2 Methodology: Co-production of Knowledge for Ownership and Sustainability

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Chapter Overview

This chapter outlines the co-production process through which this book was developed. The chapter compares its approach to other efforts to generate knowledge in transboundary basin management, and points to certain comparative advantages. Four key points that motivated the book's focus were elaborated, namely: i) new knowledge generation, ii) fostering a common perspective, iii) enhancing human development, and iv) identification of development options. The iterative process through which the book arrived at its structure, identified authors, and facilitated their joint work are also explained. Notable limitations, e.g., related to data, and challenges, e.g., political change in Afghanistan, are acknowledged, and the nuts and bolts of chapter review and evaluation are discussed. The chapter concludes with reflection on key lessons on the co-production approach applied, such as its contribution to trust-building between experts in the two countries.

Fig. 2.1. Kurram river, Mianwali district. (From: Amjad Jamal, IWMI-Pakistan)

Introduction

Transdisciplinary co-production of knowledge has been a successful approach to achieving more impactful and sustainable outcomes (Clark *et al*., 2016; Fazey *et al*., 2018; Schneider *et al*., 2019). Co-production is a process or methodology to jointly and collaboratively generate policy-related knowledge by engaging multiple and diverse actors (Lepenies *et al*., 2018). The collaborative nature of this approach enables the participants to collectively address a problem and set specific goals, which enhances transformations achieved when responding to a challenge (Lang *et al*., 2012). Ultimately, scientific knowledge generated through such an approach is likely to be more relevant and useful in policy formulation.

Unlike more traditional approaches to knowledge generation, co-production addresses the 'usability gap' through the sustained engagement of information producers and users to create credible knowledge (Cash *et al*., 2003). The proponents of this mechanism argue that the knowledge generated through this process yields greater impact and more outcomes (Lepenies *et al*., 2018; Norström *et al*., 2020). However, co-production as a process can also be challenging as it brings together a wide range of actors and stakeholders from different communities, which can be more time-consuming. Equally, diverse actors will not easily embark on a collaborative effort without some degree of trust. In addition, engagement in collaborative and co-production processes often requires specific knowledge and skills to create fruitful interactions among individuals with diverse cultures, values, thoughts, experiences, skills and knowledge (Ayre *et al*., 2018).

Sustainable water management in internationally shared river basins has always been complex, dynamic and challenging (Akamani and Wilson, 2011; Margerum and Robinson, 2015). In such contexts, knowledge created through a co-production process produces benefits well beyond the knowledge itself. By pursuing a co-production process, we can foster convergence in thinking across countries, which can help to bring key stakeholders closer to co-operation. Equally, co-production tends to be more inclusive of indigenous local knowledge, something that is often overlooked by government

water management professionals in developing countries (Zarei *et al*., 2020).

Unfortunately, co-production approaches are not always used (Maiello *et al*. 2013) and bridging the science–policy gap remains a persistent challenge. In transboundary river basins, the challenges of co-operative water management can be profound – divergent assessments on levels of water availability and use in a basin, for example, can delay progress for years. Such challenges can be partially alleviated by creating knowledge through a co-production process that helps move divergent perspectives toward common understanding (Armitage *et al*., 2012). Under this approach, experts and stakeholders from various backgrounds and with different experiences can be engaged to explore a specific topic and produce context-related information and solutions.

A review of existing state-of-the-basin reports (SOBRs), such as those in the Nile and Mekong, drives questions on the degree to which they adhere to a co-production process. It would appear that SOBRs are often prepared by consultant teams under the auspices of their river basin organization and, while there are important consultations with national stakeholders, such interaction tends to be more oriented towards review and sign-off of new knowledge rather than direct participation in knowledge production. SOBRs published by the Nile Basin Initiative (NBI) on the Nile river basin (NBI, 2012, 2020), for example, relied on consultants contracted by NBI to draft and prepare content. Although input from country contributors was sought during the drafting process and national experts from some riparian states and the Technical Advisory Committee of the NBI validated the draft chapters (NBI, 2012), country contributors did not appear to directly draft SOBR content. Likewise, three SOBRs published by the Mekong River Commission (MRC, 2003, 2010, 2018) were mainly led and drafted by consultants to the MRC, with input, review and sign-off sought from country representatives. Ultimately, while there is clear value in securing validation and sign-off from stakeholders in a shared watercourse on a set of knowledge, more direct stakeholder generation of knowledge may enhance co-production levels.

This chapter aims to outline and explain the important steps in the co-production process

through which this book was developed. This chapter first outlines the book's content and direction and how these were developed in response to the goals and purposes. Next, the authors discuss how the Afghan and Pakistani writing team was identified, assembled, commissioned and mobilized to draft specific chapters and participate in cross-chapter technical discussions. The process of chapter development is then described, in particular how data and information were collected and shared within the author team. Finally, internal and external review processes are described. The chapter concludes with a discussion of the benefits, challenges and opportunities of shared knowledge production in shared Afghan–Pakistani waters.

Rationale and Scope

This book serves four purposes. First, knowledge generation. As the output of a co-production process, it aims to generate new and credible knowledge on diverse aspects of Afghan–Pakistani shared waters. Second, a common perspective. Through an inclusive approach to assessing conditions and diagnosing problems, this book aims to promote a common perspective on the management of the water resources of the Kabul, Kurram and Gomal river basins. Third, improved human wellbeing. The creation of knowledge and a common perspective is expected to inform decision-making in Afghanistan and Pakistan, which will, it is hoped, contribute to a foundation for enhancing human development in the basins. The authors have collected and documented information summarizing the basins, including the status of their surface and groundwater resources, the impact of climate change, current developments, and social and economic circumstances. Fourth, development options. The authors look forward to outlining opportunities and pathways to enhance the human development of the basins.

To achieve its objectives, the thematic scope of this book includes a clear, complete and evidence-based account of key water and human development parameters in the basins. The reason for selecting these themes was to cover the key aspects of integrated and optimal water resource management. The scope also included gathering information and local knowledge, creating a common perspective, contributing to the improvement of human wellbeing in the basins, and highlighting the challenges and opportunities for future development.

A particular achievement of this book is the synthesis and processing of data from the two countries. As yet, there is no consolidated baseline data in either Afghanistan or Pakistan that can provide a comprehensive analysis of land, water and environment information on transboundary river basins. Data in the named areas in Pakistan is kept with public entities (e.g. Water and Power Development Authority), public universities and some individuals. Data in Afghanistan are typically kept with the Ministry of Energy and Water and the Ministry of Agriculture, Irrigation and Livestock, public and private universities, and individual experts.

This book will be revised and updated through follow-up state-of-the-basin books in the future. In the meantime, this state-of-the-basin book is expected to bolster scientific and evidence-based understanding of the basins and create a dialogue among stakeholders who will determine the future of Afghan–Pakistani river basins. In these chapters, the authors cover the following three river basins in their entirety:

- Kabul river basin
- Kurram river basin
- Gomal river basin

Book Structure and Development

The development of this book is supported by the Water Management for Enhanced Productivity project (WMfEP), which commenced in July 2018 and is scheduled to be completed in June 2023. The project is funded by the US Agency for International Development's Mission to Pakistan (USAID/Pakistan) and implemented by the International Water Management Institute (IWMI) in partnership with the government of Khyber Pakhtunkhwa (KPK). The WMfEP's activities were carried out to reduce constraints to the productive and sustainable use of water for agricultural production in KPK. Improved arrangements for water governance

Fig. 2.2. The book production workflow.

and management will enable increased farm household income and improved livelihoods to contribute to socio-economic development and political stability in the KPK and beyond (). The geographical scope of the WMfEP covered the entire KPK including merged districts. All these areas are located in the three river basins covered in this book. Achieving the project's goals would not have been possible without a collaborative, integrated approach to issues of water management. Therefore, Component 4 of the WMfEP focused on increasing cross-border collaboration on water policy, practices and water sector challenges common to each country. The objective of Component 4 was to increase opportunities for sector professionals in each country to develop skills, share experiences and knowledge, and increase understanding of water policies, water sector incentives and approaches to drive the adoption of water-efficient agricultural practices, technologies, watershed management, improved water resources management, and increased dialogue on transboundary water benefit-sharing. The book production workflow and timeline is presented in the Fig. 2.2.

Reviewing international experience to inform content structure

Before developing the outline for this book, the editorial team reviewed existing SOBRs for other transboundary river basins. This review included eight SOBRs from four river basins: Delaware (Delaware River Basin Commission

2008), Mekong (MRC, 2003, 2010, 2018), Nile (NBI, 2012, 2020) and Saskatchewan (Partners for the Saskatchewan River Basin, 2009). A review of other SOBRs was used to: (i) guide the structure of the present SOBR on Afghanistan–Pakistan river basins, manifested in the table of contents; and (ii) understand the methodology typically applied in the development of thematic chapters. The review also helped the editorial team understand the required information on the geography, hydrology, flora and fauna of the basin and the social and economic conditions of its peoples. The review indicated the following main points:

1. SOBRs aim to provide a general view of a river basin including its hydrological, climatic, geographic and socio-economic circumstances, and the status of existing co-operation or the potential for future co-operation between and among the riparian states.
2. SOBRs provide an assessment of the conditions related to the development, management and use of water and other natural resources within a basin and its related impacts.
3. SOBRs are also intended to provide a list of suggested actions for the optimal and sustainable development of an entire transboundary river basin.
4. The main aims of developing an SOBR are: (i) evaluation of the adequacy and effectiveness of existing management strategies and practices; and (ii) stimulating policy discussions

on alternative management strategies and practices.

5. SOBRs are flagship products, which can be produced every several years based on the facts and figures from the available data and information for a transboundary river basin.

To build on the existing experiences of basin assessment, the editorial team also conducted a literature review of existing and publicly available transboundary diagnostic analysis (TDA) reports, which were mostly focused on African river basins. The TDAs reviewed included those for the Tuli Karoo basin shared between Botswana, South Africa and Zimbabwe (Ebrahim *et al.*, 2019) and the Shire river basin shared between Malawi and Mozambique (Chairuca *et al.*, 2019). This review of TDAs indicated the following points.

- TDA reports help riparian states develop a common understanding of the water resources and their issues in a given transboundary river basin, which will lead to co-operative management in the basin.
- Existing TDAs are focused on shared surface and groundwater resources and their related socio-economic challenges.
- TDAs highlight the main issues a transboundary river basin faces and help create the necessary conditions for joint action by basin states.

Ultimately, structures used to organize the content of TDAs, basin books and other SOBRs were reviewed to determine and sequence the topics to be discussed. Tables of contents in the reviewed TDAs indicated the adoption of a mostly similar structure, which included socio-economics, climate, water resources (both surface and ground), land and water uses, institutions and governance. Therefore, this state-of-basin report largely adopted structures commonly used in already published SOBRs and TDAs. Based on this extensive literature review, this book is organized into 10 chapters with the preliminary titles shown below:

1. Introduction
2. Methodology
3. Demography and Socio-economics
4. Climate
5. Surface Water
6. Groundwater
7. Land and Water Use
8. Institutions and Governance
9. Co-operation in the Afghan–Pakistani River Basins
10. Conclusion and Recommendations

Chapter 1 summarizes the broader international context of the three transboundary river basins and the significance of Afghanistan–Pakistan shared waters. It also provides the rationale for choosing the three basins and summarizes all the chapters.

Chapter 2 explains the co-production methodology employed for the development of this book. This is the first book written on the subject of Afghanistan–Pakistan shared waters and was co-developed by experts from both sides of the basin. The process was designed so that all the existing knowledge on the three shared basins is synthesized to provide a baseline for further work on these basins. The chapter explains the complete co-production process of data collection, tools and techniques employed in the writing-up.

Chapter 3 discusses the level of socio-economic development, challenges and opportunities that exist in the three basins. Key parameters that receive focus include demography, poverty, health, food security, livelihood, employment, economic growth, energy security, human development and overall economic conditions.

Chapter 4 discusses the state of the climate in the three river basins. There are huge data gaps stemming from the long history of conflict in Afghanistan. These limitations are discussed to carry out a meaningful modelling analysis for future climate projections. The authors discuss climate variability and trends in the past few decades and, based on historical data, provide insights into future climate change projections. They also discuss climate governance in the basin states and implications for future development.

Chapter 5 discusses surface water resources. The chapter is organized into three sections, each dealing with the Kabul, Kurram and Gomal basins. Within each section, the authors discuss the hydrology of the basin based on actual flow data. The authors also discuss changes in stream flow over time and likely future scenarios as

well as water-quality issues on both sides of the basins. The chapter also describes the existing reservoirs and their locations in each basin and the surface water and groundwater interactions and implications for the future.

Chapter 6 provides an overview of the groundwater situation. The authors begin with a discussion on groundwater aquifers and the state of the water table in basin states. They then look at groundwater variation over time and changes in groundwater quality across the region. The authors then turn their attention to groundwater use on both sides of the border and the dependence of various economic sectors on groundwater. They conclude with a discussion of groundwater management challenges with key messages for future considerations.

Chapter 7 provides a detailed analysis of land and water use in neighbouring countries. There are maps on land use, land cover and cultivated areas on both sides of the border. The authors discuss agricultural and non-agricultural uses of water and present possible development pathways.

Chapter 8 provides a detailed analysis of legal and institutional structures. Both countries have distinct legal structures under which water institutions function. Water governance in Afghanistan consists of a complex mix of formal and informal laws and institutions. Pakistan is a federation and water is a provincial matter. The authors map institutions in both countries according to the functions they perform and the commonalities and differences in water governance. Some legal architecture has recently evolved with new laws and institutions put in place and the authors analyse how these might be used for better transboundary water governance.

Chapter 9 presents a picture of the co-operation between Afghanistan and Pakistan on shared river basins. The authors begin with the current status of (non-)co-operation between the two states in managing their shared water resources and discuss the consequences of non-co-operation and the potential barriers to co-operation on shared water resources. They then present some of the opportunities and benefits of co-operation along with guiding principles and international frameworks for co-operation on shared river basins. The key message is that Afghanistan and Pakistan have more to gain by

sharing the benefits of co-operation rather than dividing these resources as Pakistan did with India, with the Indus Water Treaty.

Chapter 10 summarizes the main messages from each chapter for policymakers willing to work on developing a co-operative framework for water sharing between Afghanistan and Pakistan and links this co-operative framework with the UN Sustainable Development Goals, in particular Goal 6: 'Ensure availability and sustainable management of water and sanitation for all'.

Identification of Experts and Co-authorship

In each chapter, every effort was made to form a team of at least three experts; a leading expert from Afghanistan and Pakistan, and an international expert from IWMI. The aim was to create technical dialogue and discussions between water professionals from the two countries as they developed the chapters assigned to them. Each expert was expected to provide all the data he/she had access to for enriching that particular chapter.

The contributing experts from Afghanistan and Pakistan were carefully selected from the research, academic and practitioner communities to participate with the international experts from IWMI in writing up the chapters. A long list of potential contributing authors was narrowed to a list of those qualified, available and willing to participate in the process. Each expert was selected on the basis of his/her education, experience, skills in water resources management and familiarity with the river basins.

Unfortunately, sustained participation of Afghan experts faced at least two challenges. First, the regime change of 15 August 2021 – which occurred in the early stages of chapter development – disrupted the lives of certain co-authors and caused them to refocus their time and energy on essential issues such as immigration. Second, certain potential authors expressed concerns about engaging on the topic due to the historically troubled relations between the two concerned countries – both before and after the regime change. Despite these

Table 2.1. Chapter authors.

Chapter	Author	Country
1	Azeem Shah Jonathan Lautze Asadullah Meelad	Pakistan International Afghanistan
2	Asadullah Meelad Azeem Shah Jonathan Lautze	Afghanistan Pakistan International
3	(Ms) Marie-Charlotte Buisson Alias Wardak Inayat ullah Jan	International Afghanistan Pakistan
4	Zia Hashmi Mujib Ahmad Azizi Tousif Bhatti	Pakistan Afghanistan Pakistan
5	Arif Anwar Hassaan Furqan Khan	Pakistan
6	Shahid Iqbal Paul Pavelic	Pakistan International
7	Taimoor Akhtar Karthikeyan Matheswaran	Pakistan International
8	(Ms) Fazilda Nabeel Azeem Shah	Pakistan
9	Jonathan Lautze Shakeel Hayat Asadullah Meelad	International Pakistan Afghanistan
10	Jonathan Lautze Azeem Shah Asadullah Meelad	International Pakistan Afghanistan

challenges, the majority of chapters contain an Afghan co-author (Table 2.1).

Knowledge Platform and Data-processing

During the first authors' meeting on 4 August 2021, it was decided that IWMI would create a knowledge platform for the shared river basins of Afghanistan and Pakistan to support chapter development. The initial version was made available to the contributing authors on 16 September 2021. This platform contains detailed resources, especially remote sensing/ GIS and hydrological data. The authors were able to access the data and add and share their data with others.

The data used in the analysis in Chapter 3 has been extracted from the National Statistic and Information Authority for Afghanistan and the Pakistan Bureau of Statistics. These two sources are the most reliable sources for this section. However, there were some other sources used such as the Afghanistan District Dashboard developed by the World Bank Group and the Pakistan Social and Living Standards Measurement Survey. For the discussion on migration, UNHCR, UNDESA and International Organization for Migration data have been used as their data is often used in academic works. The discussion on socio-economic conditions of the three basins relies on data from the UNDP, World Bank Group, Integrated Food Security Phase Classification, Global Development Indicators, UNICEF and some formal sources from Pakistan and Afghanistan. Even though this data was not tailored for the three basins, it provides relevant facts and information on socio-economic conditions. The authors adapted this data using their own calculations and analysis.

For Chapter 4, besides the published literature, the data from the Department of Metrology and Hydrology of Afghanistan, UNEP, High Asia Refined Analysis and published literature was used. The authors also used data from 21 meteorological stations in Afghanistan and 10 stations in Pakistan. Unfortunately, as the analysis of climate requires data over long periods, there were limited data for Afghanistan due to the long history of conflict.

For Chapter 5, data from multiple sources were used such as formal sources (e.g. Pakistan Water and Power Development Authority), and figures and statistics from published articles and online datasets. Chapter 6 mostly used the data and information from published scientific hydrogeological studies. Chapter 7 relies mainly on data derived from the following two remote sensing datasets:

i.   SERVIR-HKH Regional Cover Monitoring System: this dataset has a 30 m spatial resolution, which is used to estimate land use and land cover.
ii. Synthesized Global E: this dataset has a 1 km spatial resolution, which is used for estimating agricultural water use.

In addition, secondary data was collected from multiple published sources.

The discussion in Chapter 8 on water governance and its institutions relies on, to a large extent, legal and policy documents, including the fundamental, federal, national and subnational legal statutes. The data needed for this chapter was collected from official and publicly available sources. These statutes and policy documents regulate the tasks and responsibilities of water institutions in Afghanistan and Pakistan and describe the rules of governance, decision-making mechanisms, and the overall management methods of water resources in the three basins. The data and information used in Chapter 9 were collected from various publicly available academic sources.

Data limitations

While this is the first book of its kind written in cross-border co-production on the Kabul, Kurram and Gomal river basins, it may possess limitations. Limited data and information were available on all three catchments, but particularly the Kurram and Gomal. As also acknowledged by the authors in Chapter 4, long-term, reliable and adequate climate-related data and information are still lacking in these river basins. The climate-related monitoring network has yet to be adequately expanded, especially in the uppermost parts of the basins where the snowfall happens and glaciers exist. The authors stated that even though climate observation and data collection was begun in the middle of the 20th century, the prolonged conflicts disrupted the process and we now face scattered and insufficient data.

Similarly, the authors in Chapter 5 pointed out the limited availability of hydrologic datasets and scientific studies for the Kurram and Gomal river basins. As a solution, they have relied more on grey literature in these two river basins and most of their analysis is focused on the Kabul basin, which is in a much better situation interim of data availability compared to the Kurram and Gomal basins. Likewise, the authors of Chapter 6 faced a serious scarcity of data regarding the existence, size and quality of groundwater aquifers and zones across the three basins. Both the

quantity and quality of groundwater resources are not adequately monitored. Nonetheless, it is hoped that this book will provide a foundation for future work and experts will continue to build on the insights offered. Equally, in Chapter 7, the authors acknowledge the insufficiency of relevant water- and land-use data; there were some provincial- and national-level land-use data but it was not useful for basin-level analysis.

Chapter Development

IWMI convened regular meetings of authors. On 4 August 2021, IWMI hosted the first virtual meeting of contributing authors. The discussions focused on international experience with state-of-basin reports, a brief overview of the Afghanistan–Pakistan data availability, data-sharing, and timelines for completing the report.

After the first meeting, the authors were asked to discuss the initial draft outline developed from the literature review and offer their revised outlines for each chapter by the end of September 2021. During this process, each group of authors had internal discussions on the draft outline and submitted their final feedback to the IWMI team.

After receiving the authors' feedback, the IWMI team organized the second meeting on 7 October 2021. The discussions in this meeting focused on chapter outlines, a template and the creation of a shared drive for data-sharing among the authors.

According to the agreed timeline, the first draft of the chapters was planned to be finished in December 2021. To follow up on this, IWMI organized a virtual meeting on 14 December 2021. There was another virtual meeting in January 2022 to check on progress and make preparations for a workshop in February 2022.

IWMI's team organized and hosted a feedback workshop from 8–10 February 2022 in Dubai with in-person and virtual attendance (Fig. 2.3). This workshop was intended to bring together all the contributing authors and get feedback and comments from each author, the editors and other experts.

During this workshop, each group of authors delivered a detailed presentation on their chapters to stimulate discussion and to get

Fig. 2.3. Author group photograph in Dubai.

Fig. 2.4. Authors' working group meeting.

feedback from the participants (Fig. 2.4). All the comments and feedback were recorded by IWMI and shared with the authors after the workshop.

Once the authors incorporated feedback from the workshop, the editorial team reviewed the revised chapters. Further comments on all the chapters were provided to all the authors and a deadline was given to revise the drafts. Once the revised drafts were received, the editors went through another round of review and prepared versions for external reviewers. These draft chapters were then submitted to external reviewers for an independent expert review.

Following external reviews, the authors revised their chapters and submitted them to the IWMI editorial team. The editorial team did two final rounds of revision and prepared all chapters for submission to the publisher.

Conclusions

This book is the outcome of a long and at times challenging journey of co-production. This is the first time such a process has been undertaken in the shared river basins of Kabul, Kurram and Gomal. Despite the challenges, the process mobilized and engaged a diverse group of experts from both Afghanistan and Pakistan in a collaborative initiative. It comprised a significant experience in which water experts from both countries were able to put aside the historical mistrust between the two states to assess the status of water resources and lay the basis for future co-operation. The process was effective in the following ways:

- The co-production approach was successfully applied. Experts preparing future

state-of-basin reports and transboundary diagnostic analysis now have an additional template for a co-production mechanism to address the usability gap of knowledge in shared river basins.

- Participants learned that trust-building is the core component of a successful co-production process. The process created a significant degree of confidence, trust and good working relations among the contributing authors. Such trust can play an important role in laying the foundation for future collaborations.
- The process created solid, salient and reliable knowledge and information that can function as a baseline for better scientific understanding of the basins for similar works in the future.
- This work identified key issues and challenges within the shared basins using a replicable process.

As is the case with many ambitious endeavours, there were challenges during the course of this journey, which affected both the process and its outcomes. The regime change in Afghanistan took place during the process of this co-development. This situation directly and negatively affected the participation of Afghans. For instance, Afghan-based authors were not able to participate in person in the Dubai workshop due to a visa ban and the pending international recognition of the new regime in Kabul. Despite this, the co-production process progressed and concluded productively. It has created a clear and credible baseline for further knowledge generation and collaborations in the future.

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