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Assessing sustainable technology options to increase the resilience of the poorest and most vulnerable

Kriesemer[a*], Simone Kathrin, Detlef Virchow[a], and Katinka M. Weinberger[b]

a Universität Hohenheim, Food Security Center (FSC), Wollgrasweg 43, 70599 Stuttgart, Germany
b Centre for Alleviation of Poverty through Sustainable Agriculture (CAPSA), Bogor, Indonesia

Introduction

When a crisis strikes, it is often the poorest and most vulnerable people who suffer most, particularly in South and Southeast Asia where the majority of the world's poor reside. Victims often lack solutions to diversify into sustainable production activities that increase their resilience to shocks and lead to higher productivity on a sustainable level. Knowledge on appropriate technology options exists, but is mostly contained in separate "knowledge silos" (Weinberger et al., 2009). To make this knowledge available within the region would require increased South-South dialogue and intraregional learning that could spur innovation contributing to improved food security and nutrition.
Hence, an analytic framework is presented that enables relevant stakeholders and multipliers from research and extension services to identify technology options and best practices that are sustainable, productivity enhancing and appropriate for the poorest and most vulnerable parts of the population. Such technologies are called suitable technologies in this study.
Sustainability can be assessed at several levels, from international and national levels (UN Commission on Sustainable Development, 2007), down to farm level and technology level (DANTSIS et al., 2010; RIGBY et al., 2001; KRAJNC and GLAVIČ, 2004; AZAPAGIC, 2004; VELEVA and ELLENBECKER, 2001; KRIESEMER, 2009). At farm and technology levels, the authors identified over 100 criteria and three to six facets of sustainability from the literature that are used to assess sustainability. Three of these facets represent the classical pillars of sustainability: environment, economy and society.

Material and Methods

The framework contains a set of tools to collect and evaluate information on suitable technology options and practices based on criteria relevant assessing the sustainability of technologies. The collection of technology options started with an open call for applications using a questionnaire format. The application form contained sections to gather information about environmental, social, and economic sustainability, as well as on important properties of the technology itself. Figure 1 shows the problem hierarchy scheme that summarizes all criteria and sub- objectives under the overall goal, which is the identification of suitable technologies. The call for applications was sent to 213 contacts: participants of the SATNET Asia project[†], directors of international, regional and national public organizations, international and national research

[*]Corresponding author. Email: simonekriesemer@gmx.de or sk.kriesemer@uni-hohenheim.de
[†] SATNET Asia, an innovation network for food security and poverty reduction, aims to strengthening South-South dialogue and intraregional learning on sustainable agriculture technologies and trade facilitation. More information on https://fsc.uni-hohenheim.de/94107 or www.satnetasia.org.

centres, international and national Non-Governmental Organizations (NGOs), and the private sector. All contacts were encouraged to forward the call through their respective professional networks. The first application phase was set from mid-August to mid-September, 2012.

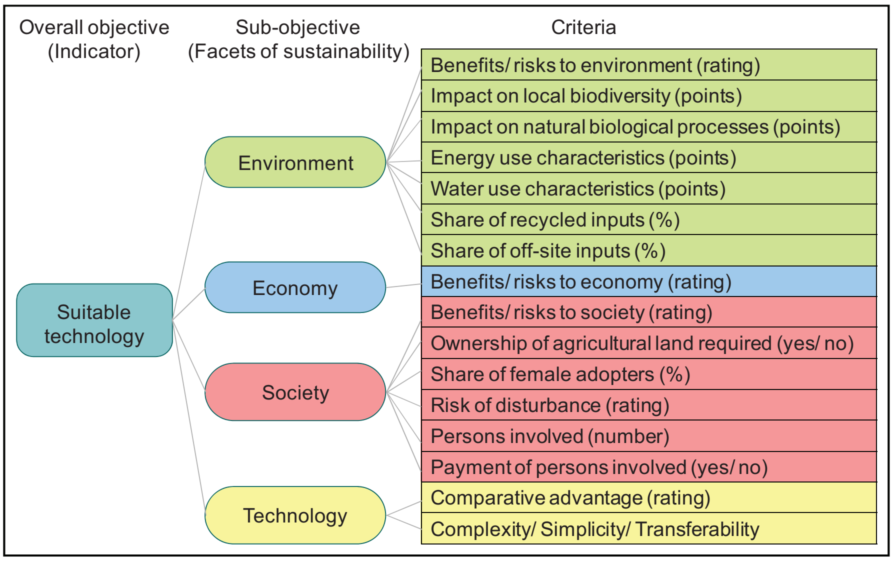

Figure 1: Problem hierarchy scheme

Note: *suitable here means: sustainable, productivity-enhancing and appropriate for the poorest and most vulnerable people in South and Southeast Asia

To decide on the relative importance of the criteria under consideration, experts assigned weights using the Analytical Hierarchy Process (AHP) developed by SAATY in the 1980s (SAATY, 1990). This approach is a multi criteria decision making process that is suitable for involving a group of experts. It was implemented via an online survey that asked experts to compare all criteria in a pairwise manner. For each pair of criteria within the same sub-objective, experts were first asked which criterion is more important or if they are of equal importance. If one was selected to be more important, experts were then asked how much more important the criterion is. Fifty one experts were invited to participate in the online survey. All expert judgements were compiled in a comparison matrix and merged using the 'aggregation of individual judgement' (AIJ) method (FORMAN & PENIWATI, 1998). The weights of the criteria were derived by the eigenvector of the matrix (SAATY, 1990).

Results and Discussion

The first round of the application process yielded six applications from four countries (Table 1).

Table 1: Technology applications collected by September 2012

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

Figure 2 shows an exemplary spider web for selected criteria of the technology 'vegetable pool' that were rated preliminarily – for illustrating purposes. Representing criteria in this format follows the style of the Response-Inducing Sustainability Evaluation (RISE) tool, which was developed by HÄNI et al. (2007) to assess sustainability at farm level.

The ratings and weights of all criteria will be used to generate a composite sustainable technology indicator comparable to DANTSIS et al. (2010) and KRAJNC and GLAVIČ (2004).

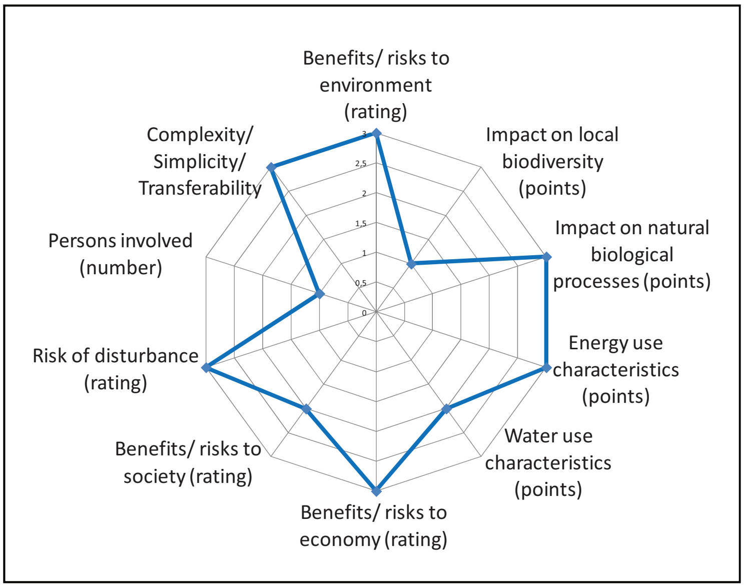

Figure 2: Spider web of criteria ratings

Eighteen per cent of invited experts participated in the online survey to assign weights to the framework criteria. The initial results point to two challenges that are linked with this type of methodology. The first challenge is the fact that human judgment is always prone to error. This is especially the case in a complex situation like the case at hand, where experts were asked to make a total of 38 pairwise comparisons. Consequently, only four out of nine experts had a consistency ratio below or slightly above the recommended threshold (CR < 0.1) (Xu, 2000). The second challenge encountered was that experts had contradicting view points about the importance of some criteria. Because of the online format of the weighing exercise, experts could not discuss their viewpoints directly to come to a common agreement. However, these challenges can be overcome with some additional methodological steps that are indicated in the outlook section.

Conclusions and Outlook

Regular calls for applications will be launched four times per year throughout the duration of SATNET Asia, so that the pool of available technologies can be enlarged successively.
The scoring of criteria needs a critical mass of applications to design suitable scales for scoring and to make meaningful comparisons. The criteria weights require a set of judgments that lie below the recommended threshold of consistency. Therefore, experts will be invited to review their judgments to improve the consistency. If still needed after this, all participating experts will be invited to an online discussion on the importance of the criteria to explain their views on the weights to be used in the subsequent calculation of a composite sustainability indicator for the technologies.
All sustainable technologies will be accessible in the online database containing fact sheets, descriptions of typical enabling environments, extension material, recommendations for dissemination strategies, as well as links to regional experts. The design and format of the database is crucial for the impact that it will have on targeted end users. The easier the database is to use for finding relevant information and the more regularly up-to-date information is posted, the more likely it will outlive the duration of the SATNET Asia project.

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