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Enhancing the impact of natural resource management research: Lessons from a meta-impact assessment of the Irrigated Rice Research Consortium

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ABSTRACT

This article present results from a multi-dimensional impact assessment of a large multi-year Natural Resource Management (NRM) research project for rice – the Irrigated Rice Research Consortium (IRRC) – and uses insights from this assessment to further understand how NRM research can be improved to have more impact in a developing country context. Results of the meta-impact assessment indicate that NRM research generated by the IRRC has provided a wide-range of impacts in multiple dimensions—from micro-level impacts on farmer livelihoods to national-level agricultural policy influence. Based on the IRRC experience, international NRM research institutions can enhance impact in developing countries by: fostering partnerships, collaborations, and cross-country learning; involving social scientists for monitoring, evaluation, and impact assessment; and, having long-term support and involvement of donors.

1. Introduction

Increased concerns about the effects of agricultural production on the natural resource base of developing countries has given rise to an emphasis on research that calls attention to these issues. Over the last two decades, national and international agricultural research institutions, including research centers under the Consultative Group on International Agricultural Research (CGIAR), have intensified research efforts that focus on developing and disseminating natural resource management (NRM) technologies and approaches (Renkow and Byerlee, 2010).

NRM research aims to generate outputs that help maintain or improve the natural resource base of agriculture and/or mitigate the negative environmental (or health) externalities from agricultural production practices. Kelley and Gregersen (2005) characterize NRM research as "research on land, water and biodiversity resources management that is focused on producing knowledge that results in technology options, information and methods or processes that enhance the productivity and stability of ecosystem resources." In general, agricultural NRM research aims to improve farmers' productivity and income, while at the same time maintaining (or enhancing) the natural resource base that would result in sustainable food production and food security for future generations.[1] Agronomy-related themes, such as soil and nutrient management and irrigation and land cover management, are typically included in the portfolio of NRM research programs (Altieri, 2002).

Given the emphasis and investments on NRM research, there is a natural interest on whether the benefits from the outputs of NRM research outweigh the cost. In particular, donor agencies that funded these NRM efforts increasingly request evidence on the impact and payoffs of NRM research outputs and technologies. In response to these pressures, several impact assessment studies of particular NRM research projects within the CGIAR centers were conducted in the early 2000s (Waibel and Zilberman, 2007). The number of studies that analyze particular NRM research technologies and outputs have also noticeably increased in the last decade (as seen, for example, in the number of NRM publications in the website of CGIAR's Standing Panel on Impact Assessment (SPIA)). The importance of NRM research is also evidenced by a recent Stripe Review commissioned by the CGIAR's Independent Science and Partnership Council (ISPC) to examine how future

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[1] More detailed definitions and descriptions of NRM research projects, especially within the CGIAR system, is provided in Waibel and Zilberman (2007) and CGIAR-ISPC (2012). Note that the emphasis in this article is on NRM work by the CGIAR because it is one of the biggest agricultural research involved in NRM. Also, the particular NRM research consortium evaluated is housed in a center that is a member of the CGIAR.

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NRM programs can produce international public goods and achieve impact at scale (CGIAR-ISPC, 2012).

Notwithstanding the available literature on the impacts of NRM research, empirical evidence about the impacts of NRM research is still considered "limited" as compared to studies that evaluate the impacts of varietal improvement research. Based on this body of work, Renkow and Byerlee (2010) found that there are substantial benefits to the investment in NRM research, but they also concluded that the net returns to investment in NRM research is relatively lower than the returns from varietal improvement research. They argue that the *measured* benefits to date have not yet justified the surge in NRM investments in the last two decades. However, it has been recognized that comprehensively capturing all the benefits of NRM research is notoriously difficult because of the complexity in tracing impacts of NRM research (i.e., attribution issues) and the lack of easily available methods for valuing some of the "unmeasured" benefits of NRM research, such as sociocultural and environmental effects.

The review article of Renkow and Byerlee (2010) and the CGIAR-ISPC (2012) report highlight the need for more multi-dimensional impact studies of NRM to strengthen the evidence base. Many of the recent NRM impact studies only focus on a single technology (or technology package) and have limited geographical scale (Alary et al., 2007; Marenya and Barrett, 2007; Ramirez and Shultz, 2000). With the limited geographical scale of these NRM impact studies, international spillovers from NRM research outputs (and the "international public good" aspect of this type of research) are not well-documented and have been questioned (SPIA, 2006; CGIAR-ISPC, 2012). The existing impact literature on NRM also noted the importance of local institutional capacity (i.e., institutional structure of research programs, country level extension capabilities) in the success of NRM outputs, yet there has been limited documentation on the agricultural research and extension structures needed to make it work,[2] as well as the sociocultural effects of NRM research.

The objective of this article is to present results from a multi-dimensional impact assessment of a large multi-year NRM research project for rice – the Irrigated Rice Research Consortium (IRRC) – and then use insights from this assessment to further understand how NRM research can be improved to have more impact in a developing country context. What can we learn from the IRRC assessment to help guide and facilitate the design and implementation of future NRM research programs in developing countries so that it can produce international public goods and achieve impact in multiple dimensions at scale? Developing successful NRM research programs is critical to the challenge of feeding the projected world population of 9 to 10 billion people by 2050, while at the same time not adversely affecting the natural resource base for sustainable agricultural production.

The assessment of IRRC program is a good case to learn from because: (1) multiple NRM technologies are evaluated at the same time; (2) several Asian countries are covered such that international spillovers and the international public good aspect of NRM research can be assessed; (3) multiple dimensions of impact are documented (e.g., economic, social, scientific, etc.); (4) the different mechanisms for successful uptake of technologies are analyzed (i.e., through impact pathway analysis, process evaluation, and influence assessment); and (5) the assessment approach utilized both qualitative and quantitative approaches to impact assessment, as recommended in Djurfeldt et al. (2009).

[2] Note, however, that there is an extensive institutional literature on the role of collective action and property rights in the successful management of natural and/or agricultural resources (see for example the studies in Chapters 6 to 11 in Mwangi et al., 2011 and the review article by Poteete and Ostrom, 2008). There is also an active literature on how social learning can help facilitate participation of farmers in management of natural resources (Schneider et al., 2009; Rodela et al. 2012). But we maintain that documentation of successful institutional structures for agricultural research and extension systems (in relation to NRM technologies for agriculture) is still limited (Lee, 2005; Smale, 2005).

2. The IRRC: Background, institutional structure, and technologies developed

The IRRC was established in 1997 at the International Rice Research Institute (IRRI) with the aim of providing a platform to facilitate identification, development, dissemination, and adoption of NRM technologies suitable for irrigated rice-based ecosystems in several Asian countries (Palis et al., 2010). With funding support mainly from the Swiss Agency for Development and Cooperation (SDC) through four project phases (Phases I–IV from 1997 to 2012), the IRRC has provided a mechanism that expedited partnerships between national agricultural research and extension systems (NARES) and scientists from IRRI. Through these IRRC-fostered partnerships, NRM technologies that address irrigated rice farmers' needs have been identified and developed through interdisciplinary research and outreach efforts. Instead of a "top-down" research and dissemination approach, the institutional structure of IRRC was expressly developed to emphasize the importance of partnerships and to make sure that local NARES are involved in identifying technologies that would be appropriate for further study and research. The IRRC has also focused on strengthening the dissemination and uptake of these technologies in target Asian countries. Arguably more than 1 million Asian farmers have been reached by IRRC NRM technologies (Rejesus et al., 2013).

The institutional structure of IRRC mainly revolves around research working groups (WGs) and a Coordination Unit (CU) that facilitates the research and delivery activities of the consortium. The number and names of IRRC WGs has evolved over time, but the four main WGs that have an established history through the four phases of the consortium are: (1) the Labor Productivity and Community Ecology (LPCE) WG, (2) the Post Production (PP) WG, (3) the Productivity and Sustainability (PS) WG, and (4) the Water Savings (WS) WG. A brief description of the different NRM technologies developed and/or disseminated by the four main WGs are presented in Table 1.

Aside from the individual "WG-specific" technologies in Table 1, the IRRC have also promoted integrated technologies that include different combinations of the technologies developed by the WGs. In Vietnam, IRRC in collaboration with the NARES promoted the "Three Reductions, Three Gains (3R3G)" and later the "One Must Do, Five Reduction (1M5R)" integrated technology packages as a means to reduce production costs, improve farmers' health, and protect the environment in irrigated rice production. The 3R3G involves reduction in seed rates and optimal application of fertilizer and pesticides. The 1M5R builds on the 3R3G by encouraging a "one must do" practice of using certified seeds, and practicing "five reductions" in the amount of seed, nitrogen application, pesticide use, water use, and postharvest losses. Another integrated technology package disseminated by IRRC is the integrated cropping management farmer field school (ICM-FFS) in Indonesia. Technologies included in ICM-FFS were AWD, Integrated Pest Management (IPM), HSS, DSR, EBRM, and SSNM (see Table 1 for the meanings of these acronyms).

Overseeing and facilitating the efforts of the WGs and the whole consortium is the CU. The CU complements the existing WGs by coordinating the integration of their activities, facilitating cross-country learning, developing the research–extension interface, developing communication strategies, conducting impact assessments, and managing of in-country outreach programs. An important characteristic of the CU is the explicit inclusion of