

A 'learning system design' for more effective agricultural research for development

Ison, R.L.^{1,2}, Bruce, C.³, Carberry, P.S.³, Maru, Y.³, McMillan, L.³, Pengelly, B.C.³, Sparrow, A.³, Stirzaker, R.³, and Wallis, P.J.¹

1 Monash Sustainability Institute, Monash University, Clayton, Victoria, Australia

2 Communication and Systems Department, The Open University, Milton Keynes, UK

3 Commonwealth Scientific and Industrial Research Organisation (CSIRO), Sustainable Agriculture Flagship, Australia

Keywords: Innovation platforms; systems theory; food security; research praxis

Abstract

A 'learning system' design is described and critically examined as an approach to integrated agricultural research for development (R4D). This learning system sits within the monitoring and evaluation (M&E) component of an Australian research initiative to improve food security across sub-Saharan Africa. This program (Africa Food Security Initiative [AFSI]) is one component of Australia's development assistance program in Africa and focuses on building capacity to increase agricultural productivity and food and nutritional security by boosting African science leadership, skills, networks and institutions. The 'learning system' design addresses the research question: Can a learning system be designed in AFSI such that reflexive and responsible research for development (R4D) practice is an emergent outcome? It also supports formal M&E by: (i) elaborating the multiple pathways for impact and the associated indicators of impact for the range of project interventions; (ii) further elucidating the qualitative and quantitative data to be collected and appropriate platforms and processes for joint data management, in order to provide content for AFSI reports and review processes as well as co-produced scientific publications; (iii) assistance to AFSI researchers in undertaking systemic action research in the context of their AFSI activities; and (iv) enabling the linking of evaluation data and theory in scientific papers which are contextualized for the current state of thinking in the field of R4D. Emergent outcomes to date that support design effectiveness and efficacy are reported; the wider applicability of the approach to the systemic design of appropriate innovation platforms in R4D is discussed.

1. Introduction

The Australian Agency for International Development (AusAID), responsible for managing Australia's overseas development assistance program, commissioned CSIRO in 2010 to coordinate two research activities in Africa through partnering relationships with: (i) the West and Central African Council for Agricultural Research and Development (CORAF/WECARD) and (ii) Biosciences Eastern and Central Africa Hub at the International Livestock Research Institute (BecA-ILRI Hub). The first partnership focuses on increasing crop productivity through more efficient water and nutrient use and management, improving animal disease management and increasing services for smallholder farmers via more effective value chains. The BecA-ILRI Hub (herein referred to as BecA) partnership focuses on building African capacity in biosciences to address Africa's agricultural, nutritional, food safety and environmental problems.

In this A\$30M initiative, AusAID has contracted CSIRO to distribute funds to both CORAF/WECARD and BecA for projects selected and administered through their project management systems. In addition, CSIRO has established a partnership fund to resource CSIRO and other institutions to provide support to CORAF, BecA and their contracted projects. This arrangement is known within CSIRO as the Africa Food Security Initiative (AFSI) and the Learning Project (LP), the focus of this paper, is resourced from the partnership fund.

Here we explore a systems-theoretical approach to designing the LP as a 'learning system' (Ison, 2010). The AFSI LP has coalesced around the meta-question: Can a learning system be designed in the situation such that reflexive and responsible research for development (R4D) practice is an emergent outcome? This research question requires an appreciation of how 'design research' has come to be understood, particularly by Schön (1983) who challenged the technical rationality of Herbert Simon and sought to establish 'an epistemology of practice implicit in the artistic, intuitive processes which [design and other] practitioners bring to situations of uncertainty, instability, uniqueness and value conflict'. Within this tradition 'learning systems' cannot be designed deterministically (i.e. as a blueprint) but rather theory-informed contextual design is pursued to create favorable conditions for emergence. Thus a 'learning system' can only be said to exist after its enactment, i.e. upon reflection (Ison and Russell, 2000). The 'design' of learning systems can also be understood as a particular form of systemic action research (Ison, 2010).

Central to systemic design processes are: (i) an appreciation that a 'system' is an epistemological device formulated for learning about a situation of interest; (ii) articulating (including negotiating) an understanding of purpose of a system of interest; (iii) engaging in boundary judgments; and (iv) formulating measures of performance. Responses to these questions remain 'live' throughout the inquiry; it is not essential to have fully formulated responses to these *ex ante*. Measures of performance of a system of interest may exist as both generic and context specific measures. Following Checkland (2011), we utilize the generic measures of efficacy (does the system work); effectiveness (does it achieve its purpose), efficiency (are resources used wisely) and ethicality (are ethics understood and appropriately enacted?).

Certain elements have been central to the purposeful design that has been pursued – all designs are a product of initial starting conditions and unfolding appreciations of a context. A high level purpose was for participating researchers to elicit learnings about African farming systems, food security and their own practice through the lens of a common theoretical framework. Other concerns included whether the LP could contribute to successfully implementing R4D and facilitating the targeted contribution of Australian participation in R4D in Africa.

Whilst not designed as a blueprint, the design, if successful can deliver certain types of outputs. Anticipated outputs include: (i) a theoretical framework against which the impacts from the AFSI initiative can be assessed and which facilitates cross, and interdisciplinary working and builds reflexive research practice; (ii) data collection, management and analysis protocols which will facilitate elicitation of learnings and the creation/adaptation of an online platform to facilitate research inquiry; (iii) AFSI reports with added contributions from CSIRO staff originating from their action research activities; and (iv) a marriage of evaluation data and theory reported in the form of scientific papers which are contextualized for the current state of thinking in the field of IAR4D.

In this paper we report and account for our design choices to-date, beginning with an exploration of history and context, a key variable in transitioning towards social learning (Ison et al., 2007). Key elements of the learning system design are described and emergent outcomes to date

reported as preliminary evidence of system efficacy and effectiveness. Possible contributions the LP approach could make to the praxis of agricultural R4D, the design of innovation platforms, enhancing project monitoring and evaluation (M&E) and communication in R4D are explored.

2. History and context

In exploring the history and context we begin by considering the initial starting conditions, including framing, which along with commitments to stationarity (that statistical parameters, e.g. climatic variables, vary only within a steady envelope), can be critical to subsequent trajectories (Schön and Rein, 1994; Milly et al., 2008; RCEP, 2010).

There is a long history of R4D in Africa entailing significant expenditure, but with quantifiable impacts difficult to discern (Giller et al., 2010; Clark et al., 2011; Ostrom et al., 2007). As AFSI implements new initiatives in Africa it is important to learn from past efforts. This means paying attention to all stages of the research cycle, and there must be relevant data, information and reflections to help inform the overall monitoring and evaluation (M&E) requirements of AFSI to ensure that learning happens and impacts are evidenced. Within AFSI there is also a strong belief that it is a research responsibility to report learnings in the literature so that others implementing R4D will benefit from these experiences. To do this requires purposeful action about learning and a means to ensure that the organizations involved and others benefit in future.

2.1 Initial starting conditions – phase 1

Many aspects of AFSI were in place before formal funding for the Learning Project was allocated. That said, the CSIRO-AusAID collaboration was negotiated and established by representatives in both organizations who were cognisant of and desirous of a broad systems approach to the research to be undertaken. Thus, undertaking action research within a R4D context was well evident in the programme design documentation and in the construction of the overall M&E plans. The Learning Project was initiated subsequently in recognition of the need to bring academic rigour to the action research and its reporting and of the shortage of these qualifications within the CSIRO team.

The history of situations builds in particular features which give rise to pathway dependencies, not all of which can be re-oriented. Some of these legacy issues have already begun to emerge e.g., role of social scientists viz a vis biophysical scientists in ‘problem’ or research question formulation; absence of dedicated funding at the project level for communications activities; role of local people in formulating farming system research questions; the implications of particular organizing metaphors, including ‘pathways to impact’ a key feature of the linear model for R&D and/or logframe project processes (data not presented). Other historical factors act as counterbalances; championing of the LP arose from experiences of key researchers with earlier African-based R4D (Keating et al., 1991; Whitbread et al., 2010) as well as positive experiences with action research and learning-based approaches (Carberry et al., 2002; 2005; Stirzaker et al., 2011).

2.2 The role of invitation

An invitation that is experienced as an invitation carries with it particular emotional entailments; one is free to accept or decline an invitation, which differs from a demand or attempts at coercion. The LP arose from an invitation to the Monash-based lead author of this article. It was not the product of a bid or a negotiation, though it did involve clarifying the invitation iteratively then accepting the invitation and formalizing the invitation though a Monash-CSIRO contract. This also involved inviting others from Monash into the project and its co-development along with assistance in drafting the contract (aims, objectives and milestones). The point about invitations is

that they create a favourable emotional foundation for collaborative action (Ison and Russell, 2007).

2.3 Conceptualizing boundaries

It was clear right from the start that developing some clear boundaries for the LP would be essential. We understand boundaries in the systemic sense as that which bounds a particular formulation of a system of interest and which, in the process, creates, at least conceptually, a relational dynamic between boundary and context mediated by boundary choices. This process can be done explicitly drawing on systems theory, or implicitly by attending to framing choices (Schön and Rein, 1994) that are utilized when engaging with a situation.

Two clear choices were made at the start: (i) to consider the key initial stakeholders in the learning system as the Australian researchers engaging in their research practice in Australian-African contexts and (ii) to understand the situation of developing and enacting the LP as one characterized by uncertainty, complexity, interdependencies, multiple perspectives and, potentially, conflict (Ison et al., 2007; 2012). The first choice can be defended for a range of reasons, particularly resource and logistical constraints, including transaction costs, but most significantly in terms of a distinction made between the co-design of a first-order learning system (i.e., the LP co-designed with AFSI researchers) and a second-order learning system (i.e., a learning system designed by AFSI researchers with their African counterparts and/or other key stakeholders). This distinction allows clarity of action in terms of responsibility within the LP. However, the broader AFSI M&E plans do propose a learning system co-designed by AFSI researchers, their African counterparts and AusAID funders with intentions of drawing on progress made in the LP. A shifting of boundaries for the LP to encompass a broader range of stakeholders is currently underway.

The second choice can be defended on the growing appreciation of failures in public policy due to inadequate framing and praxis (APSC, 2007; Norton, 2008). We can now say that our decision supports the view espoused by Taylor (2005:226–227) that an approach to research that is “reflexive” (“applying one’s method to one’s own work”) and as involving “practical reflexivity” ... “that takes into account the range of practical conditions that enable researchers to build and gain support for their representations” is needed (Norton, 2008).

2.4 Capturing reflections and stories

From the very beginning of the AFSI project staff visiting the field (i.e., Africa) were encouraged to record their reflections and to share stories of their experiences. Whilst not universally taken up, this encouragement set the scene for the next phase of purposeful design.

3. Purposeful designing – phase 2

3.1 Contextual understanding

A workshop was held with almost all the Australian researchers (a total of 33) before LP contract negotiations were finalized. We do not report this event here in detail other than to say that it was, within certain constraints, designed to: (i) be as experiential as possible; (ii) present the background to, and rationale for the LP as well as to situate it within the overall M&E effort; (iii) introduce a range of techniques and tools that could be easily used by those present in the field or in their own specific project deliberations; (iv) issue the first invitation to participate in the LP and (v) elucidate some of the factors that might preclude AFSI researcher’s taking up the invitation to participate.

Techniques and tools used included conversation mapping, systems maps, metaphor analysis and rich picturing. The active engagement of those present in using these techniques and tools has produced a rich supply of data that characterize both the initial starting conditions of the LP and the contexts of AFSI researchers.

Building on our contextual understanding, reflections of AFSI staff who had already been in the field, a negotiated contractual obligation to formulate a theoretical framework on which cross-disciplinary understanding and discourse could be built, and our own research experiences a document called 'Notes for the Field' was prepared and distributed to all AFSI staff in early 2012 (Ison et al., 2012).

3.2 Theoretical background

Theoretical framing operates at two levels in the LP. The first is the traditions of understanding in which the Project Investigators responsible for the LP as 'learning system' are immersed (Ison and Russell, 2007). The second is those theoretical framings purposefully chosen to inhabit the learning platform design that has been proposed as a central element of the LP (Figure 1; Ison et al., 2012). It is not possible to elaborate on all of these here in detail. We mention the most important from each of the levels. The purposeful choice of theoretical frameworks was guided by two organizing questions: (i) what do researchers do when they do what they do? and (ii) how can R4D contribute to a sustained performance amongst multiple stakeholders in ways that make a difference?

Research praxis (Ison, 2010): understanding research as a form of theory-informed practical action means understanding it as praxis. Figure 1 is a conceptual model of the different elements that constitute research praxis though many researchers may not be aware that this is what they do.

Co-researching and enthusiasm (Russell and Ison, 2007): co-researching as a form of research practice involves becoming clear about one's own motivations and research questions and ethically and practically demarcating between: (i) what is yours; (ii) what is ours and (iii) what is mine, in terms of responsibility and utilization of research findings. An understanding of enthusiasm as theory, methodology and emotion built from earlier research (Russell and Ison, 2007) underpins our co-researching practice including the design of learning systems.

Social learning (Ison et al., 2007; Collins and Ison, 2009; Ison et al., 2012): is understood from a viewpoint that sees knowledge not as an object that can be transferred between people, but as an emergent property of social interactions. Social learning can be understood as something to be invested in, i.e., a governance mechanism as well as a set of processes enacted in social dynamics (SLIM 2004).

Most significant change (MSC; Davies and Dart, 2005): was chosen in response to concerns about the constraints of Logframes as a sole basis for project planning and subsequent M&E. MSC is an additional methodological approach to M&E; it is 'a form of participatory monitoring and evaluation.... [it] involves the collection of significant change (SC) stories emanating from the field level, and the systematic selection of the most significant of these stories by panels of designated stakeholders or staff.' It is claimed that 'when the technique is implemented successfully, whole teams of people begin to focus their attention on program impact'.

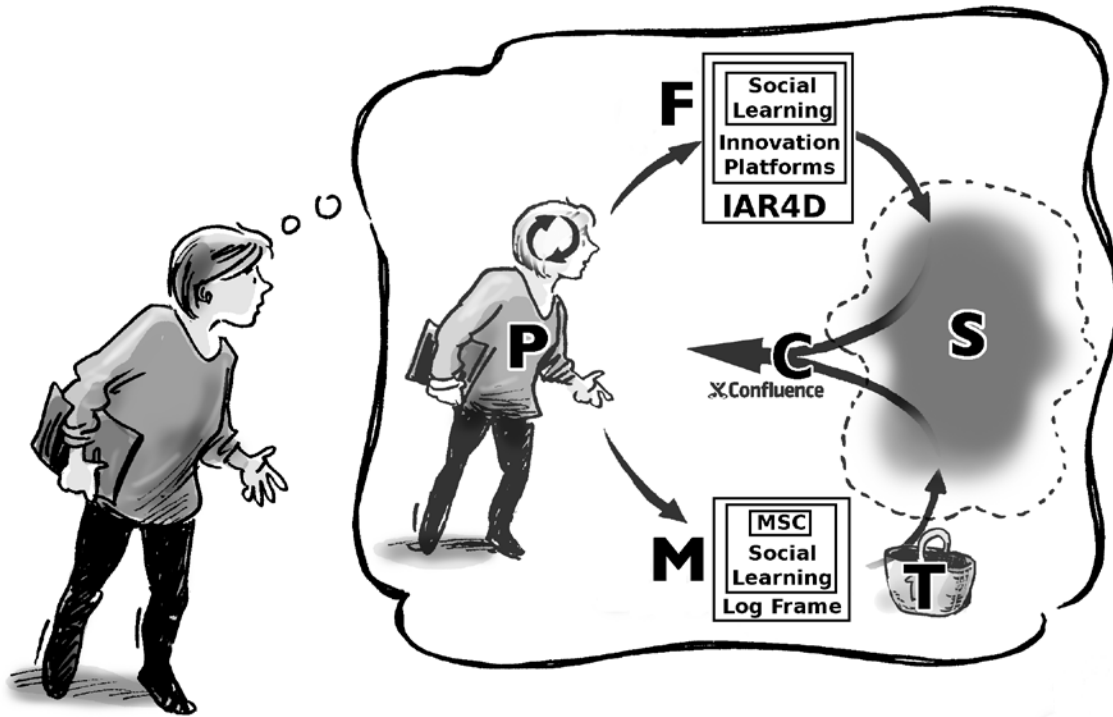


Figure 1a

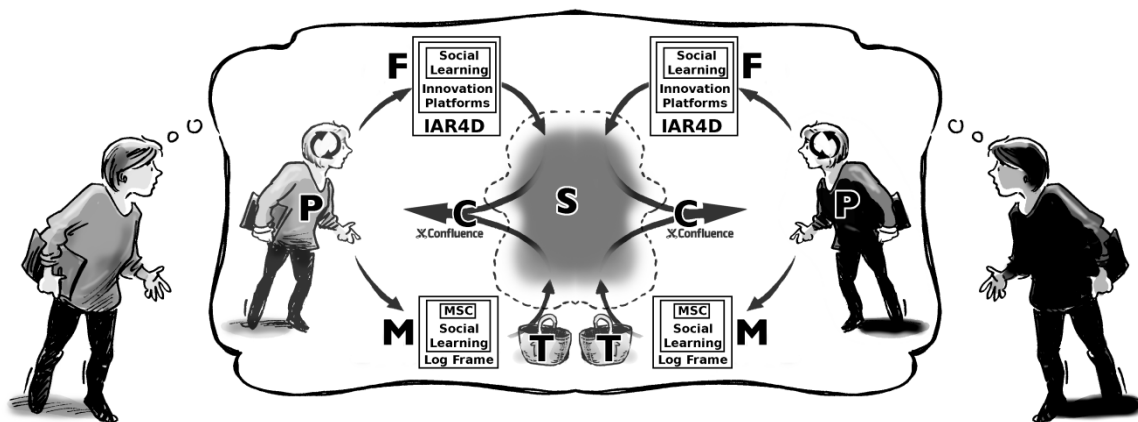


Figure 1b

Figure 1a. A way of thinking about individual research practice that comprises a set of interrelated elements comprising practitioner/researcher (P), theoretical framework (F), method(s) (M), research situation (S) tools or techniques (T) and capturing the learning through Confluence (C) (Source: adapted from Ison, 2010). Figure 1b. An example of team learning in a project team. This could include two or more researchers and partners interested in a particular situation (Source: adapted from Ison et al., 2012).

IAR4D: is a concept introduced into the R4D parlance by the Forum for Agricultural Research in Africa (FARA) to highlight the commodity value chain and its multiple actors in efforts to promote

innovation in agricultural systems (Hawkins et al., 2009). AFSI can be understood as a joint AusAID-CSIRO contribution to IAR4D as the preferred research approach proposed by its West African partners.

Innovation platform: This concept has a mixed history; it features strongly in R4D discourse, including the IAR4D concept. Innovation platforms are a cornerstone of the UK's current R&D approach as exemplified by the UK's Technology Strategy Board where an innovation platform is described as: "[an institutional invention designed to] focus on specific societal challenges where the UK Government is taking action through policy, regulation, procurement or fiscal measures to tackle the problem.....By improving co-ordination between the key players from industry, academia and government, innovation platforms can identify barriers to meeting the challenge, map possible routes to overcoming the barriers and align activities to support innovative solutions."

Systemic inquiry and systemic action research (Oquist, 1978; McCown et al., 2009; Ison, 2008): systemic inquiry is emerging as a praxis and new institutional form suited to situations of uncertainty and complexity. In such situations the traditional institutional form of 'a project' is inadequate. So even though our LP is named as a project, and has two years to run initially, it is appreciated that participants including the organizations are likely to continue to operate in this space, or similar spaces, into the future. Thus there is a strategic rationale, including the ethical issue of R4D efficacy and effectiveness, for continuing to learn and adapt. There is also an emerging rationale for systems boundary critique as one of the central elements of the LP that can assist researcher's reflection to be more systemic and critically directed at different scales and dimensions including the power and political dimensions of R4D interventions. From this perspective reflection and learning needs to treat systems boundary critically aided by tools developed by critical systems practitioners (e.g. Ulrich 1993; Midgley 1997; Maru and Woodford 2007).

Systemic inquiry draws explicitly on systems theory in its enactment and, as in this case, can be closely aligned with systemic action research in which it is recognized that all researchers are within the research situation. There is also a commitment to transform inquiry into research as recognized within the research community.

Systemic and adaptive governance: Governance research is concerned with how, as a society, humans manage their affairs in response to feedback processes (i.e. a cyber-systemic principle). Governance can operate at the level of a meeting, a project, a program, an organization, a set of policies or a government and in relation to the biophysical world and other species (e.g. biodiversity). Human-induced climate change creates a situation new to human history and thus raises questions about the adequacy of current forms of governance. Systemic governance involves breaking out of traditional linear, cause and effect thinking and practice so as to be more joined up, breaking down organizational and disciplinary silos, unpacking taken-for-granted assumptions and introducing diverse perspectives into the framing of strategies, policies and institutional innovations. Being adaptive means learning in a timely manner and changing what is done in response to a changing context (particularly as the rate of change and frequency of severe, 'surprise' events is likely to increase). We anticipate that the LP will become a platform for the articulation and synthesis of theory relevant to research praxis for IAR4D rather than the adherence to any one theoretical position.

3.3 Other learning system elements

The document 'Notes for the Field' elaborates upon Figure 1. It is designed to enable those engaged in AFSI to develop some common meta- ideas and language about R4D so as to facilitate reflection, inquiry and action that crosses disciplines and breaks out of the linear delivery model. Importantly, the material in Notes for the Field is designed to be used heuristically (i.e. as an aid to learning and reflection) not as a rigid template. Above all else we are not, in the LP, carrying out research on people.

From the start an online platform that could potentially fill multiple roles, including data storage and on-line asynchronous communication amongst project members was part of the design. Our organizing metaphor was that of 'scaffolding our learning'. A collaborative online environment, using Confluence, designed around the idea of personal and shared spaces, has been set up. Each member of the project has their own personal space that is completely private and can be used to collect ideas, store copies of emails, upload photos, audio or video, and to tag and organize this content. An added advantage of using Confluence is the powerful search function, which can be used as a way of synthesizing data.

Three actions constitute the M&E elements of the learning system design thus far. An important consideration was the a priori recognition that different stakeholders and actors in the learning system will have different appreciative settings, judge effectiveness differently, and thus come to different conclusions as to what constitutes valid knowledge. Thus a reference group has been formed of scholars immersed in similar intellectual traditions to those of the learning system designers; 'Notes for the Field' has been sent for external international peer review and participating CSIRO researchers are, as they immerse themselves in the LP, becoming a critical learning community.

4. Bringing forth a learning system – phase 3

The Learning system design is such that within AFSI the action research and learning ethos of the LP can be adopted at the level of the individual researcher, a project team, a program (e.g. BECA or CORAF/WECARD) and the whole of AFSI. This could include CSIRO researchers, Australian-based partner researchers and organizations and/or counterparts in the African partnerships. The decision to adopt this ethos and approach is the prerogative of those researchers who make up the different units of organization. Importantly it needs to be discussed and an active decision made to pursue this strategy or not. Each level also needs its champion and/or coordinator or facilitator. In conceptual terms this can be understood as nested series of learning systems organized as inquiries (i.e., system, supra-system, sub-system and sub-sub-system).

Post contract and ethics clearance, and with the general architecture of the Confluence platform developed, the following claims can be made about learning system design efficacy and effectiveness and the organizing meta-research question:

- Articulation and acknowledgement of some of the unfavorable initial starting conditions has dissolved tensions and exemplifies the positive nature of reflexive conversations
- There is growing realization that the LP has more strategic importance than was perhaps first thought - this is coming from feedback from funders, other research collaborators in developing countries; African counterparts (with whom more engagement is planned and being negotiated); in the CGIAR and with AusAID (or at least parts of it);

- The project has successfully established a collaboration based on leading expertise in systems theory/practice, learning-based approaches to innovation and new modalities of research practice - some from CSIRO and its partners, some from Monash/Open University
- The awareness of need continues to develop experientially for researchers based on their African research experiences - hence there are both ethical and strategic implications for CSIRO when operating in this space - and choosing to expand involvement.
- The AFSI project brings to the surface issues of how and where social and biophysical /technological scientists interact and operate jointly - more so than in Australian operations.
- Active engagement in the LP has opened up innovative ways to address the pathways to impact demands that AusAID are keen on and which complement the formal M&E requirements.
- Named action-research inquiries have emerged which cross disciplines and projects.

These include (i) the 'learning project': design and testing of a learning system for reflexive, action-oriented research for development; (ii) IAR4D and Innovation Platforms in the context of farming systems research: the AFSI experience; (iii) The ethics of action research in IAR4D, including partnership models; (iv) Narrative evidence and the most significant AFSI stories; (v) Exploring collaborative research and qualitative data analysis in an on-line environment (vi) Project framing and initial starting conditions for IAR4D and (vii) Boundary critique and the role of power relations in R4D.

There is growing evidence that the developing inquiry into IAR4D and Innovation Platforms is contributing theoretical, methodological and practical outcomes that are feeding into field activity in Africa.

5. Conclusions

The design research reported here has a range of novel features not widely appreciated or practiced within the IAR4D field, not least being framing the design process as a research inquiry in its own right. Evidence has already emerged that point to efficacy and effectiveness of the learning system design and shifts towards a more reflexive and responsible research culture (e.g. open discussion around initial starting conditions).

As Westley et al. (2011) observe 'the increase in our knowledge about our role in the environment cannot keep pace with the increase of the unknown impact of our actions'. There can be no better reason than this for increased focus on science as a reflexive practice informed by systems thinking and practice, even when the ambition is to contribute to significant and on-going innovation that can enhance wellbeing, livelihoods and food security. As advocates of an IAR4D approach, with experiences across multiple contexts in establishing innovation platforms, Tenywa et al. (2011) identify 'capacitating the stakeholders in requisite skills' as a major challenge. Skills in this regard are both conceptual and methodological as much as practical. However, neither Tenywa et al. (2011), or Adekunle et al. (2012) in relation to an innovation systems approach, refer to capability for reflexive research praxis, especially on the part of donor research communities. The design reported here is premised on the experience that responsible research practice requires reflexivity on the part of all research actors. It can be argued that the absence of a reflexive, learning platform from any project and program M&E runs the risk of committing to systematic, rather than systemic innovation.

Whilst recognizing that there is much for us to learn from other recent experiences of R4D, including the design and development of innovation platforms, our experience to date highlights a number of insights as well as challenges of potential interest. Our praxis-based approach built around systems and social learning theory has the potential to complement recent research which highlights the importance of institutional innovation to accompany technological innovation (see Hounkonnou et al. 2012). Making epistemologies and conceptions of research practice (Figure 1) that underpin action and make explanation transparent is also significant for ongoing systemic innovation. Bohensky and Maru (2011), in their analysis of attempts at integration of indigenous knowledge and science found four critical factors at play: new frames for integration, greater cognizance of the social contexts of integration, expanded modes of knowledge evaluation and involvement of inter-cultural “knowledge bridgers.” These findings might be equally apposite to our own project and attempts at institutionalizing innovation platforms.

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