SPIA review of:

Impact of Participatory Natural Resource Management Research in Cassava-Based Cropping systems in Vietnam and Thailand

Timothy J. Dalton, Nina Lilja, Nancy Johnson and Reinhardt Howeler

PRGA Working Document no 23 (revised), Cali, Colombia, 2005.

Background and Research Overview

Between 1994 and 2003, the International Centre for Tropical Agriculture (CIAT), in collaboration with national agricultural research partners in Thailand and Vietnam implemented a Nippon Foundation funded project titled "Improving the Sustainability of Cassava-based Cropping Systems in Asia." The purpose of the project was to address the problem of the observed widespread non-adoption of soil conservation and fertility management technologies in cassava production in Asia. Aside from conservation technologies such as contour lines, hedgerows and management technologies including inter cropping, use of manure and mineral fertilizer also genetic improvement technologies, i.e. improved cassava varieties were included in the project. Hence, the *nature of the NRM research* was that of an applied, adaptive research for already existing NRM technologies and principles but where adoption by farmers was low. Together with NARS researchers and extension agents CIAT was working with farmers in selected project villages. The "farmer participatory research" (FPR) methodology included the joint conduct of on-farm experiments to identify, test and adjust promising natural resource conservation and productivity enhancement cassava technologies. The project therefore encompassed a broader research paradigm that falls under the category of INRM as described in chapter 1.2.

The impact study was conducted in 2003 in Vietnam and Thailand. *Data* were collected from a total of 800 farm households. In both countries 8 villages were selected, i.e. four project and four control villages. In the project villages CIAT together with the respective NARS partner had implemented FPR activities. As control, near-by villages were chosen that had similar natural resource and socio-economic conditions. Also, relative to the FPR activities of the project villages, in the control villages the national extension services were engaged in promoting technology and advising farmers according to their standard operating procedure thus providing a *counterfactual* for the FPR component of the project. *The data collection protocol* followed the focus group methodology, i.e. focus group participants filled out the survey forms that contained questions on wealth, socio-economic status and details of cassava production inputs and outputs and technologies. Cassava area and cassava yields were elicited through recall questions depicting the before and after project situation in terms of farmer performance.

Impact assessment framework

Household theory served as the general *conceptual framework* to measure impacts of technology adoption and knowledge. A household utility function with a multi-product production function including commodity and non-commodity outputs was formulated. Knowledge was included as a stock resource to be enhanced by project

participation. Model estimation was only possible in a reduced form as the parameters of the equations are not directly observable. First, as a proxy for knowledge a participation dummy was used. Second, the impact of participation on non-commodity outputs was captured trough the adoption of soil conservation practices; and third, the wage effect is measured by separating the productivity impact of technology variables from the knowledge variable, i.e. the participation dummy.

Adoption and outcome

Analysis of *adoption* showed that the overall level of adoption is high for varieties and fertilizer but is lower for soil conservation practices including intercropping. For conservation practices differences between participants and non-participants are more pronounced than for varieties and fertilizer. Adoption levels are differing between Thailand and Vietnam with the latter having the lower levels of adoption. For example only about half of the project participants in Vietnam adopt improved varieties while they was 100 % adoption by project participants in Thailand. Also difference between participants and non-participants were smaller in Thailand.

Results of the impact analysis using simultaneous equations systems showed that the cassava technologies themselves and knowledge as measured by project participation significantly affected behavioural and productivity variables. In short the following outcomes can be summarized:

- Adoption of improved cassava varieties significantly contributed to expansion of cassava area and increased cassava yields
- Farmers with larger cassava areas tended to expand less than farmers with smaller areas
- Adoption of the contour ridging technology led to lower areas expansions both for cassava and total farm land area
- Female household heads tended to expand area more than male
- Adoption of hedgerows positively affected cassava yields
- There were significant positive spill over effects from participants to non participants in project villages
- Yield gains were significantly higher in Vietnam as compared to Thailand
- Project participation had a significant effect on yield indicating that participation in technology development and testing may improve managerial capacity and knowledge can lead to more effective use of cassava technology although the true relationship remains in a black box

Welfare Analysis and Rate of return

Costs included R&D costs of CIAT and the NARS as well as farmers' costs of technology adoption including investment, variable material costs and labour. The *total R&D and adoption costs* of over the ten-year period from 1994 to 2003 were $ 3.96 million. Costs were spread equally over the ten-year life span of the project. The project benefits were derived from the total yield effects as estimated in the simultaneous equation system aggregating the technology and knowledge effects and weighted with adoption rates at village level. The resulting shift in cassava output was then valued at domestic market prices for the year 2003. To estimate the cumulative benefits over the ten-year project period the usual logistic adoption curve

was used assuming that annual benefits are a fraction of the 2003 figure equivalent to the number of farmers trained by year. Based on these data the internal rate of return (IRR) was calculated at 41.2 %. Various scenario analyses revealed that the rate of return of the R&D investment was indeed a safe bet considering that the most conservative scenarios still yielded an IRR of 20 %. Since the IRR does not include the environmental benefits from the abatement of soil degradation, which is attributable to the project, the calculated IRR is most likely an underestimate.

Lessons learned

The CIAT case study is an example of an INRM type of project that focussed on the complementarities between natural resource management and genetic improvement research. The study is unique as it provides a methodology that can be applied to separate the technology effects from the knowledge effects to be assumed from FPR. Unfortunately no knowledge data were collected e.g. through knowledge tests, for participant and non-participants before and after project implementation. The conduct of a baseline survey would have allowed using a classic difference in difference model. This would have provided a better understanding of the mechanisms through which FPR can change behaviour and increase productivity. Finally the rate of return was limited to a financial analysis thus ignoring differences between domestic and world prices. Including an attempt to value the expected environmental effects of the CIAT project would have made the case more valuable.

Furthermore the study leaves the question economics of up scaling the FPR approach open. Since the R&D investment is relatively small and the yield effects in project villages are high we are getting a good rate of return. But does this justify recommending that extension services in Thailand and Vietnam should adopt the FPR approach on a broad scale? We know little about the quality of the FPR method if there is no more external project input, i.e. if CIAT support comes to an end.

Overall the case study demonstrates the need to plan for ex post impact assessment during the early phase of a R&D project in NRM.