INNOVATION NETWORK FOR FOOD SECURITY AND POVERTY REDUCTION

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ABSTRACT

By 2050, the world will require a 70 per cent increase in global food production and 100 per cent in developing countries to feed growing population. However, limited land is increasingly being used for other purposes, agricultural productivity growth is decreasing and soils are depleted and degraded. The variability in climate and growing water shortages are also challenging agriculture today.

Agriculture cannot advance without effective systems that generate innovative options and make new technology available to farmers. While knowledge on appropriate technology options exists, it continues to reside in separate “knowledge silos”. Technology transfer is a challenge that requires active participation of farmers, governments, research, and other stakeholders in innovation systems to ensure that these technologies are suitable and adaptable to farmers’ local conditions.

To make the knowledge available to those who need it requires increased South-South dialogue and intraregional learning that could spur technology adoption contributing to improved food security and nutrition. The Network for Knowledge Transfer on Sustainable Agricultural Technologies and Improved Market Linkages in South and Southeast Asia (SATNET Asia), financed by the European Union, is addressing this issue by bridging the organizations that play an important role in agricultural innovation in South and Southeast Asia.

The network has developed an analytical framework to identify innovations that are sustainable, productivity enhancing and suitable for the poorest and most vulnerable people and have potential to be adopted on a large-scale. Information on best practices is being collected to feed into a portfolio of sustainability enhancing technologies. To support the adoption process, a number of innovative knowledge-sharing tools and processes are being implemented to enable all stakeholders to make decisions and take actions that lead to the desired changes.

The paper aims to share SATNET’s work with stakeholders in reaching farmers with appropriate and innovative solutions.

Key words: agriculture, innovation, network, South-South, technology

Innovation Network for Food Security and Poverty Reduction

I. Introduction

The current organization of knowledge, science, and technology cannot adequately deal with the challenges to sustainable food systems because information on food, health, agriculture, forestry, landscape management, rural areas, environment, climate, ecology, and policy trends continue to reside in separate 'knowledge silos' (Weinberger *et al*, 2009). This has resulted in two major factors contributing to low growth: the lack of alternative technologies to address the needs of poor farmers, and bottleneck design flaws in methods for disseminating and scaling up of technologies for these farmers (Pender, 2007). Technology transfer requires active participation of farmers, governments, research, and other stakeholders in innovation systems to ensure that these technologies are suitable and adaptable to farmers' local conditions. It also requires creating opportunities for South-South dialogue and intraregional learning that could spur technology adoption contributing to improved food security and nutrition.

The Network for Knowledge Transfer on Sustainable Agricultural Technologies and Improved Market Linkages in South and Southeast Asia (SATNET Asia, 2012-2014), financed by the European Union, is addressing this issue by bridging those organizations that play an important role in agricultural innovation in South and Southeast Asia. The network has developed an analytical framework to identify innovations that are sustainable, productivity enhancing and suitable for the poorest and most vulnerable people, some of which have potential to be adopted on a large-scale. To support the adoption process, a number of innovative knowledge-sharing tools and processes are being implemented with the explicit intention of managing knowledge. This is to enable all stakeholders to collaborate, make evidence-based decisions and take actions that lead to the desired changes. This work is being implemented by the Centre of Alleviation of Poverty through Sustainable Agriculture (CAPSA) in Indonesia, in collaboration with the Food Security Center (FSC) of the University of Hohenheim in Germany.

The objective of this paper is to share SATNET's work in identification, documentation and dissemination of agricultural innovations. Section II presents the methodology outlining the analytical framework. Section III presents and discusses preliminary results. Section IV provides an outlook of forthcoming activities, in particular, a range of knowledge-sharing tools and processes through which selected agricultural technologies will be made available to stakeholders. Section V concludes the paper.

II. Methodology

The analytical framework for SATNET Asia was developed to identify suitable agricultural technologies and is depicted in Figure 1. The upper part of the graph shows the scheduled activities and the lower part the expected outcomes. A baseline survey has been completed and provided an inventory of technologies that are currently promoted by stakeholders in the project countries (Jaenicke and Spisiakova, 2012). The framework itself is shown in the central box of the graph and consists of three distinct tools – application, selection and validation. The following paragraphs describe the three tools in detail.

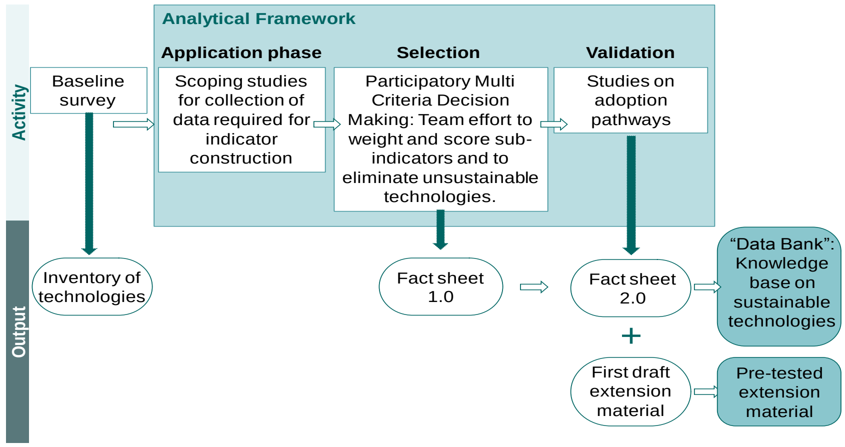

Figure 1: Analytical framework overview

Application phase

The first tool was designed to collect information on potentially suitable technologies identified from the baseline survey. Within an initial period of four weeks (August-September 2012), network participants took part in the application process. They used a questionnaire type application form to provide relevant information about a technology they judge suitable for promotion through SATNET. The aim was to gather detailed information about important criteria of the technologies necessary for the construction of a composite indicator. The application form requested general information, a brief introduction of the technology, useful documentation, and detailed data required for comparison between technologies.

A total of 104 criteria of sustainability that are relevant to the present research were identified from the literature. Out of these 27 highly relevant criteria were selected and integrated into the data collection tool and discussed with the network participants. To ease the application procedure and to respond to comments, the application was split into compulsory and voluntary parts. The questions in the compulsory part needed to be completed for the technology to become eligible for the selection process. The additional part collected information that is desirable for indicator calculation but it cannot be expected that this data is available for all technologies. Figure 2 shows the framework's hierarchy scheme with its overall objective, namely a suitable technology, meaning a technology that is sustainable, productivity-enhancing and appropriate for the poorest and most vulnerable people of South and Southeast Asia.

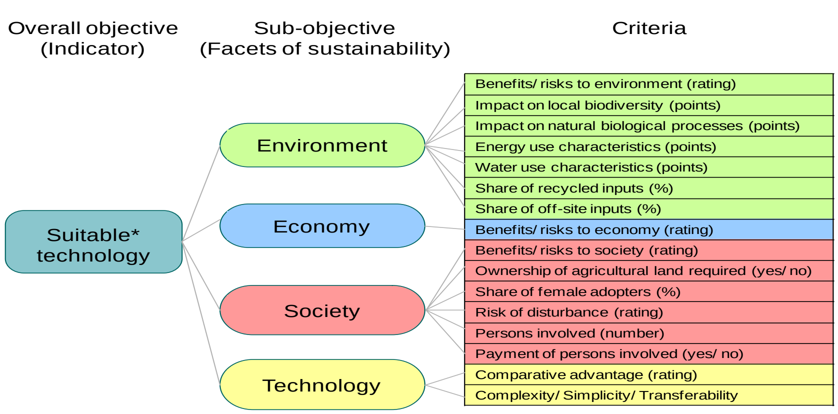

Figure 2: Problem hierarchy scheme

The sub-objectives are the three pillars of sustainability (environment, economy, and society) and the sub-objective relating to the technology itself. All essential criteria are on the right.

Selection of technologies

The second tool consists of three steps necessary for indicator construction and the elimination of technologies that do not fulfill the basic requirements of SATNET. The three steps are: (i) assigning weights to all criteria; (ii) rating of qualitative criteria; and (iii) indicator calculation. The weighting of criteria was a participatory process of Multi Criteria Decision Making (MCDM). It involved project partners and associates, and selected experts in the field of technology adoption and evaluation. The purpose was to assign weights of importance to the individual criteria based on expert judgment. The weighting was conducted through an online survey based on the Analytical Hierarchy Process (AHP) (Saaty, 1990) comparing all criteria within the four facets of sustainability in a pairwise manner.

SATNET participants were invited to compare each possible pair of criteria. When completing the survey, the participants were encouraged to rely on their experience to make judgments. For each comparison, respondents needed to decide which criterion was more important, or whether they were of equal importance. If one was more important than the other, respondents were asked to indicate how much more important it was. All results were saved in a comparison matrix from which the weights of the criteria were derived by the eigenvector of this matrix.

For the next higher level of the hierarchy scheme, a pairwise comparison would also be possible. However, per definition, the three pillars of sustainability are of equal importance. The remaining question was on importance of the technological facet of sustainability in comparison to the environmental, economic and societal facets. Hence, respondents were asked their views on the technological sub-objective compared to the other sub-objectives. Experts' views were merged using 'aggregation of individual judgment' (AIJ) method (Forman & Peniwati, 1998).

The rating work is ongoing. When a critical mass of information is collected, those criteria that are described qualitatively can be assigned ratings. A summary matrix of all collected data on criteria will be prepared by FSC. Once weights and ratings are assigned, the composite technology indicator can be calculated based on which suitable technologies can be selected. The indicator will be a composite indicator comparable to the indicators described by Krajnc and Glavič (2005) or Dantsis et al. (2010) and constructed based on weighted criteria values. The outcome of this tool is a composite technology indicator that will be presented together with the available information on all criteria in the first version of a factsheet for each technology. Factsheets will be made available publicly through the SATNET website.

Validation tool

The third tool consists of detailed studies on the selected technologies and their adoption pathways. The purpose is to cross-check and validate the suitability of the selected technology by identifying key success factors and comparing them with the indicators used. Also, the required setup, basic conditions and limiting factors of the societal and environmental surroundings will be re-examined. In addition, the studies on adoption pathways will provide the opportunity to collect visual material that can be used as illustrations in the extension materials to be produced. A more detailed methodology will be presented at a later stage of the project. The outcomes of this tool will be the second, more elaborate version of the technology factsheets and first drafts of extension materials that will be pre-tested on the ground. However, the validation studies will only be conducted in 2013 and are therefore not further considered in this paper.

III. Results and discussions

Technology options collected

After the first round of the call for best practices in sustainable agriculture, six technologies were collected from four countries (Table 1). Comparing these suggested technologies with the options identified during the baseline survey, none of the technologies listed in Table 1 was included in the latter. However, the vegetable pool can be a special type of home garden and the leasehold riverbed farming can be a kind of integrated floodplain management which were identified in the baseline survey. In any case, the technology options shown in Table 1 cannot be considered and were not meant to be considered as a representative sample, since the fact who applies was not guided by random sampling but by individuals' or organizations' decisions.

Table 1: Technologies collected through the first round of application

Technology	Country
Vegetable Pool	Bangladesh
Kharif Maize Stabilization	India
Kharif Paddy Stabilization	India
Leasehold riverbed farming	Nepal
Jeevatu	Nepal
REBLOOM / Rice-specific Ecofriendly Biofertilizer in Liquid form based on micro-Organisms consortium and Originated through a Metagenomic approach	Sri Lanka

The scoring of indicators has begun but would require a critical mass of allocations to refine the scores. However, this critical mass has not been reached yet. As indicative example of one possible output of scoring, Figure 3 depicts a spider web diagram that gives a rough orientation on the different criteria.

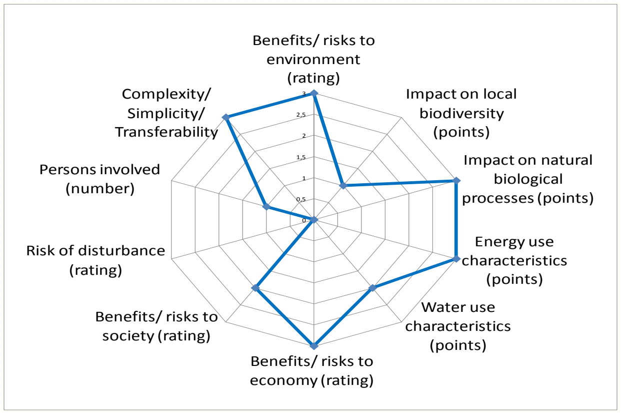

Figure 3: Example of output scoring though a spider web diagram

Representing criteria in this format follows the style of the Response-Inducing Sustainability Evaluation (RISE) tool developed by Häni et al. (2007) to assess sustainability at farm level.

Assigning weights of importance to the criteria

As this is still ongoing work, initial results of the weighting exercise are based on the views of nine experts. The consistency ratios of judgments should lie below ten per cent of the mean consistency index of randomly generated matrices (for short, RI) (Xu, 2000). Since human judgment is always prone to error, it was expected that some experts' judgements would have consistency ratios above the suggested threshold. However, from the nine participating experts, four made judgements with an acceptable consistency ratio. The online survey also revealed that some experts had diverging views on the importance of certain criteria. This shows the need for continued discussion on the criteria weights to build consensus. To illustrate the analytical approach, the judgments of four experts were merged into the criteria weights (Figure 4).

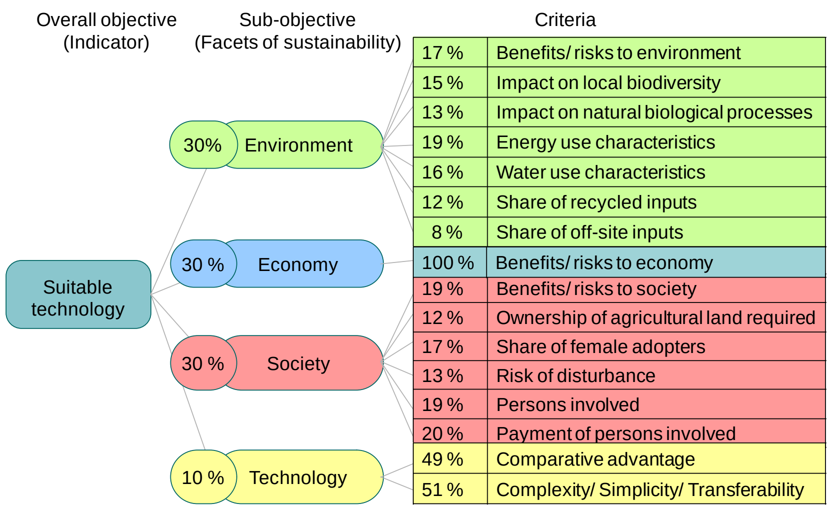

Figure 4: Criteria weights including the views of four experts

Weights will be used together with criteria scorings to calculate the overall sustainability indicator for each technology as described by Krajnc and Glavič (2005) and Dantsis *et al* (2010). The indicator will help selecting the most promising suitable technology options.

IV. Outlook

Technology transfer, which implies various processes of transferring knowledge, skills and technologies among governments, centres of excellence, non-governmental organizations (NGOs) and other institutions, is central to SATNET. The project aims to ensure that these technologies are accessible to a wide range of users who can further adapt and apply them in their local context. As this process requires active participation of all stakeholders, all SATNET activities are performed with the explicit intention of managing knowledge to support these innovation systems and to encourage collaboration. To support the technology adoption process and in line with the analytical work discussed in this paper, a number of innovative knowledge-sharing tools and processes are being implemented to enable all stakeholders to make decisions and take actions that lead to the desired changes and sustainable agriculture.

Improving access to knowledge through online tools – database, website and social media

The project is using a variety of knowledge-sharing tools to manage information and knowledge. The overall outcome of the analytical activity based on the present framework will be a "data bank" that is a database on sustainable agricultural technologies. The data bank will include all technology factsheets, supporting documents, expert information and extension material developed through SATNET. The design and functioning of the database and the contained factsheets are yet to be consulted with key stakeholders. In particular, what information should be included in the factsheets, in what format and language(s) it will be presented, how to make the database as user-friendly as possible, what search options should be offered, and whether the database can be designed in an interactive way.

Project activities, research findings and best practices in sustainable agriculture are being shared on the SATNET website and through an electronic newsletter disseminated to anyone interested in the network. The increasing access to, and popularity of, social media offers new opportunities for applying information and communication technologies to socio-economic development (CAPSA, 2011). As such, SATNET is taking the opportunity to use existing social media tools. While Facebook allows to raise awareness about the network, post calls for application for agricultural technologies, receive comments and share photos and videos, LinkedIn facilitates a variety of online discussions. Interested people who are both part of and new to the network are free to join this forum and enrich the discussions based on their knowledge and experiences. These tools are relatively inexpensive and enable most people to access, redistribute or publish information (CAPSA, 2011). They allow stakeholders to interact with each other, learn and share in a vibrant network that has potential to facilitate collaboration and sustain activities in future. Public-sector organizations are increasingly using social media as a platform for publicity, promotion as well as policy-making and public engagement (McCloskey, 2011).

Using online discussions to strengthen the innovation network

SATNET has been using online discussions to facilitate virtual engagement of the network participants that are spread over South and Southeast Asia and solicit their inputs into the analytical work. To involve the participants in the identification of sustainable, productivity-enhancing and suitable agricultural technologies early on, the project started conducting moderated online discussions through LinkedIn. For example, a discussion on "How do we evaluate the suitability of agricultural technologies to be disseminated through SATNETAsia?" sought feedback on criteria for selection of agricultural technologies that are part of the analytical framework discussed in this paper. FSC has used this information to finalize the framework as a basis for a call for applications to promote best practices in sustainable agriculture. Participants were first presented with proposed criteria for selection of agricultural technologies organized into four facets of sustainability (Figure 2) followed by the discussion.

Overall, most participants found the suggested framework comprehensive and all criteria relevant. But participants also suggested including additional criteria. For example, one participant highlighted the importance of the simplicity of agricultural technologies. Technologies suitable for poor and often illiterate farmers need to be easy to grasp and implement. Highly complex technologies that require farmers to learn many new theoretical and practical aspects are less likely to be adopted. Consequently, the criterion "Complexity/ Simplicity/ Transferability" was integrated into the analytical framework. The synthesis of the online discussion is available on the SATNET website (SATNET, 2012).

Enhancing skills for technology transfer and adaptation

Agricultural extension services, farmer organizations and non-governmental organizations in particular have huge potential to reach farmers with improved technologies and the knowledge they need to be more productive: produce more food on smaller land, earn higher incomes and enhance their livelihoods (Spisiakova, 2012). However, most of these development practitioners are not necessarily accustomed to academic discourse, and have no time or priority for long and complex analyses even if they are interested in the subject. They need easily accessible, to the point and practical knowledge on how to get a job done effectively. However, researchers are often under pressure to publish their findings to gain academic credit, which often means they spend less time and energy re-articulating their ideas for development practitioners who might need those research findings to improve their lives (Ferguson, 2005). With this in mind, SATNET ensures that every output produced through the project is relevant and appropriate for its audience and provides opportunities for its key stakeholders to learn about how to transfer this practical knowledge to farmers. Capacity-building is therefore central to SATNET in order to facilitate knowledge transfer and make technology options available to farmers. Based on the outcomes of the analytical work discussed in this paper, SATNET will organize consultations that will identify training needs of different stakeholders, including small-scale input providers and producers, extension workers, scientists, traders, and policy makers. The outcomes of these consultations will feed into a range of capacity-building programmes, most of which will take place between 2013-2014, and some of which are outlined below.

Translating research findings into knowledge accessible to extension workers and farmers will be the subject of writeshops. They will target researchers to enhance their capacity to identify the most compelling findings from their work, package, present and transfer these findings to extensionists in a simple language. Specialized programmes on building technical expertise and skills will address technology options for sustainable agricultural production and processing. They will target extension workers and others who work closely with the final beneficiaries – smallholder farmers. Furthermore, interregional visits to promote hands-on experience and South-South dialogue for smallholder value chain actors will enhance the impact of these training activities. Participants will be exposed to best practices of production, postharvest processing and other agricultural practices as identified by the analytical activities. Criteria for selection of participants will be developed to achieve the widest possible coverage and dissemination of knowledge, whilst considering possible impacts for the poorest and most vulnerable people (CAPSA, 2011).

Engaging policy makers and government officials in research for development will contribute to the strengthening of the science-policy interface. As such, SATNET will organize high level policy consultations and awareness events to present a range of options based on evidence that support sustainable agriculture, provide policy advice and build capacity needed to design appropriate policies.

V. Conclusion

The network has developed an analytical framework to identify innovations that are sustainable, productivity enhancing and suitable for the poorest and most vulnerable people. However, more communication is needed to increase the number of technology applications. The application of the criteria weighting model showed that criteria weights can be used for calculating the indicator after improvement of consistency and after a consensus on criteria importance is reached among experts. Online discussions can provide an effective forum for engaging stakeholders to seek their feedback on a range of topics. The discussion on the criteria used to assess technologies improved the analytical framework with concrete suggestions on criteria to be added or removed. It also indicated aspects that need consideration that are of importance but not covered by the suggested framework. Furthermore, the online discussions provided an opportunity to learn, share knowledge and interact with others. SATNET will continue using more knowledge-sharing tools and processes throughout the project implementation to ensure active participation, collaboration and learning during all project stages.

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