

Mediating boundaries between knowledge and knowing: ICT and R4D praxis

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Abstract

This paper offers critical reflections on the use of a wiki as a data repository for knowledge transfer (first-order knowledge management) and as a mediating technical platform for social learning (third-order knowledge management for social learning) as part of innovating in R4D praxis. First-order knowledge creates well-defined and stable boundaries around knowledge where clear distinctions are made between the ‘knowledge producers’ and ‘knowledge users’. In contrast, third-order knowledge emphasizes the social nature of learning and knowledge-making reframing knowledge as a negotiated and dynamic social practice. A sustainable social learning process was sought that fostered an emergent community of practice among biophysical and social researchers acting for the first time as R4D co-researchers. Over time the technologically mediated element of the learning system was judged to have failed. This inquiry asks: How can learning system design cultivate learning opportunities and respond to learning challenges in an online environment to support R4D practice? Confining critical reflection to the online learning experience alone ignores the wider context in which knowledge work took place; therefore the institutional setting is also considered.

Keywords: boundary judgements; collaborative wiki, learning systems, action research, institutional constraints, social learning systems

Introduction

Contemporary practices, including research for development (R4D) praxis (theory-informed practical action) is underpinned by the use of Information and Communication Technologies (ICTs) which, it is claimed, provide incalculable opportunities for communication, knowledge sharing and social networking by collapsing time and space (Simons & Laat, 2002; Cummings & van Zee, 2005). Such a framing implicitly or explicitly constructs a boundary around knowledge as reified, or commodified – or at least able to be stabilized for a period of time (first-order knowledge). In this paper we offer critical reflections on the use of an online platform for collaboration (Confluence®, Atlassian Pty Ltd – referred to herein as the ‘online platform’), as a data repository and mediating technical platform as part of innovating in R4D praxis. The key question that is addressed is: How can learning system design cultivate learning opportunities and respond to learning challenges in an online environment to support R4D practice? We draw on the shift from first to third-order knowledge/knowing concerns that has occurred in several fields, including technologically mediated, supported and open distance learning (Cook & Brown 1999; Blackmore et al 2014). Klerkx et al. (2011) note that Knowledge Management for Development (KM4D) has developed from a knowledge transfer approach where first-order knowledge management is conceived as a linear process: that is, knowledge is created by ‘knowledge producers’ and is managed by storing and retrieving knowledge for transmission to ‘knowledge users’. However, the latest development of KM4D has evolved into a third-order whereby the focus is on ‘situated learning’ involving a diversity of people, groups and organisations who have

different roles, interests and positions of power interacting together to co-develop new and shared knowledges.

A shift from first to third order KM involves a boundary expansion that entails more elements including greater awareness of the situatedness of practice–theory dynamics and the importance of making explicit the operating conditions that shape knowledge/known practices. The significance of this epistemic shift alongside the development of ICT- enabled social networks is that there are conflicts in terms of epistemological commitments, resource investment (time, effort, money) and appropriate praxis (e.g., greater value on participatory and collaborative practices in online environments to co-create social life including, for example, innovation platforms and research communities of praxis).

The challenge we sought to address was to co-construct a sustainable social learning process in emerging communities of practices involving a group of biophysical and social researchers who came together as co-researchers in 2011-2013. We experimented with using wiki technology embedded in an online platform as part of ‘The Learning Project’ (LP), contracted to researchers from the SGRP (Systemic Governance Research Program, at Monash University) and as part of AFSI (the Africa Food Security Initiative), funded through Australian Government aid, and managed by CSIRO (Commonwealth Scientific and Industrial Research Organisation). The LP was set up as an innovation system to support institutional learning based on research for development (R4D) practice experiences (Hall et al. 2016; Ison 2016); AFSI comprised a complex program

partnership between Australian, West African and East African researchers (Ison et al. 2014). The questions posed stem from the realization that designing online collaborative processes is complex particularly where there is disparity between the initial design ideas and what actually happens in practice. The success and failure of online collaboration is linked to both software design and user practices, therefore the research focuses on the functionality of the online learning platform i.e., wiki technology, and the user practices and experiences of the research-based learning community. However, confining critical reflections to the online learning experience alone ignores the wider context in which this knowledge work took place therefore the institutional setting is included in the inquiry. In this paper we first outline the R4D setting in which this inquiry is embedded. This includes how we have attempted to create a bricolage between practice and theory (Cleaver 2002) drawing on empirical evidence through examining the activities, materials and communications within the online platform as well as communications about the online platform (i.e., emails). We then reflect on the adequacy of our designs to deal with our experiences and conclude with a reflection on lessons for R4D practice and future project/program/inquiry governance.

Inquiry elements and relationships

Despite sitting within a larger R4D project, AFSI, the LP was mainly, though not exclusively, an in-country (Australia), cross-organizational collaboration involving from 15-20 geographically dispersed CSIRO staff sitting across a CSIRO internal organizational matrix structure and five university-based staff. This inquiry emerged from our experience of enacting the LP where we asked: why was it difficult, outside of

email, to foster research collaboration in an online environment? Our sensitivity to this issue arose from experiences in supported open learning (Blackmore et al. 2014) and research experience of attempting to foster a reflexive community of R4D practitioners in an organization that historically valued ‘research for research’ (R4R – see Ison et al. 2014).

Our methodological approach in the meta-project (i.e., the LP) is first described; it was a form of collaborative co-research from which this inquiry emerged. Activities conducted as part of the learning system design of the LP are then described. We then describe the design of the online community (wiki-based) ‘sub-system’. The final part describes the assessment and evaluation of the online community sub-system.

Doing co-research

Co-research is generally understood as a particular form of participatory, or systemic action research (Ison 2008). This research tradition positions academic researchers and host organization representatives (practitioners) as co-researchers who design, execute, analyze and author collaboratively throughout the life of the project (Hartley & Benington 2000; Mathiassen 2002; Ison 2008). In addition the LP (see Ison et al. 2014) drew heavily on traditions of systemic inquiry based on a lineage from Dewey (1933), Churchman (1971), Checkland (2002) to Ison (2010). Churchman (1971, p.17) articulated the essence of inquiry when he said, “[Inquiry] *is reflective learning in the literal sense: it is the thinking about thinking, doubting about doubting, learning about learning, and (hopefully) knowing about knowing*”. Put another way inquiry facilitates a particular way

of knowing which, when enacted, makes a difference; when explicitly drawing on systems understandings it becomes systemic inquiry (Ison 2010). Collaborative co-research can be difficult to enact as most mainstream institutional settings and incentive schemes are not designed to support collaborative work between researchers and practitioners (Lyytinen, 1999; Ison and Russell 2011) though there is a persistent lineage of collaboration between researchers and farmers (e.g., Feldstein and Poats, 1989; Merrill-Sands and Kaimowitz, 1989). While this co-researching dynamic with researchers as R4D practitioners has been reported on over the past three decades, it has not always been critical enough of the dynamic in seeking practice innovations (although see Hoffman et al, 2007; Klerkx et al, 2011). Tensions can exist between the time-scales, styles of discourses and competing work responsibilities of academics and practitioners which can become constraining factors (Hartley and Benington, 2000). The co-research approach of the LP was motivated by previous positive experiences of action research approaches within CSIRO (Carberry 2001; Ison et al, 2012). Our research principles were based on openness towards the many and varied dimensions of learning through a series of self-determined learning inquiries (Ison et al, 2013). However, the research process was influenced by a set of pre-determined project milestones, which had implications for the overall design of the learning system, as discussed in the following section.

Overall learning system design

The 'learning system', design for the LP is described in detail in Ison et al. (2012; 2014). The key elements were formalized in a negotiated contract, which included: (i) the preparation of a theoretical framework as a basis for action and assessing impacts, (ii) a

system for collecting, managing and analyzing data to demonstrate learning, (iii) assisting participants in pursuing emergent action research inquiries and documenting reflections at the time of action, and (iv) reporting so that effectiveness and efficacy of investment in R4D could be enhanced. In theory these ‘deliverables’, were negotiated in a context of collaborative co-research where, responsibility for delivery was held collectively by Monash and CSIRO participants. However, the role of the Monash participants was to facilitate these activities in a situation where the stakeholding of most CSIRO researchers had not been built.

A primary consideration was to be attentive to boundaries; in other words, clarifying who was and was not involved in the research. This was guided by the negotiated design of the ‘project’ and the ethical requirement for voluntary participation. In the end, five Monash researchers were involved, along with 17 CSIRO participants and one external consultant (n=23) out of approximately 40 potential participants involved in the overall AFSI program. A subset of those who ‘signed on’ to participate were active participants and contributed to the framing, conduct and steering of the research. A set of sub-inquiries emerged from the main inquiry (Ison et al, 2014) that can be understood as sub-systems of the overall learning system; these included: (1) the role of ‘Integrated Agricultural Research for Development’ (IAR4D) and Innovation Platforms (IP) in the context of farming systems research; (2) the relationship between good science and enhanced food security; (3) the integration of social, economic and biophysical sciences; (4) power relations and ethics within project teams and R4D and (5) this inquiry, which

came to be regarded as an exploration of the systemic failure of an online learning sub-system.

Creating an online environment

Contract points (ii) and (iii) were interpreted by the Monash participants, and most of the active CSIRO participants, as developing an online ICT environment as a tool to support data collection and storage, knowledge sharing and collaborative analysis. An imperative of the CSIRO-based LP champion was that in action research all trips to the field as well as group interactions were potential sources of data and the LP should facilitate collection, analysis and reporting based on reflections in and on practice. Here we note that this imperative was not supported by all CSIRO participants, with some indicating very early-on that they were resistant to the use of an online environment; in addition, from the start, there was no formal relationship between the LP and the monitoring and evaluation (M&E) components of the overall R4D program. We return to these issues later.

Following the decision to employ an online environment for collaboration, a range of design parameters were considered to be essential by active participants: (i) the online environment had to be hosted on a private and secure server; (ii) this meant that it needed to be password-protected; (iii) in effect the data could only be hosted on one of the participating research institutions servers; and (iv) the ability for individual users to have full control of privacy settings for information they posted was required (including the ability to create space for fully private content, or shared with a limited number of participants). The ability for participants to edit any fully-shared content was also

important as was the desire that many types of content could be shared, for example text, images, audio, video and embedding of various file formats. To serve research it was important that this content was able to be tagged and searched.

The main design limitation in the specified requirements was the need for private and secure hosting, and as such only collaboration tools (wikis) hosted by the two research institutions were considered. The possibilities included a CSIRO-hosted instance of Microsoft SharePoint, a Monash-hosted instance of the Sakai Collaborative Learning Environment, either a Monash-hosted or CSIRO-hosted instance of Atlassian Confluence®, or a shared Google Site, Group and/or Drive under a privacy agreement with Monash. After discussion, the Monash-hosted instance of Confluence (version 3.2) was chosen.

A wiki is a website that allows editing of content and control of access to a series of ‘pages’ via a web browser i.e., a collaborative online environment in which there are several different platforms. The chosen wiki supported all of the desired design characteristics. Access to the wiki was made available in three phases. Firstly, Monash researchers logged in to the wiki with existing institutional credentials, created a set of pages, and set them to private among Monash participants. The initial content and structure of the wiki, as designed by Monash researchers, was a simple landing page with a photo-grid listing participants and the latest posts in a blog, which at the time included a short ‘welcome’ message and a link to the outcomes of a previous workshop. Secondly, a workshop was held with a subset of AFSI participants on 5 October 2011. In advance of

the workshop, access rights were granted to enable these external participants to use the wiki. A short session at the workshop was held to demonstrate the features of the wiki, and to enable participants to test it out. Finally, accounts were created for all remaining participants and for additional participants as they opted-in to the LP.

Inquiring into the systemic failure of the online environment

During the early stages of the project, the research community was encouraged to visit and use the wiki as part of a regular practice of reflection and collaborative learning. Framed as a system for storing personal reflections and sharing learning experiences as a fundamental component of the LP it was argued that content could feed into the M&E of the overall R4D initiative. There was in theory substantial professional incentive to engage with the wiki platform. The Monash researchers regularly visited the wiki to update pages and monitor the frequency of usage and authorship of any postings. Based on 18 months of observation, it became evident that most LP members were not storing, posting or sharing their personal reflections or learning experiences. The Monash researchers sought verbal feedback from the LP membership during a workshop session in February 2013 following a presentation from the wiki administrator. This solicited feedback and provided some clues as to why the wiki failed to generate an active online learning community. Towards the end of the LP, we collated AFSI email correspondence including comments made about the wiki – all data were coded. Our analysis draws on these observations, email correspondence and feedback using an adapted grounded theory approach (Charmaz, 2008). We situate our reflections on the outcomes within a synthesis of literature related to online environments for research.

Inquiry results

Here we summarize some of the main emergent themes from the inquiry into wiki 'systemic failure'. These include: (1) considering design elements in establishing a collaborative online platform; (2) encouraging participation within ethics protocols; (3) facilitating online learning practice; and (4) critically examining barriers to institutionalizing online learning practices.

Designing and establishing a collaborative online platform

The requirement for an on-line platform was established through the contracting process (CSIRO and Monash) and involved a limited number of especially CSIRO staff; the setup was not without tensions between different perspectives on the perceived value of a LP. Despite initial conversations to scope how the wiki could be used in research situations throughout the LP e.g., an early workshop involving all AFSI participants in late 2011, there was limited stakeholding by CSIRO staff in this aspect of the LP at the start. In other words CSIRO staff in committing, or being committed, to the AFSI project had not signed up for either the LP or its constituent elements. Thus the initial starting conditions were not favorable and explain much of what happened subsequently. Further workshops and invitations to LP participants to join a range of training opportunities including written instructions, video-based tutorials and over the phone or face-to-face training did little to overcome the limitations created from the start. There was a low uptake of individual training, and for those who did have a phone-based tuition session, it did not translate into the regular use of the wiki as a repository for personal learning reflections or as a communication tool.

Encouraging participation within ethics protocols

The LP was approved as a low risk project by a human research ethics committee (initially at Monash and then also in CSIRO) but to satisfy the Monash ethics procedures the LP had to be designed to engage those involved in AFSI on a voluntary basis so as to avoid participation through coercion. While coercion would be ethically challenging in the context of the project, it was important for the research organization to learn more about getting better at interfacing between research and practice in online environments to engage stakeholders located at multiple locations and within different organisations. However, in the first instance, participants from within CSIRO were recruited through an email invitation issued by a senior manager to AFSI members:

Please note this email makes no assumption about your participation, though of course we in the AFSI management team see many advantages that can flow from involvement (AFSI LP Member 12).

Unfortunately the ethics protocols did not reflect a co-research setting and emanated from a framing of CSIRO co-researchers as research subjects in a Monash research project, rather than active participants in research design and implementation. Originally the standard consent forms did not specifically reflect the co-research situation. This points to the *ex ante* constraints to designing and enacting a joint inquiry between two collaborating organizations when institutional arrangements reinforce organizational boundaries and research praxis stereotypes.

The extent of sharing individual and collective experiences (documented as recorded conversations, self-reflections, email correspondence and meeting notes) was extremely limited over the life of the LP. Unfortunately the project's ethics protocols required ongoing consent from participants to share research 'data' with others involved in the project creating a lingering perception that data (reflections, etc.,) were being transferred from participants (CSIRO) to researchers (Monash), whereas the intent of the co-research dynamic was that data would be created and shared for the collective use of all participants:

If we are doing action and co-research, then we need ethics protocols that work to engender trust and open communication among co-researchers. Elements of the Monash protocol (esp. around confidentiality and anonymity of CSIRO and Australian Affiliate AFSI participants) presented barriers to trust and open communication, truncated the 'data' potentially available to the LP 'researchers' and to participants (from CSIRO and affiliates working in AFSI) for shared learning and thus compromised the very aim of the learning project. (AFSI LP Member 12)

In line with reflexive practice, the Monash team liaised with their Human Research Ethics Committee and AFSI LP members to clarify the situation. The strongly supported view that emerged was that the LP was designed to be a social learning experience therefore as long as individual identities remained anonymous in publications, emails and other documentation they should be understood as shared resources to be accessible

across the AFSI LP membership (AFSI LP member 7). The Human Research Ethics Committee confirmed that such material should be able to become research data once the LP members agreed to these conditions. Yet there is a legitimate concern that if all conversations, personal reflections and email correspondence were framed as potential data, people may be less inclined to engage with each other openly knowing these interactions could be potential sources of conflict, undermine trust and be subjected to differing interpretations during data analysis processes.

Facilitating online learning practices

In order to foster online learning practices, certain AFSI LP members prompted other members to use the wiki in a variety of ways. AFSI LP Member 14 encouraged the use of the wiki in real-time during a scheduled telephone conference, however this did not eventuate. AFSI LP Member 13, in the role of wiki administrator, created a suggested format for all members to record their reflections. A template was uploaded to the public space to motivate usage and to assist in transforming wiki content into shared research data in a convenient manner. AFSI LP members were advised how they could share their contributions or keep such reflections private (Ison et al., 2013a). Therefore, participants had the opportunity to manage their own content. This reflective space was sparingly used, however in one instance the wiki was used to share trip notes that were initially part of email correspondence and reports from CSIRO researchers about fieldwork with African research partners. The content provides a talking point about the realities of researching for development in-situ, for example:

My further travels through Burkina last week were very busy and fruitful...One of the [research] sites is very close to the Ghanaian border...At the site I had a good chat with the farmers about what traits they liked from the trials they had witnessed and whether they would buy seed from what they had seen.

Encouragingly many farmers would buy seed of the improved varieties, although at the moment seed is subsidised by the government, so that will skew any thoughts. The conversation was quite long, because we have to translate from English, through French to the local language and back again, so I may well have been asking them what their favourite colour hat was. (AFSI LP Member 19)

AFSI LP Member 12 considered such content a prime example of how AFSI LP members might consider recording and sharing learning experiences with others.

Great report and material for the Learning Project...Also thanks for your serious adoption of the need for documenting our experiences and reflections – this is [an] excellent example of what we as a team need to do. (AFSI LP Member 12)

Unfortunately the wiki posting did not receive any comments or lead to any online discussion. Instead the wiki has been primarily used as a repository for documents and communications: email communication, AFSI newsletters, AFSI LP administration documents and AFSI LP meeting minutes. The wiki also was used as a common area to display the evolving structure of the LP Inquiries.

In summary, there was limited use of the wiki across the AFSI LP membership as a space to post comments, conduct text based dialogues or add content to share i.e., to practice collaborative learning, or in the words of Cook & Brown (1999) to engage in the generative dance between organizational knowledge and organizational knowing. Planning how the wiki could be used in the planned second phase of the project was shaped by asking the question:

How do you make it part of daily/integrated practice? (Confluence, entry 20120309 - reflection meeting)

This question was in acknowledgement that using the wiki had not yet become an embedded, everyday practice. Unfortunately the second phase of AFSI did not come to pass because of political changes in Australia's development assistance program.

Barriers to institutionalizing online learning practices

Towards the completion of the AFSI LP it was generally recognized that the wiki had been used in a very limited sense; only a small subset, 5 out of 22 LP members, actively contributed to the wiki. A range of possible social and technical issues were identified during an AFSI LP workshop held in January 2013 that provided important insights into the AFSI LP experience. A key issue identified was the high transaction costs involved in creating and maintaining an additional login to access the Monash-based wiki site, which was an external site for the CSIRO based researchers. It also became apparent that CSIRO LP participants had little time because their time was mapped to other projects.

Participants also had variable time allocations, and conversations need engagement or >1 person: one might be keen and have time, but if not all do, then there is no interaction! AFSI LP members also expressed privacy concerns associated with openly sharing opinions, ideas and research data in a collaborative, online environment, in a space that was also accessed by senior managers and colleagues.

The success of online communities is also dependent on the self-efficacy, motivation and ability of community members to self-regulate their practice/behaviour in an online environment. No doubt 'digital natives' will be more adept in future ICT-based learning situations but efficacy will, we suggest, still require conducive institutional arrangements if participants are to exhibit transformations in learning.

Internet connections in some countries are intermittent and not conducive to working online; this was the case for AFSI researchers when outside Australia. The online platform itself was sometimes unstable or unreliable, and did not always receive adequate attention from technical support staff (AFSI LP Member 13).

In response to some of these technological issues, AFSI LP Member 13 suggested migrating the wiki pages to an internal system at CSIRO using existing authentication if the LP was to transition into Phase 3 of the AFSI. A further attempt to engage the LP membership in online collaborative practices was initiated by AFSI LP Member 4 through the provision of access to a CSIRO hosted web application platform

(Sharepoint). The platform supports document and file management, online collaboration and social networking and intranet portals. Similar to the experience with the Monash-based wiki, the web application was primarily used as a repository for relevant CSIRO based documents (e.g. reports) as an information source rather than a place to interact and co-generate knowledge.

Collaboration and learning did emerge but outside the boundary of the wiki in offline situations. Collaborative practices transpired through email correspondence, telephone conversations, face-to-face meetings and through the co-authoring of research papers which is the principle practice of the group (i.e., R4R) in Wengerian (1989) terms.

Making sense of our experiences

Mediating collaborative practice within an institutional ecology

The biggest technological constraint was the requirement for CSIRO staff to use an external login to access the space. However, it was not the technology *per se* that failed but the institutional ecology in which it was deployed, including how ICT, or any technology for that matter, is perceived systemically in relation to practice. By institutional ecology we mean the set of arrangements, rules, contracts, project elements (e.g. M&E) that characterised the LP at inception as well as the historical practices and arrangements that researchers brought with them from their organisations. Design tensions and concerns about purpose existed from the start. These included:

- (i) upon returning from the field all CSIRO staff were expected to deposit trip reports on the CSIRO project and fieldwork management system but no

provision was made for sharing these with the new wiki augmented data – at least not until 2015 after the termination of the AFSI program – see McMillan et al (submitted);

- (ii) no internal staffing were available to manage an online platform within CSIRO (which had its own collaboration tools), and had staff been available, this would have presented access problems for Monash researchers (i.e., protocols for reciprocal access were an issue);
- (iii) ethics protocols were new to many within CSIRO and lagged behind on-the-ground developments and, as discussed, were not well suited to co-research between different researcher groups i.e., research data (emails, meeting notes, reflections) could not be freely shared between AFSI LP members without prior consent according to Monash University Human Research Ethics protocols;
- (iv) there were no institutional links built between the wiki and the formal M&E requirements of AFSI, despite efforts to address this issue;
- (v) as with the whole LP, participation by AFSI researchers in the use of the wiki was voluntary,
- (vi) AFSI participants with varying managerial responsibility and seniority probably considered the online space as unsafe for maintaining confidentiality and/or being open when storing and sharing content;

- (vii) the learning context was a challenging one i.e. two organisations coming together from different learning cultures and practices to jointly use an online platform with few incentives, and
- (viii) CSIRO researchers had to deal with the complexities of different line and project managers, insufficient time allocations in their workload matrices, performance metrics and the overall political tension within the organisation over doing R4D rather than R4R.

In Figure 1 the learning outcomes from this inquiry are summarized in terms of (i) creating the starting conditions for designing an online learning system to enable co-research practice in complex project partnerships. The figure was generated to show the positioning of our online learning innovation (wiki) within the larger learning system; that practice and experience is embedded within the starting conditions (framings, assumptions, institutionalized practices) of the project process and the differentiated ‘spaces’ in the wiki between the learning space/data management space.

[INSERT FIGURE 1 HERE]

Figure 1. Learning system design features with on-line elements for enabling R4D as co-research: creating the starting conditions for designing an online learning system

Epistemic struggles

There was however, another level of systemic failure that pertains to understandings about how the co-production of knowledge happens, or could happen, and thus the

practices upon which co-production rest. In the literature this arena of contested understandings is in part captured by Cook and Wagenaar (2012) when they say:

[I]t is commonly said that knowledge is applied in practice. Professionals can be distinguished from lay people in that they have acquired through training a body of tested and proven specialized knowledge that enables them to resolve problems in their given field...Numerous writings have brought us valuable insights into the importance of practice and have done a great deal to erode the Received View of practice as explicable wholly in terms of applied knowledge. However, our understanding of how exactly practice, as a distinct phenomenon, generates knowledge and how knowledge functions within practice is underdeveloped.

(Cook and Wagenaar 2012, p. 3)

It is the 'received view' that underpins enduring commitments to the linear knowledge-transfer-model (Ison and Russell 2011). In contradistinction to what they label as the 'received view', Cook and Wagenaar (2012) explain how it is in real world practice that knowledge and the knowledge context is evoked, where each practice is performed within unique constraints, enablers, histories and futures. Knowledge was framed from the start of the LP in terms of the Received View, as being managed in application to generate practice, which was a key limiting factor. So too were the limitations in investment (budget) and staff that precluded more active processes of 'knowing management'. To appreciate what knowing management could be in contexts similar to our own, the concept of what online communal R4D practice 'is' or 'can be' needs to be

explored. In Klerkx et al (2011) framing of the 1st to 3rd order knowledge management distinctions, it is not clear whether these authors go as far as Cook and Wagenaar (2012) in seeing 'knowledge production' and 'knowing enabling' as a duality, albeit one in which the received view currently dominates the other. From this perspective third order knowledge management, or preferably knowing/knowledge managing is more than a negotiation process to bring together different knowledge interests (Klerkx et al 2011); it is also a practice in knowledge creation.

Understanding knowledge communities metaphorically

Two prominent metaphors can be used for further exploration of knowledge communities: communities as a physical place and communities as a network (Figure 2). Both metaphors can co-exist in understanding online communities.

[INSERT FIGURE 2 HERE]

Figure 2. Metaphors of online community as: (a) physical place, and (b) network

In an online community represented as a physical place, people inhabit infrastructure, interact with others, express meaning through their practices and objects, and are shaped by their context. As with town planning, one does not simply create a community by providing the infrastructure; a community emerges from a combination of infrastructure, people, objects, meanings, relationships and other variables. Generating 'content' in an online space is like furnishing a home with material artefacts; in many ways this was the main motivation for pressing ahead with the wiki, though it also had to have the facility

to track artefacts and assemble them in new ways to meet the needs of emergent inquiries and research questions. Online content generation provides visible evidence of being active in the online environment (Hemetsberger & Reinhardt, 2009).

An online community represented as a network is differentiated from a physical, place-based community because interactions mediated through ICT transcend location, allowing people to connect across space and time from the local to the global scale. Online relations are described as spontaneous and particularised to create dynamic, heterogeneous communities of interest that have variable longevity. Perhaps there was not enough focus on strengthening the ability of individual AFSI LP members to connect through their existing professional networks compared to the place metaphor which tended to emphasise a stable group involving all LP members.

The quality of online social networks emerge and are demonstrated through specific roles people adopt throughout the life of the network. Despite advances in network communications globally AFSI members working in spatially disparate sites in Australia and East and West Africa were often constrained in the technologies they were familiar with and prepared to use; email was generally the most reliable, satellite phones were required for safety protocols and attempts at inviting researchers in the field to record reflections in situ were not successful.

However the network metaphor also warrants critique. A key limitation with the network approach to understanding social realities is a tendency to focus on the structure at the expense of giving significant attention to the cultural and intersubjective dimensions of

social relations (Yuan, 2013). Network theory is criticised for accentuating individualism in social theory, which plays out in targeting the individual as the unit of analysis i.e. the social network is reduced to the ties between the individual actors (Postill, 2008).

Gurstein (2001) contends that reducing ICT-supported societies to individuals simply connecting with other individuals disregards the potential for people forming digitally enabled communities capable of taking collective action and forming powerful social identities. This also applies to the possibility of people coming together to undertake co-research using an online environment where collective action and social identity would be expressed in a culture of sharing and institutionalising collaborative practice.

Where there is a genuine desire to shift focus from R4R to R4D there is much to be gleaned in experiences from technologically mediated learning in school and higher education (e.g. Laurillard 2012, 2013) and from activity system design (Engeström, 2006).

Conclusions and future directions

Designing online spaces for collaboration is a complex process where there can be great disparity between the original design ideas and what actually eventuates in practice (Barab et al., 2004). An obvious strategy is to include users in the design process based on the situated needs and limitations of the users (Barab et al., 2004); in our situation this was only partly achieved and began with what can be now understood as the wrong institutional ecology and conceptual understanding with unexpressed epistemological commitments. The system of concern must be framed to encompass external research organisations as well as project recipients and collaborative partners (Ison et al 2014).

CSIRO might have invested in, and institutionalised, an R4D digital commons that could have exploited social networks as a potential means to bypass or work outside bureaucratic structures as a means to operate in an emergent way alongside the established social structures. Preferably there would have been more explicit framing of our R4D praxis: in our case practising both first-order knowledge management (storing, managing and transferring knowledge) and third-order knowledge management (situated mutual learning through interactions), which involves boundary tensions. While a co-researcher dynamic avoids academics acting as ‘experts’ conducting research ‘on’ practitioners; this is a profound shift in boundary conditions associated with standard R4D practice and is a far cry from mainstream R4R practice.

In terms of future directions to achieve system innovation based on the lessons we can draw from our experience we recommend:

- dedicating time to critically assess and customise online technologies to facilitate a shared learning environment including how the design may influence whether or not online participation becomes a part of everyday research practice
- negotiating ethical protocols as a collaborative exercise would seem a necessary undertaking to situate ethical practice appropriately and to provide an occasion to learn about designing an ethical framework to align with the research principles
- developing knowledge management practices to enable joint analysis, shared practices for tagging data and project narratives (see Ison et al 2013) need to be established at the outset

- the research process should avoid a “predetermined structure” and explicitly invite members to reflect as a free-form contribution to a shared site, where facilitators actively offer their interpretations to the community as a discussion forum
- actively adopting online community roles to demonstrate collaborative and learning capacities as an innovative platform, and;
- nurturing social relations/building trust online and offline as part of a ‘seamless’ learning system rather than framing the online environment as a differentiated (disconnected) space from offline research practices and social relations.

In order to succeed conducive institutional ecologies and supportive learning environments need to be created and sustained. In hierarchical research organisations, programs or projects the realisation of virtues associated with open source collaboration, emergent communities of practice and self-organising inquiries seems a long way off and probably requires capacity building efforts that explore new metaphors (Hall et al 2012).

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References

Barab, S., Scott, J., Del Valle Martin, R., & Fang, F. (2012), 'Coming to terms with communities of practice: A definition and operational criteria', In J. Pershing (ed.) *Handbook of Human Performance Technology* (3rd ed). San Francisco, CA: John Wiley & Sons, Inc, (pp. 640-664).

Blackmore, C., Ison, R., & Reynolds, M. (2014), 'Thinking Differently About Sustainability: Experiences from the UK Open University', In: Filho, W. L., Azeiteiro, U., Alves, F., & Caeiro, S. (eds) *Integrating Sustainability Thinking in Science and Engineering Curricula*. World Sustainability Series, DOI 10.1007/978-3-319-09474-8_43 Switzerland, Springer: pp. 613-630.

Carberry P.S. (2001), 'Are science rigour and industry relevance both achievable in participatory action research?' in 'Proceedings of the 10th Australian Agronomy Conference'. Hobart, Tas. (Australian Society of Agronomy/The Regional Institute: Gosford, NSW) Available at: <http://regional.org.au/au/asa/2001/plenary/5/carberry.htm>

Charmaz, K. (2008), 'Constructionism and the grounded theory method', in Holstein, A. and Gubriam, J.F. (Eds.), *Handbook of Constructionist Research*. pp. 397–412.

Checkland, P. (2002), 'The role of the practitioner in a soft systems study', notes of a talk given to OuSyS and UKSS, Saturday 8th December 2001, in Quarterly Newsletter of the

Open University Systems Society (OUSyS), Open University, Milton Keynes, No. 27, March 2002, pp. S5-S11.

Churchman, C. W. (1971), *The Design of Inquiring Systems: Basic Concepts of Systems and Organization*. Basic Books, London.

Cleaver, F. (2002), 'Reinventing institutions: Bricolage and the social embeddedness of natural resource management', *The European Journal of Development Research* Vol 14, No 2, pp.11-30.

Cook, Scott D. N. & Brown, J.S. (1999), 'Bridging epistemologies: The generative dance between organizational knowledge and organizational knowing', *Organization Science* Vol 10, No 4, pp.381-400.

Cook, S.D. Noam & Wagenaar, H. (2012), 'Navigating the eternally unfolding present: Toward an epistemology of practice', *The American Review of Public Administration* Vol 42, No 1, pp.3-38.

Cummings, S. & van Zee, A. (2005), 'Communities of practice and networks: reviewing two perspectives on social learning', *KM4D Journal* Vol 1, No 1, pp.8-22.

Dewey, J. (1933), *How We Think. A Restatement of the Relation of Reflective Thinking to the Educative Process* (revised edn), Boston, D.C. Heath.

Engeström, Y. (2006), 'Activity theory and expansive design in Theories and practice in interaction design', S. Bagnara & G. Crampton Smith (eds), Hillsdale: Lawrence Erlbaum, pp. 3–24.

Feldstein, H. and Poats, S. (Eds.) (1989), *Working Together, Gender Analysis in Agriculture*, Kumarian Press: West Hartford, Connecticut.

Gurstein, M. (2001) 'Community Informatics, Community Networks and Strategies for Flexible Networking', in L. Keeble & B.D. Loader (eds) *Community Informatics: Shaping Computer Mediated Social Relations*, Routledge: London, pp. 263-83

Hall, A., Mbabu, A.N., Beshah, T. and Komolong, M. (2012), 'In Search of Agricultural Research for Development: A New Capacity Building Agenda', in A. Mbabu & A. Hall (eds.), *Capacity Building for Agricultural Research for Development: Lessons from Practice in Papua New Guinea*. United Nations University-Maastricht Economic and Social Research and Training Centre on Innovation and Technology (UNU-MERIT), Maastricht, p. 15-40.

Hall, A., Carberry, P., Djikeng, A., Roy-Macauley, H., Pengelly, B., Njoya, A., Ndungu, L., Kollo, I., Caroline Bruce, McMillan, L., Ison, R. and Keating, B. (2016), 'The journey to R4D: An institutional history of the Australia Africa Food Security Initiative', in Judith Francis and Arnold van Huis eds., *Innovation systems: towards effective strategies in support of smallholder farmers*, CTA/WUR, Wageningen.

Hartley, J. and Benington, J. (2000), 'Co-research: a new methodology for new times', *European Journal of Work and Organizational Psychology*, Vol 9, No 4, pp. 463–476.

Hemetsberger, A. and Reinhardt, C. (2009), 'Collective development in open-source communities: An activity theoretical perspective on successful online collaboration', *Organization Studies* Vol 30, pp.987–1008.

Hoffmann, V., Probst, K. and Christinck, A. (2007), 'Farmers and researchers: How can collaborative advantages be created in participatory research and technology development?' *Agriculture and Human Values*, Vol 24, No 3, pp.355-368.

doi:10.1007/s10460-007-9072-2

Ison, R.L. (2008), 'Systems thinking and practice for action research', in Reason, P., & Bradbury, H. (eds). *The Sage Handbook of Action Research Participative Inquiry and Practice* (2nd edn). Sage Publications: London, pp. 139-158.

Ison, R.L. (2010), *Systems Practice: How to Act in a Climate-Change World*. Springer, London and The Open University.

Ison, R.L. (2016), 'What is systemic about innovation systems? The implications for policies, governance and institutionalisation', in Judith Francis and Arnold van Huis eds., *Innovation systems: towards effective strategies in support of smallholder farmers* CTA/WUR, Wageningen.

Ison, R.L. & Russell, D.B. (2011), 'The worlds we create: designing learning systems for the underworld of extension practice,' in Jennings, J., Packham, R.P. & Woodside, D. eds. *Shaping Change: Natural Resource Management, Agriculture and the Role of Extension*, Australasia-Pacific Extension Network (APEN), Australia, pp. 66-76.

Ison, R.L., Bruce, C., Carberry, P.S., Maru, Y., McMillan, L., Pengelly, B.C., Sparrow, A., Stirzaker, R., & Wallis, P.J., (2012), 'A "learning system design" for more effective agricultural research for development', in *International Farming Systems Association Conference*. Aarhus University, Denmark, 1-4 July 2012.

Ison, R.L., Wallis, P. Bruce, C., Stirzaker, R. & Maru, Y. (2013), *Enhancing learning from AFSI research: Notes for the Field*. MSI Report 13/10, Monash Sustainability Institute, Melbourne, Australia.

Ison, R., Carberry, P., Davies, J., Hall, A., McMillan, L., Maru, Y., Pengelly, B., Reichelt, N., Stirzaker, R., Wallis, P.J., Watson, I. & Webb, S. (2014), 'Programs, projects and learning inquiries: institutional mediation of innovation in research for development', *Outlook on Agriculture*, Vol 43, No 3, pp.165-172.

Klerkx, L., Pant, L.M., Leeuwis, C., Cummings, S., Borgne, E. le., Kulis, I., Lamoureux, L. and Denise, S. (2011), 'Beyond the conventional boundaries of knowledge management: navigating the emergent pathways of learning and innovation

for international development', *Knowledge Management for Development Journal*, Vol 7, No 1, pp.1-7.

Laurillard, D. (2013), 'Supporting Teachers in Optimizing Technologies for Open Learning,' in J. Willems, B. Tynan, and R. James (Eds), *Global Challenges and Perspectives in Blended and Distance Learning*, Information Science Reference, Hershey, PA.

Laurillard, D. (2012), *Teaching as a Design Science: Building Pedagogical Patterns for Learning and Technology*, NY: Routledge.

Lyytinen, K. (1999), 'Empirical research in information systems: on the relevance of practice in thinking of IS research,' *MIS Quarterly*, Vol 23, No 1.

Mathiassen, L. (2002), 'Collaborative practice research,' *Information, Technology and People*, Vol 15, No 4, pp.321-345.

McMillan, L., Davies, J., Sparrow, A., Stirzaker, R., Maru, Y., Pengelly, B., Hall, A., Descheemaeker, K. Ison, R., Watson, I., & Carberry, P. (2016), 'Partnering for IAR4D implementation: learning through the Africa Food Security Initiative and implications for research organisation', *Agricultural Systems* (submitted)

Merrill-Sands, D., & Kaimowitz, D. (1989), *The technology triangle*. The Hague: International Service for National Agricultural Research.

Postill, J. (2008), 'Localizing the internet beyond communities and networks', *New Media Society*, Vol 10, pp.413-431.

Simons, P.R.J. & Laat, M. de (2002), 'Collective learning: Theoretical perspectives and ways to support networked learning', *European Journal for Vocational Training*, Vol 27, pp.13 – 24.

Wenger, E. (1989), *Communities of Practice*, Cambridge University Press, Cambridge.

Yuan, E. J. (2013), 'Community in modern societies: A critique of "online community" in new media studies,' *New Media & Society*, Vol 15, p.5.

FIGURE 1

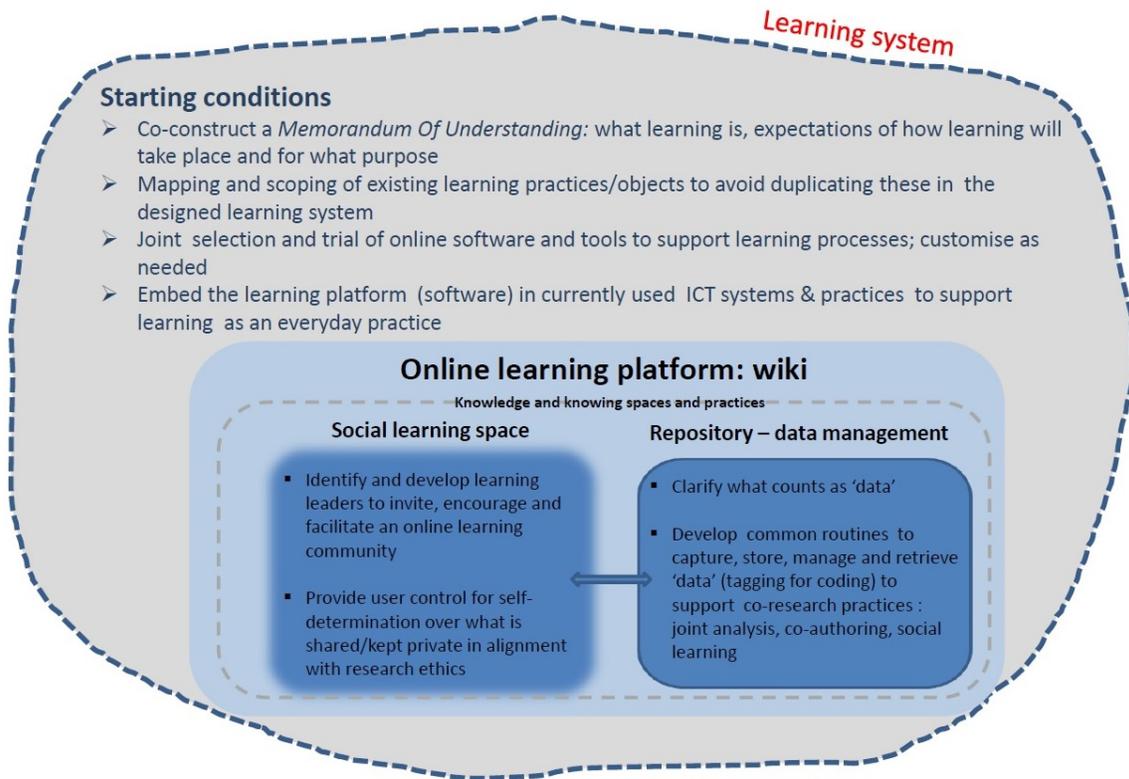


FIGURE 2

