13 and 18). The western regions also have high infant mortality, especially in Mangystau *oblast* (Figure 5).

Analysis of economic sustainability indicators

Average salary

Vladimir Lenin believed that the goal of the national economy in socialism was a complete satisfaction of increased material and spiritual needs of the society. However, Stalin's focus on industrial production fuelled by the Cold War led to a shortage of consumer goods, despite adequate salaries. To reduce the amount of money in circulation, money reform took place regularly, for example, in 1961, making salaries smaller.

Statistics concerning salaries were concealed, hiding the differential between and within sectors and occupations, and social inequality (Nove 1966). Since the first wage scale in 1918, membership of the Communist Party and its associated unions had a considerable impact on salaries. For example, a civil servant had a salary of 350 roubles per month whereas a *commissar* (an officer allocated to military troops to teach Communist Party policies and principles) had 800 roubles per month (Bergson 1984).

From the late 1940s, fraud (*pripiski*) in relation to official five-year planning targets was common (Harrison 2011). Although official salaries were low, a single bribe could easily exceed it, making bureaucracy and corruption flourish (Black and Tarassova 2003). Labour efficiency, work remuneration and motivation were very low, with huge gaps between salaries of workers and *nomenklatura*. To survive on such a low salary and to fill the gap in payments, workers also cheated the salary system by stealing products from workplaces.

At the turn of 1990, salaries of the general public remained low, but enough to survive till the next month's payment. In the 1990s, following trade liberalization, many state-owned enterprises were privatized. Numerous cooperatives were offering goods and services, mostly by buying goods at the state price and reselling them at a market price (Nuti 1989). Subsequently, some of the cooperatives became big enterprises, trading on minerals, metals and raw materials, and the wealth accumulated in the hands of their directors, who became the new oligarchs.

Following independence, Kazakhstan introduced its own currency in 1993, the tenge, replacing the FSU rouble at a rate of 1 tenge to 500 roubles. However, in the mid-1990s hyperinflation made the tenge unstable and salaries weak. Rising energy prices and exports brought economic recovery and in the early 2000s Kazakhstan, along with Russia, had the highest average monthly salary (about US$200 in local equivalent) among other FSU states (Pravda 2004).

Figure 12 illustrates that in the first year of tenge introduction, salaries increased from 128 tenge in 1993 to 1726 tenge in 1994, and by 1999 there was a 93 times increase (since 1993)

due to hyperinflation. From 1997 to 2012, however, the growth in average salary gradually slowed and was on average 18% per year.

Some professions, like teachers and physicians, have historically been paid lower salaries. The highest salaries were observed in the extractive industries, financial services and insurance industry, whereas the lowest salaries were in fisheries, rural and timber industries (Kazakhstan Today 2010). In addition, Kazakhstan has also been experiencing rapid emergence of the middle class and, subsequently, decline in people living below the poverty level (Maulenova 2009). Entrepreneurs were the biggest group in the new middle class of Kazakhstan actively looking for market opportunities (Özcan 2010).

Figure 13 shows that the regional salaries' distribution was unequal. Despite superficially high salaries, Mangystau *oblast* had the highest cost of living and the highest unemployment in Kazakhstan for several years (Figures 13 and 18) (Nasimova 2011).

Overall, regions with a predominantly urban population got significantly higher average salaries than *oblast*s with rural populations (Figures 2 and 13). In addition, the salary within an *oblast* could differ. For example, in West Kazakhstan *oblast* the salary of farm workers in 2004 was almost four times lower than an average salary in the *oblast*. There was a big variation within enterprises, where the gap in salaries among workers, non-manual specialists and management could differ by a scale of 20 times (Bisekov 2013).

Income per capita, Gini coefficient, inflation and cost of living

Historical information on Soviet income and cost of living were difficult to find. In the USSR, the concept of minimum living costs per se was not established; however, minimum salary and minimum pension were set up instead. In 1967, the minimum salary was set at 60 roubles and kept increasing, making 70 roubles (or 37% of the average salary of 190 roubles) in 1985 (Karpukhin 1978; Nizhegorodskaya 2011). After the transition, however, the minimum salary

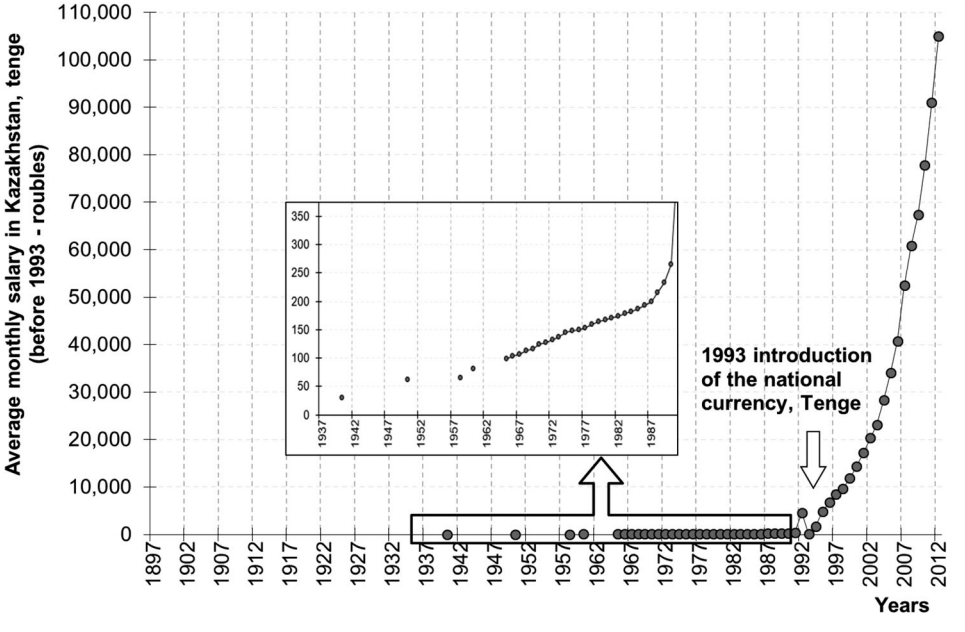

Figure 12. Average monthly salary in Kazakhstan.

Figure 13. Average monthly salary in 2011.

declined to about 10% of the average salary increasing the number of people living in poverty. A minimum cost of living in independent Kazakhstan was set up based on a consumer goods basket and consumer prices; 70% of the minimum cost of living comprised food items (Biekenov 2006).

The income inequality gap increased and income levels in various regions varied greatly (Guriev and Rachinskiy 2006). This rise was believed to be necessary for developing essential institutional transformation, a democratic political system and to promote economic efficiency. New laws, such as one on income legalization introduced in 2001, allowed the population to legalize the 'shadow' income without paying tax on it. This revealed that about US$480 million in total was kept by the population (Sheretov 2003).

Transfer of state-owned assets to private ownership was launched in 1991. However, there was a lack of transparency during privatization and the income distribution gap increased (Mitrofanskaya 1999). Average income fell by 59% and incomes of the majority fell below the minimum cost of living (Darimbetov and Spanov 2001). A recent study reported that half the respondents in Kazakhstan believed that incomes were more equally distributed during Soviet times, although 40% of them stated that their welfare had improved in comparison with the Soviet times (Eshpanova, Narbekova, and Biekenova 2012).

Inflation data were not available in the state reports, but the WB data (WB 2014) were used instead (Figure 14). Inflation peaked dramatically in the early 1990s: 1472% in 1992, 1243% in 1993 and 1547% in 1994. This explains the rapid growth in salaries in Kazakhstan (Figure 13).

The hyperinflation that occurred between 1991 and 1995 declined to 39% in 1996 and then to 16% in 2011 (Figure 14). Income inequality can be traced using the Gini coefficient (Figure 15); when closer to 0 it shows more equality; closer to 1 indicates higher inequality. Here, Gini coefficient of Kazakhstan is plotted together with that of Russia for a better understanding of Kazakhstan's position in comparison with another FSU country that is also rich in natural resources and has a multi-ethnic population living on its vast territory.

Figure 15 illustrates that in 1989 Kazakhstan had slightly higher inequality in income distribution (0.28) than Russia (0.27). During the transition in the 1990s, income distribution inequality increased in both countries – in Russia to 0.41 in 1993 and in Kazakhstan to 0.32 in 1996 – due to privatization and redistribution of the previously state-owned assets. According to Pomfret (2006), inequality in Kazakhstan in the 1990s and 2000s remained at the same level, while Howie and Atakhanova (2014) concluded that income inequality declined between 1996 and 2009. Figure 15 also shows that the Gini coefficient fell: from 0.34 in 1997 to 0.29 in 2007, while in Russia it was slowly growing. The lower Gini coefficient illustrates that Kazakhstan is doing better than Russia in providing more equal income distribution among its citizens.

In terms of real incomes, Figure 16 shows that the highest real incomes in 1998–99 and 2001–03 were in Astana and Almaty cities. Overall, rural areas of Kazakhstan had lower real income per capita than urban ones. Despite a high monthly salary and nominal income in Mangystau *oblast*

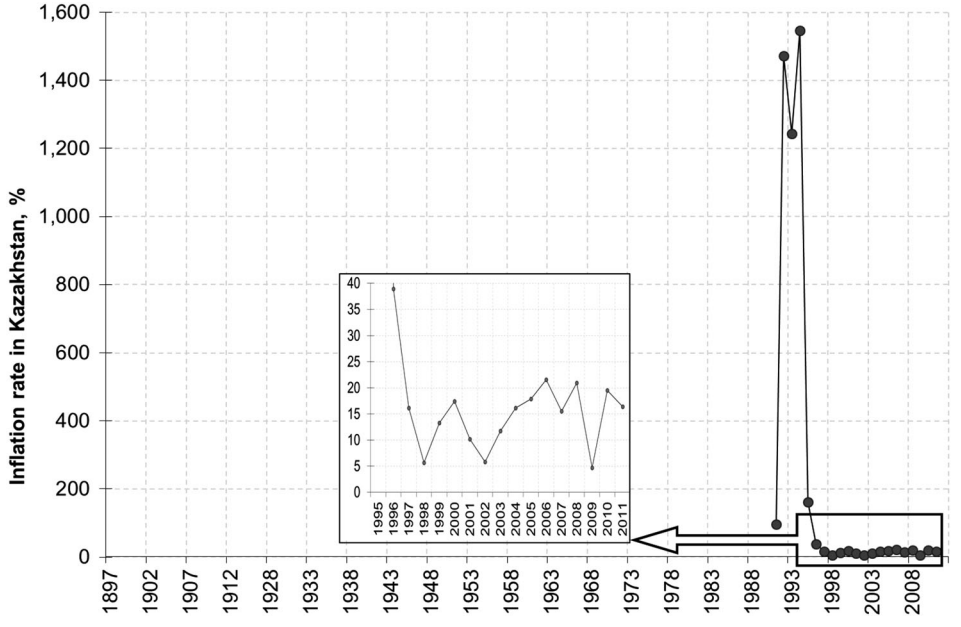

Figure 14. Inflation.

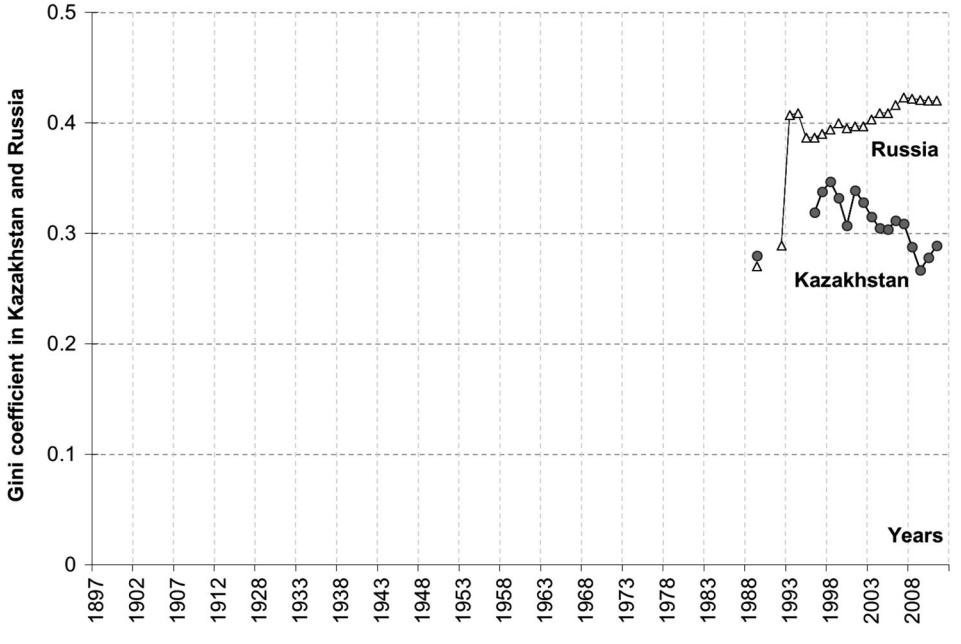

Figure 15. Gini coefficient of Kazakhstan and Russia.

(Figures 13 and 17), its real income in 2003 was one of the lowest in Kazakhstan, and comparable with that of Zhambyl *oblast* (Figure 16). The discrepancies between high nominal income/salary and low real income were most likely caused by high inflation and high living costs in western regions.

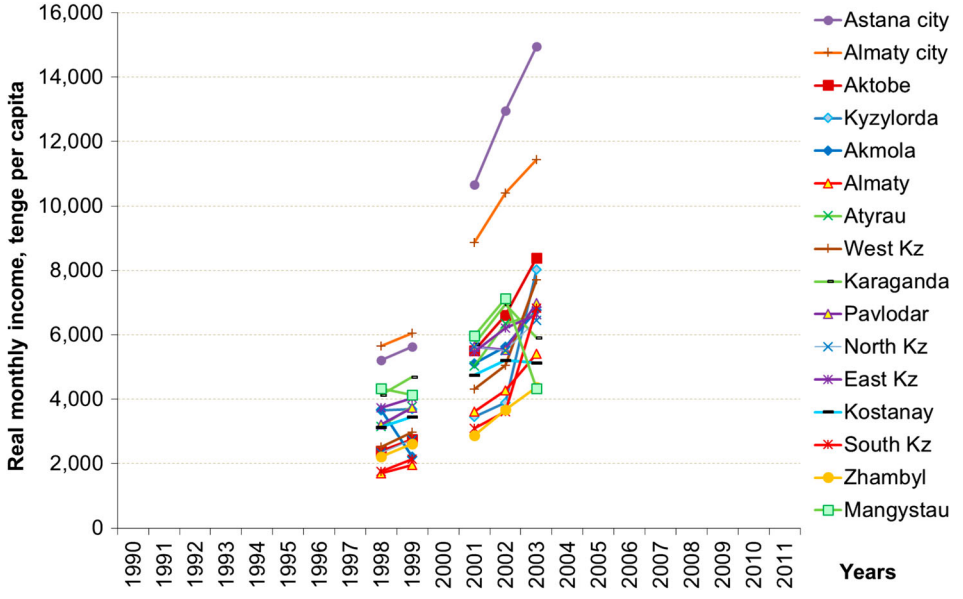

Figure 16. Real income.

Nominal income (i.e., not accounting for inflation) increased in all regions during the period 2001-2011 (Figure 17). However, the gap between income levels in the four regions (Atyrau, Mangystau, Astana and Almaty city) and the rest of Kazakhstan (especially its southern areas) increased greatly (Figure 17).

Figure 18 illustrates that the cost of living grew in all regions with especially high levels in Mangystau *oblast*. As 70% cost of living consisted of food items, it can be assumed that this

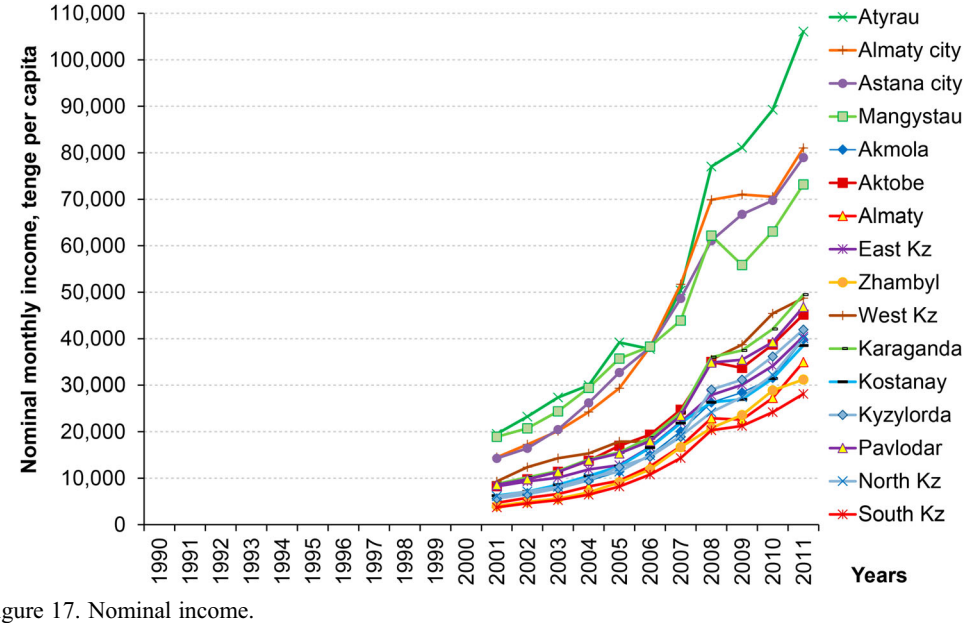

Figure 17. Nominal income.

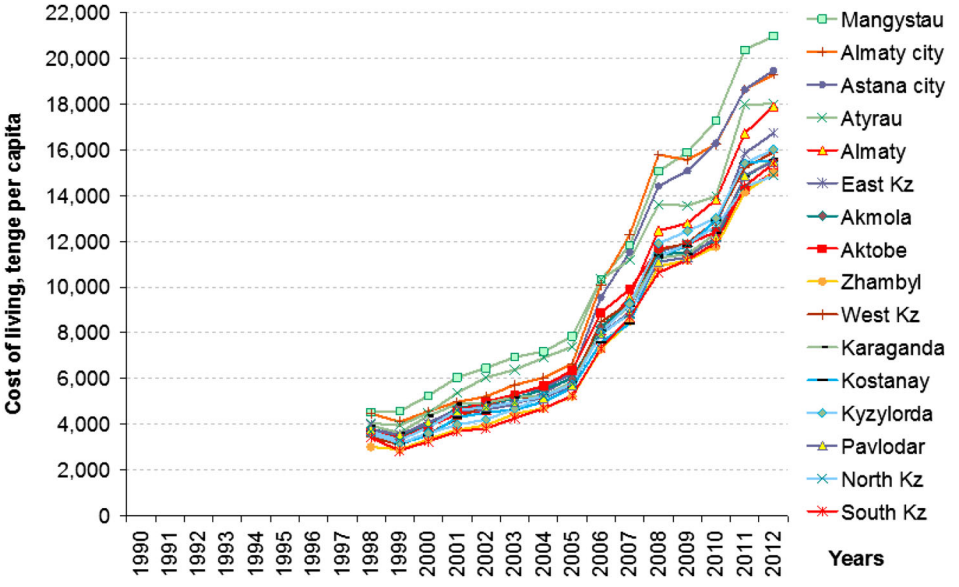

Figure 18. Cost of living.

region had more expensive food with a lack of agricultural produce due to the lowest precipitation in south-west Kazakhstan (fewer than 100 millimetres per year). In Mangystau *oblast* intensive exploitation of uranium, oil and gas resources on the barren Ustyurt plateau since the 1960s contaminated the land heavily. In the case of Astana and Almaty cities, higher population densities have caused a higher demand for essential goods, like food and accommodation.

The low cost of living in the southern regions (Zhambyl, South Kazakhstan and Almaty *oblast*s) is associated with the fact that their population was predominantly rural and could grow their own food (Figure 3) (Kazpravda 2005). Nevertheless, three southern regions (Zhambyl, South Kazakhstan and Kyzylorda *oblast*s) had the largest number of people with an income below the minimum cost of living, although their number declined from 55% in the total population in 2003 to 12% in 2009 (Zhankubayev 2012).

When average monthly salary and living costs are compared, then salaries in the western *oblast*s (Atyrau, West Kazakhstan and Mangystau) were on average 6.5 times higher than their living costs, whereas salaries in the southern *oblast*s (Zhambyl, South Kazakhstan and Almaty) were only 3.4 times higher than their living costs (Figures 13 and 18). Low income and a smaller gap between salary and living costs in the southern regions might imply that more people could slip close to the poverty line.

Conclusions

The analysis shows that the inception of the Soviet Union brought both positive and negative impacts. On the social development front, decline in infant mortality and an improved healthcare system were leading positive trends during the USSR period. However, for Kazakhs, disruption of their traditional nomadic life, collectivization and the 'Virgin Land' campaign brought about major catastrophes and cultural annihilation. With militarization and economic stagnation in the 1960s–80s, infant mortality in Kazakhstan fluctuated. The highest IMRs were observed in the areas of former nuclear testing sites in East Kazakhstan, the Aral Sea desiccation zone in Kyzylorda and uranium mining areas in Mangystau *oblast*.

Rapid industrialization and relocation of industrial plants during the Great Patriotic War contributed to widespread pollution and environmental damage. While pollution levels in Kazakhstan went down in the 1990s, the decline was not intentional. The largest volumes of air emissions from stationary sources were in the urbanized Karaganda and Pavlodar *oblast*s, which used locally mined coal with a high ash content for generating heat and power.

During the Soviet period, water management in Central Asia was regulated centrally. Since the 1960s excessive water use for cotton irrigation led to the desiccation of the Aral Sea. The idea of diverting Siberian rivers into Central Asia has recently been revisited by regional leaders. Since independence, Kazakhstan had the lowest water availability among the CIS countries and the issues of transboundary rivers management and pollution (especially those originating in China) became crucial. Water preservation and efficient water management are necessary to prevent water deficit in Kazakhstan in future.

Kazakhstan has historically been very dependent on energy exports, especially oil and gas. However, high oil production in Atyrau and Mangystau *oblast*s pose significant risks to the unique Caspian Sea environment and biodiversity.

Despite improvements since the 1990s, Kazakhstan shows stark inter- and intra-regional inequality. Salaries in Kazakhstan were devalued due to hyperinflation in the 1990s. Among regions, as well as among various professions, salaries and incomes are distributed unequally. Despite high salaries, the western regions (especially Mangystau *oblast*) had the highest living costs, low real income and remain among the poorest in the country. This leads to occasional social unrests as seen in Zhanaozen in 2011. Although nominal incomes and salaries have risen massively in post-transition, the regional income gap also increased. However, since the late 1990s, wealth inequality dropped, demonstrating more equal income distribution, especially in comparison with Russia.

In 2006 Kazakhstan accepted the strategy for its transition to SD for 2007–24. Although the population and life expectancy increased according to the strategy, the SD strategy, along with environmental security strategy, was made void in 2011. This might be associated with a lack of funding or lack of long-term commitment and management over the implementation of the SD strategy's actions.

The findings suggest that change in ownership and management of environmental and economic assets was associated with initial social and economic turmoil, environmental pollution decline, hyperinflation and wealth inequality. Later, however, the development of Kazakhstan became more sustainable as its demographic situation improved and citizens were provided with new opportunities. In order to move to a more sustainable course of development, Kazakhstan should apply policies aimed at improving quality of life, encouraging equal wealth distribution among social groups as well as regions, developing renewable energy sources and ensuring decoupling of socio-economic development from wasteful use of natural resources.

Kazakhstan can choose different scenarios of development, and whether or not the country achieves its 'limits to growth' mainly depends on its current and future paths of development and policy choices. The Kazakhstan 2030 Development Strategy focused on socio-economic affairs and raising living standards. It also provided a basis for a national consolidation and nation-building. With recent falling oil prices there are concerns over economic growth, but at the same time this can be an opportunity for institutional reforms and the promotion of economic diversification.

While Russia's annexation of Crimea in 2014 might look threatening to the territorial sovereignty of Kazakhstan (especially to its northern regions), separatism is highly unlikely. First, there is a lack of a political movement in Kazakhstan. Second, Kazakhstan legitimized the Russian language as the language of inter-ethnic communication, whilst making Kazakh the state language. In addition, the 1998 move of the capital city from Almaty in the south (with a

predominantly Kazakh population) to Astana in the north (with a predominantly Russian population) caused a positive long-term effect in attracting more ethnic Kazakhs to the northern regions. Finally, Kazakhstan's balanced foreign policy and equal representation of Russian people in political, social and economic life have been a key factor in retaining political stability.

Providing that political stability is maintained, more renewable energies sources are used and the finite natural resource extraction (and associated pollution) is slowed down, Kazakhstan stands a better chance of achieving the SD targets of meeting the needs and aspirations for several generations. Historically, traditions and the mentality of Kazakh people were coherent with SD principles, as they were based on empirical observations, self-sufficiency and environmental protection. There should be a renewed effort to bring these values alive again through public education, raising environmental awareness and standard setting by the government, scholars and businesses in modern Kazakhstan.

Acknowledgements

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Disclosure statement

No potential conflict of interest was reported by the author.

Notes

1. There are more than 80 various definitions of SD (Williams and Millington 2004). The most commonly used definition was introduced by Gro Harlem Brundtland, former prime minister of Norway. This states that SD 'seeks to meet the needs and aspirations of the present without compromising the ability to meet those of the future' (WCED 1987, 43).
2. Central Asian republics of the FSU (and later the Commonwealth of the Independent States – CIS) include the republics of Kazakhstan, Kyrgyzstan, Tadzhikistan, Turkmenistan and Uzbekistan.
3. Their predecessor was an international professional team established in 1996 and called the Consultative Group on Sustainable Development Indicators (CGSDI), which published a 'Dashboard of Sustainability'.
4. IMR is defined as death in the period between when a baby is born and when (s)he reaches the age of one year.
5. The data presented here were collected over the course of three years (2010–13) as part of the author's doctoral research.
6. A total of 70% of power plants in Kazakhstan use coal, 15% use hydroelectric power and 15% use natural gas (Atakhanova and Howie 2007). More than half of domestic energy needs are satisfied with coal; however, the energy efficiency of a typical coal power plant is very poor at 27%, and that of a combined heat and power (CHP) coal plant is even lower at 18–21% (Sarbassov et al. 2013).

Data sources

Pre-transitional period

The main source of data for the pre-transitional period was found in annual reports of the USSR National Economy, stored in the Russian State Library (RSL) in Moscow. The earliest country-wide report I found in the RSL archive was dated 1956. In addition, each Soviet republic used to issue separate reports on their socio-economic development, and these reports were available for the Kazakh socialist republic. The reports included numerous detailed tables with statistical data necessary for the five-year planning scheme ("*pyatiletka*").

A typical report of the USSR National Economy in 1956 consisted of useful and detailed information on development in various areas, including: population growth, industry, transport, trade, science, finance, construction, agriculture, education, and employment. It also contained comparative tables with data for the years 1939 and 1955. Some of the data were compared with 1913, i.e. prior to the First World War. The annual reports were large (up to 520 pages) and often contained comparable tables with other socialist and capitalist countries, demonstrating overall progress of the Soviet socio-economic system. The data were available in hard copy and had to be transcribed manually into spreadsheets during my visits to the Russian State Library in Moscow and Kazakhstan National Academic Library in Astana (2010–13).

Data collection for this research occurred over a period of three years, in stages as follows:

- April–May 2010: trip to Kazakhstan, collection of data from the statistical agency;
- November 2010: data collection for Kazakhstan regions through remote access;
- April–May 2011: trip to Russia, collection of statistical data from the RSL;
- February–March 2013: trip to Kazakhstan, data collection from the National Library.

Sources of SD indicators data for the pre-transitional period

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Post-transitional period

The main data sources for the post-transitional period were the annual statistical reports of the newly emerging state, accessible through the state libraries and official web sites of the government statistical agencies of Kazakhstan. Most of the post-transitional statistical data were obtained during visits to the Kazakhstan National Academic Library in Astana and electronic sources. As with the pre-transitional data, no other sources of post-transitional data were used in this research, mainly due to differences in methodologies between the Kazakhstan statistics and other international institutions and to preserve purity of the data.

Sources of information for the post-transitional development

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Online resources: http://www.stat.kz

Regional maps

Regional maps of SD indicators for Kazakhstan were created using ArcGIS 10.2. The maps give a better graphical representation of the various regions in my case study country, and make it easier to understand the spatial distribution of indicators (e.g. infant mortality and oil production) and see detailed information for specific oblasts.

The shape files which provided the basis for my maps were downloaded from the Internet, using DIVA-GIS web-site, supported by University of California, Biodiversity International,

International Rice Research Institute, Museum of Vertebrate Zoology and International Potato Center (http://www.diva-gis.org/gdata).

Regional maps for Kazakhstan were created based on the most recent data available for my regional indicators of SD. They show the current development of the country and clearly identify potential future development paths towards SD goals of Kazakhstan.

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