

PARTICIPATORY IMPACT PATHWAYS ANALYSIS: A PRACTICAL APPLICATION OF PROGRAM THEORY IN RESEARCH-FOR-DEVELOPMENT

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Abstract: The Challenge Program on Water and Food pursues food security and poverty alleviation through the efforts of some 50 research-for-development projects. These involve almost 200 organizations working in nine river basins around the world. An approach was developed to enhance the developmental impact of the program through better impact assessment, to provide a framework for monitoring and evaluation, to permit stakeholders to derive strategic and programmatic lessons for future initiatives, and to

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provide information that can be used to inform public awareness efforts. The approach makes explicit a project's *program theory* by describing its impact pathways in terms of a logic model and network maps. A narrative combines the logic model and the network maps into a single explanatory account and adds to overall plausibility by explaining the steps in the logic model and the key risks and assumptions. Participatory Impact Pathways Analysis is based on concepts related to program theory drawn from the fields of evaluation, organizational learning, and social network analysis.

Résumé : Le programme *Défi pour l'eau et la nourriture* vise à améliorer la sécurité alimentaire et à réduire la pauvreté dans le cadre d'un ensemble de quelque 50 projets de recherche axés sur le développement. Ces projets impliquent près de 200 organisations œuvrant dans neuf bassins fluviaux à travers le monde. Les auteurs ont mis au point une approche destinée à augmenter l'impact du programme au plan du développement par l'entremise d'une meilleure mesure des impacts de chacun des projets. Cette approche comprend un plan de suivi et d'évaluation permettant aux parties prenantes de tirer des conclusions stratégiques destinées à améliorer les projets à venir, et de générer les données requises pour les campagnes d'information à l'intention du grand public. L'approche comprend également une présentation explicite des *fondements théoriques* du programme, ainsi qu'une description des réseaux d'impacts basée sur un modèle logique et sur une cartographie de réseaux. L'intégration du modèle logique et de la cartographie de réseaux en une présentation unifiée incluant les étapes logiques, les facteurs de risques, et les principales hypothèses contribue à étoffer la pertinence globale du modèle. L'approche participative de l'impact des cheminements critiques (PIPA) repose sur des concepts associés à la théorie de programme, à l'apprentissage organisationnel, et à l'analyse des réseaux sociaux.

BACKGROUND

■ The Participatory Impact Pathways Analysis (PIPA) described in this article was developed within the context of a large and complex, five-year, research-for-development (R4D) program—the Challenge Program on Water and Food (CPWF). The key dimensions of impact pursued by CPWF are food security, poverty alleviation, improved health, and environmental security. The program is geographically extensive, covering the Limpopo, Nile, Yellow, São Francisco, Karkheh, Mekong, Indo-Gangetic, and Volta river basins, and the Andean system of basins. It currently funds 51 projects that are

implemented by 198 different institutions including the Consultative Group for International Agricultural Research (CGIAR) Centres,¹ advanced research institutes (ARIs), NGOs, community-based organizations (CBOs), and national agricultural research and extension organizations. The partnerships and the research are coordinated by basin coordinators (one for each basin) and five theme leaders. There are three systems-level research themes—crop water productivity improvement, water and people in catchments, and aquatic ecosystems and fisheries; one basin-level theme—integrated water basin management systems; and one global-scale theme—global and national water and food systems. The first five-year phase of the program began in 2004 and operates with a budget of approximately US\$66 million for the five-year period.

The CPWF is “impact-oriented,” which means the performance of the program and its projects is being evaluated not just on the delivery of research outputs, but on how those outputs are used, by whom, and to what effect (Ryder-Smith, 2002). The CPWF will be judged successful if it can demonstrate that the research it has supported has in a meaningful way “increased the productivity of water for food and livelihoods, in a manner that is environmentally sustainable and socially acceptable” (CPWF, n.d.) in and beyond the river basins in which it works.

If the CPWF and its constituent projects are to be successful they must be managed for impact, that is, projects must plan and manage to achieve development outcomes, not just to deliver the outputs listed in their project documents (Ryder-Smith, 2002). Managing to achieve developmental outcomes is more challenging than managing for outputs because, while projects can largely control whether they deliver their outputs, many factors in addition to research contribute to achieving developmental outcomes (Hartwich & Springer-Heinze, 2004; Mayne, 2004).

A second challenge facing the CPWF is securing adequate funding streams for long enough to achieve measurable developmental outcomes. It can take 10 years to move from basic research to useful technologies and then another 10 years to see widescale impacts (Collinson & Tollens, 1994). The CPWF generally commissions projects on a three-to-five-year basis. Hence the CPWF needs an *ex-ante* impact assessment approach that can plausibly demonstrate to donors how project outputs will lead to development outcomes and widespread impacts after the end of the projects that developed them.

The ever-increasing challenges facing the CPWF are those faced by all medium- and large-scale R4D programs. This article reports efforts to date by the CPWF's informal Impact Group (the authors of this article) to develop Participatory Impact Pathways Analysis to meet these challenges, specifically to

1. present the logic that explains how project activities and outputs are hypothesized to contribute to a sequence of outcomes and impacts
2. facilitate development of shared understanding of, and agreement with, the project logic among project team members
3. provide the basis of a plausible *ex-ante* impact assessment methodology for the CPWF that will also provide a solid foundation for later *ex-post* impact assessment
4. provide the basis for monitoring and evaluation that fosters learning and change in the CPWF
5. clarify and communicate the research-for-development processes out of which impact emerges.

The first section of this article introduces the “impact challenge” facing complex programs such as the CPWF. The second explores the characteristics required of PIPA. The third describes PIPA in terms of its component parts and their relation to existing tools and approaches, and the literature. The fourth offers an account of how PIPA is used in practice with CPWF projects and their teams. The article concludes with a discussion of the value added by PIPA to agricultural R4D and to the practice of evaluation in general.

THE “IMPACT CHALLENGE” FACING R4D PROJECTS AND PROGRAMS

The success of R4D projects and programs such as the CPWF depends upon achievement of intended results. This, in turn, depends on (a) sound project and program management geared to meeting the outcome expectations of funding agencies, and (b) maintaining and increasing resources as projects proceed beyond the pilot stages and the program gathers momentum. There is a close-knit relationship between these two issues, particularly when funds come from diverse sources. Convincing arguments are required to persuade multiple funding agencies of the likely potential uptake of research products and services by networks of diverse partner organizations and of the eventual impacts of these on a wide range of beneficiaries. Without an initial well-founded and persuasive *ex-ante* account of how project managers, basin coordinators, and theme leaders predict

their projects will have impact, and later *ex-post* evidence of impact, the executing organizations' efficacy and their very right to existence is cast in doubt (Anderson, Bos, & Cohen, 2005; OECD, 2006; Ryder-Smith, 2002). Both management and funds are vulnerable without critical and timely information for informed decision-making and effective ways of communicating anticipated and actual results to funding agencies. This information should come from monitoring and evaluation and, initially, from *ex-ante* impact assessment.

Plausible impact assessment must quantify impacts achieved or to be achieved and then make a convincing case that the project or program being assessed will contribute or has contributed to that impact (EIARD, 2003). To be able to do so requires understanding and communication of the R4D processes being employed, and the theory or theories supporting them. Monitoring and evaluation has the potential to provide this information but often does not, in part because evaluative inquiry as an organizational learning system is highly underdeveloped (Cousins, Goh, Clark, & Lee, 2004). It is not uncommon to keep impact assessment separate from monitoring and evaluation. For example, in the CGIAR system, within which this work is being conducted, impact assessment—both *ex-ante* and *ex-post*—has been viewed as a legitimate research activity while M&E has been viewed as an accountability mechanism but not contributing to research (Horton, 1998). M&E in the CGIAR has largely been based on the use of logical frameworks to identify and report on milestones, which in a research sense is of limited interest. The logical framework was originally developed by the US Department of Defence in the late 1960s (Horton, Ballantyne, Peterson, Uribe, Gapasin, & Sheridan, 1993, p. 113) and since then has been modified and widely used by development agencies throughout the world (Kellogg Foundation, 2004; Rush & Ogborne, 1991; Saldanha & Whittle, 1998; Schmitz & Parsons, 1999) as well as in the private & public sectors (Cooksey, Gill, & Kelly, 2001; McLaughlin & Jordan, 1999).

The logical framework builds a causal chain of how a project or program will achieve its development goal (Figure 1). The chain begins with identifying activities and shows how these will produce project outputs if a certain set of assumptions and necessary conditions are met. The next step in the hierarchy is to show how outputs will achieve the project purpose and then how that purpose achieves the goal, or final expected impact.

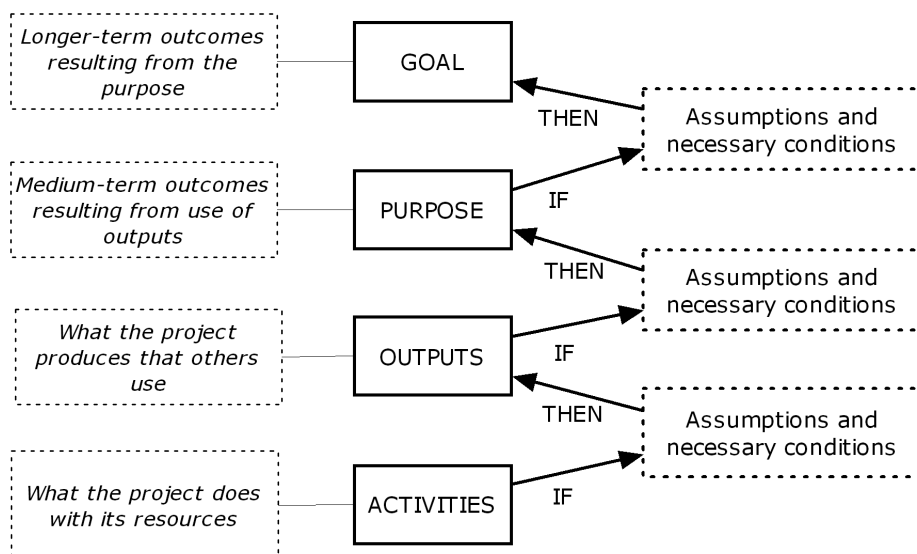
While the typical logical framework does show a causal chain, in practice it tends to be a very simple one, often with just one level of

outcomes between production of project outputs and the eventual goal. In practice, whole chains of intermediate outcomes link project outputs with eventual impact. Also the opportunity for a detailed description of causality within the logical framework tends to be weak and provides only superficial explanations of causation. More seriously, logframes can lead to a false idea of the linearity and predictability of impact pathways that project and program managers find seductive. As a result, managers tend to stick with their original logframes developed at the outset and do not regularly revisit them to reassess the underlying assumptions.

THE POTENTIAL OF PROGRAM THEORY

In recent years a number of R4D scientists have increasingly begun to look beyond logical frameworks to program theory to help remedy this lacuna (Horton, 1998; Douthwaite, Kuby, van de Fliert, and Schulz, 2003). Logic modelling is largely limited to normative theory—what is expected to happen. Program theory is concerned with both normative and causative theory (Chen, 2005). Causative theory explains how use of project outputs leads to a chain of intermediate outcomes

Figure 1
The Logical Framework



and eventual impact. It is an explanation of process based on either stakeholder theory or scientific theory. Examples of scientific theory is the published learning-selection model of early grassroots adoption and adaptation of technology (Douthwaite, 2002; Rogers, 2003) innovation decision process. Scientific theory is different from stakeholder theory as Chen (2005, p. 41) explains:

Stakeholder theory is implicit theory. It is not endowed with prestige and attention as is scientific theory; it is, however, very important from a practical standpoint because stakeholders draw on it when contemplating their program's organization, intervention procedures, and client-targeting strategies. Stakeholders' implicit theories are not likely to be systematically and explicitly articulated, and so it is up to evaluators to help stakeholders elaborate their ideas.

The use of program theory in R4D projects offers a number of benefits. Evaluators would help project staff to articulate their implicit theories and, where appropriate, suggest scientific theory on which to base all or part of the project or program's causative theory. Subsequent M&E would then become tools in a legitimate research exercise that would contribute to knowledge by (a) testing stakeholder-implicit theory and potentially establishing it as new scientific theory, and (b) validating scientific theory in different conditions. M&E of the validity of a project's causative theory would support learning and change and adaptive project management, thus making project impact more likely. Information from M&E would also help refine the causative theory and contribute to process knowledge about how research outputs do, or do not, lead to developmental outcomes and impacts. Such process understanding can help improve the plausibility of qualitative *ex-ante* and *ex-post* impact assessment.

Some donors have begun calling for changes in evaluation and impact assessment practice in R4D projects, changes that program theory could help deliver. The Task Force on Impact Assessment and Evaluation, European Initiative for Agricultural Research for Development (EIARD), a group of European donor agencies, wrote:

Impact assessments and evaluations should not be limited to directly measurable impacts; they should seek to capture the complexity and non-linear nature of agricultural innovation and sustainable development. Impact

assessments and evaluations should also be integrated as far as possible into research programmes, to facilitate internal learning processes and changes that enhance the probability of impact. (EIARD, 2003, p. 329)

EIARD (2003) then went on to recommend that evaluators make explicit the model of how innovation occurs both for *ex-ante* and *ex-post* impact assessment.

Program theory is starting to be used in R4D projects. Douthwaite, Schultz, Olanrewaju, and Ellis-Jones (in press) report the use of impact pathways evaluation to monitor and evaluate the development, adaptation, and adoption of integrated weed management techniques in Northern Nigeria. Impact pathways evaluation develops and uses a causal model of how adoption and adaptation is expected to take place, and makes explicit mention of its roots in program theory (Douthwaite et al., 2003).

The Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA, 1999) uses an *impact chain* to represent the several intermediate steps and actors along the way to impact. Projects and programs use their resources through planned activities to produce outputs. With the intervention of other actors, these outputs are transformed into outcomes. The resulting impact chain is characterized by a time dimension and organizational level. Depending on the complexity of the impact chain, ASARECA acknowledges that it can become difficult to ascertain the proportion of credit due to which actor for what impacts—the classical “attribution problem.” While the ASARECA approach goes beyond the simple logical framework by allowing the identification of chains of intermediate outcomes and by introducing an organizational dimension, it falls short of program theory as it does not make causal theory explicit.

The International Development Research Centre (IDRC) has been working for a number of years to develop Outcome Mapping, an adaptation of Outcome Engineering (Kibel, 2000) to the field of development research that focuses on making explicit the changes in behaviour that are expected as a result of project and program intervention (Earl, Carden, & Smutylo, 2001). Outcome Mapping is similar to PIPA in a number of ways. Like PIPA, Outcome Mapping usually begins with a participatory workshop, takes a learning-based and user-driven view of evaluation, and identifies the stakeholders that the project needs

to influence to achieve its expected outcomes. PIPA is different in two important aspects. First, PIPA attempts to integrate both a results- and actor-orientated view, while Outcome Mapping focuses on the latter (Ambrose, 2007). The use of problem trees in PIPA makes it more accessible to project staff already used to working with logic models. Second, PIPA uses network mapping to explore how stakeholders are linked to and influence each other, and how the project aims to change the existing network. Outcome Mapping does not consider this dimension, taking more of a project-centric view.

Hartwich and Springer-Heinze (2004, p. 5) argue for improving the impact orientation of agricultural research by means of impact pathways. However, their conceptualization of an impact pathway is similar to the logical framework with just one level of outcome.

The CGIAR Science Council also encourages progressing beyond the normative use of logical frameworks. The Science Council's mission is to "enhance and promote the quality, relevance and impact of science in the CGIAR," and one of the functions it plays is to analyze CGIAR Centres' medium-term plans <www.sciencecouncil.cgiar.org>. The Science Council recently requested that CGIAR Centres prepare for each CGIAR Centre project a "description of the plausible impact pathway from research outputs through outcomes to the ultimate impacts" (Science Council, 2006, p. 3). They acknowledge that the logical framework they ask to be prepared is by definition "only a simplified version of the impact pathway from outputs to outcomes to one level of intended impacts" (Science Council, 2006, p. 5). The Science Council requests that the plausible account of the full impact pathway be given in a written description called the "project narrative." A plausible narrative would imply some discussion of theories of causality, and would be greatly helped by the use of program theory.

We have, so far, argued that R4D projects and programs should increasingly use program theory because it has the potential to (a) raise the status of M&E to a research activity and thus be more likely to be taken seriously and attract resources, (b) provide sound assessments of what changes will or might occur, (c) provide descriptions of how project research outputs might achieve or have achieved developmental outcomes and impact, and (d) provide process information to assist project and program management as well as to improve *ex-ante* and *ex-post* impact assessment. Program theory is already being used in a R4D context under the name of "impact pathways" (IP), and we choose to continue this tradition.

THE CPWF'S REQUIREMENTS FOR IMPACT PATHWAYS ANALYSIS

In collaboration with other CPWF participants, the Impact Group agreed upon three general and two technical characteristics that IP analysis must fulfil to meet the requirements of the CPWF. In general terms, it must be capable of providing (a) a better appreciation of the existing and potential impact of research on water use in agriculture to justify current and future funding, (b) a deeper understanding of what impacts the CPWF expects to attain and how, and (c) a framework for an effective M&E approach that fosters and tracks progress toward achieving impact. In more technical terms, the model must also be capable of (a) making explicit each project's causative theories, and (b) generating quantifiable measures of the likely intermediate and final outcomes and impacts for which managers and funders hold the projects accountable.

DESIGN OF PARTICIPATORY IMPACT PATHWAYS ANALYSIS

We chose to base PIPA on ideas from program theory (Chen, 2005), organizational learning (Argyris & Schön, 1974), and network theory (Cross & Parker, 2004). The characteristics of PIPA will be discussed in terms of the two technical requirements.

Make Project Causative Theory Explicit

Causative theory describes how project and program research outputs are adopted and promulgated. There has been an increasing recognition in agricultural R4D that two types of adoption are important: scaling-out and scaling-up. Scaling-out is the increasing adoption of project outputs from farmer to farmer, community to community, within the same stakeholder groups. It is a horizontal spread, as shown in Figure 2.

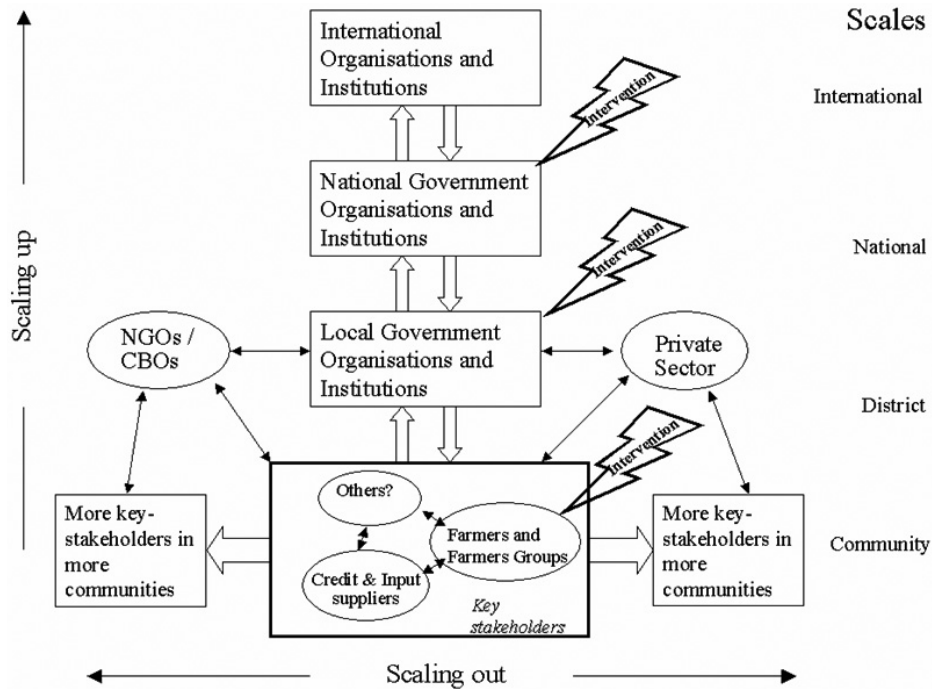
Scaling-up is a vertical institutional expansion, based largely on a desire or need to change the rules of the game. It can be driven by the influence of first-hand experience, word-of-mouth, and positive feedback, from adopters and their grassroots organizations on policy makers, donors, development institutions, and the other stakeholders who then have an interest in building a more enabling environment for the scaling-out process. Sometimes the process is reversed and driven by political conviction. Interventions at a higher scale—for example, policy research—can affect scaling-out processes at lower ones, as shown in Figure 2.

Combining Logic Models with Network Maps

In PIPA, project impact pathways are described in terms of an Impact Pathways (IP) logic model and network maps. The IP logic model is a flowchart that shows the chains of outcomes that link outputs to eventual developmental impacts. It is similar to Chen's (2005) change model, except that where possible it incorporates one or more published (confirmed) causative theories as recommended by Renger and Titcomb (2002).

The network maps give additional detail to the causative theory. PIPA builds on an innovation systems perspective that recognizes that scaling-out and scaling-up are brought about by the formation and actions of networks of stakeholders in what is essentially a social process of communication and negotiation (Douthwaite, 2002; Hall, Mytelka, & Oyeyinka, 2004). Network maps are drawn for the beginning of the project and for the future, usually two years after the

Figure 2
The Concepts of Scaling-out and Scaling-up (Douthwaite et al., 2003)



project has finished. The “future” network is essential for the project to achieve eventual impact, because if no one is using or promulgating the project outputs after the end of the project, the project will not achieve its goal. Clarifying and making explicit how the project will build its “future” network helps project staff identify the key stakeholders that the project needs to engage with to achieve scaling-out and scaling-up of project outputs.

The network maps are crucial to PIPA. The network maps include the “softer” behavioural and relational dimensions of a project or program’s impact pathways, complementing the “harder” mechanistic description given by the IP logic model. A number of writers have identified the need to blend “hard” and “soft” to gain a fuller understanding of change and innovation processes (Campbell et al., 2001; Checkland & Scholes, 1990; Douthwaite, de Haan, Manyong, & Keatinge, 2001).

The network maps also help compensate for a weakness of logical frameworks and other types of logic models that do not give sufficient information about the actors involved in bringing about developmental change. For example, logical frameworks commonly contain narrative statements without people in them, “rice yields increased by 25% in pilot sites.” Network maps play a similar function to the concept of “reach” (Montague, 1997) introduced to provide actor information in traditional logical frameworks (Mayne, 2001; McLaughlin & Jordan, 1999). Reach refers to the sphere of influence—that is, the “with whom?” (partners and stakeholders), “for whom?” (direct and indirect beneficiaries), and “how many or how much?” (proportion of beneficiaries)—over which an organization wishes to spread its resources.

EIARD (2003) has noted that agricultural development comes about through complex and non-linear processes. This reality is not represented in logic models, but it is implicit in network maps. Network maps show relationships between actors involved in an innovation process and can “incorporate mutual and circular processes of influence as well as simple linear processes of change. This enables them to represent systems of relationships exhibiting varying degrees of complexity and chaos” (Davies, 2003, p. 2).

Integrated Impact Narrative

The IP logic model and the network maps are woven together by an impact narrative. We, and others, have found that textual descrip-

tions can make up for or supplement the incompleteness that is an inevitable concomitant of flow charts, diagrams, and matrices, useful as these undoubtedly are (Cooksey et al., 2001; Mayne, 2004). The impact narrative describes the relationships between the outcomes in the IP logic model with the network maps. By virtue of the demand that the narrative create an integrated unity, the IP group and project personnel find that the process of creating it subjects the assumptions on which the project is based to exacting scrutiny. This enhances the comprehensibility and reinforces the plausibility of both the logic model and the network maps, and hence the overall causative theory. This scrutiny helps project managers and staff to develop a better, more robust, and complete impact pathways for their project or program.

The impact narrative is more than the more traditional “narrative summary” that accompanies a logical framework. That is usually little more than a statement of each of the project’s goals, outputs, and activities and inputs (Horton et al., 1993). It is also substantially richer than the stand-alone “impact narrative” used to provide an account of significant program efforts and milestones and the effects of the program on its target population (Hamilton, 2005; Taylor & Fugate, 1993). It is similar to Mayne’s (2004) “performance stories,” although CPWF impact narratives, because of their *ex-ante* orientation, explain what is expected to happen while performance stories recount what has happened.

In terms of the relationship between program theory and theories of action, the whole process of developing the IP logic model and the network maps and then writing the impact narrative works to improve the project or program’s espoused theory about how they will achieve impact by making explicit project members’ theories-in-use. The process used to construct project and program impact pathways (i.e., program theory) is described in the next section.

Quantifiable Measures of Outcomes and Impacts

The Impact Group’s IP logic model goes further than identification of the likely intermediate and final outcomes and impacts. It quantifies these so that managers and funding agencies can be clear about the magnitude, in appropriate units of measurement, of what is expected from the project. Mayne (2004) has highlighted the importance of having clear, quantified statements of expectations. It is not practicable to measure everything, but without a concrete statement of

expected results, “all one has is results information” (Mayne, 2004, p. 34). The two quantitative techniques are geographic extrapolation domain analysis and scenario analysis. The effective use of the latter depends upon the prior execution of the former, and so geographic extrapolation domain analysis will be discussed first.

Geographic extrapolation domain analysis

Simply stated, geographic extrapolation domain (GED) analysis helps identify where one would expect a technology to be adopted. GED analysis uses Weight of Evidence (WoE) techniques, using data from geographic databases to calculate where in the tropics one is likely to find areas with similar socio-economic and agro-ecological conditions as found in CPWF project pilot sites. The purpose is to determine, *ex-ante*, the sites most likely to offer the potential for successful adoption of research products and services generated by CPWF. With this information, the project and/or the CPWF can then plan to scale out into areas that offer the greatest likelihood of success so as to augment and maximize their impact and thereby optimize the use of the financial contributions of the agencies funding the research.

GED analysis is so far unable to take into account similarities between the institutional environments of sites in the most probable replication areas, making the technique less useful for the purposes of determining the success of scaling-up. Indeed, it is unlikely that GED or any other quantitative technique will ever be able to account for any uncontrolled institutional factors that influence results in different social contexts (Dahler-Larsen, 2001).

Scenario analysis

Scenario analysis has gained in importance over more predictive approaches in a number of global environmental assessments over the last 20 years, because it allows for including surprises and unexpected developments outside of currently existing boundary conditions. Scenario analysis is used to quantify project impact pathways over a 25-year time scale. The analysis is carried out using an existing water and food supply and demand quantitative modelling framework called IMPACT-WATER. The framework allows economic policies, including trade policies, and climate outcomes of other basins and regions to be taken into account when building scenarios for the impact of different project research outcomes.

HOW IMPACT PATHWAYS ARE DEVELOPED FOR CPWF PROJECTS

Project impact pathways are developed basin by basin. The process begins with an Impact Pathways Workshop at which two or more representatives from each project work to develop the inputs required to build their project's IP logic models and network maps. The workshop is facilitated by members of the Impact Group. A "road map" of the entire process is shown in Figure 3. The purpose of the workshop is to clarify and surface the participants' often implicit program theory. The first part of the workshop clarifies a linear "logic model" view of the project's impact pathways, that focuses on outputs and outcomes. The second part clarifies an actor-orientated view focussing on the relationships needed to achieve impact.

Impact Pathways Workshop: Clarifying and Making Participants' Program Theory Explicit

The nature of the workshops

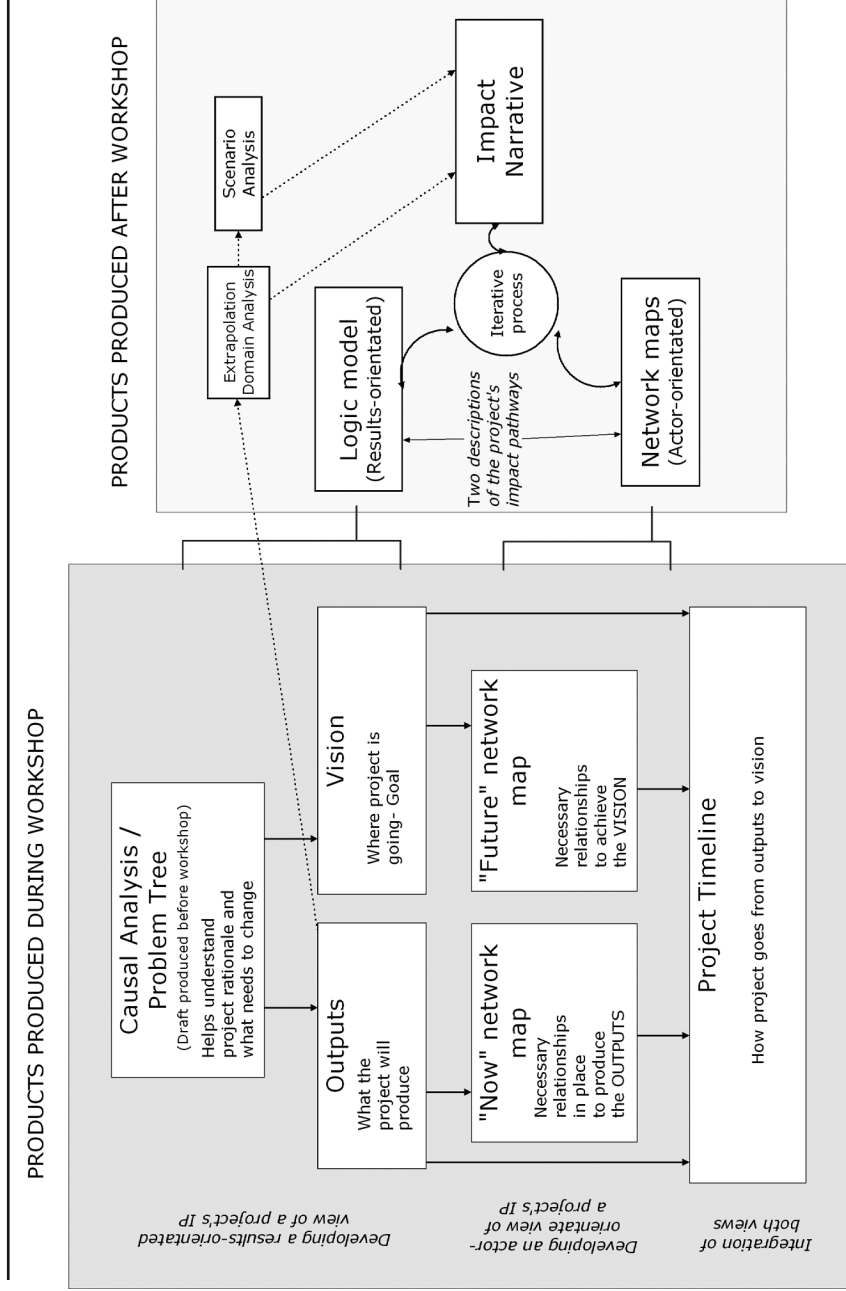
Workshops employ strategies for participation and the sharing of power that have already proven successful in earlier CGIAR projects involving evaluative inquiry and capacity development (Horton, 2001). These strategies derive from principles of "negotiated rationality" (Guba & Lincoln, 1989; Lincoln & Guba, 1985) and "deliberative, democratic evaluation" (House, 2004). They include the inclusion of all participating stakeholder views, a willingness to share power, extensive dialogue to make value positions explicit, and deliberation to allow parties to change their positions if they encounter new and persuasive information.

A negotiated process for developing the impact pathways model for each project is time-consuming and can be expensive. However, it is an effective process to ensure that stakeholder reality, and not merely researcher assumptions, drives the IP models. Value for money is exacted from the process by using the workshops as occasions for capacity building and for exchanging information from similar but widely dispersed projects.

Unit of analysis

The unit of analysis of PIPA is the project because this is what the CPWF funds. CPWF projects last for 3 to 5 years, while it can take 20 years to go from basic research to developmental impact (Collinson & Tollens, 1994). A CPWF project therefore cannot expect to achieve highly aggregated developmental impacts such as poverty reduction

Figure 3
The PIPA Process

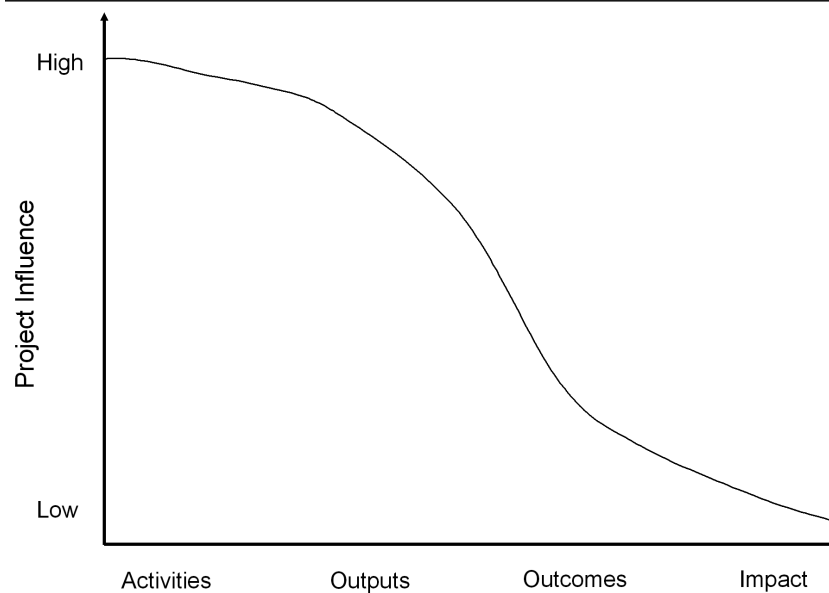


in the lifetime of the project. Nevertheless, workshop participants are stretched to think and plan beyond their current projects. The diagram in Figure 4 is presented to workshop participants, and the point is made that while a project has little control over whether it achieves impact, that influence is not zero and can be maximized by identifying impact pathways and following them during the project cycle. Impact pathways may well involve looking for subsequent project funding after the end of the current one.

Clarifying a Linear View of a Project's Impact Pathways

In preparation for an Impact Pathways workshop, the first two authors develop a draft problem tree for each project from the respective project proposals. This is considered necessary because CPWF project proposals are written in different styles and generally do not use logical frameworks. It can be quite difficult for an outsider to grasp the project's program theory. A problem tree is a visual problem-analysis tool used to identify problem situations and their key causes, starting with the root cause. We and others (Renger & Titcomb, 2002) have found that it is an excellent tool for clarifying, building, and communicating a project's underlying logic.

Figure 4
Project Influence on Outputs, Outcomes, and Impact



The managers and staff of each project are asked to reflect on the draft problem tree and to bring their own comments and modifications with them to the workshop. The first exercise in the workshop (see Figure 3) is for the project groups to modify and redraw their problem trees on cards and poster paper and then present them in plenary (see Figure 5). The next exercise is for the project groups to convert their problem trees into objective trees. This involves reframing the problem positively by describing the situation when the problem has been solved. For example, “food insecurity” becomes “food security.” The idea of reframing in the positive is shared with Appreciative Inquiry (Whitney & Trosten-Bloom, 2003) and other so-called “asset-based” approaches that have found that people are more motivated by positive outcomes than by problems.

Constructing the problem tree helps clarify which problems the project is tackling and hence what its outputs should be. The next step in the workshop is for each project to construct a vision of project success two years after the end of the project. The visioning exercise is adapted from Appreciative Inquiry and is based on this question:

Figure 5
Constructing and Presenting Project Problem Trees Helps Clarify a Linear View of a Project's Impact Pathways



Photo: Boru Douthwaite, taken January 2006 in Volta Impact Pathways Workshop.

You wake up two years after the end of your project. Your project has been a success and is well on its way to achieving its goal. Describe what this success looks like:

- What is happening differently now?
- Who is doing what differently?
- What have been the changes in the lives of the people using the project outputs and who they interact with?
- How are project outputs scaling-out and scaling-up?

The visioning exercise has proved very useful because existing project-espoused theory about goals is usually couched in very general terms, if described at all. The vision also provides the context for the “future” actor network map constructed in the second part of the workshop. An example of a project vision is shown in Table 1.

Table 1
Example of a Project Vision—CENESTA

What is happening differently now?

- Extension and research are working together to support farmer-led research and are working with local community-based organizations as their interface in Honam and Merek
- Local communities are better organized; their organizations are based on traditional water and natural resource management organizations; have revived use of traditional knowledge and institutions; have local legitimacy and also recognized by the government
- Enhanced water productivity with positive impact on livelihoods

Who is doing what differently?

- Extension and research are working together and both working at the service of farmers and pastoralists
- Local communities more independent: solving their own problems and conflicts
- Government is starting to develop policies for the Karkheh River Basin as a whole

What have been the changes in the lives of the people using the project outputs and who they interact with?

- Greater self-confidence among local communities
- Better relationship between government and local communities
- Farmers/pastoralists are using more productive and appropriate technologies based on traditional knowledge and new technologies to improve their livelihoods and this is starting to spread to other communities
- Greater farmer income

How are project outputs disseminating?

- By local community-based organizations with support from the government where needed

What political support is nurturing this spread? How did that happen?

- Growing political support for cooperation between research and extension to serve farmers better in technology development and extension
 - Growing political support for the role of customary institutions
 - Political support gained by showing productivity gains with these new approaches which leads to food self-sufficiency (national policy) and more efficient use of government resources
-

The final exercise in this first part of the workshop is for the project groups to develop a timeline of key events and activities that show how the project outputs are developed and then what needs to happen to those project outputs to achieve the vision.

Clarifying an Actor-Orientated View of a Project's Impact Pathways

The second stage of the workshop involves asking participants to construct two network maps, one for the present and one corresponding to their vision for two years after the end of the project. The participants are also asked to indicate the influence that the stakeholders wield. The "now" network map shows the existing relationships between the project partners and their links to other stakeholders and the ultimate beneficiaries of the project outputs. The relationships mapped include research, provision of funding, scaling-out, and scaling-up. The "future" network shows the relationships that the participants think are necessary to achieve their respective visions. Before participants draw this network, the facilitator reminds them of the concepts of scaling-out and scaling-up, and stresses that their respective projects will only achieve their vision and goal if a network of organizations actively works to scale-out and scale-up their project outputs after the end of the project.

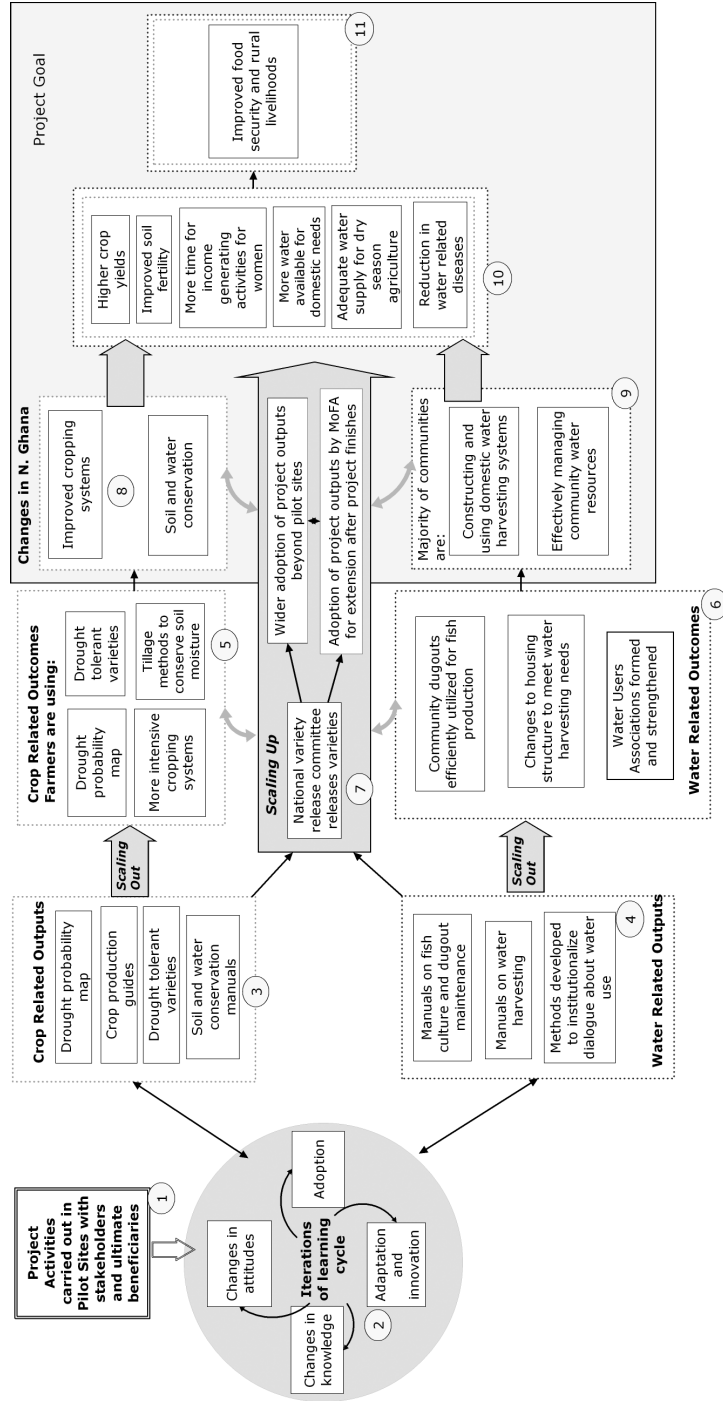
Once the two maps are drawn, the facilitator then asks them to compare and contrast them. They are also told that if the "future" map is very different from the "now" map, and usually it is, then this implies that the project must work to build these new relationships before the end of the project, as the relationships are unlikely to emerge spontaneously afterwards. This need to forge new relationships suggests additional ways of working with existing partners and points at which new stakeholders should enter the project. Participants develop a relationship action plan as part of the workshop.

After the Workshop

Development of project IP logic models

After the workshop, the facilitators in their role as evaluators synthesize the objectives tree, the project outputs, vision, and timeline into the project IP logic model. The IP logic model is a flow chart that shows both scaling-out and scaling-up processes (Figure 6) by which project outputs are increasingly used and promulgated such that they contribute to developmental outcomes. A published causative theory is integrated into the IP logic models of the projects carrying out participatory research in pilot sites. The theory describes how

Figure 6
IP Logic Model for the Strategic-Innovations-in-Dryland-Farming Project



scaling-out and scaling-up occur as a result of iterative and interactive experiential learning (Douthwaite et al., 2003). The narrative for this change model is as follows:

The project partners work in the pilot sites to develop, adapt, and validate new technologies and their use strategies, in partnership with key stakeholders. The pilot site trials lead to the participants—farmers, scientists, extension workers, and so on—going through experiential learning cycles that lead to individual and collective changes in attitudes and perceptions, experimentation, adaptation, and adoption. End-user adoption increases in the pilot sites based on positive feedback and promotion by the first adopters, and scaling-out begins as the technologies and strategies begin to spread to other villages. At the same time scaling-up begins, as the project partners and stakeholders, who are taking part in the field work, gain ownership of the project outputs and begin to promote them in their own organizations. Early adopters begin to see real increases in income as a result of adoption and this helps fuel continuing positive feedback which drives an acceleration of adoption from farmer to farmer (scaling-out). Positive feedback also drives an increase in institutional knowledge and support for the project outputs (scaling-up).

Drawing Project Network Maps

The Impact Group takes the network maps and matrices drawn in the workshop and redraws them using the Social Network Analysis (SNA) software package UCINET and NetDraw in order to make them easier to understand and use. The maps drawn in the workshops show all the relationships (e.g., research, provision of funding, scaling-out) and, while useful for showing which are the most central (i.e., most linked) actors, they can be somewhat confusing. The software allows separate maps to be drawn for each relationship that has proven invaluable for clarifying theory-in-use about how relationships currently work and how they need to change in the future. This clarification comes through an iterative question-and-answer process involved in writing the Impact Narrative.

Writing the Impact Narrative

The first step in writing the Impact Narrative occurs when the Impact Group sends the draft project IP logic model and network maps back

to the workshop participants, together with clarifying questions. If the project works in pilot sites, we then explain the Douthwaite et al. (2003) scaling-out and scaling-up theory-of-action and ask them if it applies to their project. Members of the Impact Group, again in their role as evaluators, then write the first drafts of the Impact Narratives based on the answers. This in turn throws up more questions and clarifications. In each round we press the workshop participants to quantify expected outcomes as much as possible for the reasons expressed earlier.

The iterative process of writing the impact narrative changes both the IP logic model and network maps as the projects' respective program theory improves and becomes clearer. For example, the Strategic-Innovations-in-Dryland-Farming Project's scaling-out network maps changed radically (Figure 7). The process helped the project clarify that they expect seven different organizations, including their own, to be involved in extending project outputs to the ultimate beneficiaries. At present only three organizations are doing this, so this implies that before the end of the project they need to forge relationships with four new organizations. Not all these relationships are likely to work equally well in scaling-out project outputs, nor had most of the relationships yet been formed. Hence the network maps introduced the ideas that (a) work had to be done to build relationships, (b) the relationships are likely to develop in unknown ways, producing both opportunities and threats to the project achieving eventual impact, and (c) these relationships should be monitored. None of this was in the original project description, nor in the IP logic model. Hence drawing the network maps helped improve the project's causative theory by introducing ideas of relationship building and development, uncertainty, non-linearity, and opportunity.

We integrate the IP logic model and network maps in the impact narratives by cross-referencing the network maps as much as possible with the outcomes and the scaling-out and scaling-up processes shown in the logic model. We then present the results of the extrapolation domain analysis and the scenario analysis to provide further quantification of likely impact.

The finished output includes a four-page executive summary and the main text (see <<http://impactpathways.pbwiki.com>> for an example). The executive summary is designed to be the basis for communication materials such as a press release, web page, or glossy handout for donors. The main text contains within it sufficient description of the

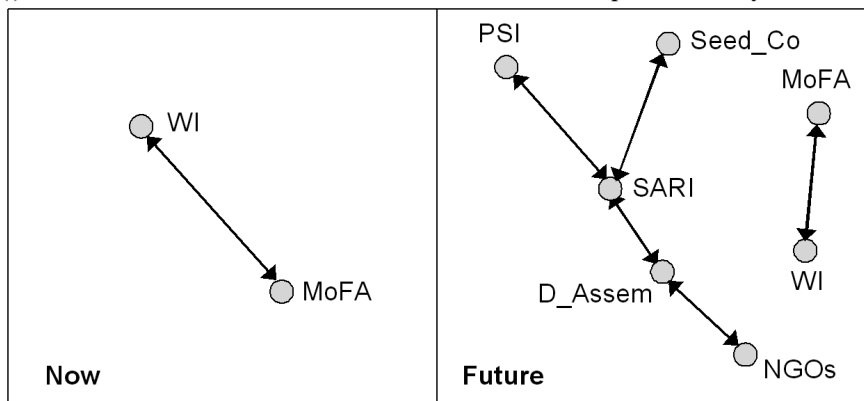
project's impact pathways to be the basis of monitoring and evaluation to test and update the project.

Using Impact Pathways for Monitoring and Evaluation

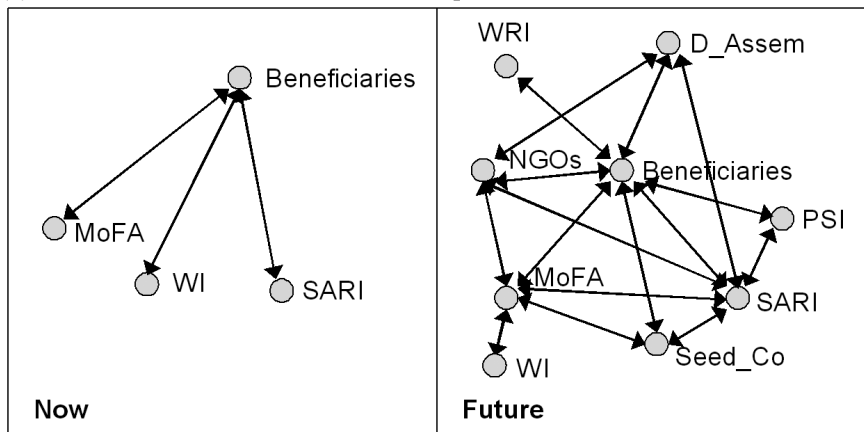
A project's impact pathways represent assumptions and theories about how project outputs will be developed and used. The CPWF now expects its new projects to base their monitoring and evaluation on checking whether these pathways are being followed. The expectation

Figure 7
Scaling-out Network for the Strategic-Innovations-in-Dryland-Farming Project

(i) Networks drawn based on information from the Impact Pathways workshop



(ii) Networks redrawn after an iterative process



is that because projects operate in complex environments, both the projects and their impact pathways will evolve, and that the information provided by Impact Pathways M&E will aid this evolution.

UNDERSTANDING PIPA FROM AN ORGANIZATIONAL LEARNING PERSPECTIVE

Research from the field of organizational learning helps understand how PIPA works. Argyris and Schön (1974) stated that people act on the basis of theories of action. Theories of action are the mental models that people use with regard to how to act in situations and that influence the ways they plan, implement, and review their actions. Argyris and Schön (1974) distinguish between two types of theories of action—*espoused theory* and *theory-in-use*. A project or program's espoused theory is equivalent to its program theory written down in the form of a logic model or impact narrative. A project's theories-in-use are found in the project staff and stakeholders' usually tacit understandings of how change happens that affects how they implement the project. Argyris (1980) and later Patton (1997) state that developing congruence between the two can lead to greater effectiveness, thus suggesting that projects are more likely to achieve their development outcomes if there is closer agreement between program theory and practitioners' theories-in-use. PIPA works to incorporate practitioners' theories-in-use into the project theory to achieve this congruence. It also works to include published theory where appropriate.

Our initial results suggest that the network mapping in particular is a powerful tool in making explicit project staff's implicit theories about how relationships need to develop to achieve scaling-out and scaling-up. This actor-orientated view of a project's impact pathways is usually missing in conventional logic models. Research from the field of organizational learning helps to provide an understanding of how PIPA works (Figure 8).

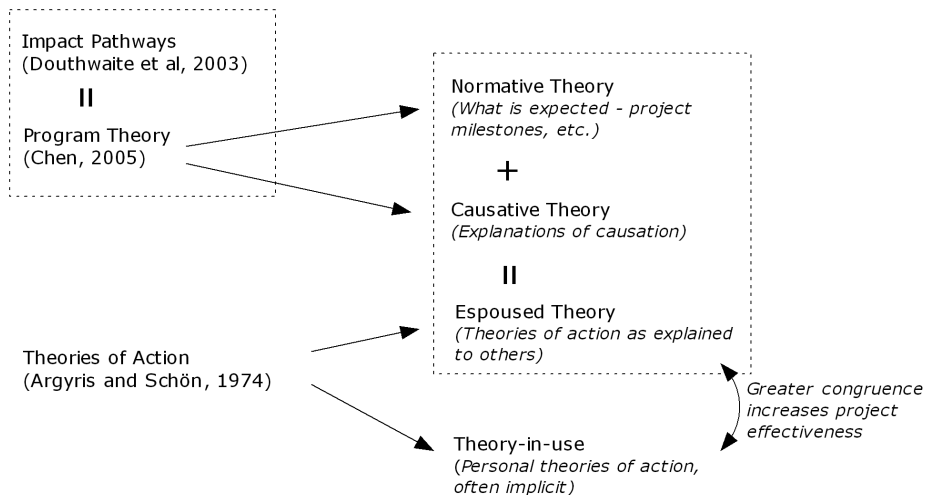
PIPA AND ITS CONTRIBUTION TO R4D PROJECTS

PIPA uses the outputs of a workshop to produce two descriptions of a project's impact pathways: an IP logic model and actor network maps. The process of constructing and refining these two descriptions helps clarify and make explicit (a) assumed causal linkages between project outputs, outcomes, and impacts, and (b) the relationships between organizations necessary for this to happen. Much of the clarification

and surfacing of program theory come from refining the network maps, while writing the project's impact narrative. The Impact Group, as evaluation specialists, give advice, question assumptions, and suggest relevant theory to further improve the theory upon which a project has been conceived.

Once developed, the impact narrative helps a project better understand and communicate what it is doing, with whom it is doing it, and why. This makes the project more fundable because it presents a cogent, rational argument for support to funding agencies. It helps with project monitoring and evaluation because it permits managers to compare what they have predicted should be happening with what is actually happening. It also helps the project members develop a shared understanding of their project that can help with implementation, in part by identifying and giving focus to high priority activities and relationships. Moreover, constructing impact pathways for the projects in a basin helps project leaders, the basin coordinator, and the CPWF Secretariat better identify complementarities and synergies between projects, thus contributing to the broader field of basin research program development. The workshops themselves have been found to foster better inter-project understanding and programmatic spirit.

Figure 8
Program Theory, Theories of Action, and Impact Pathways



The added value of PIPA with respect to evaluation and impact assessment in the field of agricultural research-for-development is the explicit use of concepts from program theory (Chen, 2005) and organizational learning (Argyris & Schön, 1974) to clarify and describe projects' impact pathways. These impact pathways are built from a number of hypotheses and assumptions about how research will lead to adoption, changes in peoples' behaviour, and developmental outcomes such as poverty reduction. The hypotheses and assumptions may be based on stakeholder-implicit theory or scientific theory. Hence, monitoring and evaluation of project and program impact pathways becomes a research activity with the potential to (a) test stakeholder-implicit theory and publish it as scientific theory and (b) evaluate scientific theory in new contexts. This research process will yield new knowledge and insights into the processes by which research outputs do or do not achieve developmental impacts. This understanding is increasingly recognized as essential in the adaptive management of existing projects and conceptualizing new interventions designed to improve living conditions of the rural poor. Such process understanding is also needed to give plausible *ex-ante* assessments of impact.

A second contribution is that this is the first time that concepts from program theory have been integrated with extrapolation domain analysis and scenario analysis to produce a qualitative and quantitative *ex-ante* impact assessment approach that includes both quantitative and qualitative elements.

A third contribution is the emphasis PIPA places on networks. One of the important long-term effects of projects is the networks they form, strengthen, or undermine. Actor networks help projects identify linkages, and think about how they wish to alter and strengthen them so as to achieve their purpose and goal. Actor networks, kept up to date, can help projects monitor and evaluate their progress in this regard. Analyzing actor network maps can help projects prioritize their relationships and thus foster a strong network without incurring overly high transaction costs. The analysis can also clarify the essential future partnerships that need to exist after the end of the project.

Network maps help projects achieve impact by showing the multiple linkages between partners and thus the multiple ways in which ideas and technologies can interact and be developed and diffused (see Figure 7). This helps people see that they are part of a network, and it is the network, not just their organization alone, that will achieve

impact. It also helps people appreciate that the interactions between actors, indicated by the links in the map, make the innovation process inherently unpredictable in the medium and long term, thus placing more emphasis on the need for continual monitoring and evaluation to support adaptive project management.

The novelty of PIPA to the field of evaluation is the use of network maps as a method to describe a project's "reach." PIPA follows Mayne's (2004) counsel to make explicit the detailed expectations for each project. The activities involved, including the preparation of current and future network maps, helps make explicit practitioners' theories-in-use particularly about the relationships that will be required for their projects to accomplish the results they seek.

PIPA supports the *ex-post* analysis of impact. By making explicit and then monitoring and evaluating progress along impact pathways, the project provides invaluable process documentation for impact evaluation after the project has finished. EIARD (2003) states that one of the requirements of good impact evaluation is that the impact pathways are described. Hence, if PIPA is carried out, the evaluator's job is to verify them.

Finally, PIPA offers project managers and evaluators a practical set of tools that can provide (a) a better appreciation of the existing and potential impact of research to justify current and future funding, (b) a deeper understanding of what impacts projects and programs might attain and how, and (c) the framework for an effective M&E approach that fosters and tracks progress toward achieving impact.

NOTES

- 1 The 15 international agricultural research centres of the CGIAR system carry out research-for-development. For more information see <www.cgiar.org>.

REFERENCES

- Ambrose, K. (2007, March). Outcome mapping in Ecuador: Enhancing learning in the M&E processes. *Capacity.Org*, 30. Retrieved July, 2007, from <www.capacity.org/en/content/pdf/1940>.
- Anderson, J., Bos, M.S., & Cohen, M.J. (2005). *Impact assessment of food policy research: A stocktaking*. Impact Assessment Discussion Paper 25. Washington, DC: International Food Policy Research Institute.

- Argyris, C. (1980). *Inner contradictions of rigorous research*. New York: Academic Press.
- Argyris, C., & Schön, D. (1974). *Theory in practice: Increasing professional effectiveness*. San Francisco: Jossey-Bass.
- ASARECA. (1999). *Workshop on impact assessment of agricultural research in Eastern and Central Africa*. Entebbe, Uganda, November 16–19, 1999.
- Campbell, B., Sayer, J.A., Frost, P., Vermeulen, S., Ruiz-Perez, M., Cunningham, A., et al. (2001). Assessing the performance of natural resource systems. *Conservation Ecology*, 5(2), 22. [online] <<http://www.consecol.org/vol5/iss2/art22/index.html>>.
- Challenge Program on Water and Food. (n.d.). *Development objective*. <<http://forum.waterandfood.org/>>.
- Checkland, P., & Scholes, J. (1990). *Soft systems methodology in action*. Chichester, UK: John Wiley.
- Chen, H.T. (2005). *Practical program evaluation: Assessing and improving planning, implementation, and effectiveness*. Thousand Oaks, CA: Sage.
- Collinson, M.P., & Tollens, E. (1994). The impact of the international research centers: Measurement, quantification and interpretation. *Issues in Agriculture: 6*. Washington, DC: CGIAR Secretariat.
- Cooksey, L.J., Gill, P., & Kelly, P.A. (2001). The program logic model as an integrative framework for a multimethod evaluation. *Evaluation and Program Planning*, 24(2), 119–128.
- Cousins, J.B., Goh, S.C., Clark, S., & Lee, L.E. (2004). Integrating evaluative inquiry into the organizational culture: A review and synthesis of the knowledge base. *Canadian Journal of Program Evaluation*, 18(2), 99–141.
- Cross, R., & Parker, A. (2004). *The hidden power of social networks*. Boston: Harvard Business School Press.
- Dahler-Larsen, P. (2001). From program theory to constructivism. *Evaluation*, 7(3), 331–349. London: Sage.
- Davies, R. (2003, November). *Network perspectives in the evaluation of development interventions: More than a metaphor*. Paper presented at the EDAIS Conference, <<http://www.mande.co.uk/docs/nape.pdf>>.

- Douthwaite, B. (2002). *Enabling innovation: A practical guide to understanding and fostering technical change*. London: ZED Books.
- Douthwaite, B., de Haan, N., Manyong, V. M., & Keatinge, D. (2001). Blending “hard” and “soft” science: The “follow the technology” approach to catalyzing and evaluating technology change. *Conservation Ecology*, 5(2). Available from <<http://www.consecol.org/Journal/vol5/iss2/art13/index.html>>.
- Douthwaite, B., Kuby, T., van de Fliert, V., & Schulz, S. (2003). Impact pathway evaluation: An approach for achieving and attributing impact in complex systems. *Agricultural Systems*, 78(2), 243–265.
- Douthwaite, B., Schulz, S., Olanrewaju, A., & Ellis-Jones, J. (in press). Impact pathway evaluation of an integrated *Striga hermonthica* control project in Northern Nigeria. *Agricultural Systems*.
- Earl, S., Carden, F., & Smutylo, T. (2001). *Outcome mapping: Building learning and reflection into development programs*. Canada: IDRC. <<http://www.idrc.ca/booktique>>.
- EIARD. (2003). Impact assessment in agricultural research for development. *Agricultural Systems*, 78, 329–336.
- Guba, E.G., & Lincoln, Y.S. (1989). *Fourth generation evaluation*. Newbury Park, CA: Sage.
- Hall, A., Mytelka, L., & Oyeyinka, B. (2004). *Innovation systems: Implications for agricultural policy and practice*. ILAC Brief 2. Rome, Italy: IPGRI.
- Hamilton, W.V. (2005). *Writing an impact report (Technology and resource spotlight tip sheet)*. <<http://cahe.nmsu.edu/tipsheets>>. Las Cruces, NM: New Mexico State University, College of Agriculture and Home Economics.
- Hartwich, F., & Springer-Heinze, A. (2004). *Enhancing the impact of agricultural research: An impact pathways perspective*. ISNAR Briefing Paper. Retrieved on September 7, 2006, from <<http://www.isnar.cgiar.org/publications/pdf/bp-66.pdf>>.
- Horton, D. (1998). Disciplinary roots and branches of evaluation: Some lessons from agricultural research. *Knowledge, Technology and Policy*, 10(4), 31–66.
- Horton, D. (Ed.). (2001). *Learning about capacity development through evaluation*. The Hague: International Service for National Agricultural Research.

- Horton, D., Ballantyne, P., Peterson, W., Uribe, B., Gapasin, D., & Sheridan, K. (1993). *Monitoring and evaluating agricultural research: A source-book*. Wallingford, UK: CAB International.
- House, E.H. (2004). The role of the evaluator in a political world. *Canadian Journal of Program Evaluation*, 19(2), 1–16.
- Kellogg Foundation. (2004). *Logic model development guide*. Battle Creek, MI: Author.
- Kibel, B. (2000). *Outcome engineering toolbox*. Chapel Hill, NC: Pacific Institute for Research and Evaluation. <<http://www.pire.org/result-mapping/OEToolbox.PDF>>.
- Lincoln, Y.S., & Guba, E.G. (1985). *Naturalistic inquiry*. Beverly Hills, CA: Sage.
- Mayne, J. (2001). Addressing attribution through contribution analysis: Using performance measurements sensibly. *Canadian Journal of Program Evaluation*, 16(1), 124.
- Mayne, J. (2004). Reporting on outcomes: Setting performance expectations and telling performance stories. *Canadian Journal of Program Evaluation*, 19(1), 31–60.
- McLaughlin, J.A., & Jordan, G.B. (1999). Logic models: A tool for telling your program's performance story. *Evaluation and Program Planning*, 22, 65–72.
- Montague, S. (1997). *The three Rs of performance: Core concepts for planning, measurement, and management*. Ottawa: Performance Management Network.
- Organisation for Economic Co-operation and Development. (2006). *Promoting pro-poor growth: Poverty impact assessment*. Paris: Author.
- Patton, M.Q. (1997). *Utilization-focused evaluation* (3rd ed.). Thousand Oaks, CA: Sage.
- Renger, R., & Titcomb, A. (2002). A three-step approach to teaching logic models. *American Journal of Evaluation*, 23, 493–503.
- Rogers, E.M. (2003). *Diffusion of innovations* (5th ed.). New York: Free Press.
- Rush, B., & Ogborne, A. (1991). Program logic models: Expanding their role and structure for program planning and evaluation. *Canadian Journal of Program Evaluation*, 6(2), 95–106.

- Ryder-Smith, D. (2002). *Institutionalizing impact orientation*. London, UK: Natural Resources Institute, University of Greenwich.
- Saldanha, C.D., & Whittle, J.F. (1998). *Using the logical framework for sector analysis and project design: A user's guide*. Manila, Philippines: Asian Development Bank.
- Schmitz, C.C., & Parsons, B.A. (1999). *Everything you wanted to know about logic models but were afraid to ask*. <<http://www.mospfsig.org/LinkClick.aspx?fileticket=t9QQ7u3%2fFVc%3d&tabid=394&mid=980>>.
- Science Council. (2006). *Guidelines for preparing 2007–2009 medium term plans and 2007 financial plans*. Rome: FAO.
- Taylor, C.L., & Fugate, A. (1993). *Writing the county report of accomplishment: Accomplishments / impact narrative*. Circular PE-42. Gainesville, FL: Agricultural Education and Communication Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.
- Whitney, D., & Trosten-Bloom, A. (2003). *The power of appreciative inquiry: A practical guide to positive change*. San Francisco: Berrett-Koehler.

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