



## Knowledge mapping and strategy-building for agricultural change: Lessons learnt from participatory stakeholder events in Tajikistan's cotton-growing region

Alff, H.<sup>1</sup> , Spies, M.<sup>1</sup> , Zakirova, A.<sup>1</sup> ,

<sup>1</sup> Both authors are affiliated with Eberswalde University for Sustainable Development (HNEE), Eberswalde, Germany; \* Corresponding author (corresponding author's second affiliation: College of Social Sciences (CSS), KIMEP University, Almaty, Kazakhstan)

### ABSTRACT

The present article concisely reviews the outputs of a transdisciplinary research with the active engagement of local farmers aimed to enhance understanding of human wellbeing factors, provisioning of eco- and social system services, as well as risks and threats to social-ecological environment and strategies to tackle them. All of these factors were considered in relation to a south-western Tajikistan's cotton-growing region. Methodologically, this paper draws on the participatory research toolbox (PARSCO) designed by the authors on the basis of the previous methodology (MARISCO) to assess the complexity of social-environmental systems, and identify and evaluate more socially and ecologically sustainable development strategies (see PARSCO, 2025). The study findings reveal that a participatory stakeholder approach can be useful for not only forging and reflecting upon local expert knowledge, but also for amplifying contributions by otherwise underrepresented societal actors, particularly smallholder farmers, to interdisciplinary knowledge production.

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## 1. Introduction

Since the end of the Soviet Union, Central Asia's agricultural development has seen far-reaching policy, socio-economic and environmental transformations. The dissolution of large-scale state and collective farms in the majority of the region's countries has given way to often precarious smallholder farming (Hermans et al., 2024; Lowder et al., 2025). A trend towards re-collectivisation and re-industrialisation of agriculture has been observed - at least in parts of Kazakhstan - over the past 20 years (Petrick et al., 2013). Conversely, in Tajikistan, this trend has been of a negligible informal nature (Mukhamedova & Wegerich, 2018). At the same time, agricultural strategies are continuously molded by a top-down authoritarian policy culture often neglecting bottom-up and participatory perspectives (Spies & Welp, 2021; Kurmanov & Knox, 2022). This means that the people directly impacted by the target policies, especially rural communities and smallholder farmers, are not adequately involved in knowledge generation (and, eventually, decision-making), leading to policies not fully addressing their needs and concerns (Liao et al., 2014). The lack of local actor engagement in the processes above likewise spawns missing acknowledgement of everyday- and practice-based expert knowledge - an issue thematised in the literature since at least the 1990s (DeWalt, 1994; Lwoga et al., 2010; Van Assche et al., 2013). Moreover, the predominance of productivist approaches within agricultural top-down imposed strategies prioritises higher production at the expense of tackling social and ecological intricacies of local biomass production systems (Hackfort, 2024; Keilbart, 2021; Spies et al., 2022).

Since 2019, the TRANSECT project (Agrarian Transformations and Social-Ecological Complexities: Local Bioeconomy Scenarios in Central and South Asia, [www.transect.de](http://www.transect.de)) has been investigating agricultural and bio-economic dynamics since the dissolution of the Soviet Union (specifically, in Kazakhstan and Tajikistan) and the Green Revolution era (in Pakistan). To do so, qualitative and ethnographic field research as well as participatory stakeholder workshops have been applied.

This article stems from a previous working paper that has already yielded another analytical piece (Spies et al., 2025), and introduces participatory knowledge mapping and scenario-building as potential apparatus to tackle these major issues, with a particular focus on Tajikistan's agricultural sector. It is an attempt to answer the question of how to methodologically grasp the heterogeneity (and hybridity) of local knowledge and perspectives, as well as make it aid the purpose of transdisciplinary - or applied participatory - study on biomass production and agricultural development in the case of Tajikistan. Based on the long-term qualitative field missions and participatory stakeholder research during 2019-2025 under the TRANSECT Project in Central and South Asia, the authoring team has designed and rigorously tested a

systemic and participatory method to address at least some crucial shortcomings. On the one hand, this workshop-based method allowed local stakeholders assess local farming systems holistically, including the many ways they are affected by threats and complex underlying factors. On the other hand, the stakeholder workshops helped farmers and other stakeholders in formulating and critically evaluating sustainable management strategies in terms of improving farming systems and combatting the challenges swaying them. Tajikistan's case study was chosen for this article due to the particularly large gap between state-imposed top-down decision-making and control - to the extent of steering the types of cultivated crops - and the relatively limited agency of smallholder farmers to negotiate state specifications (Hofman, 2018, 2021; Zakirova et al., 2023, 2025). The authors believe this case serves an especially stark example of how participatory stakeholder processes can be helpful in comprehending local farming systems from an everyday knowledge perspective, including smallholder farmers' positioning in such a socially and politically strained atmosphere. In addition, the case of Khatlon Oblast (Region) also illustrates that a flat hierarchical approach to knowledge production reveals the complexity of local knowledge otherwise largely hidden from the public albeit high-level policy radar in authoritarian systems.

The PARSCO methodological toolbox (Participatory Strategy Development for Sustainable Biomass Production) (PARSCO, 2025) stems from the MARISCO methodology ([www.marisco.training](http://www.marisco.training) and below) applied over many years in the context of stakeholder-informed conservation management around the globe. Like MARISCO, PARSCO endorses an approach that is both systemic and participatory. Agriculture or, more generally, biomass production comprises complex adaptive systems interacting in dynamic and nonlinear ways (PARSCO, 2025: 11). Inside these systems, multiple economic, social, ecological and political factors mutually impact each other, producing feedback loops in turn altering the initial systems' setup. The authoring team argues that: 1) PARSCO is methodologically sensitive to this complexity and, hence, is grounded in complex adaptive systems theory, as well as related concepts in assemblage theory (Spies & Alff, 2020); and 2) participatory approach is critical for getting a deeper sense of farming systems, as it helps the crucial task of heeding the perspectives and knowledge of - first and foremost - the producers. The call to better integrate local insights into knowledge generation, and as an extension into decision- and policy-making, has been articulated since the early 1990s and is still embedded in contemporary development studies (Blaikie et al., 2004; Rhoades & Nazarea, 2006; Zuberi et al., 2025). In the first place, this means formalising local citizens' knowledge and granting it significance and relevance alongside the so-called academic knowledge. By doing so, the method aims to bolster the contribution of local communities and stakeholders' knowledge to policy making and strategy development.

The following section of the article renders a detailed methodological overview with the focus on implementing the method in Tajikistan. The paper's remainder provides insights into the findings of the proposed participatory approach, as well as analyses its suitability for biomass production systems applied research in Central Asia and beyond.

## 2. Methodological background

With the aim of designing and testing a participatory stakeholder approach, the research team based its methodology on a proven toolbox - Adaptive Management of vulnerability and RiSk at COnservation sites (MARISCO) designed earlier at the Centre for Econics and Ecosystem Management (CEEM) of Eberswalde University for Sustainable Development (HNEE) as a participatory methodological toolbox (Ibisch & Hobson, 2014). Its main purpose is to enable stakeholder-based knowledge co-production and engage stakeholders through scenario-building. MARISCO has been already applied in conservation settings globally, mostly in local contexts. Under the TRANSECT Project, the authoring team revised the methodology for it to better suit the context of (managed) agro-ecosystems or biomass production systems, among others, by putting more emphasis on social systems and services in their linkages with ecosystems. The study team entitled their particular methodological approach as the Participatory Strategy Development for Sustainable Biomass Production (PARSCO). Based on its practical adoption, the authors elaborated a detailed user manual to make PARSCO conducive for a wide range of applications in various agricultural and biomass production settings (PARSCO, 2025).

### *Khatlon Oblast case study*

In the course of the TRANSECT Project in Tajikistan, two consecutive workshops were held with 22 and 24 local stakeholders in May 2022 and March 2023, respectively. Due to the patriarchal structure of Tajikistan's society, women participation was limited. Hence, only two females attended both events, each accompanied by a male family member. Observing this gender imbalance, an additional female-only event was held in Khuroson District, with nine women attending, engaged in small-scale horticulture and vegetable production (sold at local markets). The stakeholders hailed from Jaloliddin Balkhi and Khuroson Districts of Khatlon Oblast (Region) in the country's southern part, where the authors had previously (2019-2023) carried out long-term research focusing on the dominant local cotton production system.

Located in south-western Tajikistan along the Vakhsh River, Khatlon Region had emerged as the country's leading cotton-producing region instead of zone during the

Soviet era of large irrigated state and collective farms. From the 1950s onward, the expansion of canals and major irrigation networks on the Vakhsh had enabled intensive cotton monoculture tying the economy to irrigated cotton growing (Zakirova et al., 2023a). The dissolution of the Soviet Union and turmoil of the Tajik Civil War (1992-97) had delayed meaningful reforms to the country's agricultural sector (Spoor, 2008; Van Atta, 2009, 2017). Under the presidency of Emomali Rakhmon, however, cotton still remains Tajikistan's main cash crop and export commodity. Due to its strategic significance, cotton cultivation is rigidly controlled by the state, and smallholder farmers are obliged to grow it on at least 60% of their plots, even though larger-scale state farms no longer exist (Hofman, 2018; Zakirova et al., 2023a). Smallholder farmers often struggle to balance among the obligation to produce cotton for the informal state quota, the essential need to grow food crops for subsistence and the market, and the requirement to align with agricultural innovations, e.g., organic farming promising higher profits (Zakirova et al., 2025).

Thanks to previous field research mission in Khatlon Oblast, the authors managed to identify and recruit - with relative ease - key stakeholders for their participation in the workshop series. All events were organised and accompanied by a team of 4-5 facilitators from HNEE and local partner institutions. The audience's vast majority were male farmers with diverse backgrounds, representing different social strata in the study areas. The participant group included both resource-poor smallholder farmers, whose primary livelihoods depend on small plots (1-3 ha), and relatively better-off farmers with additional income sources, e.g., small businesses or non-agricultural activities. Other participants comprised agronomists from the study area, as well as representatives of local institutions and decision-making bodies such as water user associations. The methodology and results outlined below draw largely on the male-dominated workshops in May 2022 and March 2023 as - from an allocated time perspective - they allowed for more in-depth discussions and rating exercises.

As mentioned above, the additional female-only workshop was held in Khuroson District to evaluate local agricultural challenges and specifically women's perspectives on the ongoing and proposed sustainable farming strategies. In Tajikistan, local customs pose severe limitations for mixed-gender gatherings, i.e. females can only partake if accompanied by male relatives, and normally they hardly express their opinion with men present. The women-only setup, thus, allowed a more open environment for female participants expressing their opinions.

### *Workshop 1: Knowledge mapping and systemic situation analysis*

The first three-day participatory workshop took place in Dushanbe, the national capital, in May 2022. Its goal was to create comprehensive knowledge map, or a systemic model, depicting the local resource use systems in their environment,

as well as the different threats and risk factors (Fig. 1); moreover, the participants systematically evaluated them against the corresponding criteria. Utilising coloured (red, yellow, light and dark green) stickers, the group rated the threats and risk factors based on their past, current and anticipated future criticality - from red symbolising 'highly critical' to dark green representing 'not critical at all'. In addition, each threat and risk factor was rated in terms of its manageability and level of perceived awareness among the participants (Fig. 2).



Figure 1. Participants working on the knowledge map during (Workshop 1, Dushanbe).

|  |                  |                     |                     |
|--|------------------|---------------------|---------------------|
|  | Past criticality | Current criticality | Future criticality  |
|  | Manageability    | Level of knowledge  | Strategic relevance |

Figure 2. Moderation card template for threats and risk factors with rating fields.

The exercise produced a comprehensive knowledge map prioritising human wellbeing and depicting the various ways in which resource use systems and, ultimately, human wellbeing are affected by an intricate interplay of social, ecological or political factors and threats (Fig. 3).

At the initial phase of knowledge map-building, the group defined the case study areas as per key administrative and ecological key variables, as well as plotted it accordingly over the prepared aerial image. Then, the audience identified human wellbeing targets/elements, i.e. their own needs for having a good life (right side of Fig. 3), with the following assessment of the ecosystem services (ES) and social services (SS) ensuring the welfare targets. The ES were conceptualised in the study and communicated to the participants as functions of the natural environment and its subsystems to the wellbeing of the population of the predefined case study area. Subsequently, the respective eco- and social systems underwent mapping. The final exercise was to identify the threats and contributing factors impacting the social and ecosystems providing the services above. In the course of such a step-by-step mapping process, the facilitators normally took a passive and guiding-only role, thereby allowing the participating stakeholders to freely engage in in-depth reflections and deliberations.

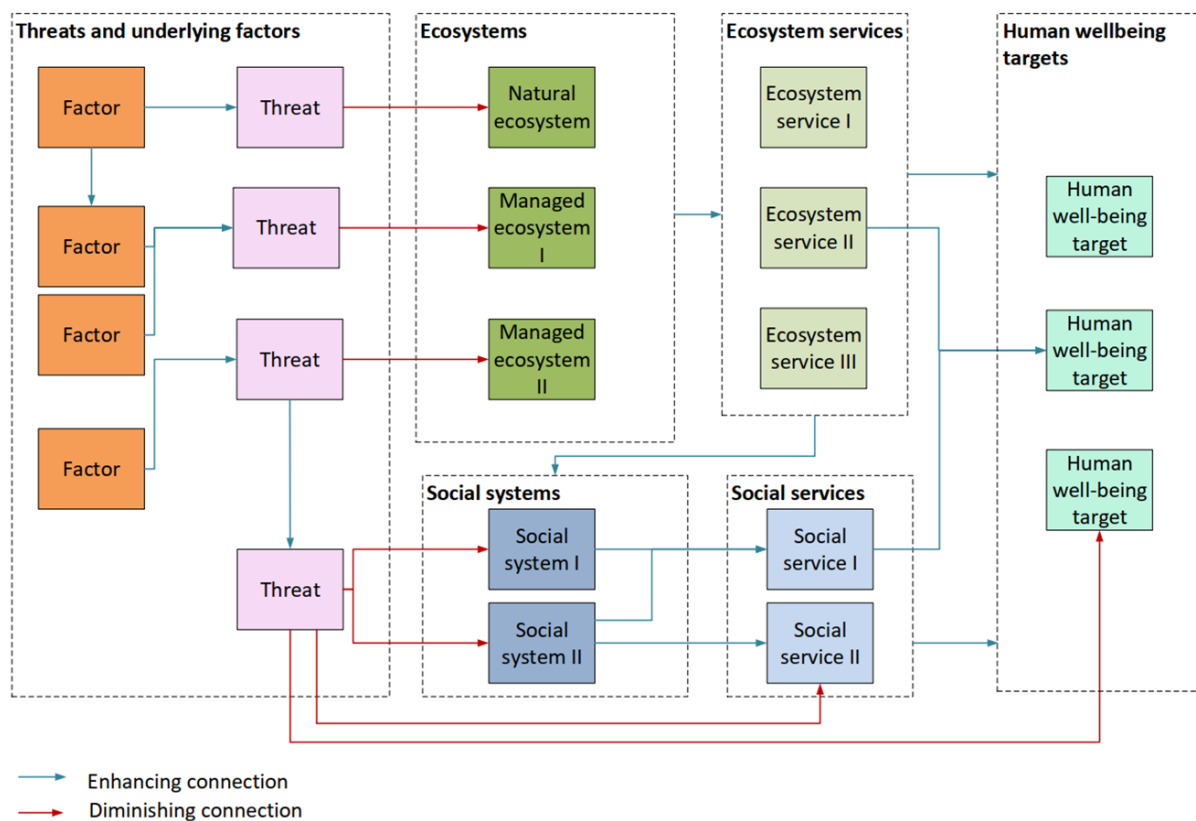


Figure 3. Simplified knowledge map.

The workshop proved local farmers well aware of the broad spectrum of threats and factors directly or indirectly impacting their livelihoods and local environments. While that observation did not come as a surprise, the detailed participant assessments, including personal formulations of underlying social-environmental interactions, demonstrated complex and systemic thinking.

### *Workshop 2: Strategy formulation and assessment*

The second event in Dushanbe in March 2023 gathered 24 participants, with the vast majority overlapping with the first workshop. The two key objectives of Workshop 2 were to conduct a systematic evaluation of existing and proposed strategies, and carry out a scenario-like analysis of local implications (Fig. 4). The organisers defined the overall strategy as comprising a series of decisions related to the deployment of available resources (management) and establishment of appropriate socio-institutional conditions (governance) fostering effective action(s) to accomplish desirable goals and objectives.



Figure 4. Participants rating strategies (Workshop 2, Dushanbe City).

First, the participants identified and plotted the ongoing strategies onto the knowledge map linking them to the corresponding factors, threats or other elements. After doing so, the group identified the gaps not addressed by the existing strategies and proposed alternative or complementary approaches to close them. Next up, both the existing and alternative strategies were systematically assessed against a variety of predefined criteria. The participants utilised the same colour coding - i.e., from dark green ('positive') to red ('negative') - to mark the feasibility and various expected impacts those policies could have on local resource use systems. A similar rating system was applied two weeks later during the women-only workshop. Female trainers facilitated the event to ensure a comfortable environment and encourage open dialogue, thereby overcoming linguistic and cultural barriers often curbing women's participation in mixed-gender settings.

### 3. Outcomes and outputs

The workshop series in Tajikistan revealed a wide range of knowledge, perspectives and ideas among local agricultural stakeholders combining in-depth local expertise and practice with the ideals of agricultural modernisation politics and top-down policy implementation. That was particularly reflected in the proposed strategies, not only mirroring hands-on solutions for social-ecological threats, but likewise calling for outside interventions by the state or international cooperation initiatives. The latter comprised, e.g., educational programmes for strengthening sustainable agri-development and financing infrastructure. Prior to dissecting the more general research findings, the subsections below briefly outline the two workshops' results to get a deeper insight into the local context, earmarked issues and ongoing strategies as mapped and assessed by the event participants.

#### *Knowledge mapping and systemic modelling*

The human wellbeing targets identified early in the first workshop ranged from food, water and health to religion, education and social cohesion within communities (incl. within households). The ecosystem and social services mentioned by the group inter alia encompassed water provision, crops, education, and income opportunities. The identified ecosystems included various types of farmland, pastures, forests, and aquatic ecosystems like lakes, canals and streams, while the social systems referred to a broad range of institutions such as local community organisations, state and religious bodies, as well as agricultural trading places, schools and other educational institutions.

During the exercise, the participants mapped and evaluated 47 threats and 49 factors, i.e. underlying root causes. The highest rated threats comprised expensive fuel, soil salinity, and unemployment. This reflects the local situation on the ground, as diesel fuel has to be purchased for market prices, and agricultural land often falls out of production due to the by now largely defunct former Soviet irrigation and drainage infrastructure. The rating also mirrored the high degree of labour migration from the study area to Russia and Kazakhstan due to limited livelihood opportunities. The pinpointed risk factors had to do with a wide range of aspects - from biophysical (e.g., lack of rainfall) to institutional (e.g., inaccessibility of state programs) and demographic (e.g., migration to cities and abroad). Monopolistic setups, lack of domestic fertiliser production, and high energy prices were among the highest rated factors. Again, this assessment reflects the challenges specific to Tajikistan, a highly authoritarian state, where business interests are often concentrated with top state officials, and where a lack of resources and a limited industrial base restrict domestic production.

In general, the first workshop showed a high degree of analytical skills and system-thinking among the participating stakeholders. The group were well aware of and quite knowledgeable about the complexity of threats and factors directly or indirectly affecting their livelihoods and local environments every day. Even highly sensitive issues were mentioned as factors, albeit worded in a cautious way. Corruption, e.g., was framed as the ‘human factor’ and not followed up further in the rating exercise. In the feedback session, the audience highly praised the workshop’s openness and the scope it allowed for out-of-the-box thinking, that they would not normally have the opportunity to engage in.

### *Assessing existing strategies*

In the second workshop, the audience first re-evaluated the knowledge mapping and systemic analysis results, before agreeing on an overall goal/vision that the later assessed strategies should aim at. The goals were formulated by the participants as ‘good life, favourable conditions, effective long-term natural resource use, and higher production.’

During the next phrase of the second workshop, the group identified 17 existing strategies and corresponding measures already applied locally in two target districts by various stakeholders, namely, state agencies and international actors. The active strategies with the highest overall ratings included horticulture promotion, government support for water pumps, and bio-humus production and use. The utilisation of imported hybrid seeds and chemical pest control was among the low-rated strategies.

While it does not appear scientifically sound to directly compare the ratings by females and males due to the different criteria applied and a limited number of strategies rated by the former, their perspectives shed valuable insights into gendered priorities and challenges. The deliberations revealed that women perceived themselves as particularly vulnerable within existing rural power schemes, especially in terms of accessing water and agricultural training. They conveyed strong concern over the lack of water in their villages, linking it to local power hierarchies and inefficiency of water user associations (WUAs). Therefore, WUAs - as a foreign donor-supported strategy to resolve water issues in Tajikistan - was rated highest by men but lowest by women, who deemed it a complete failure, with a key reason for this stark contrast in views being that a WUA member partook in the previous workshop attended by men. Despite the biased outcome regarding strategy-rating, the participants were nevertheless outspoken.

### *Formulating complementary strategies*

In the next phase, the event participants suggested and formulated several complementary or alternative strategies to address the identified gaps in the active

strategies. The group indicated nine complementary strategies and, interestingly, the one rated the highest was related to knowledge creation, namely, providing training for farmers and expanding their knowledge and skills. Remarkably, in the female-only workshop, education-related strategies, among others, were rated significantly lower than in the male-dominated events - the women's argument being that they were usually excluded from such trainings, even though assumed most of the farming work.

Overall, the suggested strategies were quite disparate, with many of them rather straight-forward demands for external assistance, e.g., training, provision of credit/loans, or construction of infrastructure by the state or other investors. Notably, many of the proposed 'alternative' strategies emphasised technological approaches and top-down interventions well-aligned with Tajikistan's mainstream agricultural policies, putting into question the binary notion of 'local vs. external' knowledge and perspectives. Several of the proposed strategies appeared to support productivist paradigms of modern intensive agriculture promoted by mainstream national agricultural policies across Central Asia - a feature that has dominated the modernisation-inspired development discourse in the region since post-independence and even during the Soviet time (Alff & Spies, 2020). For instance, state-administered and technology-focused strategies were mentioned, such as 'expanding greenhouse farming and introducing multi-level greenhouses'. Interestingly, in the comprehensive assessment, such strategies often scored lower than more holistic and ecosystem-based models, e.g., 'establishing self-sufficiency of local seed systems'.

It's noteworthy that the second workshop participants came up with relatively few strategies for implementation by themselves, which may be interpreted as a result of the strong paternalistic and top-down political culture of the existing authoritarian regime in Tajikistan, that farmers have internalised to an extent. Yet, there were also certain notable exceptions. One of the medium-rated strategies ('green manure') referred to the practice that farmers could deploy on their own using their limited resources provided access to the necessary knowledge. Moreover, the group formulated an innovative idea of forming local seed-saving and sharing systems ('establishing self-sufficiency of local seed systems'), although it was rated lower than other strategies in terms of feasibility, as the farmers argued the need for external support, access to which is considerably limited.

#### 4. Discussion

The workshop series in Tajikistan revealed a plurality of perspectives among the participants integrating locally grounded knowledge with different sets of 'external' expertise and ideals, regardless of possible conflicting underlying principles or paradigms. Hence, local agricultural stakeholders' knowledge and imaginations

could be described as ‘hybrid’ (Thomas & Twyman, 2004; Chaudhary et al., 2022), in the way that they often embedded or nested local knowledge with overarching principles of top-down imposed agricultural development requiring state or other external intervention. That became obvious, in particular, based on the diverging essence of the proposed strategies the event participants agreed upon - ranging from educational and productivist interventions, requiring outside support in line with existing policy paradigms, up to more ecosystem-based approaches. In part, that interconnection of knowledge sets and associated strategies was likely due to the ‘overprint’ of ‘traditional’ farming systems by the decades of Soviet and post-Soviet modernisation campaigns that had strongly influenced local ideas around agri-production (Scott, 1998). This reflects a widespread notion in rural Tajikistan (and wider Central Asia) suggesting a lack of agricultural knowledge prevalent in contemporary smallholder farming. More precisely, it is widely assumed that vital farming expertise is - or rather was - a key characteristic of the ‘scientific approach’ applied in the Soviet collective and state farms and, thus, became extinct as those entities were dismantled in the 1990s and state support, e.g., extension services, diminished (De Danieli & Shtaltovna, 2016).

However, while the political and historical contexts are pivotal for accessing knowledge and shaping visions and ideas, it would be over-simplistic, as well as patronising, to assume that the rather ‘conservative’ nature of many of the proposed strategies was merely a result of superimposed ideas. In our assessment, that would underestimate the analytical skills and thorough deliberations of local stakeholders well aware of the complexities of their livelihoods and environment. Thus, strategies may be reflective not of their local knowledge and constrained perspectives but rather of how farmers envision accessing resources.

Yet, how can this heterogeneity of local knowledge and perspectives be grasped methodologically and put into use for transdisciplinary research on biomass production and agricultural development in Central Asia? The proposed methodological approach offered several features that the authoring team find useful in this regard and in the regional context.

First, the applied method of participatory knowledge mapping and systemic assessment is based on an open conception of knowledge production aiming to reduce power hierarchies. All ideas and suggestions by the participating stakeholders were collected side by side on the same plane of expertise, represented by the knowledge map devised in Workshop 1 complemented with strategies in Workshop 2. That meant that each element was deemed equally valid, regardless of who put it forward. The only criterion for judging the ‘quality’ of knowledge was the joint rating of ‘level of knowledge’ for the identified threats and factors that represented a critical self-assessment of the participants in terms of how well-informed they felt

about a particular element and its causal processes. The identified and proposed strategies were jointly contemplated and critically reviewed during the comprehensive assessment, i.e. all approaches were cross-evaluated based on the principle of consensus and without a-priori categorisation. In this regard, the visual method of plotting strategies into the jointly developed situation model and attributing them to the factors, threats or other jointly identified elements, we argue, also helped hedging hierarchical and binary thinking. This outcome, especially under Tajikistan's authoritarian political climate, can potentially expand the contribution of local and other grassroots-level stakeholders otherwise underrepresented or simply ignored in knowledge generation. An elevated positioning of local actors in producing what is considered 'valid' knowledge likewise has the potential of boosting the agency of local stakeholders like smallholder (and other) farmers in decision-making processes. Last but not least, the participating stakeholders highly appreciated the events and the applied PARSCO tool case as an opportunity to reflect and express their visions, knowledge and needs, something they would not have a chance to do normally.

Second, applying a systemic approach grounding strategy elaboration and evaluation in a comprehensive situation analysis improved consensus-making while also helping avoid binary or dogmatic thinking. By jointly and thoroughly pondering the complex social-ecological systems in which farming practices are embedded, as well as the manifold and interrelated challenges and their root causes, the word division is strange were more likely to come to the same conclusions despite varying opinions, when compared to other methods such as participatory scenario-building that place less emphasis on a detailed situation analysis (e.g., [Palomo et al. 2011](#)). In contrast, the method proposed herein - of grounding strategy formulation in a thorough situational analysis - could also mean that proposed strategies may be more 'realist' and conventional compared to the outcomes of participatory co-design processes emphasising creative visioning ([Gray et al., 2024](#)). However, we argue that this limitation is not only a disadvantage - our workshop outcomes and outputs are based on deliberative consensus bringing together heterogeneous knowledge and viewpoints, which, we contend, can generate context-specific innovations more likely to be widely accepted.

Nonetheless, other challenges related to deliberative stakeholder and participatory processes still remain. Bringing together heterogeneous stakeholder groups requires power inequalities and difficult group dynamics handled with care. When preparing the PARSCO stakeholder workshops in Tajikistan and other case studies, the study team had deliberately refrained from dividing stakeholder cohorts into more/less powerful actors, as that could produce potentially biased pictures hard to link together. As the case of the WUA representative in the strategy-building exercise showed, participatory stakeholder involvement does indeed run the risk of being

affected by power misbalances. As discussed elsewhere, managing group dynamics in a power-sensitive manner requires a good deal of facilitator skill and experience (Spies et al., 2021). In our methodology, a combination of silent brainstorming sessions - with participants writing on cards and engaging in open discussions and carefully selected breakout group sessions - was applied to encourage less outspoken individuals and curb dominant ones. Moreover, great care by facilitators is required to not impose their own normative ideas on participants, which cannot be fully avoided, as this often happens subconsciously when managing group dynamics (Tavella & Franco, 2015). Hence, reflecting one's own positionality as a facilitator is crucial not only when moderating a process, but also afterwards when making sense of the (sometimes messy) interconnectedness of expertise and perspectives. Interpreting the outcomes of participatory strategy-building necessitates understanding the structural barriers and possible mental lock-ins affecting the process (Gaventa & Cornwall, 2006). However, at the same time results should be taken seriously by the facilitators, even if they conflict with their own normative notions of sustainability and what constitutes 'local' knowledge.

Finally, while certainly with limitations, the participatory method of knowledge co-production and co-design proposed by the study team provides stakeholders with an 'open space' for collective learning and deliberation of visions and concrete ideas. This very sense of openness was noted and highly appreciated by the workshop participants, as such settings for expressing, formulating and re-evaluating perspectives - as they claimed - were largely absent in their public lives. While the aspect of providing open venues for debating ideas may seem trivial from a theoretical point of view, its importance should not be underestimated in the societal context of rural Central Asia, where farmers and other agricultural stakeholders often lack opportunities for free thought and - even more so - expression.

## 5. Conclusion

Workshop-based stakeholder engagement proved instrumental in different ways. Firstly, it showed that participants, as local experts, had a thorough understanding of their unique complex social-ecological environs, and the many factors influencing them. The systemic approach of the method encouraged stakeholders to think holistically rather than in a sectoral way, and comprehensively analyse the social, institutional, political-economic and ecological processes affecting their local environment and everyday lives.

Secondly, this exhaustive and systemic understanding was also reflected in the assessment of existing and formulated complementary strategies to address ongoing issues, that covered a wide spectrum of sectors and leverage points - ranging from educational activities to policy measures and new farming practices. We, hence,

discovered that some strategies proposed by participants were later slightly devalued by themselves. This phenomenon underscored the importance of using systemic evaluation approaches to thoroughly evaluate and refine ideas that initially sound good. This is also a reminder that our understanding of what works can evolve over time, and it is crucial to adapt accordingly.

Thirdly, the application of the PARSCO methodological toolbox did help generating knowledge aimed at reducing power hierarchies. In particular, the word division nature of assembling and negotiating knowledge sets in the course of the workshop cycle made the opinions of all participants appear equally valid, regardless of power misbalances within the group. Joint knowledge deliberation, without the normative interference of facilitators, allowed for consensus-making and demeaned dogmatic thinking inside the group, particularly when it came to realistic yet implementation-prone development scenarios. Last but not least, the applied methodology provided participants with open space to freely formulate and discuss their thoughts - an opportunity that smallholder farmers are largely deprived of in their usual settings.

Lastly, thanks to separate women-only workshops, the study team observed a noteworthy gender disparity in evaluating existing and complementary development strategies. Women in Tajikistan, or at least in Khuroson District - where a separate female-only event was held - were more critical in their judgement of the social risks and benefits associated with the strategies. This divergence in perspectives sheds light on the need for gender-sensitive approaches in policy and strategy development, particularly in rural Central Asia, where female voices often remain mute - and, thus, ignored - in public debates and decision-making.

The authors summarised the method in the form of the practical user manual (PARSCO, 2025), allowing to effectively facilitate a systematic and bottom-up assessment of local biomass production systems, and that has proven to be a valuable instrument adaptable to different local contexts and participatory research tasks. Furthermore, it not only offers insights for bottom-up policy formulation, but likewise manifests as an evaluation and management tool for planning teams. This approach, we argue, magnifies the contribution by local communities and stakeholders, including smallholder farmers, in Central Asia to knowledge generation, ensures their voices are heard, as well as lays the groundwork for effective and context-specific decision making at the local level. Further methodological testing is required to forge ways in which the acquired knowledge and better scenario-building could properly 'bridge the gap' between local experts and administrative bodies to guide local-level decision-making.

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