Republic of Kazakhstan: Risk Profile

Basic Country Statistics

INDICATOR[1]	VALUE
POPULATION (2018)	18.404 million Urban 57.4% Rural 42.6% Density: 6.75 per km²
POPULATION GROWTH (DECADAL, 2009-2018)	13.72%
AREA	2.725 million km²
DIRECT DISASTER ECONOMIC LOSS (ANNUAL LOSSES, 2017)	12.3 million USD
GDP, 2010 USD (2017)	198400.0 million USD
GDP GROWTH RATE	4.03%
GDP BY SECTOR	Agriculture – 4.7% Industry – 34.1% Service – 61.2%
GROSS FIXED CAPITAL FORMATION, GDP 2010 (2017)	53008.2 million USD
CAPITAL STOCK	734,309.99 million USD
GROSS SAVINGS (% OF GDP, 2018)[2]	26.03%
HDI (2018)[3]	0.800
GINI INDEX (INCOME EQUALITY COEFFICIENT, 2015)	26.5

Introduction

This document presents the disaster risk profile of Kazakhstan. The analysis builds on a global probabilistic risk model used for GAR in 2017 and downscales the results to the first administrative levels in order to present a sub-national or disaggregated risk profile of the country. Managing disasters as a reaction to a hazard is a myopic view of disaster of disaster management and has significant financial and socio-economic implications. A first step towards building a solid political and economic imperative to manage and reduce disaster risk is to estimate probable future disaster losses. Unless governments can measure their levels of risk, they are unlikely to find incentives to manage disaster risk.

The purpose of this sub-national assessment is to encourage risk informed policy and investment decisions so as to minimize disaster induced losses in the long term. These risk metrics can guide not just disaster risk policies but also facilitate the progress towards SDGs which is threatened by increasing disaster risks. Effective public policies in disaster risk reduction and sustainable

[1] All figures are from UN ESCAP data
[2] Calculated as gross national income less total consumption, plus net transfers (source: World Bank Statistics)
[3] Human Development Report, 2018

development, ranging from financial protection, risk-informed public investment, resilient infrastructure, territorial planning and impact-based early warning can all benefit from appropriate estimations and layering of risk. The original datasets on hazard, exposure and vulnerability used in the assessment here were prepared for a comparative global analysis. Therefore, further downscaling to the second or third administrative level will significantly increase the uncertainty in the estimates thereby making them redundant for decision making.

***Intensive disaster risk** refers to risks from high-severity, mid to low-frequency disasters, mainly associated with major hazards such as earthquakes, tropical cyclones, riverine floods and tsunamis.*

***Extensive disaster risk** refers to risks from low-severity, high-frequency hazardous events. These risks are generally highly localized and difficult to model analytically at a global scale.*

The metrics presented in this summary provide comparable estimations of risk for earthquake and flood and analyze the implications for economic resilience and sustainable development in each of the first level administrative region. In addition, the risk profile has taken into account the likely cost of extensive risk, a risk layer that is often ignored in catastrophic risk assessments and has also estimated the probable cost of indirect disaster risks on the country's economy.

Methodology

When it comes to modelling disaster risks for the future, a general trend analysis or any assessment based on historical data underestimate the impact of future high-severity, low-frequency risks. Therefore, this method here uses probabilistic risk models to simulate those future disasters which, based on scientific evidence, are likely to occur but which may, as yet, not have occurred. This disaster risk profile builds on a global probabilistic risk model, the first of its kind to provide worldwide coverage for multiple hazards, originally developed for the United Nations.

The probabilistic risk analysis is based on determining losses' probability density functions for each one of the hazardous events for different levels of intensity, by estimating said losses in each one of the exposed assets, caused by each scenario contained in the stochastic set that exhaustively represents each one of the hazards (earthquakes, floods etc.).

The main output from the probabilistic risk analysis is commonly described as the 'Loss exceedance curve' (LEC) that describes the annual frequency of occurrence for different loss values. The inverse of the annual rate of the loss corresponds to its return period.

__Slow-onset risk__ originates from disasters that are relatively slow in their advancement such as droughts.

Risk is a function of hazard, exposure and vulnerability. Thus, any risk assessments would require estimates for hazards, a stock of exposure and vulnerability of exposed stock. The hazard associated with a natural phenomenon is measured using its frequency of occurrence and its severity, where the latter is characterized through a parameter of intensity computed at specific geographical locations. The damage susceptibility of every asset exposed to the considered natural hazards is modeled through vulnerability functions, which characterize the behavior of elements belonging to a specific construction class during the occurrence of a hazard event. The loss is generally understood as the loss relative to the replacement value of the exposed element. In general, an exposed element is any object that is susceptible to suffer damage or loss because of the occurrence of a hazardous event.

__Average Annual Loss (AAL)__ is the expected loss per annum associated to the occurrence of future perils assuming a very long observation timeframe.

__Probable Maximum Loss (PML)__ is a risk metric that represents the maximum loss that could be expected, on average, within a given number of years

The calculation of the loss exceedance probability curve constitutes the most appropriated method to assess the risk. From this curve, it is possible to derive risk metrics such as the average annual loss (AAL) and the probable maximum loss (PML), that can be assessed for one or more return periods. The average annual loss is the most robust measure of risk, being a compacted probabilistic metric that is relatively insensitive to uncertainty. This metric is calculated through the sum of the product of the expected losses from each event with the annual frequency of occurrence of the same event, assuming a stationary and exhaustive process of events (i.e. all the possible events are considered). Furthermore, the annual average loss can be expressed as a fraction of the exposed value. This versatile metric is known as the “pure premium” and can be used to express the risk for a building, for a portfolio of buildings, for a city or for a country.

Multi Hazard Risk Results

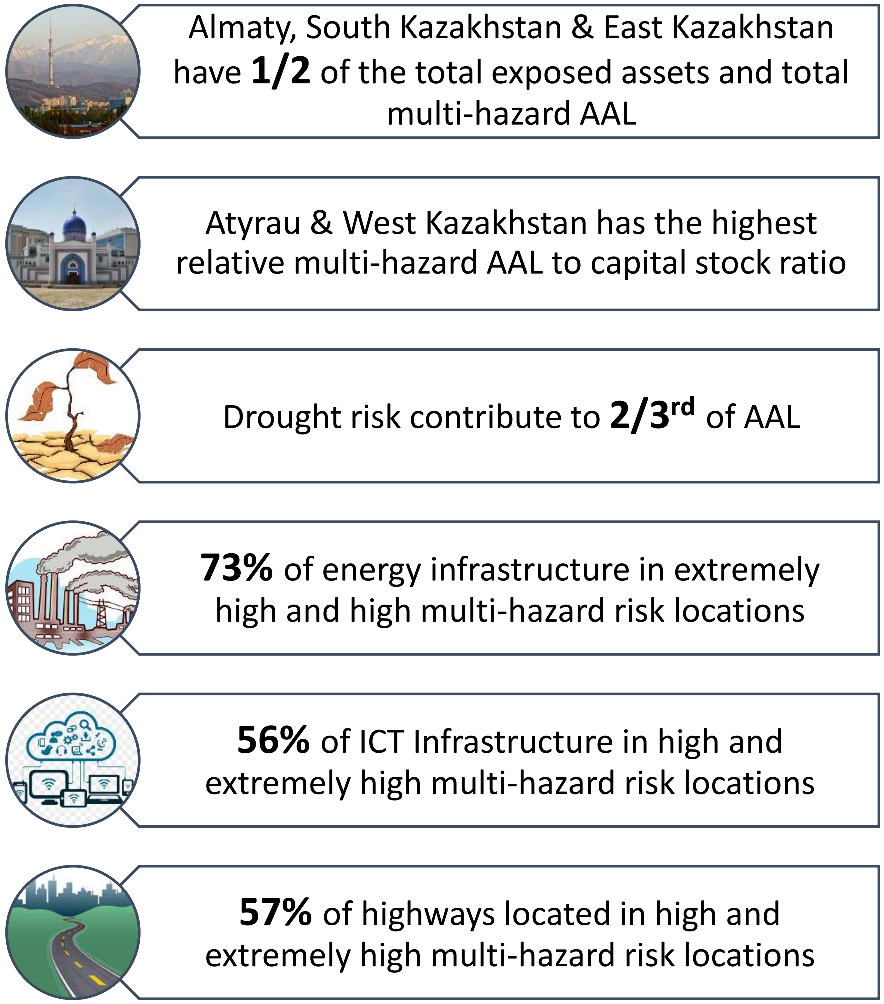
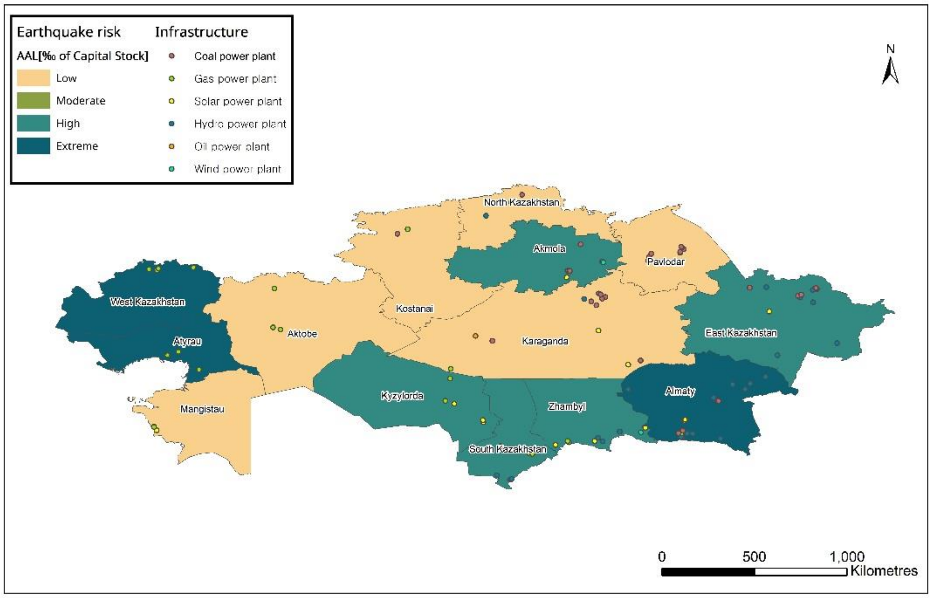


Figure 1: Key results from Multi-Hazard Risks

The total absolute multi-hazard Average Annual Loss (AAL) for Kazakhstan is USD$ 750.46 million, which represents 0.05% of the regional multi-hazard risk. Of this total multi-hazard AAL, 51.61 % is contributed by earthquakes and 48.39 % by riverine floods. The multi-hazard AAL is heavily concentrated in the provinces of Almaty and South Kazakhstan that together account for more than 50% of the total multi-hazard AAL (36.3% and 16.1% respectively), followed by the provinces of East Kazakhstan (13.5%) and Akmola (10.5%).

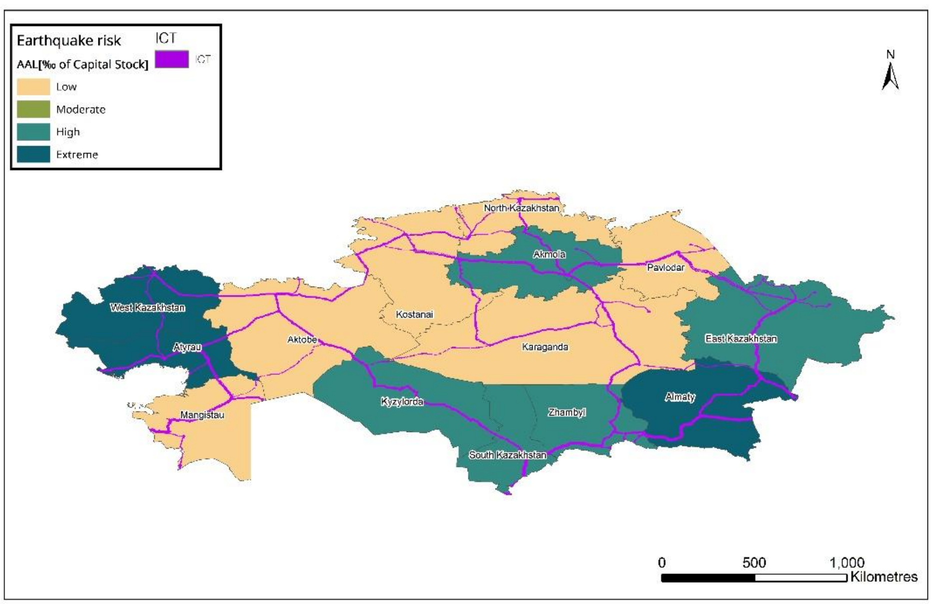
Drought risk estimation was included using a proxy value of 20% of the agricultural GDP, which for Kazakhstan means a drought AAL of USD$ 1390 million, thus increasing the total multi-hazard AAL to $2140 million, which represents 1.34% of the country's GDP. A probabilistic assessment of drought risk has also been done for different crops under RCP 8.5 climate scenario.

Multi-Hazard Risk Maps



Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Map 1: Multi Hazard Risk and Energy Infrastructure



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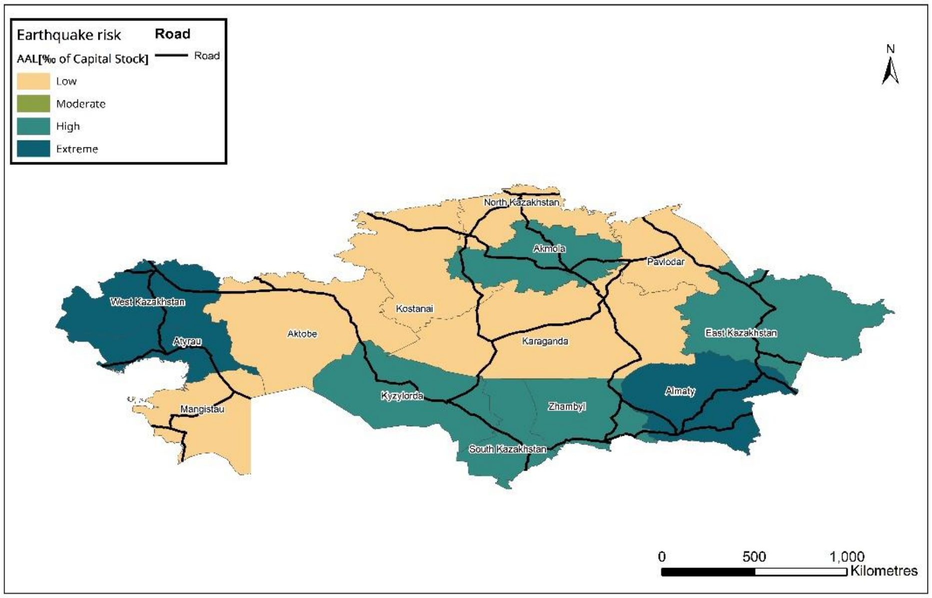
Map 2: Multi-Hazard Risk and ICT Infrastructure



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Map 3: Multi-Hazard Risk and Roads

Earthquake Risk Results

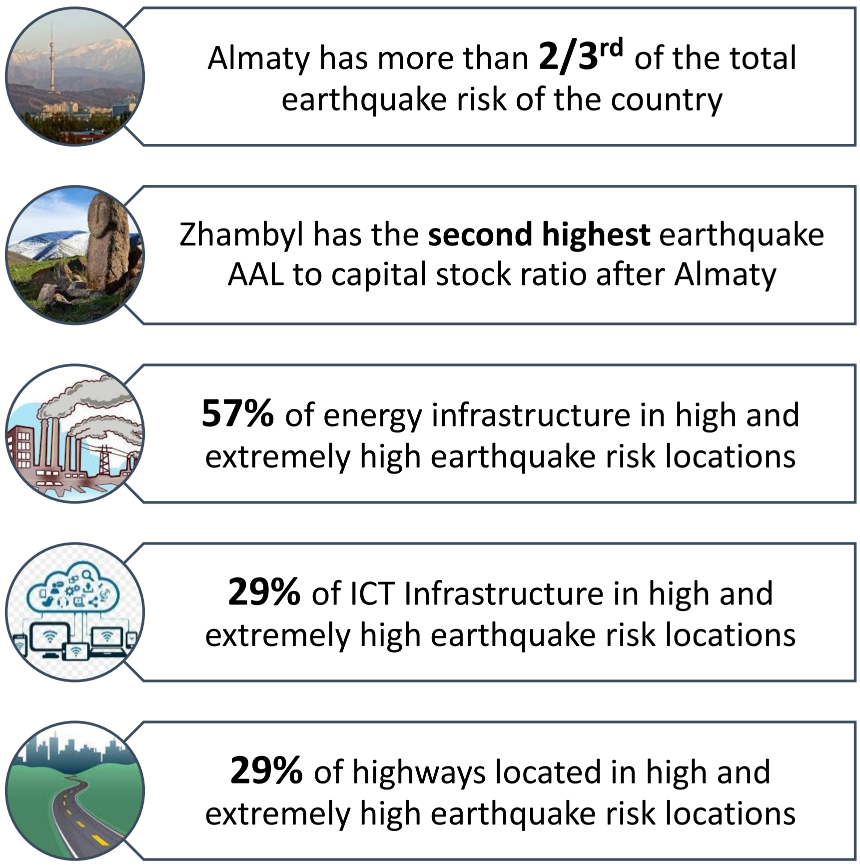
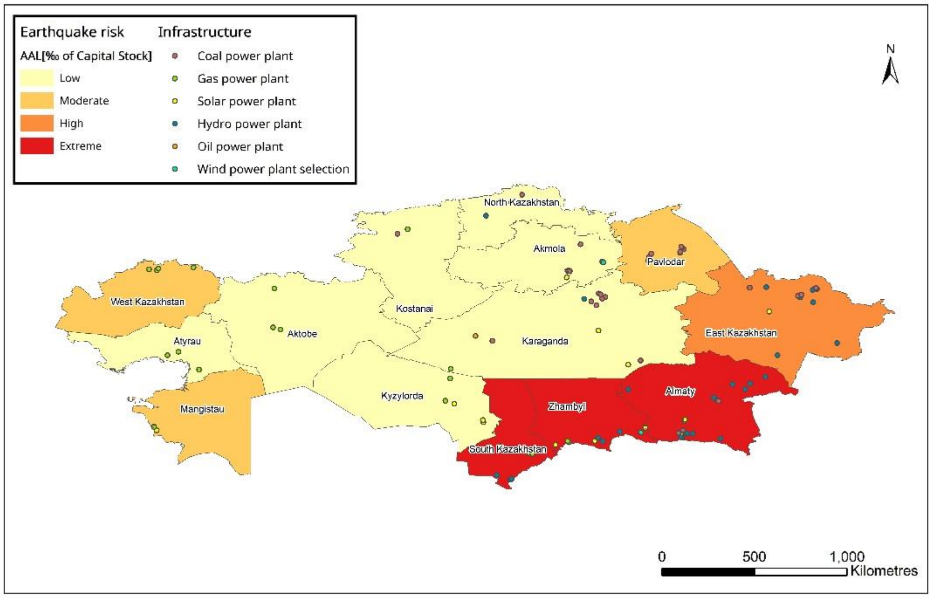


Figure 2: Key results from Earthquake Risks

In terms of earthquake hazard, the province of Almaty has the highest AAL accounting for the 64.5% of the total earthquake AAL. The four provinces of Almaty, South Kazakhstan (18.9%) and East Kazakhstan (7.1%) and Zhambyl (6.9%) have 97.4% of the total earthquake AAL. In relative terms, Almaty is the province with the highest value of AAL to capital stock ratio (1.3‰), followed by Zhambyl (0.8‰) and South Kazakhstan (0.7‰).

Earthquake Risk Maps



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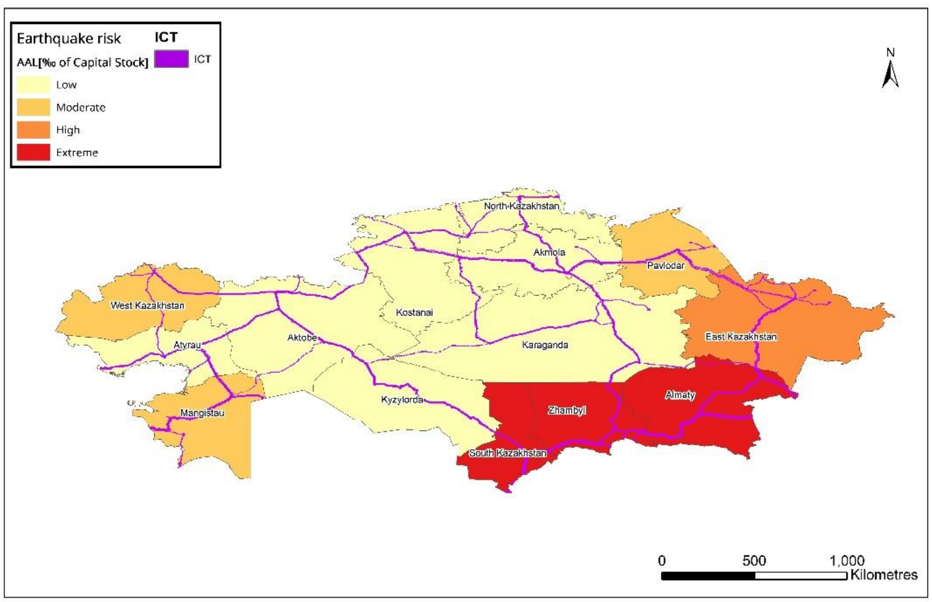
Map 4: Earthquake risk and Energy Infrastructure



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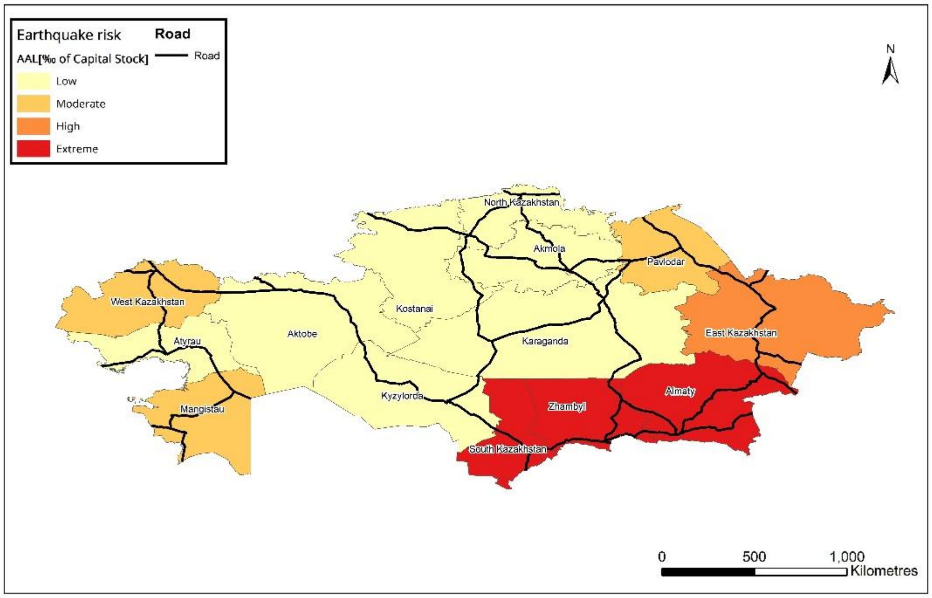
Map 5: Earthquake risk and ICT Infrastructure



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Map 6: Earthquake risk and Roads

Flood Risk Results

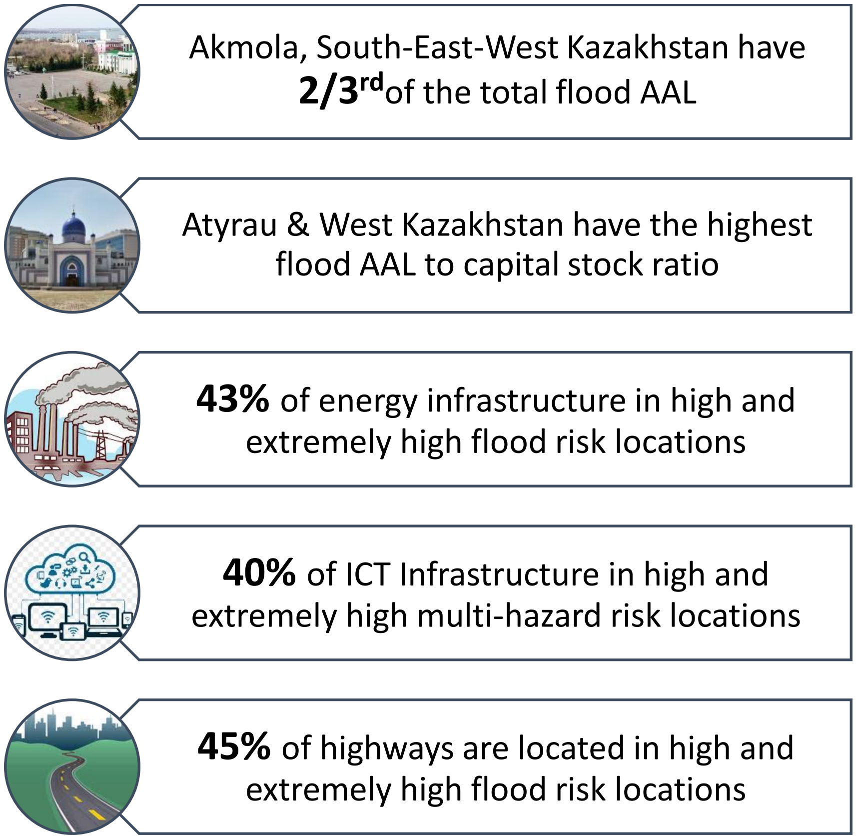
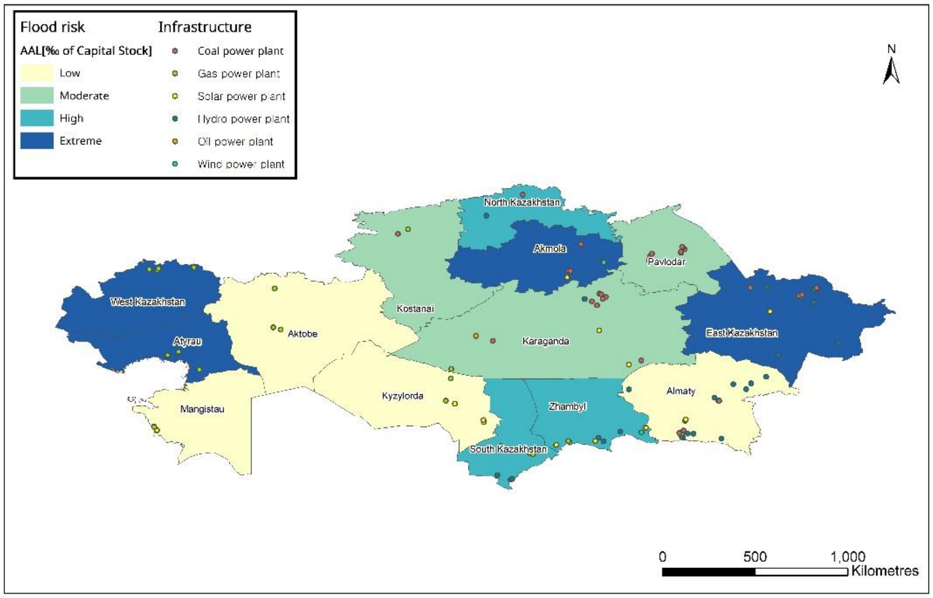


Figure 3: Key Results from Flood Risks

In terms of flood risks, the major part of the flood AALs are concentrated in the provinces of Akmola (21.7%), East Kazakhstan (20.3%), South Kazakhstan (13.1%) and West Kazakhstan (11.1%). However, in relative terms, the higher relative flood risk is in the province of Atyrau, which has a flood AAL to capital stock ratio of 2.00‰, followed by West Kazakhstan (1.84‰) and Akmola (1.08‰).

Flood Risk Maps



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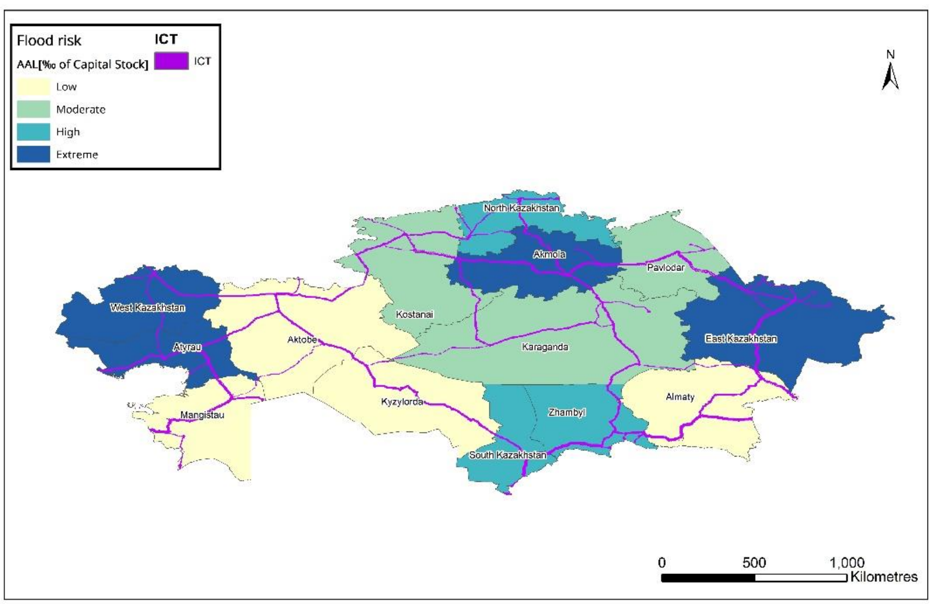
Map 7: Flood Risk and Energy Infrastructure



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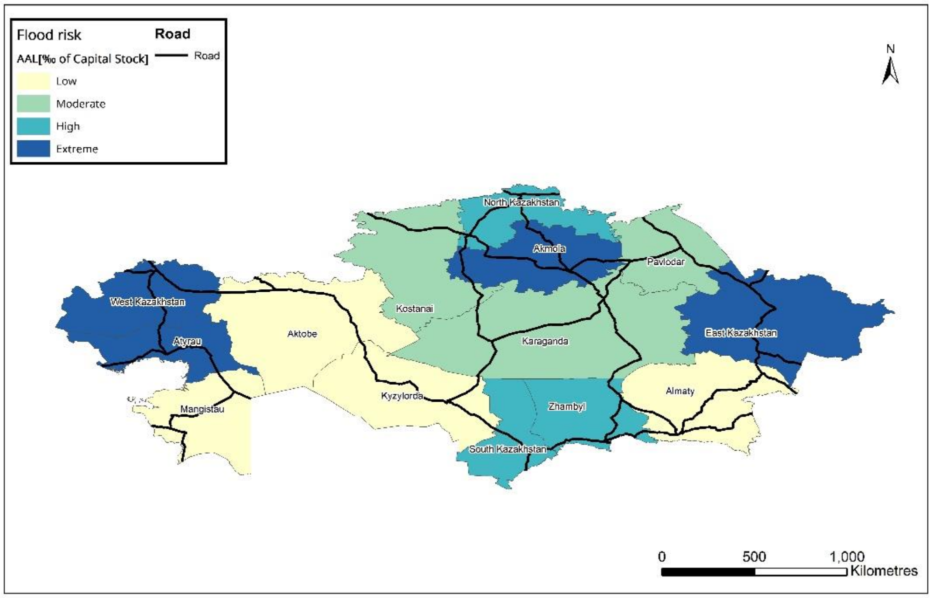
Map 8: Flood Risk and ICT



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Map 9: Flood Risk and Roads

Regional Risk Profile

For the north and central Asia region, the droughts have a significant share in the total multi hazard AALs. This is followed by earthquakes for all countries with the exception of Russian Federation where flood risk losses follow droughts. In the region, about three fourth of the AAL comprises drought related losses. The total multi-hazard risks while including slow onset disasters is the highest for the Russian federation. Russia is followed by Uzbekistan, where the total multi-hazard AAL is about a quarter of the Russian federation. If we exclude the risk from slow onset disasters, the Russian Federation still tops the tally in total multi hazard risks, followed by Kazakhstan, which is again a quarter of the AAL for Russia. Uzbekistan is fourth on this list because about 90% of its AAL is attributed to drought losses.

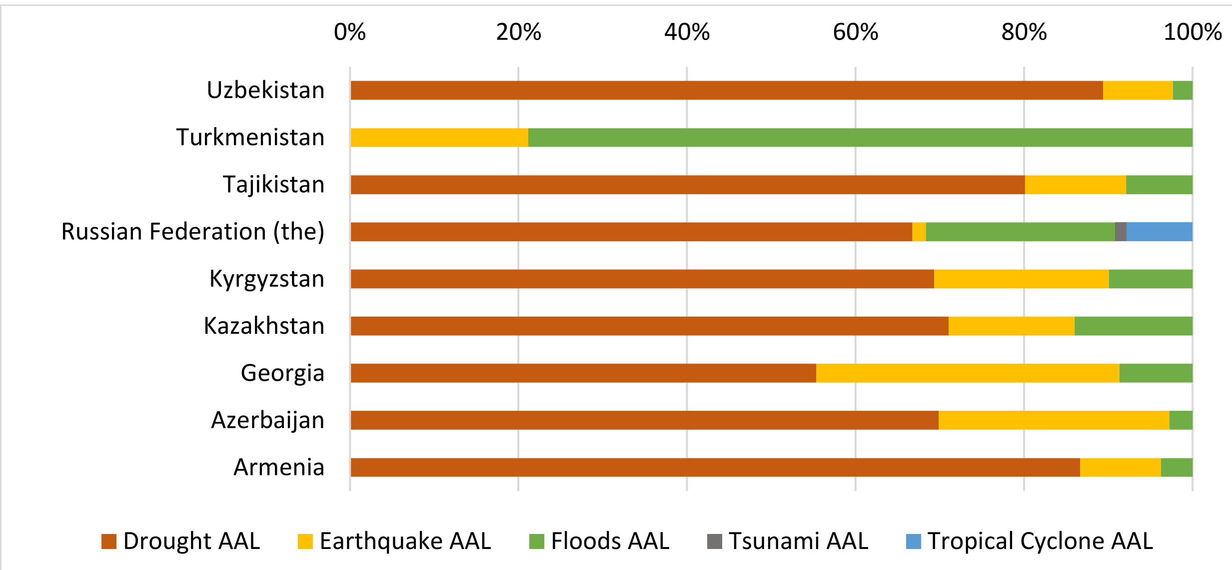

Figure 4: Hazard Disaggregated AAL for North and Central Asia Region

In terms of absolute numbers, the AAL numbers for individual hazards, indirect losses and extensive risks are the highest for the Russian federation. In all cases, the losses for the country next in line ranges from one third to a quarter of losses as projected for Russia. If we compare total multi hazard AAL per capita and total multi-hazard AAL as a percentage of GDP, then Russia and Kazakhstan flair close enough. All countries in the region are close enough with respect to per capita AAL. Tajikistan and Kyrgyz Republic experience the highest total multi-hazard AAL as a percentage of GDP.

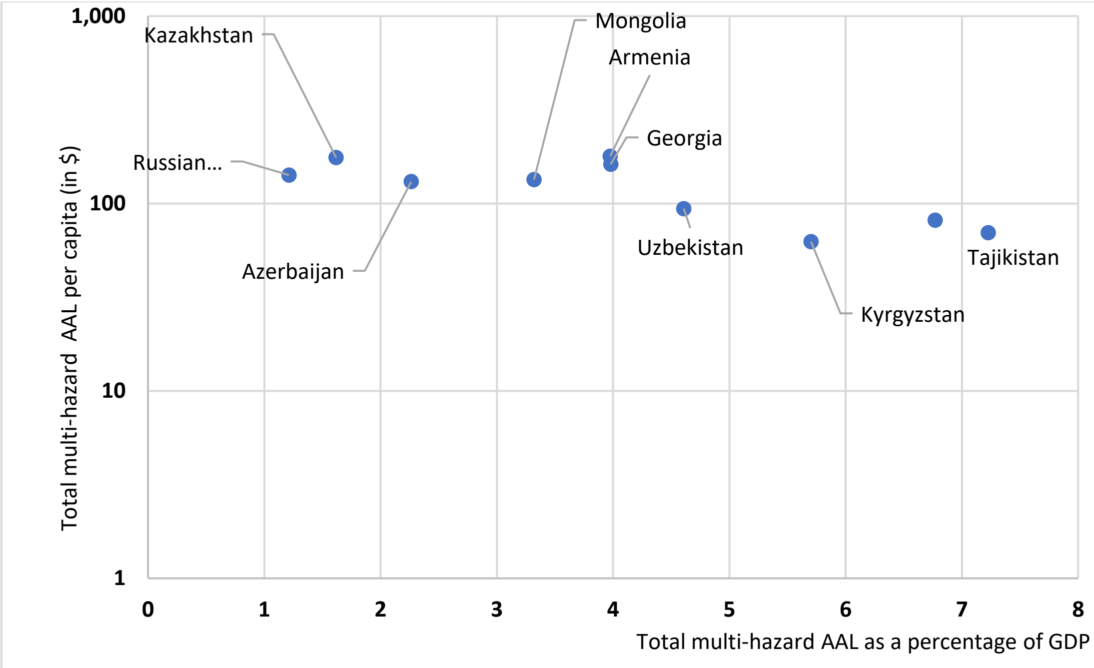

Figure 5: Scatter Plot for North and Central Asia Countries comparing Total AAL per capita and Total AAL as a percentage of GDP

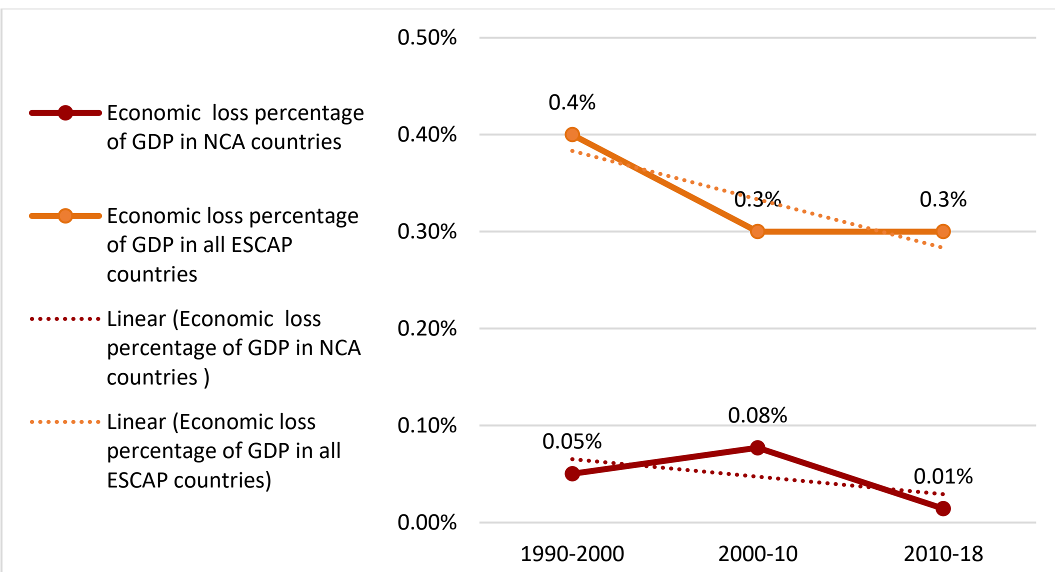

Figure 6: Economic Losses as a percentage of GDP (1990 – 2018) for North and Central Asia vis-à-vis ESCAP Region

Sustainable Development Implications

The Disaster Risk Implications on the Socio-Economic Development of Countries (DRDIi) index examines the opportunity cost of disaster risk on sustainable development. For example, where the AAL represents a high proportion of a countries social expenditure, that country will have difficulties in maintaining or increasing its social expenditure and thus achieving social sector Sustainable Development Goals (SDG). Similarly, countries where the AAL represents a high proportion of capital investment will have difficulty in achieving infrastructure related SDGs.

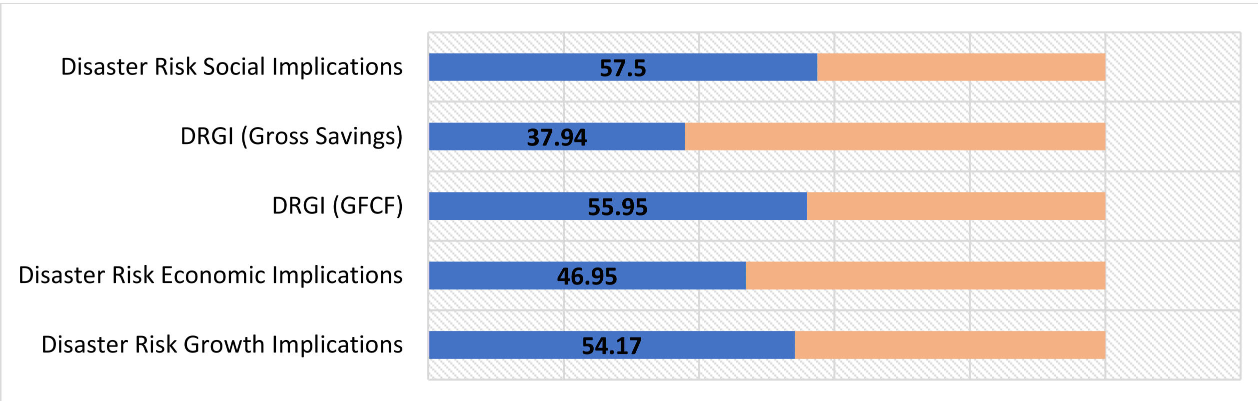

Figure 7: DRDIi values for Kazakhstan

This index attempts to reveal the weight of the AAL on the social expenditure, capital investment and savings (domestic investment), reserves (financial capacity) and the produced capital or capital stock (assets at risk) of each country. It reflects the constraints to sustainable development posed by disaster risk. In the figure above, the values of economic, financial and social implications are very similar for Kazakhstan. Considering the average annual loss of 5.02‰ of capital stock, investment, savings and expenditures would be severely affected if the potential losses were paid every year.

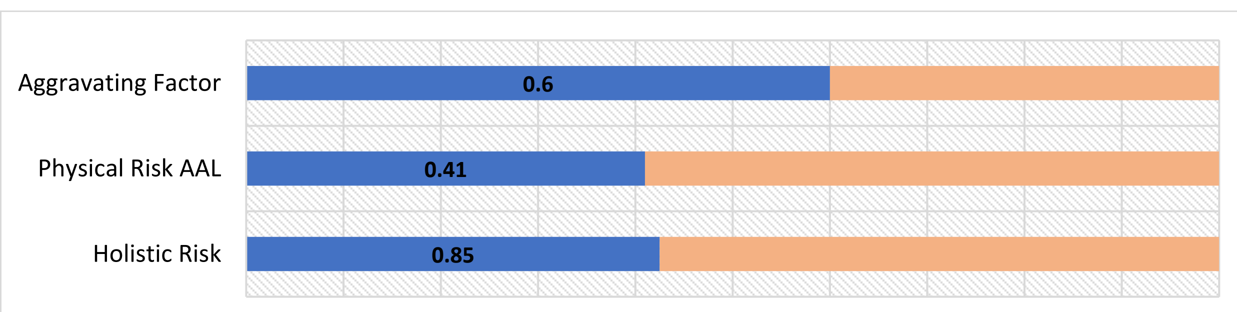

Figure 8: Holistic Risk Values for Kazakhstan

The holistic risk indicator is calculated for each country by capturing how underlying risk drivers or social, economic, environmental factors– (using an aggravating factor, F), which, worsen the current existing physical risk (RF). Fourteen variables were chosen to represent the underlying risk drivers or aggravating factors. These variables are: Internet access, Access to sanitation, Access to improved drinking water, GINI Index, Unemployment, Inflation and Urban growth rate. Indicators of Lack of Resilience are: Gross National Savings, Social expenditure, Governance, Human Development Index, Ecosystems vitality, Paved roads and Infant mortality. The total risk value for Kazakhstan 0.85.