

# **Scenario Workshop Report**

# **Indus River**

## **Integrated Solutions for Water, Energy, and Land**

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**DRAFT**

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## Background

This workshop was organized in the context of the Integrated Solutions for Water, Energy, and Land (ISWEL) project, led by the partnership between the International Institute for Applied Systems Analysis (IIASA), the Global Environment Facility (GEF), and the United Nations Industrial Development Organization (UNIDO). The main goal of ISWEL project is to assess cost-effective solutions to meet future water, energy and lands demands under a number of different socioeconomic and hydro-climatic pathways. The project takes a global approach but it also zooms into two transboundary basins facing important development and environmental challenges: The Indus and the Zambezi.

To accomplish its main goal, a next-generation of tools is now in development and are being linked together into a systems analysis framework, which will be suitable to model and quantify synergies and trade-offs for meeting water, energy and land demands across scales. To ensure that project tools and outcomes contribute to developing capacities and knowledge for nexus management, significant efforts are being allocated to engage with a wide range of stakeholders, particularly within the basins. To this end, a number of workshops have been planned in each basin with the purpose of:

- Identifying country and basin challenges, priorities, and trade-offs in relation to water-energy-land nexus
- Build a range of stakeholder informed scenarios of water-energy-land futures to gain understanding of the consequences of different decisions and what opportunities exist to maximize sectorial and transboundary co-benefits
- Support the development of local capacities in nexus research and management
- Cooperate with other organizations and institutions pursuing the implementation of a nexus agenda

This was the second out of the three stakeholder workshops planned in the Indus Basin for the phase I of the ISWEL project (2017-2019). The first workshop consisted of two country meetings (New Delhi, 23 March 2018 and Lahore 23 March 2018), and each meeting brought together about 25 national representatives, with the purpose of identifying the main challenges and opportunities the two riparian countries have with regards water, energy and land and its interlinkages (*nexus*).

## Objectives and expected outcomes

The purpose of this second workshop was to build on the first meeting bringing now together experts and stakeholders from the four riparian countries, to jointly discuss desirable futures and pathways for the Indus basin and its riparian countries with regards to water, energy, and land security.

The workshop was based on scientific approach but it also aimed to produce policy relevant results. Its ambition was to contribute solutions to otherwise intractable problems.

The main goal of this workshop was to co-develop in partnership with sectoral experts from all four riparian countries:

- 2-3 visions and pathways to desirable futures for the Indus basin taking into account different global developments and climate scenarios.

- Enhanced and shared understanding on the implications of different investments in the basin and their consequences cascading through the WEL sectors.
- Partnerships to support the agenda on nexus research and management in the Indus and its riparian countries.

## Pathway Development Process

### STEP 1: Reviewing current situation in the Indus Basin and its major challenges

The process of stakeholder-led pathway development started with characterizing the current situation of a basin, represented in a simplified visual format. To this end, a predefined set of materials such as maps and cards with descriptions of infrastructure, economic activities and resources uses were provided to facilitate discussions. These materials are carefully selected to provide sufficient information and knowledge without narrowing down participants' scope of exploration and breadth of choices – they could always add additional elements be it physical, social, economic or environmental. Such visual representation provided an opportunity for better understanding and a deeper discussion of key issues among stakeholders.

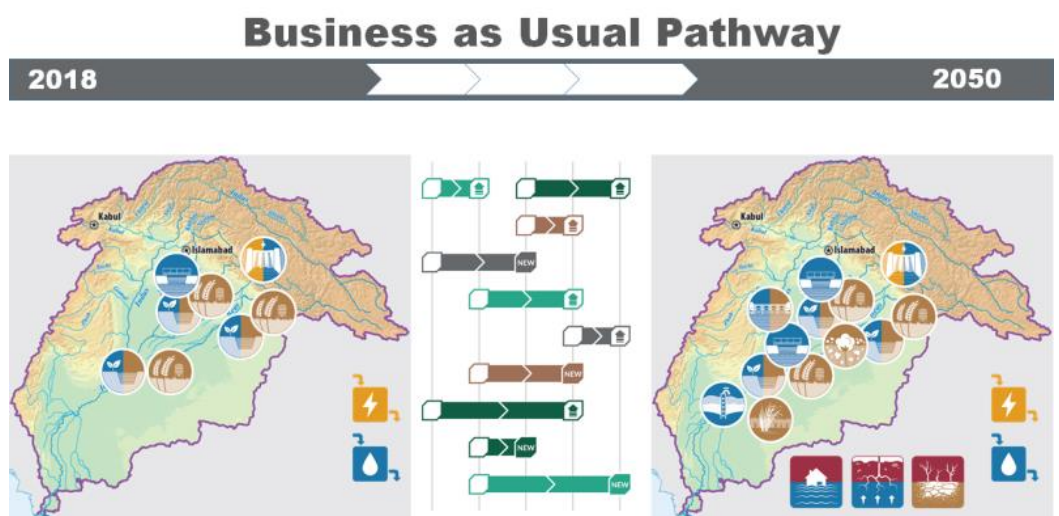


Participants developed this representations of the current situation separately for different riparian countries (China, India, Pakistan; participants from Afghanistan joined the workshop on the second day so this map was not developed).

### STEP 2: Developing future pathways: "business as usual"

Based on this joint assessment of the the current situation (developed in the previous step), participants developed "business-as-usual" pathways – i.e. a series of changes of the existing situation that is

likely to happen if current policies will continue. These changes were represented visually by adding or

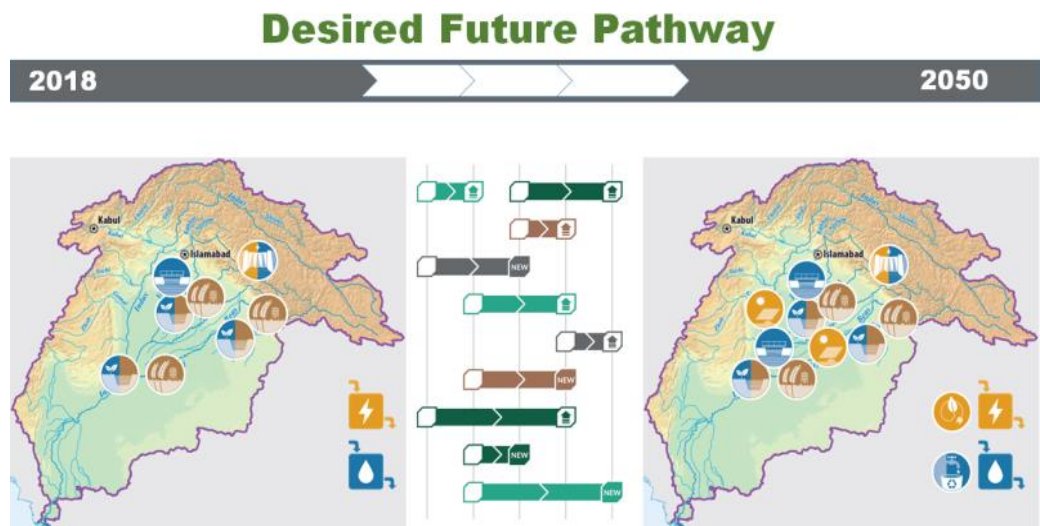


changing existing elements on the map. Additionally, the changes (new investments or initiatives) were represented separately with the timeline depicting the pathway from “now” to the future.

The resulting assessment of the current situation and the business as usual pathways were made available to workshop participants for feedback and clarification.

### STEP 3: Developing Indus visions (desired futures) and pathways leading to them

Three visions of “desired futures” were developed together with their corresponding pathways. Unlike the business-as-usual that continues existing policies and directions, the desired futures started from clear, ambitious but realistic visions of what can be achieved.

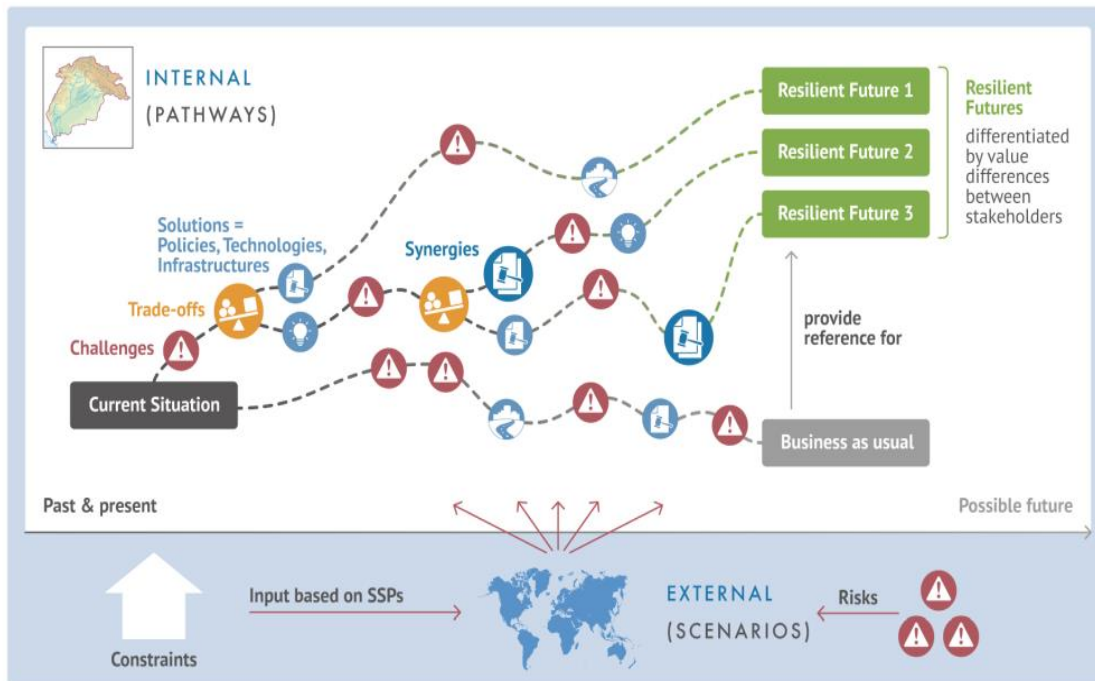


Three different groups worked assuming 3 different priorities: economy, society, and environment respectively. The focus on priorities were not supposed to eliminate other important concerns - all the visions were aimed to be desired and holistic. They included both hard (e.g. infrastructure) and soft (e.g. behavioral change) elements. The pathways leading to the crafted visions were represented on the timeline including specific initiatives and investments.

The resulting visions and pathways were shared with the workshop participants for feedback and further clarifications.

### STEP 4: Improving the robustness of pathways – addressing challenges from global scenarios

In order to test robustness of the chosen solutions under unfavorable external circumstances (scenarios) it is also beneficial to consider some undesired global scenarios. The differences between alternative global scenarios are represented with a set of externally imposed challenges along the analyzed regional pathways. Although a sustainability scenario (consistent with SSP1) is often attractive, strategies designed by stakeholders should also be robust to unfavorable external conditions. Implications of other global scenarios (based on SSP2-5) on regional pathways will be considered and pathways will be revised to improve their feasibility.



## Indus narratives: Summary of the visions and pathways developed by stakeholders

Based on the information obtained from the workshop, three narratives have been developed summarizing the main outcomes of the exercise. These narratives describe the vision and the pathways towards these visions. A description of the resulting narratives is provided below.

### Indus Vision – priority on economic issues

Under this vision, the transboundary (regions and countries) economic cooperation is the key driver that can lead to economic growth of the Indus basin. Such cooperation among the riparian countries should reduce conflicts on: 1) water sharing and resources management; 2) existing conflicts at the borders; 3) disagreements among provinces; and 4) implementation of environmental conservation protocols. The key challenge is how to convince the riparian countries to cooperate. It is not obvious how to achieve this, however, the potential pathway for the region assuming transboundary cooperation would look as follows.

One very first step to improve the economic cooperation would require reducing the barriers to movement of people, goods and services. This can be achieved by fostering the free trade agreements starting from the *South Asian Association for Regional Cooperation (SAARC)* and the *China–Pakistan Economic Corridor (CPEC)* and involving in them all four riparian countries. SAARC need to be strengthened, and China needs to be involved. CPEC China-Pakistan economic corridor (not limited only to transport but also other infrastructures) could be extended to include Afghanistan and India. Further trade agreements may be needed including establishing a customs union and easing visa constraints as options. Besides international agreements, it is important to expand the existing transport infrastructure – roads, railways, ports, etc. – in the basin.

Water is a critical resource for socio-economic development and to meet current and future demands, there is a need to increase storage facilities (big and small dams), in combination with other measures like

improved groundwater use efficiency in agriculture or the development of storm water drainage and sewer systems in urban areas. Measures to improve water quality are also essential with a special focus on those aiming to address salinity. Rivers should also support trade through creating navigating channels. Allocation rules need to be re-explored as agricultural and industrial water uses should not constrain urban water supply systems.

Agriculture is a key economic sector and will continue growing but under the premise of increasing its productivity, in terms of its economic revenues, job creation and more efficient use of water resources (surface and groundwater). Irrigated areas will continue expanding and the upgrading of irrigation technologies (swift towards drip and sprinkler irrigation) and crop diversification will contribute to buffer the growing water demands. Rain-fed agriculture can also be expanded to new areas. In order to reduce dependency on oil import, oil-seed production should be improved. Cotton and livestock production should also increase. It is of crucial importance to improve the market access for farmers, and introduce price harmonization. Many ways to support rural population should be implemented in addition to agricultural support e.g. tourism development and creation of non-farm jobs in rural areas.

Energy production is critical for economic development – the focus should be on Upper Indus with the increase of energy production and its efficiency. With an obvious attention to hydropower (big and small) it is also important to promote renewables (big and small) as well as grid interconnection between the countries. Transboundary energy cooperation is required for efficient energy sharing and system cost minimization – i.e. a joint hydropower projects production in one country delivering energy also for a neighbor country.

The modernization and growing competitiveness of the agricultural sector should be accompanied by the industrialization of some parts of the basin to better balance the regional development. The issues of capital, labor, and land availability should be carefully considered. Among the specific industries with a development potential are: manufacturing, mining, textiles and others. The economy should be ready for low carbon future. However, the commitment for climate action is different among countries, as low emitting countries like are currently not very committed to reducing its emissions.

Social changes and transitions are affecting many economic issues. The most important are introducing some measures for population growth control, improving education access and achievements, especially for women, provide many opportunities for capacity building, increasing gender inclusion in many sectors especially in decision-making. Urban development should be based on sound water management and infrastructures (described earlier). Pollution should be handled efficiently including both solid waste processing and wastewater treatment. All new buildings should be designed with water and energy efficiency solutions. Environment is an underlying basis of the economy. Following the Paris Agreement, it is important to improve climate change monitoring system (climate gauge stations). Water monitoring should also be improved with further enhancing of the flow gauging systems. Vital ecosystems should be protected. Afforestation should be promoted in the northern area and close to the rivers and environmental friendly engineering implemented.

### **Indus Vision-priority focus on environmental issues**

A prosperous Indus basin requires ensuring a sustainable use and conservation of its natural capital, including its water and terrestrial ecosystems. Implementation of this vision requires the presence of strong facilitating factors including: leadership, funds, leveraging of NGOs, political will, and facilitation of stable geopolitics. The water cycle dynamics determining the river flow, maintained by groundwater, glaciers melt, and monsoons, need to be understood and respected in policy development and

implementation. There is a strong need for coordinated strategy and capacity building involving all stakeholders.

Improving the management of water ecosystems requires significant investments in implementing water quantity and quality monitoring systems. Storage infrastructure like dams should be planned considering carefully the potential effects on the river systems. Risk of sedimentation impact of big dams should be accounted for in feasibility studies and prevented. Dams construction and operations should also be aligned with the flood management measures (dual purpose infrastructure). Actions should prioritize the improvement and optimization of the existing infrastructure before planning for new developments. Strategic storage dams should be carefully planned in critical points. Groundwater storage and groundwater recharge should be considered as an alternative for the construction of new dams. Wastewater recycling and reuse should be applied broadly to manage aquifer recharge (MAR). Water should be zoned and priced to achieve the above objectives. Better water allocation should be designed – it should be more evenly distributed among sectors (less to agriculture and more to cities and industries), while return flows can be reused downstream to increase environmental flows and feed downstream ecosystems (including Indus delta). Full scale implementation of the water allocation scheme is possible only through water accounting in the monitoring stations that need to be expanded. Widespread salinization resulting from intensive irrigation is a huge problem. Irrigation efficiency policies through water efficiency systems in agriculture can lead to rebound effects and an increase in total irrigated area that offsets the water savings. To avoid this, it is necessary to apply side measures such as a cap in total irrigated area. High efficiency-precision agriculture is critical to achieve water objectives. It should be based on: 1) selection of seed varieties and efficient cultivation practices; 2) application of digital technologies including smart sensors and tele-connection via smart phones; 3) efficient application of water and fertilizers; 4) rehabilitation of irrigation canals (reduction of system losses); 5) sprinklers and drip irrigation; 6) reducing fertilizer use and introducing organic agriculture; 7) hydroponic crops; and 8) management of canopy density and height, as well as specific species combination to generate synergies and maximize yields.

Renewable energy generation to complement hydropower: solar (Kashmir, Balochistan and areas close to Kabul; Rajasthan is already implementing it.) and wind (significant potential for wind in Rajasthan).

Protected zones should be created in sensitive ecosystems or areas (forest and wetlands) of great ecological value to avoid degradation by tourism or urban expansion. Biodiversity can serve as an indicator of water quality status and improvement (e.g. Dolphin as a natural indicator of healthy water quality). Existing laws on species, habitats and designated protected areas should be enforced. Sustainable tourism should be promoted to counteract the problems created by the current massive tourism. Green corridors could be established for power generation and then used for sustainable tourism activities. UNESCO Geoparks system could serve as an example of protected zones. It requires protection policies and investment in security systems. Income from ecotourism could support indigenous people. Coastal areas should also be protected. Coastal mangroves, which has been proven to increase atmosphere water moisture and thus promote and stimulate upstream precipitation, should be restored. Fishery zones should be implemented, sedimentation avoided, and environmental flows increased. A buffer zone beyond the basin boundaries should be considered to assess the effects on and interactions with the surrounding socio-economic-environmental systems e.g. food trade to Delhi and rest of India, energy policies in China and development (mining) plans and policies in Afghanistan.

The following flood adaptation measures should be considered: 1) Interconnected early warnings system (both for flood and landslide); 2) Create riparian zone where it is forbidden to live; 3) Moving people outside these regions (To find affordable places); 4) Sustainable urban planning respecting the flood plains;

5) Need for an agreement of cooperation and collaboration among countries (especially India-Pakistan) and data sharing in order to reduce the need for infrastructure and generate a smart network; and 6) Early warning systems in place across the whole basin.

Industry development should be considered carefully. Low carbon transport system should become the standard. Improvements of urban environment should be identified and implemented including: 1) implementation of solid waste recycling and appropriate treatment systems; 2) investing in waste to energy systems; 3) constructions of green-efficient buildings; and 4) promoting of electric vehicles.

A bigger participation and integration of the whole society is needed including government, NGO, population, enterprises. Communities living in the mountains, who are the natural 'glacier keepers', should be involved and supported. Clean Water Act should be enforced. Other environmental laws, actions and regulation rules should be enforced. Laws should be introduced ensuring appropriate measures in case of strong environmental damages – they should be treated as environmental crimes. Water pricing scheme should be designed and enforced.

Cultural and behavioral changes towards more sustainable practices should be promoted including norms and attitudes for improved hygiene and waste management. Expectations and pressure for pollution mitigation should be enhanced. Investments are needed in education to improve the population awareness about the importance of the environment. Investment in capacity building are needed at different levels including in particular: 1) exchange between students; and 2) creation of Indus Research Centre and Network.

### [Indus Vision-priority focus on social issues](#)

The most important components of the social vision includes: 1) Transboundary management (community & technology driven); 2) Resilient Communities; 3) Supporting Indus Entrepreneurs; 4) Technological Revolution; 5) Joint Transboundary Governance; and 6) Easier mobility. Indus basin should agree on its customized Indus Development Goals with time horizon until 2050.

This pathway is strongly based on better transboundary collaboration – both technology and community driven. It is characterized by smart technological progress, with specific solutions addressing the major challenges in the basin. Technology is creating and enabling new possibilities, for example new developments in ICT such as open data sharing, using data warehouses, and satellite telemetry can strongly improve the capacity and functions of existing and new infrastructures by, for example, applying them to early warning systems. The necessary transition to these new technologies requires a new generation of science and technology education.

Water problems in Indus are complex and in order to improve for both soft and hard Infrastructure is needed. Irrigation is crucial for agriculture and in order to sustain rural population, the area for irrigated cotton, sugarcane, wheat, and rice need to be expanded. This needs to be accompanied with substantial investments in drainage to reduce waterlogging. In the areas where groundwater is low, its recharge need to be carefully managed for example using wetlands ecosystem services. There is a strong need for smart irrigation techniques to increase the water use efficiency. Some areas located far from canals and rivers, like Thal and Sindh, already use drip and sprinkler irrigations techniques, but it needs to be broader. Floods pose more and more serious risks and they need to be handled jointly by the riparian countries using transboundary flood management. Water treatment should be implemented more broadly to improve access to drinking water. Water demand in cities can be managed by using for example urban wastewater recycling.



Salinization is the biggest threat and needs to be controlled. It won't be possible without increasing agricultural water use efficiency. An important contribution may come from transboundary community management combined with easier regional mobility including country borders. Such management could lead to the exchange of best agricultural practices leading to improved water management and efficiency. Other specific include improving animal house boundaries and building roads and increasing agriculture import into Gilgit Baltistan.

One of the more promising solutions to increasing energy production in the Indus basin is based on the benefits sharing approach in relation to hydropower construction and use. Small storage dams should be built in Jhelum and Balochistan. New run off the river power plants should be built in Kashmir Small run of the river power plants can be built in many places of Upper Indus. Large storage area dams should be constructed in KPK province. With growing energy demand hydropower should be complemented with coal power plants.

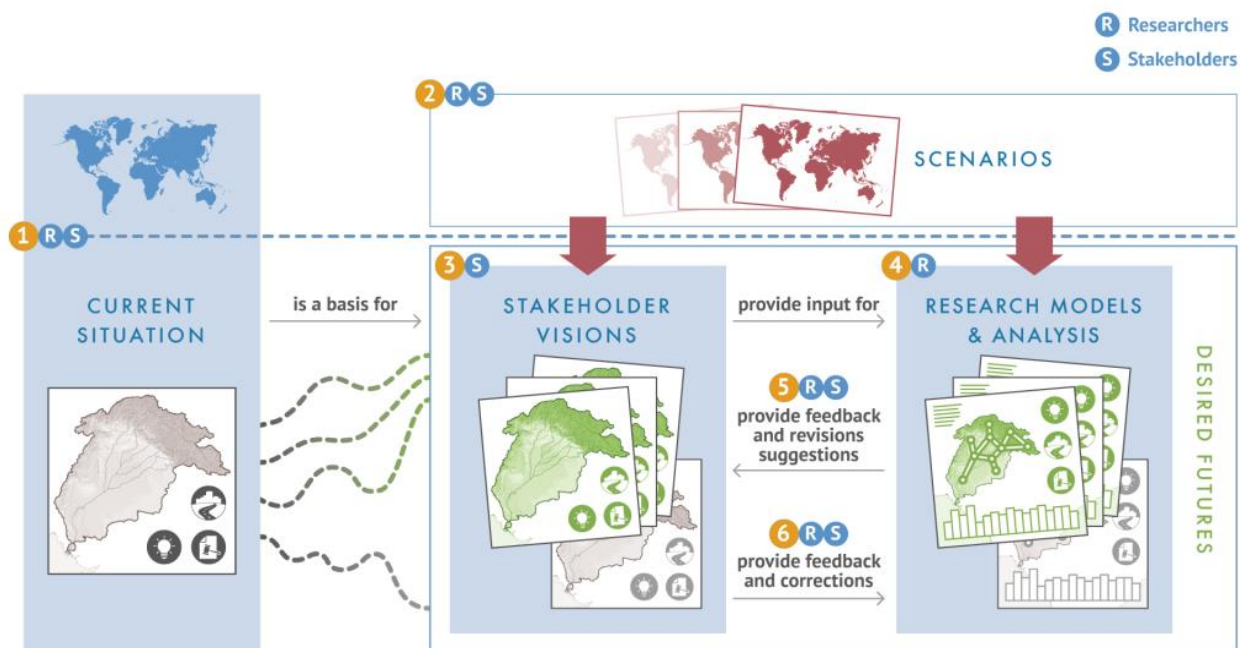
Agriculture should be balanced with industrial development – both traditional textiles industries as well as food processing industries. To this end, special economic zones can be used.

Improving social indicators shouldn't lead to further environmental problems. In particular, minimum environmental flows should be maintained, both transboundary and within countries.

The progress in achieving a sustainable Indus future is relying strongly on improving governance in the region. Transboundary institutional mapping, identifying exemplary resilient communities, and sharing of their best practices, that can be based on article 7 of the Indus Water Treaty (benefits sharing), can lead to significant progress, especially with respect to energy production and distribution. Drought, floods and other disaster risks should be managed transboundary by establishing regular data sharing and cooperation of the National Disaster Management Authorities (NDMA) in the riparian countries. A broad group of stakeholders (experts) from the riparian countries should be granted the observer status for better understanding of the common problems, sharing existing and formulating new, joint solutions. Examples of such innovative practices include both community and individual (entrepreneurship) level instruments: e.g. community water budgets and wells entrepreneurship (e.g. water ATMs) linked with the private data providers. However, regulations will not suffice without also improving compliance to water and environmental regulations. Public awareness of water issues can be enhanced by authorities and clear communication strategies to spread resilient practices.

## Continued cooperation of stakeholders and researchers in the ISWEL project

We will continue the dialogue of engaged stakeholders and researchers using the information and documents mentioned above. Based on this information the Indus NEXUS model for the Indus River at IASA will be further developed and narratives will be translated into quantitative scenarios. The results will be shared with stakeholders during the III Workshop the ISWEL team is planning to organize in the first quarter of 2019 in the Indus Basin, to provide participants an opportunity for further revising and improving visions and pathways.



Summary of the Scenario Process developed in ISWEL and its different steps.