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Building plausible futures: Scenario-based strategic planning of industrial development of Kyrgyzstan

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ABSTRACT

Industrial development is often considered to be a major engine of economic growth. Kyrgyzstan is an open, small, landlocked, developing economy in Central Asia. In 2018 the Government of Kyrgyzstan decided to elaborate a new industrial development strategy that would facilitate economic growth, reduce the country's dependence on foreign financing, and increase the welfare of inhabitants. This paper presents a set of plausible scenarios of industrial development of Kyrgyzstan to 2040. The scenarios were used as a basis for a Strategy for the Sustainable Development of Industry in Kyrgyzstan for 2019–2023, prepared by co-authors of this paper in collaboration with local experts in 2018. This strategy was officially adopted by the Government of Kyrgyzstan in September 2019. To construct scenarios, we used an approach developed by Roland Berger and Leipzig Graduate School of Management (HHL) Center for Strategy and Scenario Planning within the Intuitive Logics scenario planning paradigm. This approach relies on a systematic step-by-step scenario-building process that can be carried out when time and resources are limited. We augmented this approach by revealing and utilizing causal relationships among drivers. We also considered a denser spectrum of scenarios. The outcomes of each scenario-planning step were validated in consultations with local stakeholders. We also designed a monitoring dashboard based on well-established publicly available development indicators. These can help policymakers identify which scenario the system under consideration is tending toward, so that necessary policy interventions can be executed in a timely manner.

1. Introduction

Manufacturing is the engine of growth in many developing countries. There is empirical evidence that the higher the degree of industrialization in a country, then the higher, too, is its income per capita (UNIDO, 2018). Past experience indicates that sustainable economic growth in many countries stems from expansion of the internationally competitive manufacturing sector (UNIDO, 2018). In fact, all historical examples of success in economic development and catch up since 1870 have been associated with successful industrialization (Szirmai, 2008). A major recent example is the experience of the East Asian countries (Szirmai & Verspagen, 2015) which have developed very rapidly in the last 50 years. On the other hand, the example of India in the 1990s shows that service sectors, especially business-related ones such as software development, business services, finance, and tourism, are also drivers of

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development, when the role of manufacturing is in decline (Szirmai & Verspagen, 2015). There is a strong interconnection between services and manufacturing through the input–output structure of the economy, which generates multiplier effects (Ariu et al., 2019). Strengthening the manufacturing–services nexus leads to new opportunities for developing countries because strong backward and forward linkages of many manufacturing industries bring spillovers to other parts of the economy such as business-related services (UNIDO, 2018).

New opportunities for industrial development come from growing globalization, which increases the interconnectedness of countries embedded in complex supply and value chains. Countries also become increasingly interdependent through transnational transport corridors, the exchange of information and knowledge, investments, and migrant flows, among other factors.

Careful strategic planning entails avoiding dead ends and ensuring that short- and medium-term measures are compatible with long-term goals. For example, extensive extraction of coal and using it to generate energy may initially be an economically justified solution for improving the country's energy security, which is crucial for supporting manufacturing development. However, in the longer run, investments in coal-firing capacities will lock the country into a highly carbon-intense and air-polluting activity, preventing it from transitioning to more modern, efficient, and clean energies.

Such a large policy intervention as the introduction of a national-level industrial development strategy will likely lead to societal transformation (Evans, 1995; Kamrava, 2000). It should thus be based on compromise solutions and participatory design (Stiglitz, 2002), involving a broad variety of stakeholders to shape industrial policy development and implementation in the country.

1.1. Background of the case study

Kyrgyzstan, a landlocked mountainous country in the eastern part of the Central Asian region, has a small and open economy, a limited resource base, and a population of slightly over 6 million. It has set ambitious targets to facilitate its industrial development: this should contribute to its growth, reduction in dependency on foreign financing, and increased welfare for its inhabitants. These goals are reflected in the National Development Strategy of the Kyrgyz Republic for 2018–2040 adopted in 2018 (Government of Kyrgyzstan, 2018). The manufacturing sector, which includes agro-industries, textile, leather and machinery production, and a number of other industries, as well as the service sector, is expected to become the engine of growth. At the same time, industrial development–driven growth should include a strong societal component, providing benefits to all regions in the country, and a strong environmental component, preserving the natural heritage of Kyrgyzstan. According to the National Development Strategy, transition to sustainable economic development implies "gradual restoration of natural ecosystems to a level that provides environmental sustainability and at which there is a real possibility for future generations to live while meeting their vital needs and interests" (Government of Kyrgyzstan, 2018, p. 42).

The future of the Kyrgyz Republic is heavily dependent on global and regional geopolitical and geoeconomic processes. The country's reserves of natural resources, notably gold, make it an important part of the global commodity trade network, albeit putting its economy in a vulnerable position due to the volatility of global commodity prices. Kyrgyzstan's geographical location at the crossroads of the People's Republic of China, the Russian Federation, and Europe creates significant potential for trade. The political and economic activity of the Russian Federation and the People's Republic of China in the region, including the expansion of the Eurasian Economic Union (EAEU) and the creation of the Silk Road Economic Belt (SREB) initiative, involves Kyrgyzstan and will shape its economic and social spheres to a large extent (Shaimergenov & Abisheva, 2017; WEF, 2014). The country's vicinity to countries with rapidly growing populations and demands, such as India and Pakistan, offers new export opportunities.

To achieve the sustainable economic development and welfare of the society under the National Development Strategy, it is crucial for Kyrgyzstan to reinvigorate its industrial sector, which virtually eroded after the collapse of the USSR and also, to a large extent, because of the country's highly volatile political situation. Weak and inefficient institutions and a large informal economy amplify the level of uncertainty. Dependence on remittances from labor migrants and development assistance flows from abroad add to the already high level of volatility affecting the prospects of the Kyrgyz economy. Environment and environmental services are becoming a limiting factor of economic development in many developing countries, as human activities challenge the planetary boundaries. Climate change is expected to have a significantly adverse effect on Kyrgyzstan's water resources, which are crucial for the future development of several sectors of the economy, including agriculture and energy. Kyrgyzstan must devise an adaptation policy to cope with the adverse effects of climate change. It must anticipate changes in water availability and predictability, soil quality, and related public health impacts.

Moreover, the interdependencies between food production, energy generation, and water availability, often referred to as the food–water–energy nexus, must be taken into consideration. With growing production due to increasing demand, water will become a limiting factor in terms of defining a feasible extension of cultivated land and the amount of crops the country can grow in relation to the amount of hydropower energy generated or coal produced and converted (Gao et al., 2018). Further development of production can be secured only by deploying newer more efficient technologies, machinery, fertilizers, and qualified human resources. If this is not pursued in a timely manner, the competitiveness of domestic agro-products could decline, leading to an increase in unemployment in rural areas and consequently to rural-to-urban migration or to migration of labor abroad, both of these with adverse consequences for economic growth. Such interconnections within the food–water–energy nexus are just one example of important systemic effects that policymakers must take into consideration when building a strategic plan in the face of an uncertain future.

Kyrgyzstan has to deal with various developmental challenges that are typical for lower-middle-income countries (LMIC). These challenges arise from both general socioeconomic conditions, such as low levels of purchasing power parity, low demand on the domestic market for manufactured products, and also particular issues related to the manufacturing sector, such as difficulties in accessing capital, insufficient labor skills (UNIDO, 2018; WEF, 2018) and incomplete reforms of the general regulatory framework,

including price and foreign trade liberalization, privatization, and deregulation, as well as the presence of non-tariff barriers, which limits development possibilities for industrial enterprises (UNIDO, 2018).

1.2. Addressing the challenges of strategic policy planning

Conventional strategic planning approaches are often forecast-based and assume extrapolation of currently observed trends. However, such approaches can be deficient in complex and highly uncertain environments (Chermack et al., 2001; Varum & Melo, 2010). Strategic planning outcomes can be enhanced by changing the scope of the planning from considering a single future, which is perceived to be the most probable one according to forecasts, to taking into account a number of plausible futures (i.e., scenarios). A plurality of methods for producing scenarios has been developed, with the majority of them attributed to the scenario planning approach (Peterson et al., 2003; Schoemaker, 1995).

Each scenario is a narrative that represents an internally coherent picture of a possible future. Scenario planning usually combines the following features: (i) generation of new ideas —scenarios should be novel and can differ substantially from the present situation; (ii) coverage of an appropriate number and ranges of uncertainties — scenarios should cover a sufficiently rich set of uncertainties and should work with the entire uncertainty space in each case of uncertainty; this is achieved by considering extremes on each uncertainty axis (Ramirez & Wilkinson, 2014), which act as edges/boundaries defining the multi-dimensional uncertainty space (Cairns & Wright, 2018), and, on the other hand, (iii) plausibility and feasibility as well as public acceptance — scenarios should assume at least some consistency between the currently observed trends and future developments.

The World Economic Forum lists the following benefits of using scenarios in a strategic planning process on a large scale (e.g., a country or a geopolitical region [WEF, 2014]): (i) it improves the robustness of a policy or strategy by identifying and challenging the underlying assumptions and established wisdom; (ii) it enables better strategic decision-making by discovering and framing uncertainties, which not only leads to a more informed understanding of the challenges involved in making substantial and irreversible commitments but also contributes to strong and pre-emptive positioning on the part of a government or organization; (iii) it improves the awareness of change by shedding light on the complex interplay of underlying drivers and critical uncertainties and also by enhancing sensitivity to weak and early signals of upcoming significant changes; (iv) it increases the stakeholders' preparedness and agility in coping with unexpected developments by equipping them to visualize possible futures and to mentally rehearse responses; and (v) it fosters mutual understanding and collaborative action by providing different stakeholders with a common language and concepts in a non-threatening context, thereby facilitating dialogue and providing the space to create robust, effective, and innovative strategic options.

Scenario planning has proven to be a useful approach for strategic planning in both the private and public sectors and is used by government planners, corporate managers, and military analysts as a powerful tool to aid decision-making in the face of deep uncertainty (Leitner et al., 2018). Scenarios can help decision-makers build a robust strategy that shows reasonable performance across different operational environments (Lempert et al., 2006; Vilkkumaa et al., 2018). Scenario planning has been applied in foresight studies focusing on the Central Asian region in several other analyses (Shaimergenov & Abisheva, 2017; WEF, 2014). However, the application of scenario planning is often more challenging in the public than the private sector, and methods used for corporate planning may need to be improved if they are to be suitable for policy design (Kharrazi & Kakuwa, 2017a). Scenarios explicitly addressing industrial development challenges are lacking at the national level (cf. scenarios at the level of the firm [Phadnis et al., 2014] and at the industry level [Lavikka et al., 2018]) and so too are established methodological foundations for producing such scenarios. Once developed, such scenarios together with their underlying methodology can inform further studies on plausible industrial development, driven by the demand to achieve inclusive and sustainable development worldwide (UNIDO, 2017).

This paper contributes to the scenario planning literature by describing a scenario-based strategic planning approach to the long-term industrial development of a country. We present a participatory scenario planning framework based on the conventional Intuitive Logics (IL) paradigm (Cairns & Wright, 2018; Wright & Cairns, 2011); this accounts for the many uncertainties that complicate strategic planning, provides directions to policymakers on developing a robust industrial development strategy, and supplies them with a situation-monitoring toolkit. This framework makes use of stakeholder engagement, which allows the inclusion of a broad variety of views and visions about the development of the industrial sector as well as providing insights to different stakeholder groups into the importance of various industrial policy interventions. Using this framework, we produced six plausible futures of industrial development of Kyrgyzstan until 2040.

Our research has been informed by a diagnostic study conducted by UNIDO (UNIDO, 2018), a comprehensive review of strategic documents from Kyrgyzstan, an analysis of data from a number of national and international databases, in-depth interviews conducted with key stakeholders in Kyrgyzstan, extensive stakeholder engagement processes in the country, including formation of a critical stakeholder group, and four roundtable discussions in the regions of Bishkek, Osh, Karakol, and Jalal-Abad held in May and July 2018.

The scenario planning study underlying this paper was conducted as part of the project dedicated to producing an industrial development strategy for Kyrgyzstan until 2040. The formulation of the strategy itself is, however, beyond the scope of this paper.

The rest of the paper has the following structure. Section 2 describes the scenario planning method that was used, and outlines the process via which it was applied to the case study. In Section 3, we present the results of the scenario planning activity, six plausible futures of industrial development of Kyrgyzstan, and indicators enabling their development to be monitored. In Section 4 there is a discussion about the benefits and limitations of the method applied, the policy implications of the study, and conclusions.

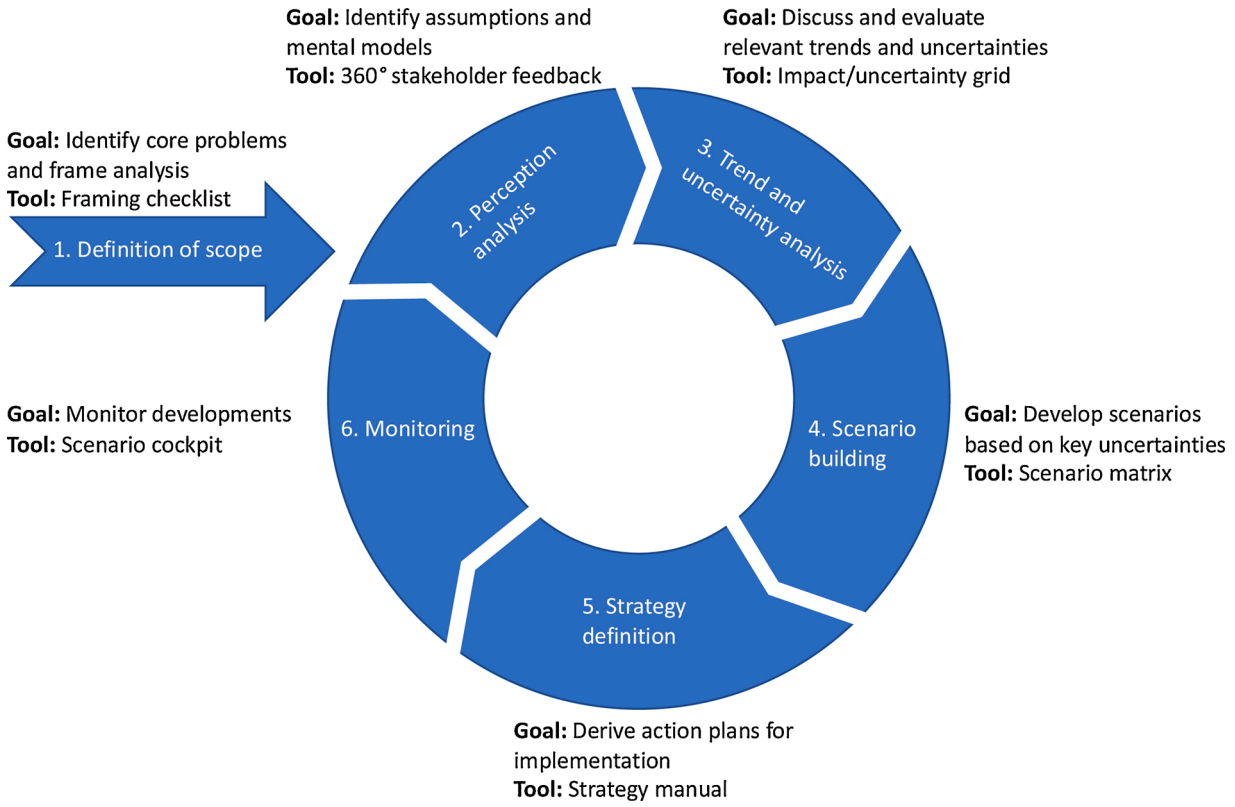

Fig. 1. Scenario planning process steps. Reproduced from (Brands et al., 2013).

2. Methodology: scenario planning

2.1. A brief overview of existing paradigms

"Scenario planning" is an umbrella term for several approaches that differ both in their goals and in their design process. However, all these approaches share a common objective, that is, of producing a set of plausible futures for the development of the system under consideration. Three main scenario planning paradigms are usually distinguished in the literature (Bradfield et al., 2005; Huss & Honton, 1987): (i) *Intuitive Logics*, pioneered by Shell and General Electric, which uses qualitative methods to produce scenarios and to evaluate the performance of strategies against them (Jungermann & Thüring, 1987; Wack, 1985; van der Heijden, Bradfield, Burt, Cairns, & Wright, 2002); (ii) *Probabilistic Modified Trends,* which develops scenarios using subjective probability estimates regarding the manifestation of extraordinary events elicited from experts, complemented by Trend-impact analysis (TIA) and Cross-impact analysis (CIA) (Gordon, 1994); and (iii) *La Prospective*, developed in France and based on morphological methods and specially designed software, which can be regarded as an elaborate, complex, and somewhat mechanistic combination of the intuitive logics and probabilistic modified trend approaches (Godet, 2000, 2001). In practice, scenario planning case studies often combine elements of the different paradigms.

Another typology considers objectives of the scenario planning process, most often distinguishing scenarios into (i) predictive — aiming to forecast the future, and often relying on the continuity of historic and currently observed trends; (ii) normative — focusing on determining a desired state of the system in the future and the pathways leading to it from the current situation; and (iii) explorative — which neither determines a desired future nor aims at exact forecasts, but rather outlines plausible alternatives of how this future might look and concentrates on uncertainties having a driving role in the system (Börjeson et al., 2006). This classification is also non-mutually exclusive; in reality, a scenario planning study can combine several types of scenarios.

2.2. Scenario-based strategic planning

Based on the goals of this case study and available resources, we have chosen to use the Intuitive Logics paradigm to develop explorative scenarios. The Intuitive Logics paradigm enables an enhanced understanding of causal processes, connections, and logical sequences of underlying events, thus revealing how the system under consideration may unfold in the future (Wright et al., 2013). It is a group-process-based approach (Wright et al., 2019) which allows incorporation of the expertise of the participating stakeholders (McBride et al., 2017), for example, through surveys and workshops. Explorative scenarios are powerful when the system under

consideration is subject to rapid and irregular changes and the mechanisms leading to changes in its state are not fully known. Explorative scenarios are useful when fairly good knowledge about the present state of the system is available (in our case due to a large body of existing diagnostic studies and access to the stakeholders) but the consequences of alternative developments need to be explored (Börjeson et al., 2006). A distinctive feature of such an approach is that the exact probabilities of how the scenarios materialize do not need to be defined (all are assumed to be plausible) and there is no single desired future preset.

There is no single commonly accepted guideline or best practice for applying this approach; instead, numerous implementations have been executed (Bradfield et al., 2005). It is argued that scenarios should satisfy the criteria of transparency, completeness, relevance, creativity, consistency, differentiation, and plausibility (Amer et al., 2013) to be sufficiently credible to be used by decision-makers in a policy planning process.

To construct plausible scenarios of the economic and industrial development of Kyrgyzstan until 2040, we relied on one particular implementation of the Intuitive Logics paradigm, "scenario-based strategic planning" (Brands et al., 2013; Wulf et al., 2013), a method developed by the Roland Berger and Leipzig Graduate School of Management (HHL) Center for Strategy and Scenario Planning. The scenario-based strategic planning approach is a structured process with standardized frameworks for its application and consists of six consecutive steps, outlined in Fig. 1 (Brands et al., 2013). It makes the scenario planning process systematic and, at the same time, decreases the amount of time required to build scenarios. This approach also addresses the challenges of increasing volatility, rapid change, and the complexity of the planning environment by integrating different stakeholders into the planning process and allowing for different outcomes (Wulf et al., 2013); this minimizes the limitations of the intuitive logic paradigm observed and recognized in its other implementations (Wright et al., 2013), and makes the resultant scenarios achieve the abovementioned criteria.

While we used the scenario-based strategic planning approach as a basis, we further augmented it to address the specific challenges of our case study. Additional efforts were made regarding the identification of causal links between different drivers using causal loop diagrams (systems maps). Several recent studies suggest that the Intuitive Logic approach could be augmented to address causality between factors and drivers in a comprehensive way (Derbyshire & Wright, 2017; MacKay & Stoyanova, 2017). We used systems mapping both (i) to systematically reduce the number of the initially identified factors and cluster them for further impact and uncertainty assessment and (ii) to build the skeletons of the scenario narratives (Wright et al., 2019). Systems thinking is often considered to be a cornerstone of scenario planning (van der Heijden et al., 2002v; Chermack, 2011); systems mapping is a powerful tool to implement systems thinking in practice (Haraldsson, 2004). Systems maps enable a better understanding of the logic and the feedback structure behind the future scenarios and can thus ultimately improve the quality of decision-making (van Oorschot, 2016v).

To incorporate a higher-than-typical number of critical uncertainties, an extended scenario matrix was created, which ultimately led us to produce six scenarios. Most scholars and practitioners develop, and advocate using, no more than four scenarios (which are often created using a 2×2 scenario matrix) — a larger number is considered to be difficult for stakeholders to digest (van der Heijden, 2005v; Chermack, 2011). A number lower than four is sometimes used; however, many experts point to the drawbacks of such an approach. For example, two scenarios tend to represent "good "and "bad" future alternatives. If a third scenario is added to the best and worst cases, it will tend to depict an "optimal" scenario in between them (Chermack, 2011). Despite these drawbacks, some prominent organizations consistently use two scenarios (e.g., Shell) or three (e.g., World Economic Forum). The "classic" number of four also comes in for criticism. For example, some argue that using a 2×2 scenario matrix may lead to excessively polarized thinking and limit the exploration of the uncertainty space to only two drivers represented by the matrix axes (McBride et al., 2017). Some authors assert that up to six scenarios may be appropriate (Amer et al., 2013), while others employ a higher-dimensional matrix (e.g., 3×3) to produce four scenarios (Rueda-Sabater & Derosby, 2011). According to (Dammers et al., 2019), having so many scenarios can help meet the needs of many different target groups, as each group can find a scenario that represents its own expectations or ambitions. This can be important if complex negotiations are to take place.

In our case study, we created an extended 5×2 matrix (i.e., the number of drivers by the number of their extreme values) to enable a denser coverage of the uncertainty space. We then filtered six plausible scenarios out of 32 possible combinations, using morphological analysis (Johansen, 2018). Examples of studies that have developed more than four scenarios include at the regional level (Bertrand et al., 1999; European Commission, 2017) and (Raskin et al., 2002; Shell, 1973) at the global level. The latter two studies, similar to our approach, suggested six scenarios and presented them in clusters.

Because of the pressing schedule and limited resources of the scenario planning team, identification of weak signals and blind spots were excluded from the study. Although these are considered to be a useful aspect of the original methodology (Meissner et al., 2017), they are not prerequisites for identifying the drivers and building scenario narratives and can thus be omitted. Furthermore, due to the high number of scenarios obtained and the broad set of policy areas under consideration, we did not use the Strategy Manual framework, as suggested by the authors of the original approach.

Notably, scenario-based strategic planning goes beyond the sketching of plausible futures of the considered system and suggests, as the last step in the process, the development of a proper monitoring toolkit. Such planning aims to track changes in the recognized trends and drivers and to identify the actual scenario path that the system is following. The attachment of appropriate quantifiable indicators to qualitative scenarios increases their plausibility and facilitates the timely observation of developments as they happen (Wulf et al., 2012). This also helps to improve the outcomes of a strategic planning process, especially when it takes place at a high level of complexity and uncertainty, which is the case for a national long-term strategy of industrial development.

An indicator should be useful for the precise tracking of the developing situation and enable rapid policy responses, for example, to divert the system away from moving toward an undesirable scenario, once the very first signs of that are spotted. An appropriate indicator can be often selected from a manifold of existing indices produced by reputable organizations (e.g., United Nations Sustainable Development Goals [SDG] Indicators, World Economic Forum [WEF] Competitiveness Index, etc.). However, for some deeply uncertain factors, a ready-to-use quantitative indicator may not be available. In that case, a suitable composite indicator or even a

qualitative measure may have to be used.

In the next section, we detail the implementation of each step of the scenario-based strategic planning approach and its outcomes in our case study.

2.3. Six steps toward a development strategy for the industrial sector in Kyrgyzstan

Step 1. Definition of scope. To devise the scenario-building process, we used the *Framing Checklist* framework (Brands et al., 2013). This allows the scope of the study and the key stakeholders to be identified and frames the entire analysis.

The goal of the study was to develop realistic scenarios of the industrial development of Kyrgyzstan to inform an industrial development strategy for the country. The strategic analysis was conducted at a national level. We considered the country of Kyrgyzstan, including its population, natural resource base, political and administrative systems, multiple economic sectors, etc., as the system under examination and subject to external forces. Both the transactional (e.g., political and legislative system of Kyrgyzstan) and the contextual (e.g., geopolitical situation, state of the world economy) environments (Ramírez & Wilkinson, 2016) were examined. Our study considered the time horizon until 2040 with an additional focus on the short-term horizon until 2023. We focused on building explorative (descriptive) scenarios (Börjeson et al., 2006), namely, plausible future alternatives under which the suggested policy options, that are designed to reach the desired goal, would be "wind-tunneled" (van der Heijden et al., 2002v; Chermack, 2011).

The core research team consisted of seven researchers from the International Institute for Applied Systems Analysis (IIASA) and three experts from the State Committee for Industry, Energy and Subsoil Use of the Kyrgyz Republic, coordinated by a project manager from United Nations Industrial Development Organization (UNIDO). The study involved numerous local stakeholders and experts from Kyrgyzstan. A Critical Stakeholder Group which comprised representatives of ministries, academia, the business sector, and civil society — including so-called "remarkable people" (van der Heijden et al., 2002v) — was formed by the State Committee of Energy, Minerals and Subsoil Use of the Kyrgyz Republic. The goal of this Group was to provide input to the strategy of sustainable industrial development engaging with, among others, the Deputy Minister of Economy of the Kyrgyz Republic, the Deputy Chairman of the State Committee of Industry, Energy and Subsoil Use of the Kyrgyz Republic (SCIESU), as well as experts from various Kyrgyz ministries: Ministry of Education, Ministry of Finance, Department of International Organizations and Security of the Ministry of Foreign Affairs, Department of Food Security and Agromarketing of the Ministry of Agriculture, Food Industry and Melioration, and Food Industry (MAFIM), National Statistical Committee, Chamber of Commerce and Industry, National Institute for Strategic Studies (NISS), Agency for Promotion and Protection of Investments, Center for Climate Financing, and local and international UNIDO experts.

Step 2. Perception analysis. We began the actual scenario-building process with the identification of the key factors of influence likely to shape the industrial development of Kyrgyzstan in the perspective to 2040. This step aimed to elicit the experts' point of view on the crucial features of the socioeconomic system of Kyrgyzstan as well as the external forces that could have a significant impact on the country's development trajectory in the future. These factors were collated and evaluated using a two-stage *360°Stakeholder Feedback* framework (Brands et al., 2013). During the first stage, a survey was administered in person, by telephone, or via the Internet to collate factors of influence.[1] To ensure a diversity of opinions and to minimize possible biases, experts from Kyrgyzstan and international specialists with relevant backgrounds were approached. They were asked to list the influencing factors according to the PESTEL (Political, Economic, Societal, Technological, Environmental, Technological and Legal) framework (Oxford College of Marketing, 2018).

The collated factors were validated and then complemented with an analysis of strategic documents developed by Kyrgyzstan government authorities, research papers, and media sources, etc. Altogether, we reviewed around 212 various strategic documents, including strategies, roadmaps, action plans, etc., produced for Kyrgyzstan by international and national organizations. The factors of influence were also reviewed by the Critical Stakeholders Group.

The factors were further added to through extensive stakeholder processes which included roundtable discussions with key stakeholders in the industrial policymaking process in Kyrgyzstan. Four roundtables in various Kyrgyz regions were organized, including Bishkek, Issyk-Kul, Jalal-Abad, and Osh. Each roundtable lasted a full day and included 15–20 participants, comprising the major key stakeholders from the provincial government, from private sector enterprises active in the region, and representative of academia and civil society. In this way, we were able to benefit from local stakeholders' knowledge and expertise to initiate the co-design process.

A total of approximately 250 factors were identified. Similar and congruent factors were then aggregated by the research team, giving a final output of 75 factors. The full list is presented in Appendix A (Table A1).

In the second stage of the framework, another expert survey was launched to assess the impact and manifestation uncertainty of the final 75 factors. For each factor, the experts were asked to rate

- its impact on the industrial development of Kyrgyzstan (1 – weakest impact; 10 – strongest impact); and
- the certainty/uncertainty of its manifestation (1 – most certain; 10 – most uncertain)

on time horizons until 2023 and 2040.

[1] The main survey used is available at https://goo.gl/forms/fkH4OcYpu2RiQsGi1. An identical version in Russian was also used.

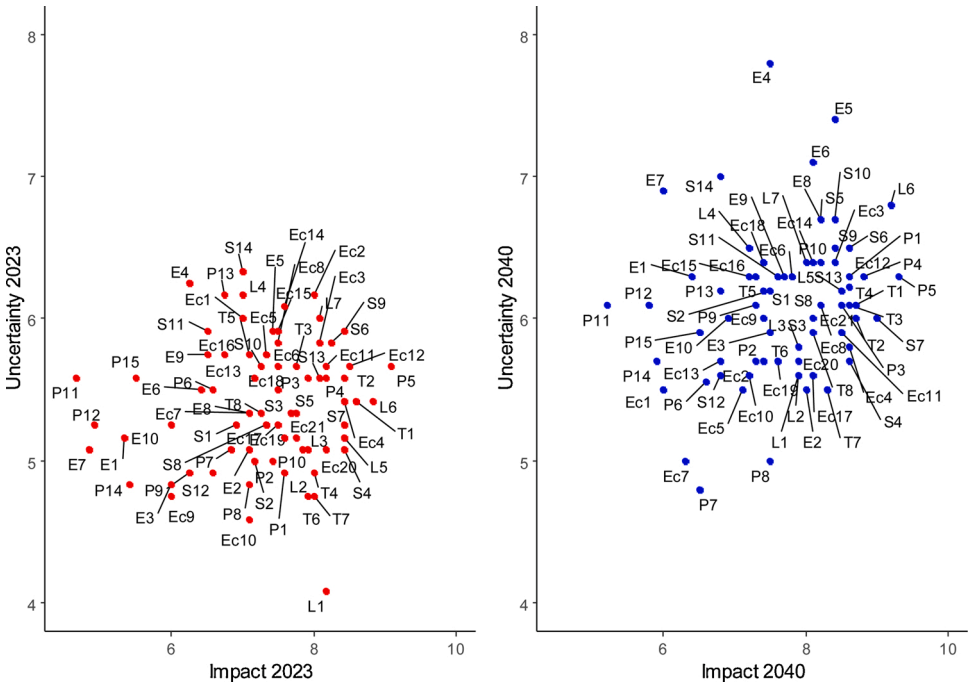

Fig. 2. Impact-Uncertainty Grid: average impact (on the industrial development of Kyrgyzstan; 1 – weakest impact; 10 – strongest impact) and uncertainty (of manifestation; 1 – most certain; 10 – most uncertain) values of 75 factors of industrial development of Kyrgyzstan based on expert surveys. The axis ranges are truncated to magnify the representation.

Step 3. Trend and uncertainty analysis. The survey results obtained were further averaged and presented on the *Impact-Uncertainty Grid* (Brands et al., 2013) (Fig. 2).

Based on these data and a model suggested by Brands et al. (2013), the so-called secondary elements (Brands et al., 2013) were first identified. Secondary elements are factors located in the left part of the axes, that is, those with a lower impact on the industrial development of Kyrgyzstan, as perceived by the experts, with the perceived uncertainty not being considered in this case. Overall, 19 factors (25 % of all the collated factors) were classified as secondary elements and excluded from further analysis. Nevertheless, this does not mean that they were irrelevant to industrial development of Kyrgyzstan in general, but rather that they were evaluated as less important on the target time horizon compared with the other factors.

However, a clear distinction between trends and critical uncertainties, as prescribed by the Impact-Uncertainty Grid framework, was not possible. Therefore, the number of factors was subsequently reduced by clustering them into larger groups based on both generalization and the causal dependences identified by the research team (Wright & Goodwin, 2009). For this purpose, an *Influence Diagram* (Brands et al., 2013) was designed. First, causal links between the remaining 56 factors were identified using the Participatory Systems Mapping method (Sedlacko et al., 2014). Second, on the basis of causality and similarity of impact, 15 clusters of factors and the causal links between them were identified and analyzed (Fig. 3).

Five of the 15 clusters of factors obtained were identified as *key uncertainties* (or *drivers*) based on their degree of centrality in the obtained network (Fig. 3) of factor clusters. All five drivers represent the internal features of Kyrgyzstan; however, major external developments have different outcomes in different scenarios that principally affect the internal drivers. This reflects the fact that the Kyrgyz economy is currently heavily dependent on the influence of external forces.

For each of the five drivers, aggregate polar (opposite) values were identified by the members of the research team (Fig. 4).

Step 4. Scenario building. The *Scenario Matrix* framework (Brands et al., 2013) for five identified drivers may produce as many as 32 scenarios, which would be not feasible for further analysis and would be difficult for stakeholders to grasp. Thus, additional filtering was needed in order to produce a reasonably sized set of plausible scenarios. All possible combinations of the drivers' polarities were carefully examined in terms of their plausibility and consistency. This step was conducted similarly to the Cross Consistency Assessment (Johansen, 2018) in a morphological analysis approach (Ritchey, 2011), that is, we systematically assessed the consistency of each of the possible 32 combinations of the drivers' extreme values. The original Cross Consistency Assessment, however, usually implies more values for each of the drivers that need not be polar (Johansen, 2018). To decrease possible individual bias in selecting plausible combinations, an independent cross-check by two members of the research team was conducted. Ultimately, six combinations of drivers' polarities were recognized as plausible and embraced six scenarios summarized in the extended Scenario Matrix (Fig. 5).

For each of these combinations, an instance of the Influence Diagram was updated with suitable values for each factor cluster (Table 1). Based on these instances of the Influence Diagram and supporting materials (strategic documents, related research [for

Fig. 3. Influence Diagram of 15 factor clusters. Arrows between two clusters denote a significant impact or causality between source and destination clusters. Double lines denote a mutual significant impact or causality.

example, WEF, 2014; Shaimergenov & Abisheva, 2017], interviews with experts, media, etc.), narratives for the scenarios were created. The names for the scenarios were chosen in order to highlight their essence (e.g., a strong or weak central power) and were named symbolically after different types of buildings (see below).

Step 5. Strategy definition. The ultimate goal of the project was to design a national industrial development strategy. The strategic priorities determined by the National Development Strategy of the Kyrgyz Republic for 2018–2040 (Government of Kyrgyzstan, 2018) were considered through the lens of the explorative (descriptive) scenarios produced, and a set of policies was outlined to steer the industrial development toward the established objectives, that is, achieving sustainable economic development and welfare of the society. The policy set suggested consists of core policies that should be implemented, whatever scenario develops and scenario-dependent measures that should be applied only if the system is evidently developing toward a certain scenario. These policies were discussed at the highest level (Supreme Council of the Kyrgyz Republic, 2018) and are summarized elsewhere (Komendantova et al., 2018a; Komendantova et al., 2018b). Ultimately, they formed the basis of the Strategy for Sustainable Development of Industry of Kyrgyzstan for 2019–2023 prepared by the State Committee for Industry, Energy and Subsoil Use of the Kyrgyz Republic and approved by the Kyrgyz Government in September 2019 (The State Committee for Industry Energy & Subsoil Use

Fig. 4. Key drivers of the industrial development of Kyrgyzstan and their polar values.

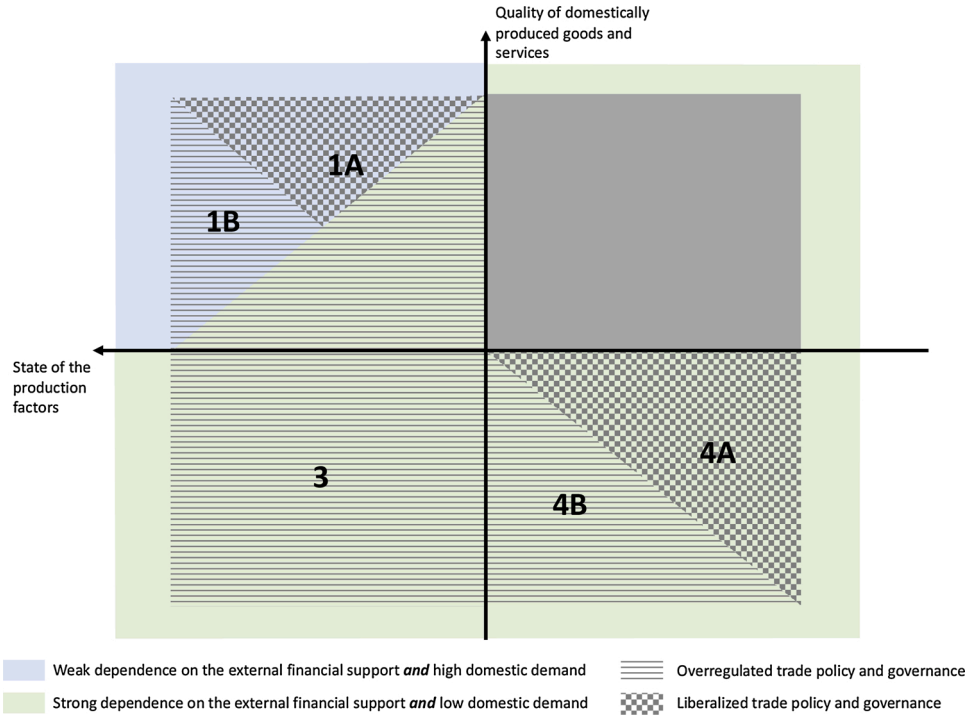

Fig. 5. Extended Scenario Matrix. Areas with different color patterns denote different scenarios.

of the Kyrgyz Republic, 2019). The process of formulating the exact implementable actions of the strategy is currently under way. Hence, the outcomes of this step are not presented in this paper.

Step 6. Monitoring. Once the suggested scenarios and policies were accepted by the stakeholders, monitoring indicators were developed to allow early recognition of a certain scenario development happening in reality. For this purpose, the *Scenario Cockpit* tool (Brands et al., 2013) was used. First, based on the Influence Diagram (Fig. 3) and analysis of ready-to-use indicators, an indicator was suggested for each of the five drivers. Second, for each scenario and each driver, a threshold value for the corresponding indicator was

Table 1
Important groups of factors shaping the industrial development of Kyrgyzstan and their developments in different scenarios. Groups of factors in **bold** are identified as major drivers, namely, the scenario dimensions.

Industrialization level	High			Low		
Scenarios	1A. Modern yurt	1B. Khagan's fortress	2. Assembly shop	3. Sandcastle	4A. Falling tower	4B. Abandoned palace
Key drivers						
Quality of domestically produced goods and services	high	high	high	low	low	low
State of the production factors	developed	developed	developed	developed	under-developed	under-developed
Trade policy and governmental regulation of the economy	liberalization	advanced autocracy	overregulation	overregulation	liberalization	overregulation
Dependence on external financial support	no dependence	weak	strong	strong	strong	strong
Domestic demand	high	high	low	low	low	low
Other uncertainties						
Integration with the EAEU	active member, regulations convergence	EAEU expansion. Integration deepening	administrative barriers	administrative barriers	EAEU provides support	EAEU provides support
Educational attainment and quality	increasing	increasing	stays as current	stays as current	stays as current	stays as current
Emergent technologies' proliferation	increasing	slightly increasing	increasing	increasing	stays as current	stays as current
Labor force supply	improving	improving	slightly improving	stays as current	stays as current	stays as current
Quality of institutions and governance	improving	slightly improving	stays as current	stays as current	stays as current	stays as current
Cooperation with the Central Asian countries	actively developing	moderately developing	stagnating	border tensions	stagnating	stagnating
State of the natural resource base	decreasing importance	decreasing importance; nationalization	good climatic conditions, water, and arable land availability	climate change impact, water shortages	severe climatic change, natural disasters	severe climatic change, natural disasters
State of the rule of law	increasing	slightly increasing (corruption risks persist	slightly increasing	slightly increasing	decreasing	stays as current
Social tension level	low	low	elevated	moderate	elevated	moderate
Economic and political situation in major partner countries	China dominates India and Pakistan develop. Geopolitics turns into geo-economics	China develops the SREB initiative	Japan and China import technologies and open plants in Kyrgyzstan	Competition for influence in Central Asia. China develops the SREB initiative	Political instability in neighboring countries	External forces try to exploit Kyrgyz natural resources. Geopolitics dominates geo-economics

selected based on analysis of the available indicator values for other countries (e.g., the World median value for an indicator; in some cases, where a driver was assumed not to take a polar value in one of the scenarios, but rather an intermediate one, the lower and upper threshold values were identified. A comparison of the observed indicator values with these thresholds can reveal the scenario path closest to reality and thus provide a justification for implementing policies that are scenario-dependent in the policy portfolio that is developed (see Step 5). To enable the participating stakeholders to quickly grasp the framework, a "traffic light" representation (Brands et al., 2013) was used.

The narratives of the scenarios are presented further in Section 3.1 while the developed indicators are presented in Section 3.2.

3. Results

3.1. Scenarios of industrial development of Kyrgyzstan

To distinguish among the scenarios and to symbolize their essence, we named them after different types of buildings:

- “Modern yurt” (1A)
- “Khagan’s fortress” (1B)
- “Assembly shop” (2)
- “Sandcastle” (3)
- “Falling tower” (4A)
- “Abandoned palace” (4B).

Notably, these scenarios are neither unconditionally negative nor unconditionally positive. The realization of each scenario depends both on external forces and on decisions of local stakeholders. Scenarios 1A, 1B, and 2 imply a high level of industrial development, while Scenarios 3, 4A, and 4B suggest a relatively low level of industrial development.

3.1.1. Scenario 1A. Modern yurt

Kyrgyzstan enjoys rapid economic growth and a massive liberalization of the economy and trade. The quality of domestically produced goods and services ensures their competitiveness in regional and global markets; Kyrgyz industry has become embedded in international supply and value chains facilitated by the trade and transport infrastructure that has been built. Production is export-oriented with multiplier effects serving to improve the performance of other sectors in the country as well as the welfare of the population, which eventually stimulates domestic demand. Kyrgyzstan has overcome its dependence on external financial support and has become a high-income country.

Geopolitics turns into geo-economics worldwide. Kyrgyzstan, too, has experienced a transformative change of political elite. A new generation of reformers and technocrats educated in the framework of New Keynesian Economics has come to power.

Various forms of economic integration and cooperation among countries proliferate globally. Kyrgyzstan is an active member of the EAEU (Eurasian Economic Union) and of a number of other arrangements at various levels of commitment, ensuring win–win cooperation opportunities. The EAEU membership has triggered export growth first to its member countries, and then also to third countries. This is thanks to the enhanced trade cooperation between the EAEU and a number of its key trade partners through tariff reductions and gradual convergence of standards.

National political, business, and intellectual elites cooperate to build up the prosperity of the Kyrgyz nation and to integrate the country into the global economy. The rule of law is commonly practiced, the informal sector of the economy has been substantially reduced, and the corruption level has decreased significantly due to affirmative actions on the part of the government and the change in mentality of the new generation of stakeholders.

Kyrgyzstan, as a part of the Central Asia region, has become a “Eurasian gate” for China, which has achieved a dominant position in the global economic hierarchy, and for other Asian countries (e.g., India, Pakistan), which have become considerable economic powers. Transport-logistical infrastructure plays a key role, developed with the assistance of partners, notably, China, Russia, and the European Union (EU). Through this, new supply chains emerge, and the overland trade in Eurasia has increased substantially overall, notably between the EU and major Asian economies. The connectivity in the region has thus been increasing, and Kyrgyzstan is able to benefit from its transit position to become a major hub supporting the trade flows between Europe and Asia.

Massive investment from the development partners has poured into Kyrgyzstan, also bringing the transfer of technologies and modern international practices; most of its capital is foreign-owned; transnational corporations have set up branches here. The technological gap between Kyrgyzstan and developed countries has significantly reduced. Foreign investments are targeted at, inter alia, the development of innovative and green technologies including renewable power sources (i.e., hydroelectric power plants, solar and wind power). Kyrgyz energy is exported to neighboring countries and to South Asia.

The national economy is significantly diversified, and the traditional reliance on raw materials has gradually declined. The country is strongly embedded in regional and global value and supply chains. Notably, the cooperation with other Central Asia countries has been enhanced, in particular, in terms of joint infrastructure projects and in the energy field. As the country produces more goods and services with higher value-added, more jobs have been created and labor migration has been reduced; remittances are no longer a noticeable source of income for the country. Importantly, the government focuses on the essential role of human capital and has developed the education system to produce skilled professionals in the fields needed for the economy. The "dual" education system, in which students can acquire practical hands-on skills while studying, has been introduced. It delivers professionals satisfying the increased demand for skilled labor in major economic sectors.

Economic growth, in turn, supports the political stability of the country, improves the welfare of the population, and helps reduce poverty. Domestic consumption increases and a broad middle class starts to emerge. The liberal economic policy stimulates a rapid development of small to medium-sized enterprises (SMEs) in the light industry, services, and tourism sector. The political-economic regime can be defined as *liberal region-integrationism?)*

3.1.2. Scenario 1B: Khagan’s fortress

Kyrgyzstan enjoys growth under a strongly centralized power model. The quality of domestically produced goods and services is ensured by strict governmental control in the spirit of "advanced autocracy." The Kyrgyz economy has reached a decent level of self-sufficiency; the commodities that are not produced domestically are imported mainly from the EAEU and from Central Asian neighbors. Kyrgyzstan has overcome its dependence on external financial support and has become a high-income country.

The country has continued to follow the model of strong centralized power. The ruling elite appreciates the importance of industrial development as a basis for economic growth. In their efforts to enhance growth, they refrain from experimenting with political and economic modernization, preferring to rely on traditional economic development models, in which growth is first ensured by natural resource exploitation, before a progression takes place to higher value-added activities. The political stability increases the investment

attractiveness of the country, but corruption remains. As the major economic agents are mainly from the same region, they are familiar with these practices and can also embed themselves in this system.

Kyrgyzstan follows a pragmatic approach, engaging in regional cooperation arrangements that it sees as fitting its strategic goals. These include the Commonwealth of Independent States (CIS), the Shanghai Cooperation Organization (SCO), as well as China's SREB initiative. Its membership of the EAEU plays a crucial role; the EAEU itself has expanded and now includes other Central Asian countries (Tajikistan, Uzbekistan) and other Asian countries (e.g., Vietnam). The EAEU has also deepened its integration level and essentially has become the "Eurasian Union" mimicking the EU model; it has also adopted a common currency the "Eurasion."

The Kyrgyz economy has reached an adequate level of self-sufficiency; commodities which are not produced domestically are imported mainly from the EAEU and Central Asian neighbors.

The role of the state in the national economy is essential. The Kumtor gold mine has been nationalized, which substantially increases its contribution to the state budget; moreover, light industry and the food processing industries make a major contribution to the economy. supplying both the domestic market and the EAEU and partners' markets. However, the overregulation of the market and the absence of free competition may lead to unequal growth.

The government conducts a dedicated social policy, in which it redistributes the state revenues to society to support the public sector, reduce inequality, and eliminate poverty. Such a policy reinforces the formation of the middle-income working class which generates basic domestic demand. This policy also enhances social cohesion and reduces the incentives for emigration.

Environmental quality is not regarded as a great concern by the Government; the green economy is not a priority. Climate change effects are moderate. Local communities and environmentalist NGOs are consulted, but they do not have much power.

3.1.3. Scenario 2: assembly shop

Kyrgyzstan has become an assembly shop/raw materials appendage for richer countries. International investors (mainly Chinese) have been attracted to several sectors, including gold mining, automobile industry, and food processing. The production base has been modernized, and the quality of domestically produced goods and services is high. As investors brought workers, technologies, and inputs, the Kyrgyz economy has not been able to benefit from multiplier effects. The economy remains overregulated. Inequalities among the population are increasing; overall national welfare remains low. Domestic demand is low, and dependence on external financial support continues to exist.

The government is stable; its belief in the importance of a strongly centralized power structure for the country's prosperity is consistent. The ruling elite has been able to attract foreign investors, mainly from China and other Asian countries. Several contacts reactivate idle industrial plants, including those that manufacture machinery and equipment, and create new ones with the assistance of foreign donors.

Kyrgyzstan has not been able to take advantage of membership of the EAEU, as Kyrgyz goods remain discriminated against through non-tariff (administrative) barriers. Rapidly developing Southeast Asian countries are seeking cheap assembly lines and are ready to invest in the manufacturing sector of Kyrgyzstan. New technologies are imported from Japan and South Korea. However, the professional educational programs for the local population are not developed, and Kyrgyz people mainly occupy low-skilled positions. Workers at plants receive low wages. High-skilled labor is imported from abroad. In the gold mining and production sectors, concession agreements have been concluded with foreign investors. Reciprocally, the government has been able to negotiate deals with international donors to acquire cheap long-term loans, which it uses mainly for social purposes and to develop the transport and trade infrastructure. Some of the plants are owned by local oligarchs. The state's budget is small and has a significant deficit. Taxes and various levies grow as the government attempts to increase the national income. However, this leads to lower revenue, as a large share of SMEs stays in the shadow zone.

Foreign investments boost coal mining, coal-based energy generation, oil refinery, and hydropower electricity. Kyrgyzstan exports energy and electricity to its neighbors. These developments have aggravated air pollution in the cities, which negatively affects public health and causes economic losses.

Relatively good climatic conditions and water availability favor agricultural activities. There are large agro-holdings and small, mainly family-based, farms. Agro-holdings use modern foreign irrigation technologies and production lines; they produce selected food products that are exported to the EAEU and other regional markets. As the production is largely automated, they do not need much labor. The rural population is mainly involved in small farms and for the most part uses primitive technologies to grow crops and cultivate livestock to produce food for domestic consumption. As small producers cannot ensure competitive efficiency, cheaper products are, in many cases, imported from the EAEU.

The income inequality, low social guarantees, and prevalent regulatory and administrative barriers dampen the social mood, and many people choose to emigrate.

3.1.4. Scenario 3: sandcastle

Global superpowers compete for influence over the Central Asian region, as it connects Asia and Europe overland, plays a role in the global security, and has some important natural resources, which are becoming scarce as a result of the ever-growing global population. Foreign donors invest heavily in the country, but the country cannot take advantage of it. The economy remains overregulated. The production base has been modernized, but in the absence of skilled managers and an overall national development strategy, the quality of domestically produced goods and services remains poor. Oligarchs and high-level politicians personally benefit from foreign aid; inequality is extreme, and most of the population is in poverty. Domestic demand is low, and the dependence on external financial support continues.

The country has reached political stability, and the government is able to serve at least one full term of office. External borrowings are vital for this stability; the government negotiates loans from external donors, for example, the Russian-Kyrgyz Development Fund and the International Monetary Fund (IMF). Public debt has reached 150 % of annual GDP. Corruption and inefficient institutions are

barriers to the development of SMEs and to improved quality standards in manufacturing.

China is interested in improving the transport infrastructure in Kyrgyzstan to use it as a part of its SREB initiative and is ready to invest in it. However, transport corridors do not become development corridors. At the same time, despite common markets, the EAEU countries apply protectionist policies and subsidize their own producers; Kazakhstan continues to impose non-tariff barriers for Kyrgyz agricultural products. These limit the opportunities for Kyrgyzstan to take advantage of its EAEU membership. Border tensions with neighboring Central Asian countries (e.g., over shared water resources) do not allow the markets to be extended in these directions. Large investments and foreign aid have allowed manufacturing to be modernized and energy generation developed, notably, green energy using hydropower. Kyrgyzstan exports electricity to the EAEU.

Climate change causes significant water shortages, and even recently imported modern technologies do not permit agricultural production to be increased. Energy generation by HPSs is also unstable, and enterprises face electricity shortages.

These developments increase unemployment. A significant share of the population is stuck below the poverty line. Due to a lack of quality professional education and unattractiveness of the domestic job situation, emigration continues. Remittances are a vital source of income for people. Domestic demand remains low, and the export potential of the manufactured goods is hindered by their insufficient quality and by competition on the open EAEU market.

3.1.5. Scenario 4A: falling tower

Massive liberalization reforms have not delivered sustainable economic growth; the economy is reliant on natural resource extraction and is essentially stagnating. The production base has aged, and the quality of domestically produced goods and services is low. The population is poor, domestic demand and consumption are low. International donors continue to provide substantial financial support, which saves the country from bankruptcy.

The ruling elites, though convinced that liberalization is the key to growth, have been unable to establish appropriate institutions and conduct other reforms needed for the country to participate in global and regional supply and value chains, and thereby benefit from the open economy. Governments replace one another every year, the race for power continues and undermines the trust in the state. Kyrgyzstan suffers from the natural resource curse; the population lives on income from the extraction of resources, notably gold, but state revenues are low.

Neighboring countries also suffer from political instability, poor governance, and the stagnation of the economy. Illegal economic operations, crime, and illegal migration are widespread in the region. The shadow and informal economy rate reach as high as 50 %. Kyrgyzstan experiences a massive brain drain, losing much of its human capital.

The Government would like to develop the service and tourism sectors as a viable alternative to industrial development, as these sectors have a higher return on investment. However, the lack of an entrepreneurial culture prevents this. The infrastructure and production base has aged and has not been modernized. Due to the plethora of various risks and uncertainties, few entrepreneurs are ready to commit to long-term investments in the agricultural or manufacturing sectors. All the attempts to attract transnational corporations and international investors to the country have failed; the country ranks very low in terms of credit risks and business opportunities. Manufactured goods are of low quality and do not comply with international standards; they are mainly sold on the domestic market or in neighboring countries bypassing customs control. Farmers use primitive technologies to grow crops; extensive agriculture leads to soil and water degradation. Petty-commodity production and small firm sizes mean that the advantages of economies of scale cannot be used.

Climate change is severe. Increased droughts, floods and heatwaves further depreciate public and private capital, and force people to migrate. People are poor and often protest against the current power structure. Minimal living standards are maintained due to international aid and remittances.

3.1.6. Scenario 4B: abandoned palace

Strongly centralized power has been unable to adapt to modern conditions and trends. A massive global financial crisis has shrunk world financial resources, and international donors are not willing to invest in a country with an outdated political system. The economy, which is reliant on natural resource extraction, is essentially stagnating. The production base has aged, and the quality of domestically produced goods and services is low. The population is poor, and domestic demand and consumption are low. The EAEU provides some support; together with a large flow of remittances, this helps the population from falling into extreme poverty.

The political system has stabilized; the bureaucratic system has become bloated, and business and other spheres of life are regulated by numerous, often ambivalent, rules and laws. The government dominates the economy, owning or co-owning major resources and enterprises. In the absence of competition and transparency, the quality of governance is poor. Overregulation hampers efficiency and threatens international investment.

Geopolitics dominates geo-economics in the region. External forces, such as China, Russia, and the United States (USA) use political and societal instability to their own benefit and try to conclude agreements for natural resource use that are not in the best interests of Kyrgyzstan. The government is unable to negotiate joint infrastructure projects and beneficial trade agreements with neighboring Central Asian countries.

Kyrgyzstan suffers from the natural resource curse; the population lives on the income generated by resource extraction, notably of gold. All attempts to revive the industry remain declarative, and outdated methods are still being tried. The state revenues are used to maintain the large bureaucratic system, leaving few resources for investment in the modernization of infrastructure and the production base. Consequently, the latter have aged; manufactured goods are of low quality and do not comply with international standards; they are mainly sold domestically or to regional markets. The failure to implement necessary transformations through the joint efforts of stakeholders at all levels prevents recovery of the country from economic fragility and increases its exposure to external shocks.

Table 2
Scenario cockpit framework representation. For each driver, a range of values of the attached quantitative indicator is defined, indicating development toward a certain scenario. The latest reported values are presented for reference.

Level of industrialization			High			Low			Latest observed value (year)
Scenarios			1A. Modern yurt	1B. Khagan's fortress	2. Assembly shop	3. Sandcastle	4A. Falling tower	4B. Abandoned palace	
Factors	Indicators	Source							
Dependence on the external financial support	Net official development assistance (ODA) received, % of Gross national income (GNI)	(World Bank, 2018b)	*<1 %*	***1-6 %***	**>6 %**	**>6 %**	**>6 %**	**>6 %**	6.3 % (2017)
Domestic demand	Households and Non-profit institutions serving households (NPISHs) final consumption expenditure, % of GDP	(World Bank, 2018b)	>58 %	>58 %	<58 %	<58 %	<58 %	<58 %	83 % (2018)
Quality of domestically produced goods and services	Local supplier quality, index	(WEF, 2018)	*4.4–7*	*4.4–7*	*4.4–7*	**1-4.3**	**1–4.3**	**1-4.3**	3.94 (2017)
Trade policy and governmental regulation of the economy	Burden of government regulation, index	(WEF, 2018)	*4–7*	***3.4-4***	**1-3.3**	**1-3.3**	4–7	**1-3.3**	3.31 (2017)
State of the production factors	Production process sophistication, index	(WEF, 2018)	*3.6–7*	*3.6–7*	*3.6–7*	*3.6–7*	**1–3.5**	**1-3.5**	2.98 (2017)

Climate change is severe; increased droughts, floods, and heatwaves further depreciate public and private capital, and make people migrate. People are poor; minimal living standards are maintained due to aid from the EAEU and remittances.

3.2. *Indicators of development*

For monitoring real-world dynamics, a Scenario Cockpit instance was created. As explained in Section 2.2 (Step 6), a quantitative indicator from a reputable database (World Bank World Development Indicators (World Bank, 2018a) or World Economic Forum Global Competitiveness Index (WEF, 2018)) was attached to each of the drivers and a threshold value (or in some cases, lower and upper threshold values) were estimated (Table 2). If the observed values of the indicators fell in the defined range for each scenario, then its development, in reality, can be anticipated, and the corresponding policy measures should be implemented.

4. Conclusions and discussion

In this paper, we presented an augmented scenario-based strategic planning approach and used it to develop scenarios for the industrial development of Kyrgyzstan until 2040. We produced six different scenario narratives based on the development drivers identified and on plausible combinations of their polar values. The drivers were selected based on expert surveys and a literature analysis, followed by impact-uncertainty analysis and identification of causal links between them. To ensure the rigor of the scenario-based strategic planning process, the outcomes of each step were validated by a dedicated group of stakeholders.

Scenario narratives serve to delineate the uncertainty space and highlight feedback loops to help policymakers understand the major challenges Kyrgyzstan will face in the coming decades. However, real development is likely to combine features of different scenarios (Strelkovskii et al., 2018) or it may happen that another future, not covered by the present scenarios, takes place. At the scenario building step (Section 2.2, Step 4) such developments were considered implausible but not, however, impossible, which goes along with a general scenario building paradigm (note grey area in the upper-right quadrant of the extended Scenario Matrix, Fig. 5).

The approach used is constructed to be illustrative rather than predictive and is usually reported as having a robust performance (Mercer, 1997). It is best used to test strategic management options in the medium and long term to see how stable are these options in different environments. Scenarios developed using this method typically cover a time frame of 5–20 years (Wright et al., 2013; Wulf et al., 2012).

Typically, a scenario-based strategic planning process generates four distinct scenarios for an area of interest; it places a major uncertain factor influencing the future of the object of the study on each of the two axes that intersect to form four quadrants. The factors chosen for the axes should have high impact and, at the same time, high uncertainty to ensure that all four alternatives defined by their intersection are clearly differentiated. These alternatives are then developed into script narratives, reflecting the impact of other events and trends in addition to those represented on the two axes. An extended scenario matrix, as suggested in our study, allows more than two dimensions to be introduced (in our case, five); however, as the number of possible alternatives grows exponentially,

Table 3
Correspondence of scenarios developed in this paper to existing global and regional scenarios.

Scenarios of industrial development of Kyrgyzstan	Global scenarios (Raskin et al., 2002)	Plausible scenarios of the Central Asian region development (Shaimergenov & Abisheva, 2017)
1A "Modern yurt"	New sustainability paradigm	Golden Age 2.0
1B "Khagan's fortress"	Policy Reform	Thriving autocracy
2 "Assembly shop"	Market forces[a]	N/A
3 "Sandcastle"	Fortress World	N/A
4A "Falling tower"	Breakdown	N/A
4B "Abandoned palace"	N/A	New Middle Age
N/A	Eco-communalism	N/A

[a] The "Assembly shop" scenario assumes preferable environmental conditions, while the Market forces scenario assumes deteriorating conditions. Other scenario features are, however, similar.

filtering out implausible combinations is often required (cf. the World Economic Forum scenarios often consider only three out of four possible alternatives in a two-dimensional scenario matrix, discarding the fourth one as implausible (WEF, 2014)). Thus, we have found a reasonable balance between covering the multi-dimensional uncertainty space and keeping the number of scenarios low enough to be analyzed by the scenario team and grasped by participating stakeholders. Similar to (Raskin et al., 2002) who consider three global scenarios, each split into two branches, we also consider two pairs of scenarios (1A /1B and 4A/4B) as being close to each other, which is reflected in their labels.

The ultimate goal of scenario-based strategic planning is, in our case, to formulate the industrial development strategy. The strategy comprises a list of recommendations in certain policy areas and sectors (Komendantova et al., 2018b). The recommendations are informed by the set of long-term scenarios representing possible paths of Kyrgyzstan's future industrial and economic development. Namely, these are the recommendations that emerge in all scenarios, and they constitute the core strategy that should be implemented whichever scenario is developing (Wulf et al., 2013). This is complemented by scenario-dependent recommendation packages, which should be activated only when a certain scenario development is being steadily observed. Although a relatively dense scenario set (six scenarios instead of the typical four) makes the process of developing such packages technically more challenging, incorporating multiple uncertainty axes does allow the creation of a comprehensive set of packages covering several policy areas relevant for industrial development.

Careful implementation of the policies elaborated is crucial to ensure resilient industrial development of the country. The implementation plan of the strategy is currently under development.

The monitoring phase closes the continuous loop of the scenario-based strategic planning approach. It helps to determine which strategic options would be timely in implementation terms, depending on the state of the environment. It also enables assessment of the validity and plausibility of the scenarios, and it can indicate if the scenarios need to be updated (Wulf et al., 2010). Nevertheless, even if indicators are attached to the relevant drivers to observe their development, it can be challenging to come up with the relevant measures at the relevant time. The indicators are usually published by the corresponding institutions with a delay (of about 1–2 years), which creates a potential lag in a policy intervention that could otherwise mitigate the development of a negative scenario or catalyze the development of a positive scenario. The possible high volatility of the indicators (especially when the indicator frequently crosses the defined thresholds) presents an additional challenge. As the existing literature does not provide clear guidance on addressing such issues, policymakers should rely on their experience and intuition. Observation of additional indicators attached to uncertainties other than key drivers (Table 1) can also be useful for faster identification of an actually developing scenario path. However, taking into account the number of scenarios, the Scenario Cockpit could become too cumbersome, in this case, to navigate in. While several external drivers (e.g., climate change and the politics of neighboring countries and the big players) undoubtedly have an influence on the development of Kyrgyzstan — as reflected on the systems map (Fig. 3) — we believe that the suggested indicators do, in fact, include the impact of these external drivers on Kyrgyzstan.

The applied methodology received positive feedback from the involved stakeholders. Among other questions, they requested a justification for the choice of methodology in comparison to other existing approaches. This is quite typical for scenario planning projects as "there are almost as many ways of developing scenarios as there are practitioners in the field" (Bradfield et al., 2005, p. 800). The participatory element of the approach received especially positive feedback.

Our scenarios echo some scenarios proposed in other studies, for example, some of the global scenarios developed by (Raskin et al., 2002) and scenarios of the Central Asian region development (Shaimergenov & Abisheva, 2017). Approximate matching is provided in Table 3.

Our study also partially shares some of the drivers with (Raskin et al., 2002), for example, "state of the production factors" and "technology," "social tension level" vs "conflict," and with (Shaimergenov & Abisheva, 2017), for example, "trade policy and government regulation of the economy"vs "political life development." We argue, however, that the scenarios developed in this paper are individually crafted to suit the required objectives, for example, by embodying specific drivers (e.g., dependence on external financial support) and narrative lines (e.g., political and economic processes in the EAEU). This was achieved by careful co-design with the local stakeholders and international experts.

The stakeholders criticized two aspects of the study: the perception of some scenarios as being negative and the names of the scenarios. The stakeholders, especially policymakers, seemed to have difficulties in accepting negative outcomes and did not want to know much about them. They suggested instead that these results be framed as risks for further development. A similar perception by

Table A1
75 PESTEL factors influencing industrial development of Kyrgyzstan based on expert surveys and review of the strategic documents.

Political	Economic	Social	Technological	Environmental	Legal
P1. Mechanisms of interaction between industrial development subjects (state and regional authorities and self-management, business, civil society, development partners)	E1. Availability of fossil resources	S1. Increasing consumers requirements, fashion trends	T1. Shortage of electricity, development level of fuel and energy resources	N1. Climate warming and natural climatic conditions	L1. Tax system and state social insurance, harmonization of the tax system with the EAEU
P2. An integrated approach to the development of regions, cities, and villages	E2. Dependence of the economy on global commodity prices	S2. Social tension	T2. The technical and technological level of production, equipment's state, material and technical base, engineering and technical support, energy efficiency	N2. Ecosystem state and quality of ecosystem services (land resources, yields, etc.)	L2. Degree and quality of state regulation and supervision of business (including the bureaucratization level)
P3. The institutional environment for economic development	E3. Deficit and rational use of own and borrowed financial resources, deficit and transparency of the budget, budget discipline, debt burden, coherence of monetary and fiscal policy	S3. Employment and occupational safety	T3. Innovations' adoption, level of digitalization, promotion of environmentally friendly technologies	N3. Air pollution	L3. Quality and efficiency of the legal framework for investment activities
P4. Governance quality	E4. Stability of the national currency and inflation	S4. Population welfare level (solvency, middle-class development, social protection of vulnerable population groups, pension system, crisis of cities)	T4. Quality of goods and packaging, the competitiveness of products	N4. Natural disasters (droughts, heavy rains, etc.)	L4. Level of the shadow and informal economy
P5. Internal political stability	E5. Reliance on remittances from abroad	S5. Demographic situation and migration	T5. Technogenic catastrophes and prevention and mitigation systems	N5. Water availability (including water quality), melting of glaciers and snowfields	L5. Efficiency and continuity of reforms, predictability of changes in legislation
P6. Simplification of the visa regime with partner countries	E6. Dependence on external sources of financial resources	S6. Adequate distribution of human resources (labor mobility), conformity of skills of workers to labor market, labor productivity, brain drain	T6. Availability of certification laboratories	N6. Land resources, desertification	L6. Private property rights guarantee
P7. The EAEU Membership and formation of common markets; EAEU cooperation with other countries and associations	E7. Dependence on imports, dependence on re-export of Chinese goods in the CIS	S7. Quality of education	T7. Transport and logistics infrastructure	N7. Greenhouse gas emissions, decisions of the Paris climate conference	L7. Harmonization of customs procedures, technical regulation, and standardization, plus veterinary, phytosanitary, and epidemiological control within the EAEU; quality of EAEU standards
P8. Development of cooperation with Central Asia countries (CAREC) program, transport corridors, energy infrastructure,	E8. Level of economic diversification	S8. Public health	T8. Global trends: The fourth Industrial Revolution, nanotechnologies, biotechnologies, composite materials, information technologies, green economy,	N8. Environmental safety requirements and environmental legislation	

(*continued on next page*)

Table A1 (*continued*)

Political	Economic	Social	Technological	Environmental	Legal
water resources management)			alternative energy sources, new medicine, etc.		
P9. WTO membership, GSP + user preferential status	E9. Development of the private-public partnership system	S9. Corruption, distrust of the state by population and business		N9. Waste management (including tailings)	
P10. Proximity to China in view of its geopolitical position and market size; Linking up with the Silk Road Economic Belt	E10. Governmental support of the domestic manufacturers	S10. Legal literacy, social competencies, entrepreneurship culture		N10. Usage of GMOs	
P11. Cooperation with South and Southeast Asian countries	E11. Development of banking and insurance sectors, availability of loans for business and individuals	S11. Involvement of society in political processes, dialogue between local population and business			
P12. Cooperation with the USA	E12. Development of market mechanisms and business environment	S12. Social infrastructure and social cohesion			
P13. Political instability in neighboring countries and geopolitical tensions (sanctions against Russia; situation in Ukraine; situation in Syria, Turkey, and the Middle East), trade "wars"	E13. Petty commodity production, agricultural production fragmentation	S13. Public security, access to justice			
P14. Participation in other integration blocks (SCO etc.)	E14. Accumulation and reproduction of capital	S14. Cross-border crime, extremism and terrorism			
P15. Regionalization, globalization, increasing the importance of new centers of influence (e.g., BRICS, etc.), a rapidly changing world	E15. Tariff policies, consumer discipline				
	E16. Economic diplomacy				
	E17. Development of services and tourism				
	E18. The volatility of global commodity prices				
	E19. Economic situation and business activity in the main partner countries (Russia, Kazakhstan, China, etc.)				
	E20. Access to foreign markets, the openness of the EAEU markets				
	E21. Development of the world economy				

policymakers of the scenario planning process, namely, that there was only a single possible “normative” future that could bring about a major improvement of the current situation, has also been observed in another case study in Japan by (Kharrazi & Kakuwa, 2017b). However, such a reaction shows that traditional beliefs and practices of policymakers are being challenged (Wright et al., 2013). Such a

"derailment" experience can be used to increase policymakers' awareness about possible negative developments that could impair their normative vision of the way the situation will develop (Kharrazi & Kakuwa, 2017b) and thus encourage them to include corresponding mitigating policies in the planned strategy. Importantly, after several workshops and presentations of the scenario drafts, the stakeholders gained a better understanding of the purpose of the scenarios for instance, by acknowledging the differences between normative and explorative scenarios.

The stakeholders were also sensitive to the names of some of the scenarios, for example, "Falling tower," as the tower is a national symbol of Kyrgyzstan. Therefore, names and descriptions of the scenarios should be elaborated carefully to take into account the specific cultural features of a given study.

Nevertheless, the use of scenario planning for producing the industrial development strategy was perceived overall very positively by both participating stakeholders and the high-level policymakers to whom the results were presented.

Our approach of augmenting scenario-based strategic planning can be applied to designing national industrial development policies that take into account multiple possible alternative futures and account for deep uncertainty in other countries and regions striving to achieve inclusive industrial development. The procedure successfully tested in Kyrgyzstan can enable a scenario planning process to be conducted over a relatively short time frame and at a low cost while, at the same time, involving local stakeholders and experts to ensure the substantive soundness of the content of the scenarios and their feasibility in terms of addressing the local policymaking challenges. The scenarios can be applied with some modifications reflecting the local features to other lower-middle-income countries (LMIC) facing similar challenges on their path to achieving inclusive industrial development.

Declaration of Competing Interest

The authors report no declarations of interest.

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Appendix A. Factors impacting industrial development of Kyrgyzstan

References

Amer, M., Daim, T. U., & Jetter, A. (2013). A review of scenario planning. *Futures, 46*, 23–40. https://doi.org/10.1016/j.futures.2012.10.003.

Ariu, A., Breinlich, H., Corcos, G., & Mion, G. (2019). The interconnections between services and goods trade at the firm-level. *Journal of International Economics, 116*, 173–188. https://doi.org/10.1016/j.jinteco.2018.10.005.

Bertrand, G., Michalski, A., & Pench, L. R. (1999). *Scenarios europe 2010. Five possible futures for Europe*.

Börjeson, L., Höjer, M., Dreborg, K.-H., Ekvall, T., & Finnveden, G. (2006). Scenario types and techniques: Towards a user's guide. *Futures, 38*(7), 723–739. https://doi.org/10.1016/j.futures.2005.12.002.

Bradfield, R., Wright, G., Burt, G., Cairns, G., & van der Heijden, K. (2005). The origins and evolution of scenario techniques in long range business planning. *Futures, 37*(8), 795–812. https://doi.org/10.1016/j.futures.2005.01.003.

Brands, C., Wulf, T., & Meissner, P. (2013). Six tools for scenario-based strategic planning and their application. In B. Schwenker, & T. Wulf (Eds.), *Scenario-based strategic planning. Developing strategies in an uncertain world* (pp. 69–152). Gabler Verlag. https://doi.org/10.1007/978-3-658-02875-6_4.

Cairns, G., & Wright, G. (2018). *Scenario thinking. Preparing your organization for the future in an unpredictable world* (Second edi). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-49067-0.

Chermack, T. J. (2011). *Scenario planning in organizations: How to create, use, and assess scenarios*. San Francisco: Berrett-Koehler Publishers, Ed.

Chermack, T. J., Lynham, S. A., & Ruona, W. E. A. (2001). Scenario planning: A review of the literature. *Futures Research Quarterly, 17*(2), 7–31.

Dammers, E., van' t Klooster, S., de Wit, B., Hilderink, H., Petersen, A., & Tuinstra, W. (2019). *Building scenarios for environmental, nature and spatial planning policy: A guidance document*. Retrieved from. The Hague: PBL Netherlands Environmental Assessment Agency https://www.pbl.nl/sites/default/files/downloads/pbl-2019-building-scenarios-for-environmental-nature-and-spatial-planning-policy-3434.pdf.

Derbyshire, J., & Wright, G. (2017). Augmenting the intuitive logics scenario planning method for a more comprehensive analysis of causation. *International Journal of Forecasting, 33*(1), 254–266. https://doi.org/10.1016/j.ijforecast.2016.01.004.

European Commission. (2017). *White paper on the future of Europe: Reflections and scenarios for the EU27 by 2025*. Retrieved from. Brussels https://ec.europa.eu/commission/sites/beta-political/files/white_paper_on_the_future_of_europe_en.pdf.

Evans, P. (1995). *Embedded autonomy: States and industrial transformation*. Princeton, New Jersey: Princeton University Press. https://doi.org/10.2307/j.ctt7t0sr.

Gao, J., Xu, X., Cao, G., Ermoliev, Y. M., Ermolieva, T. Y., & Rovenskaya, E. A. (2018). Optimizing regional food and energy production under limited water availability through integrated modeling. *Sustainability (Switzerland), 10*(6). https://doi.org/10.3390/su10061689.

Godet, M. (2000). How to be rigorous with scenario planning. *Foresight, 2*(1), 5–9. https://doi.org/10.1108/14636680010802438.

Godet, M. (2001). *Creating futures: Scenarios planning as a strategic management tool*. London: Economica.

Gordon, T. J. (1994). Trend impact analysis. *Futures research methodology, AC/UNU millennium project*.

Government of Kyrgyzstan. (2018). *National development strategy of the Kyrgyz Republic for 2018-2040. Bishkek*. Retrieved from https://policy.asiapacificenergy.org/sites/default/files/National Development Strategy of the Kyrgyz Republic for 2018-2040 %28EN%29.pdf.

Haraldsson, H. V. (2004). Introduction to system thinking and causal loop diagrams. *Ecology and environmental engineering*.

Huss, W. R., & Honton, E. J. (1987). Scenario planning—What style should you use? *Long Range Planning, 20*(4), 21–29. https://doi.org/10.1016/0024-6301(87)90152-X.

Johansen, I. (2018). Scenario modelling with morphological analysis. *Technological Forecasting and Social Change, 126*, 116–125. https://doi.org/10.1016/j.techfore.2017.05.016.

Jungermann, H., & Thüring, M. (1987). The use of mental models for generating scenarios. In G. Wright, & P. Ayton (Eds.), *Judgmental forecasting*. London: John Wiley & Sons.

Kamrava, M. (2000). *Politics and society in the developing world* (Second edi). London: Routledge. https://doi.org/10.4324/9780203013298.

Kharrazi, A., & Kakuwa, M. (2017a). Scenario projects in Japanese government: Strategic approaches for overcoming psychological and institutional barriers. *Futures, 86*, 18–26. https://doi.org/10.1016/j.futures.2016.08.003.

Kharrazi, A., & Kakuwa, M. (2017b). Scenario projects in Japanese government: Strategic approaches for overcoming psychological and institutional barriers. *Futures, 86*, 18–26. https://doi.org/10.1016/j.futures.2016.08.003.

Komendantova, N., Rovenskaya, E., Strelkovskii, N., Karabashov, N., Atakanov, N., Chekirbaev, U., et al. (2018a). *Connecting regional development, regional integration and value added creation: Strategic elements for industrial development of Kyrgyzstan*. Retrieved from. Vienna: United Nations Industrial Development Organization (UNIDO) and International Institute for Applied Systems Analysis (IIASA) http://pure.iiasa.ac.at/id/eprint/15674/.

Komendantova, N., Rovenskaya, E., Ekenberg, L., Strelkovskii, N., Sizov, S., Sedighi, E., et al. (2018b). *Industrial development of Kyrgyzstan: Recommendations and responsible bodies*. Laxenburg, Austria. Retrieved from http://pure.iiasa.ac.at/id/eprint/15503/.

Lavikka, R., Kallio, J., Casey, T., & Airaksinen, M. (2018). Digital disruption of the AEC industry: Technology-oriented scenarios for possible future development paths. *Construction Management and Economics, 36*(11), 635–650. https://doi.org/10.1080/01446193.2018.1476729.

Leitner, M., Bentz, J., Lourenco, T. C., Swart, R., Allenbach, K., & Rohat, G. T. (2018). Foresight for policy & decision-makers. *Work package 4-institutional strengthening. Task 4.3-promote foresight*. Retrieved from https://www.placard-network.eu/wp-content/PDFs/Foresight-report-2018.pdf.

Lempert, R. J., Groves, D. G., Popper, S. W., & Bankes, S. C. (2006). A general, analytic method for generating robust strategies and narrative scenarios. *Management Science, 52*(4), 514–528. https://doi.org/10.1287/mnsc.1050.0472.

MacKay, R. B., & Stoyanova, V. (2017). Scenario planning with a sociological eye: Augmenting the intuitive logics approach to understanding the Future of Scotland and the UK. *Technological Forecasting and Social Change, 124*, 88–100. https://doi.org/10.1016/j.techfore.2016.08.026.

McBride, M. F., Lambert, K. F., Huff, E. S., Theoharides, K. A., Field, P., & Thompson, J. R. (2017). Increasing the effectiveness of participatory scenario development through codesign. *Ecology and Society, 22*(3), art16. https://doi.org/10.5751/ES-09386-220316.

Meissner, P., Brands, C., & Wulf, T. (2017). Quantifiying blind spots and weak signals in executive judgment: A structured integration of expert judgment into the scenario development process. *International Journal of Forecasting, 33*(1), 244–253. https://doi.org/10.1016/j.ijforecast.2015.08.002.

Mercer, D. (1997). Robust strategies in a day. *Management Decision, 35*(3), 219–223. https://doi.org/10.1108/00251749710169422.

Oxford College of Marketing. (2018). *PESTEL analysis*. Retrieved July 29, 2018, from https://blog.oxfordcollegeofmarketing.com/2016/06/30/pestel-analysis/.

Peterson, G. D., Cumming, G. S., & Carpenter, S. R. (2003). Scenario planning: A tool for conservation in an uncertain world. *Conservation Biology, 17*(2), 358–366. https://doi.org/10.1046/j.1523-1739.2003.01491.x.

Phadnis, S., Caplice, C., Singh, M., & Sheffi, Y. (2014). Axiomatic foundation and a structured process for developing firm-specific Intuitive Logics scenarios. *Technological Forecasting and Social Change, 88*, 122–139. https://doi.org/10.1016/j.techfore.2014.06.019.

Ramirez, R., & Wilkinson, A. (2014). Rethinking the 2×2 scenario method: Grid or frames? *Technological Forecasting and Social Change, 86*, 254–264. https://doi.org/10.1016/j.techfore.2013.10.020.

Ramírez, R., & Wilkinson, A. (2016). *Strategic reframing. The oxford scenario planning approach. Strategic reframing*. Oxford: Oxford University Press. https://doi.org/10.1093/acprof:oso/9780198745693.001.0001.

Raskin, P., Banuri, T., Gallopín, G., Gutman, P., Hammond, A., Kates, R., et al. (2002). *Great transition. The promise and lure of the times ahead*. Boston. Retrieved from https://greattransition.org/documents/Great_Transition.pdf.

Ritchey, T. (2011). Wicked problems - social messes decision support modelling with morphological analysis. *Risk, Governance and Society, 17*. https://doi.org/10.1007/978-3-642-19653-9.

Rueda-Sabater, E., & Derosby, D. (2011). The evolving Internet in 2025: Four scenarios. *Strategy and Leadership, 39*(1), 32–38. https://doi.org/10.1108/10878571111095402.

Schoemaker, P. J. H. (1995). Scenario planning: A tool for strategic thinking. *Sloan Management Review, 36*(2), 25–40. https://doi.org/doi.org.proxy2.lib.umanitoba.ca/10.1.

Sedlacko, M., Martinuzzi, A., Røpke, I., Videira, N., & Antunes, P. (2014). Participatory systems mapping for sustainable consumption: Discussion of a method promoting systemic insights. *Ecological Economics, 106*, 33–43. https://doi.org/10.1016/j.ecolecon.2014.07.002.

Shaimergenov, T. T., & Abisheva, M. A. (2017). *Central Asia 2027: The changing strategic landscape. Possible scenarios for 10 years forward*. Retrieved from. Astana: First President of Republic of Kazakhstan Library Publishing http://www.fes-centralasia.org/ru/statja/centralnaja-azija-2027-menjajuschijsja-strategicheskij-landshaft-verojatnye-scenarii-na-10-let-vpered.html.

Shell. (1973). *Scenarios for the 1973 planning cycle*.

Stiglitz, J. E. (2002). Participation and development: Perspectives from the comprehensive development paradigm. *Review of Development Economics, 6*(2), 163–182. https://doi.org/10.1111/1467-9361.00148.

Strelkovskii, N., Rovenskaya, E., Komendantova, N., Sizov, S., Sedighi, E., Stepanova, A., et al. (2018). *Industrial development of Kyrgyzstan: Plausible futures*. Laxenburg, Austria. Retrieved from http://pure.iiasa.ac.at/id/eprint/15502/.

Supreme Council of the Kyrgyz Republic. (2018). *Participants in parliamentary hearings discuss issues in the field of state industrial policy and the prospects for new industrial development*. Retrieved September 26, 2019, from http://kenesh.kg/ru/news/show/6542/uchastniki-parlamentskih-slushaniy-obsuzhdayut-voprosi-v-sfere-gosudarstvennoy-promishlennoy-politiki-i-perspektivi-novogo-industrialynogo-razvitiya.

Szirmai, A. (2008). *Explaining success and failure in development. MERIT working papers*. Retrieved from. United Nations University - Maastricht Economic and Social Research Institute on Innovation and Technology (MERIT) https://ideas.repec.org/p/unm/unumer/2008013.html.

Szirmai, A., & Verspagen, B. (2015). Manufacturing and economic growth in developing countries, 1950–2005. *Structural Change and Economic Dynamics, 34*, 46–59. https://doi.org/10.1016/j.strueco.2015.06.002.

The State Committee for Industry Energy and Subsoil Use of the Kyrgyz Republic. (2019). *Kyrgyzstan prepares strategy for sustainable industrial development until 2023*. Retrieved November 13, 2019, from http://www.gkpen.kg/index.php/press/news/699-2019-2023?fbclid=IwAR1gpMe0hQB-FCS89DQbijbDUsjG54BTFuter6xxYYeaFyPAJW9vJn1FN70.

UNIDO. (2017). *Industrial development report 2018. Demand for manufacturing: Driving inclusive and sustainable industrial development*. Vienna. https://doi.org/10.18356/62a26775-en.

UNIDO. (2018). *Diagnostic for the Programme for Country Partnership (PCP). The Kyrgyz Republic. Building a competitive manufacturing base for strong and inclusive growth*.

van der Heijden, K. (2005v). *Scenarios: The art of strategic conversation* (Second edi). Chichester: John Wiley & Sons Ltd.

van der Heijden, K., Bradfield, R., Burt, G., Cairns, G., & Wright, G. (2002v). *The sixth sense: Accelerating organizational learning with scenarios*. Chichester: Wiley.

van Oorschot, K. (2016v). Foresight in organizations. In P. van der Duin (Ed.), *Foresight in organizations: Methods and tools* (pp. 215–222). New York: Routledge. https://doi.org/10.4324/9781315728513.

Varum, C. A., & Melo, C. (2010). Directions in scenario planning literature – a review of the past decades. *Futures, 42*(4), 355–369. https://doi.org/10.1016/j.futures.2009.11.021.

Vilkkumaa, E., Liesiö, J., Salo, A., & Ilmola-Sheppard, L. (2018). Scenario-based portfolio model for building robust and proactive strategies. *European Journal of Operational Research, 266*(1), 205–220. https://doi.org/10.1016/j.ejor.2017.09.012.

Wack, P. (1985). Scenarios: Uncharted waters ahead. *Harvard Business Review, 63*(5), 73–89.

WEF. (2014). *Scenarios for the south caucasus and Central Asia*. Retrieved from. World Economic Forum https://www.weforum.org/reports/scenarios-south-caucasus-and-central-asia.

WEF. (2018). *The global competitiveness report 2017-2018*. Retrieved from. World Economic Forum https://www.weforum.org/reports/the-global-competitiveness-report-2017-2018.

World Bank. (2018a). *DataBank. World development indicators*. Retrieved September 7, 2019, from https://databank.worldbank.org/source/world-development-indicators.

World Bank. (2018b). *DataBank. World Development Indicators*.

Wright, G., & Cairns, G. (2011). *Scenario thinking: Practical approaches to the future*. London: Palgrave Macmillan UK. https://doi.org/10.1057/9780230306899.

Wright, G., & Goodwin, P. (2009). Decision making and planning under low levels of predictability: Enhancing the scenario method. *International Journal of Forecasting, 25*(4), 813–825. https://doi.org/10.1016/j.ijforecast.2009.05.019.

Wright, G., Bradfield, R., & Cairns, G. (2013). Does the intuitive logics method – and its recent enhancements – produce "effective" scenarios? *Technological Forecasting and Social Change, 80*(4), 631–642. https://doi.org/10.1016/j.techfore.2012.09.003.

Wright, G., Cairns, G., O'Brien, F. A., & Goodwin, P. (2019). Scenario analysis to support decision making in addressing wicked problems: Pitfalls and potential. *European Journal of Operational Research, 278*(1), 3–19. https://doi.org/10.1016/j.ejor.2018.08.035.

Wulf, T., Meissner, P., Brands, C., & Stubner, S. (2013). Scenario-based strategic planning: A new approach to coping with uncertainty. In B. Schwenker, & T. Wulf (Eds.), *Scenario-based strategic planning. Developing strategies in an uncertain world* (pp. 43–66). Gabler Verlag. https://doi.org/10.1007/978-3-658-02875-6_3.

Wulf, T., Meissner, P., & Stubner, S. (2010). *A scenario-based approach to strategic planning – Integrating planning and process perspective of strategy (Chair of strategic management and organization No. working paper No. 6)*.

Wulf, T., Stubner, S., Meißner, P., & Brands, C. (2012). Szenariobasierte strategische planung in volatilen umfeldern. *Controlling & Management, 56*(S2), 34–38. https://doi.org/10.1365/s12176-012-0380-z.