Putting the Capabilities Approach into Action (Research): A Comparative Assessment of a Technology Stewardship Training Program for Agricultural Extension in Sri Lanka and Trinidad

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Abstract

This paper reports on a technology stewardship training program aimed at operationalizing the Capabilities Approach with agricultural extension practitioners in Low and Middle-Income Countries (LMICs). The training program is rooted in a "technology-augmented" Capability Approach to inform the design of an in-service training program for agricultural extension officers and advisors..

We assessed the training program using a multimethod approach with cohorts in Sri Lanka and Trinidad. Evaluation of training was carried out using the Kirkpatrick Model with four levels of assessment: reception, learning, behaviour, and results. Findings show a positive response to the training, that learning objectives of the course are achievable when offered as an in-service program, that self-confidence with ICT is improved, and that participants applied their learning in a post-course activity with their community of practice.

This paper will first describe the overall context and goals for the project and introduce a Technology-augmented Capability Approach model as it applies to the study. We will then discuss research design, assessment of the Field School training, as well as short term results with illustrative examples involving participants from Sri Lanka and Trinidad between 2018 and early 2020. We conclude that this training can advance the normative aim of the Capabilities Approach by providing extension officers with effective techniques for leading a change through choice strategy. Future efforts will be required to carry out in-depth field research on stewardship-informed practices with extension officers post-training.

Keywords

Information and communication technologies, ICT4D, technology stewardship, communities of practice, Capability Approach, participatory action research, agricultural extension, Sri Lanka, Trinidad

Introduction

With the growing availability of affordable digital devices and services in Low and Middle Income Countries, governments and development organizations continue to place a priority on promoting ICTs within the agricultural extension systems for capacity development and education programs (Trendov, Varas, & Zeng, 2019). Some have even labelled the latest phase of development practice as "ICT4D 3.0" to reflect this ongoing effort (Heeks, 2020).

At a national level, and recognizing the need for more training and related research to improve ICT competencies in agricultural extension, the Postgraduate Institute of Agriculture at the University of Peradeniya in Sri Lanka and the Faculty of Food and Agriculture at the University of West Indies have partnered with two Canadian universities to offer in-service training intended to encourage the uptake of digital technology in extension services. The target group is

primarily agriculture and rural development officers, such as extension workers, community development agents, field officers of private and nonprofit sectors who are seeking skills and competencies in the use of ICTs to improve work practices and outcomes.

The training was created as part of an ongoing international action research project to improve effective use of ICTs for rural development, and particularly among agricultural extension practitioners and their communities of practice (Gow et al., 2018). "Effective use" is a concept from the community informatics literature and refers to "the capacity and opportunity to successfully integrate ICTs into the accomplishment of self or collaboratively identified goals" (Gurstein, 2003). In our view, effective use implies a transformative approach to development (Avgerou, 2008, p. 136) that aligns with the principles of Sen's Capability Approach (Sen, 1999). Following that normative lead, we apply a Technology-augmented Capability Approach (TaCA) model to inform the design and evaluation of participatory action research carried out in conjunction with in-service training (hereinafter referred to as the "Technology Stewardship Field School").

This paper will first describe the overall context and goals for the project and introduce the TaCA model as it applies to the study. We will then discuss research design, assessment of the Field School training, as well as short term results with illustrative examples involving participants from Sri Lanka and Trinidad between 2018 and early 2020.

Context and Goals for the Project

Since 2012, the authors have been involved in a collaborative action research project with the primary goal of better understanding how to build capacity for effective use of ICT for rural development in low and middle income countries. This work has coalesced around a Joint Education and Training Initiative (JETI) that launched an introductory course in technology stewardship in 2016 through a partnership between the University of Alberta, the University of Guelph, the University of Peradeniya (Sri Lanka), and later the University of the West Indies. The JETI provides the foundation for conducting participatory action research in combination with an in-service training course that has run successfully twice in Sri Lanka and twice in Trinidad. The initial phase of the project has been focussed on development, testing, and validation of the course material as we refine the overall research design.

The course is based on an "Action Notebook" for technology stewardship from the book *Digital Habitats: Stewarding Technology for Communities*, which prescribes "a practitioner-oriented" collection of activities that "takes you through the steps of stewarding technology and outlines what to keep in mind at each step" (Wenger, White, & Smith, 2009, p. 147). We have made adaptations for a sector-specific audience; in this case, agricultural extension officers and advisors in Sri Lanka and Trinidad who are the primary focus of the JETI at this time. Our version includes sector-relevant language and localized case study guides, while also adding activities in the areas of community engagement, action research methods, and evaluation. The

workbook is now available for free as an open educational resource (Gow, Hambly Odame, et al., 2020).

Technology Stewardship

Technology stewardship is characterized as a leadership role for cultivating the "digital habitat" of a community of practice. A digital habitat describes the collection of digital tools and resources available to the community to carry out its various communications, knowledge sharing, and social learning activities. The technology steward is a community member who pays attention to the life and social practices of the community and encourages innovation through experimentation:

> Technology stewards are people with enough experience of the working of a community to understand its technology needs, and enough experience with or interest in technology to take leadership in addressing those needs. Stewarding typically includes selecting and configuring the technology, as well as supporting its use in the practice of the community. (Wenger et al., 2009, p. 25)

This should not be viewed narrowly as IT support, but instead as a multifaceted role that requires intimate knowledge of the technology-related social practices of community members, the ability to engage with community members to create visions for the future in alignment with community aspirations, to be aware of developments and opportunities in the technology landscape, and to encourage and support innovative technology practices in fulfillment of community choice.

Interestingly, the role appears to share features with "ICTD champions" defined by Renken as "individuals who make decisive contributions to ICT4D initiatives by actively and enthusiastically promoting their progress through critical stages in order to mobilize resources and/or active support and cooperation from all stakeholders" (Renken, 2019, p. 307). Similar to Renken's findings with ICTD champions, we see a combination of motivations for technology stewarding, including personal actualization, business success, and social concern.

Our overall research design is guided by a technology-augmented Capability Approach (Haenssgen & Ariana, 2018). Our model also incorporates Kleine's (Kleine, 2013) "Choice Framework" with the concept of "informational capabilities" (Gigler, 2015) as we put the model into practice with the Technology Stewardship Field Schools (Figure 1).

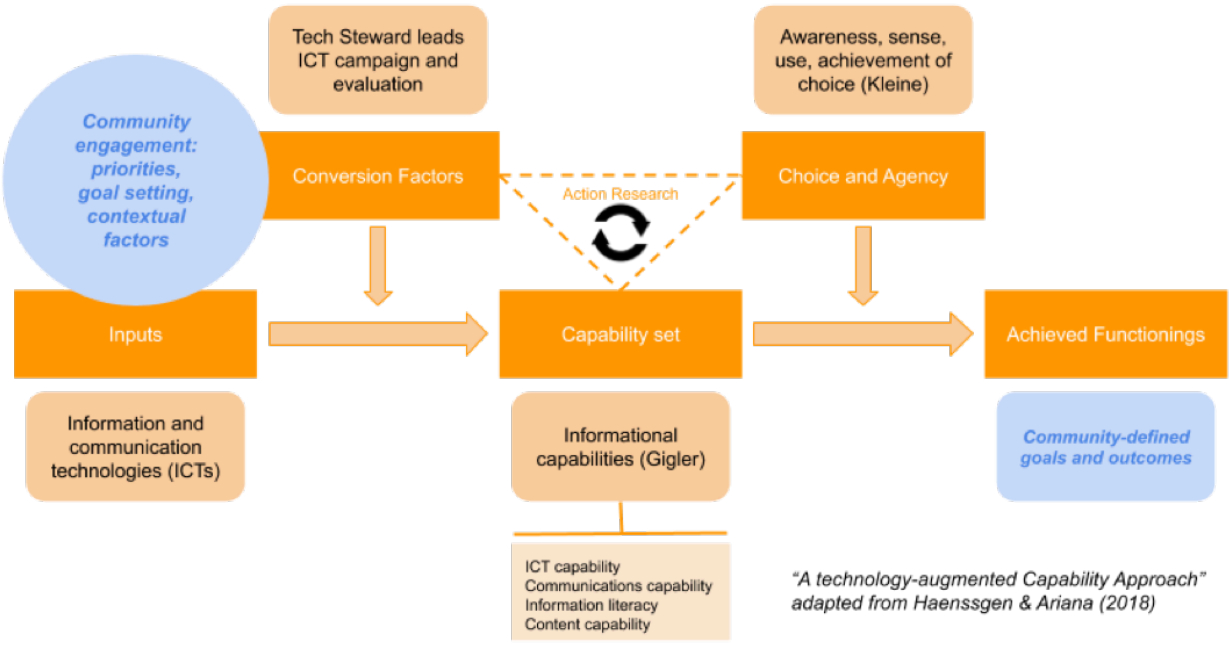

Figure 1: The technology-augmented Capability Approach (TaCA) model for this project

Within our TaCA model, technology is conceived in a dual role as both an "input" and a "conversion factor" emphasizing both its generative and transformative dimensions. In the generative dimension, ICT serves as a technical input (e.g., a mobile phone) with specific characteristics intrinsic to the object. However, digital technology can serve a multitude of purposes and its flexibility across a wide range of applications must also be considered:

> In [the] transformative dimension, technical objects fulfill functions that are otherwise the domain of conversion factors, namely moderating the translation of other inputs into valued capabilities. … If we accept that technical items have a dual nature that generates characteristics and modifies the characteristics of other inputs, it leaves open the question how an object acquires transformative qualities. We maintain that these qualities are not intrinsic to the object but assigned to it within the socio-technological context. (Haenssgen & Ariana, 2018, p. 103)

Viewed through this lens, the Technology Steward's role in the TaCA model is to foster the transformative qualities of ICTs in alignment with community priorities and aspirations. These are expressed in part through a "capability set" that includes informational capabilities which in turn enable "choice and agency" resulting in "achieved functionings."

Informational capabilities includes a set of outcome indicators developed by Soren Gigler and summarized in the diagram below (Figure 2). In the TaCA model, enhanced ICs contribute to a wider capability set and provide a basis for effective use because community members are more empowered to make reasoned choices about technology practices in relation to desired outcomes or aspirational goals.

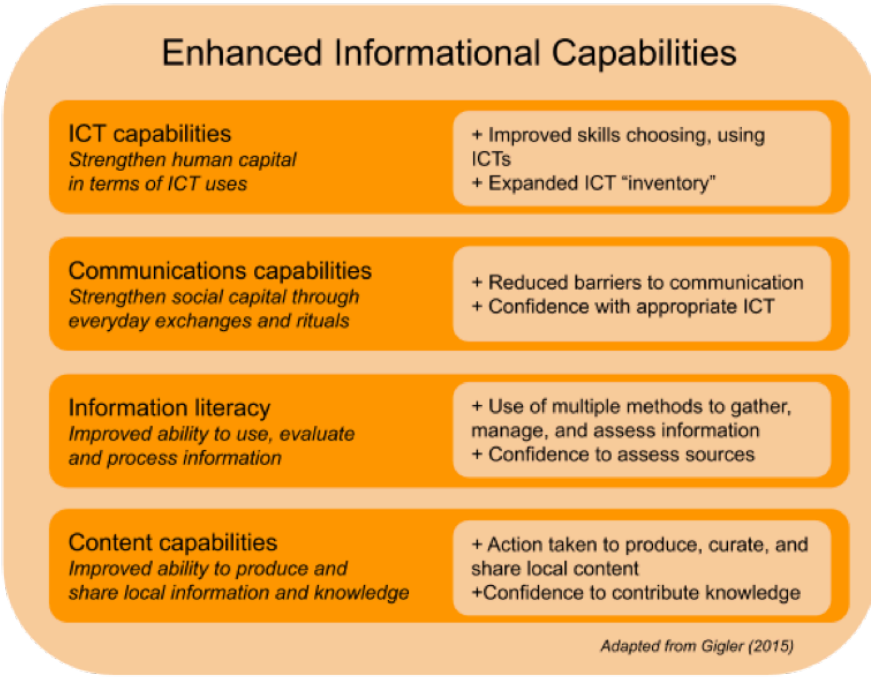

Figure 2: Informational capabilities and outcome indicators

The role of the technology steward includes community engagement, goal setting, and helping to articulate and prioritize specific informational capabilities. Following Kleine's Choice Framework, technology stewardship training sets out four action priorities that recognize varying degrees of empowerment and agency for community members. These degrees of empowerment are expressed in four dimensions:

- Make the community *aware* of the existence of choice (i.e., that digital ways of doing things are possible)
- Help the community to develop a clear *sense of choice* (i.e., how they might take advantage of digital choices available to them)
- Facilitate and support the *use of choice* (i.e., assist with trying a new digital practice or deploying unfamiliar digital tools)
- Recognize and sustain the *achievement of choice* (i.e., report on the outcome of new deployments, analyze and understand points of failure, and acquire resources to build on success)

A technology steward's role is not to impose a specific choice on the community but instead to facilitate conditions supportive of the four dimensions of choice in relation to community-defined goals or outcomes. In other words, the technology steward assumes leadership in facilitating technology-augmented social practices (Shove, Pantzar, & Watson, 2012) that will lead to achieved functionings.

Participatory Action Research

The Technology Stewardship Field School (TSFS) provides the foundation for enacting the TaCA model through participatory action research. Invited participants receive training at the TSFS and then design and lead a capping project with their community of practice (COP). The capping project is intended to involve participants in the co-creation of knowledge as both a subject and a co-researcher (Chevalier & Buckles, 2019, p. 24). In this way, the TSFS serves a dual role in the JETI. First, as a professional development opportunity with immediate benefits for practitioners; second as a means to build capacity for conducting participatory action research in the area of technology stewardship.

The training material revolves around a set of activities intended to establish a "campaign goal" that can serve as the centrepiece for action research with the community of practice. The technology steward's role first involves a consultation with community members out of which the campaign objective is developed. Participants are guided through a process that results in a campaign goal structured into three key parts:

- It states a specific outcome
- For a specific communicative action
- With a clearly defined community of practice

For example, the following campaign goal statement is based on one created in the classroom by a group of participants from the 2018 cohort in Sri Lanka:

> *The goal is to improve awareness and attendance at training events by using ICT to help organize and scheduled meetings with small scale coconut growers in Dankotuwa ASC Division.*

It is important to note that the campaign goal does *not* mention a specific ICT. It refers to a specific outcome (to improve attendance at training sessions) in relation to specific informational capabilities (organize and schedule meetings) for a defined community of practice (small scale coconut growers in a specific location).

Having articulated a campaign goal, the technology steward then proceeds through a series of steps to identify and assess a suitable ICT tool or platform or tool before integrating it into a "campaign" with the community. A campaign usually takes the form of a relatively short duration (around 4-8 weeks) action research intervention to evaluate the suitability of the ICT platform in relation to the campaign goal. Stewards are encouraged to "understand failure and build on success" with the campaign, success being measured in part by identifying the informational capabilities that will ultimately empower the community members to make reasoned choices about technology-related practices. Emphasis is therefore placed on a holistic evaluation with the community of practice rather than focussing exclusively on a specific choice of ICT tool or platform.

Evaluation Framework

The overall study is based on a multiple, embedded case study design (Yin, 2018). Individual participants in each course receive training as part of a single cohort, but for the purpose of the capping project each member of the cohort is given freedom to act in accordance with the needs and interests of their own community of practice. The study is therefore designed around multiple units of analysis, namely: (1) the experience and impact of the training program at the cohort level; (2) the experience and impact of training at the individual participant level; (3) the impact on the community of practice to which the technology steward belongs.

Data are collected at various stages pre-, mid-, and post training using questionnaires, participant-observation, and semi-structured interviews. Participants submit an individual action plan (IAP) at the conclusion of the course that indicates if they intend to carry out a capping project and, if so, what activities from the course they intend to apply for that project. Participants are asked to submit a capping project report with some form of documented evidence of completion, upon which they are recognized with a certificate of advanced standing from the JETI partners. Participants are advised to submit their capping project reports within eight weeks of completing the course (we also received a project report from a participant from the Sri Lanka cohort in early 2020, a year and a half after the course).

At the cohort level of analysis, Kirkpatrick's evaluation framework (Kirkpatrick, 1994) was used to assess the technology stewardship course and its suitability in creating capacity for participatory action research. Kirkpatrick's framework is widely accepted and used for evaluating organizational, community, as well as ICT related training programs. The model takes into account different styles of training and considers both short and long-term effects by comprising four levels of evaluation: (1) participant reaction; (2) learning objectives; (3) behavioural change; and (4) results.

Overall results across the first three levels for both cohorts are promising. We provide a brief summary here, but details for Trinidad are available (Gow, Chowdhury, Ramjattan, & Ganpat, 2020) as are details for Sri Lanka (Gow, Dissanayeke, et al., 2020b).

Kirkpatrick Level 1 (reaction) was measured by responses to a course evaluation questionnaire and indicate that the quality of the course was rated "excellent" by most participants, that the course material added to their knowledge, the quality of instruction was rated highly, and that most participants were motivated to take additional courses related to the subject.

Kirkpatrick Level 2 (learning) was assessed through classroom observation and artifacts produced and shared during the course. The training material and activities appear to support the learning objectives. Participants working in small groups were able to achieve key learning objectives, such as identifying a community of practice, identifying and prioritizing key concerns

for the community, and developing an action research plan ("campaign") that could be carried out with members of their community of practice.

Participants in both cohorts were asked to complete an Individual Action Plan (IAP) during the final training session. The IAP asked if they intended to apply their learning with a capping project and what activities from the workbook they would choose. The completed IAPs provided evidence responsive to Kirkpatrick Level 3 (behaviour) in assessing participants' intent to act on the training. Most participants indicated an intent to act but later analysis reveals that approximately 25 percent of participants across the two cohorts submitted a capping project report based on their IAP. Follow-up interviews were conducted with all participants and revealed a number of obstacles to acting on the IAP, including resource constraints and administrative hurdles.

Assessing Kirkpatrick level 4 (results) is more complicated. Following the principles of qualitative inquiry generally, and the logic of the Technology-augmented Capability Approach (TaCA) model in particular, a holistic perspective is required to account for numerous interacting factors including the profile and motivation of individual technology stewards, local community history and social dynamics, as well as the political, economic and environmental context within which rural development is taking place. A full assessment of results will require longitudinal and field intensive research with individual technology stewards from future cohorts as they carry out their capping projects. This will be a central focus for the next phase of the project.

For the initial phase of the project we can report on short term results to the extent that the submitted capping project reports provide evidence of the technology steward's role in identifying informational capabilities and enhancing choice for the community of practice in one or more of the four dimensions of empowerment (as described above).

Findings: Technology Stewardship in Practice

We received a total of 11 capping project reports from 40 participants across the two cohorts. Participants were instructed that they could choose to complete a single activity or combination of activities from the course workbook. Participants were also advised to keep the reports brief and use whatever format they felt most comfortable with to convey their efforts. Submitted reports varied in their content and detail, but all included a description of the capping project activity, or activities, and some discussion of the results achieved. The documents included written text, graphs or charts, and sometimes photographs.

Based on the evidence provided in the submitted reports we organized the various capping projects into comparator groups reflecting the variety of activities and scope of effort for each participant (Figure 3). Reports from comparator group 1 provide evidence showing technology stewards applying the course material in a community engagement but did not include a campaign goal statement in the submitted report. Those in comparator group 2 presented a campaign goal statement in the submitted report but some did not carry out the preceding

community engagement activity. Reports submitted by those in comparator group 3 described plans for, or results from, a small scale campaign with their community of practice. Of the 11 reports, only one participant submitted a report that included activities from all three categories.

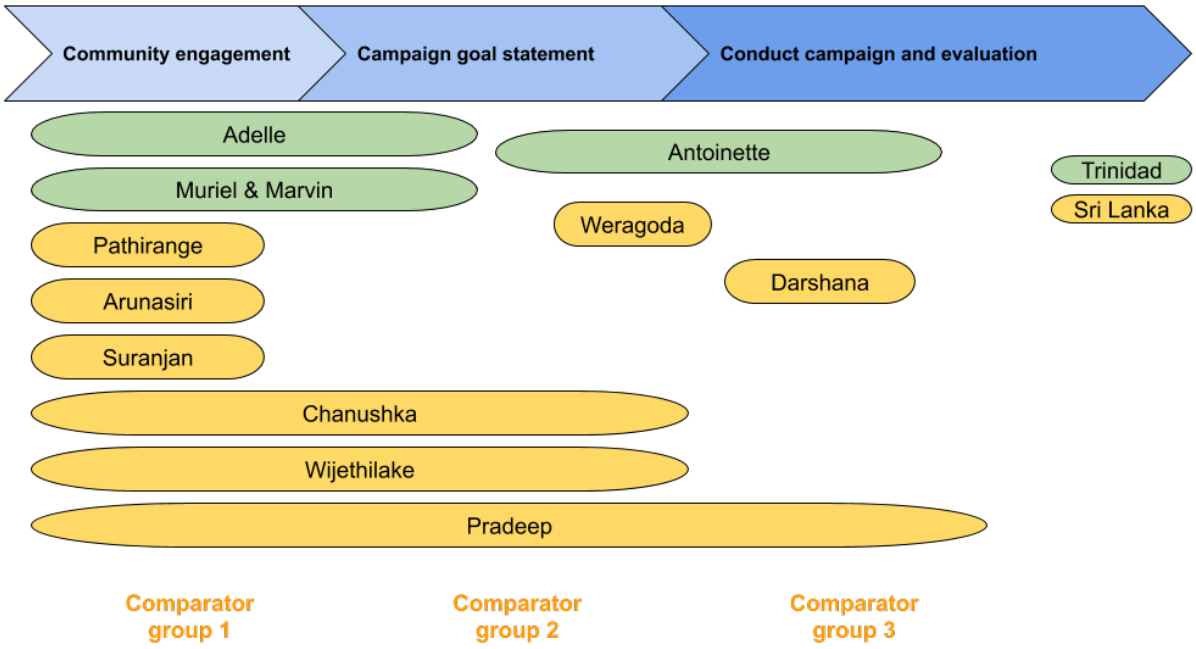

Figure 3: Submitted capping project reports sorted into comparator groups

The following descriptions are based on reports from several participants and we include them here to illustrate the range of activities submitted in the capping reports and indicative of the comparator groups.

Fostering a sense of choice with rice producers in Sri Lanka

Suranjan is an instructor with the Dept. of Agriculture who was in the 2018 TSFS cohort at the University of Peradeniya. His capping project identified "Seed paddy producers in the Galle District" as the community of practice. He conducted a consultation with farmers to discuss barriers to communication using a problem/opportunity tree activity and guided by the course workbook. The activity helped community members to articulate difficulties in communicating with extension services. Suranjan then assisted community members to identify specific skills and competencies that could address some of the challenges. Among these was improving confidence in using mobile phones for text messaging.

Figure 4: Suranjan and his team hosting a community consultation for their capping project

Suranjan's project report was based on this consultation and did not develop a campaign goal; however, it demonstrates how the technology steward can foster *awareness* and *sense* of choice among community members with respect to ICTs. The results of the consultation provide further direction for a steward like Suranjan to introduce ICT training activities targeted to enhance specific informational capabilities within the community of practice.

Enhancing content capabilities for fisheries training in Trinidad

Muriel and Marvin work with the Caribbean Fisheries Training and Development Institute and were in the 2019 TSFS cohort at the University of the West Indies. Their capping project identified Seafood technology training assistants as the community of practice (COP). Using the training material as a guide, they conducted a community consultation and developed a campaign goal directed to enhance content capabilities as a step toward a specific campaign goal: "to improve access and availability anywhere/anytime by using ICT to curate content" for the "STFTP trainers group."

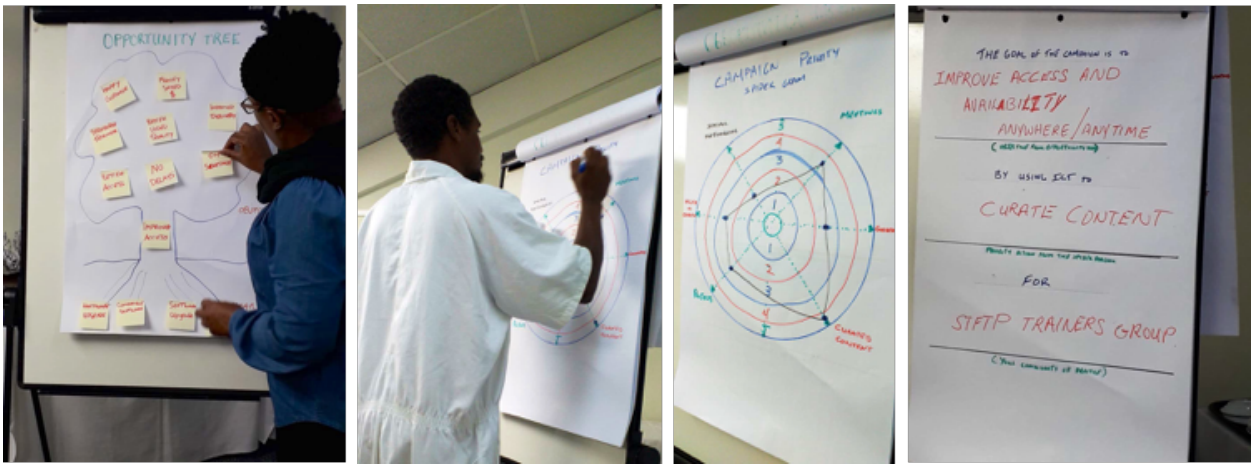

Figure 5: Muriel and Marvin leading a campaign goal setting activity for their capping project

While their capping project did not set out a campaign plan, the goal statement identified informational capabilities related to production and sharing of local content. The activity has created an awareness and enhanced sense of choice among community members, positioning the technology stewards to begin to consider various ICT tools and platforms that could be introduced in a campaign with the community of practice.

Exploring use and achievement of choice with cocoa researchers in Trinidad

Antoinette is an researcher and outreach coordinator with Cocoa Research Centre in Trinidad who participated in the 2019 TSFS cohort. Her capping project report did not carry out a community engagement activity but provided a campaign goal statement to "improve management of [Cocoa Research Centre] through [an] increase in effective communication with members of staff." From an informational capabilities perspective, this goal reflected a perceived need to enhance communications capabilities that include "sharing files, discussions, synchronous and asynchronous communication, communicating updates" for event management.

The significance of this case is that Antoinette was able to apply the goal statement and course material to support *use* of choice with ICT. She chose Trello and WhatsApp for a campaign in conjunction with World Cocoa and Chocolate Day Expo. In a followup email with the research team, she describes some valuable insights gained from the capping project experience:

> I think [communications for] the event could have been better managed with ICT but our team is somewhat in need of convincing (let's say) with regard to the efficacy of it...so I used it and mostly observed others reactions to whenever it was mentioned - so it wasn't a proper campaign … I think maybe a less complicated undertaking would be a better candidate for testing out an ICT with my colleagues ...

Antoinette's capping project report also included an evaluation plan based on a framework from the course workbook. The plan identifies a set of metrics, data sources, and methods for assessing *achievement* of choice in relation to a campaign goal. Not all campaigns will be successful, so achievement of choice refers to honest reporting on the outcome of a deployment, analyzing and understanding points of failure, and acquiring resources to build on success. In this case, Antoinette reflected on the experience and concluded that a "less complicated undertaking" was needed for a future campaign effort, which presumably would serve to guide the next iteration of a campaign in a typical action research cycle.

Negotiating use of choice among extension officers at the Talawakelle Techno Park in Sri Lanka

Pradeep participated in the technology stewardship course held at the University of Peradeniya in November 2018. He submitted a 9-page capping project report about a month after the course, and was the only participant among the two cohorts that carried out a full campaign. Pradeep's community of practice was described as the advisory and extension division officials from the Talawakelle Techno Park, which is part of the Tea Research Institute of Sri Lanka.

His community assessment led to the conclusion that assigning maintenance activities on a shared basis among the extension officers might address some of the current workload concerns. He presented the following campaign goal in his report:

> The goal of the campaign is to improve the maintenance of the TRI Tea Techno park area by using ICT to [support] social networking for sharing the responsibilities ... between the officials of TRI Talawakelle advisory and extension division officials.

Pradeep's report is remarkable inasmuch as it shows him working through all of the activities in the course workbook, from community engagement through to campaign evaluation planning. Moreover, he carried out a 2-week campaign with the community of practice, introducing Google calendar in a way that would be responsive to the campaign goal, and gathered data for the evaluation. Pradeep reported mixed results for the campaign with some staff choosing to continue with Google calendar while others resorted to previous methods. A more detailed presentation of Pradeep's capping project report is available elsewhere (Gow, Dissanayeke, et al., 2020a).

Pradeep's experience brings to light the importance of the technology steward's role in fostering use and achievement of choice with a community of practice, but in this case the campaign also revealed that members of the community are not unified in their choice of ICT for scheduling purposes. As such, it brings to light some potential inherent tensions that Kleine (2013, p. 30) identifies with respect to negotiating individual versus collective choice with respect to technology-augmented social practices. How technology stewards address that tension is unclear at this point but it will be an important consideration as we continue to study technology stewardship in action.

Conclusion

The technology stewardship field school integrates a Technology-augmented Capability Approach model (TaCA) with the communities of practice literature to provide a foundation for participatory action research. The creation, implementation, and evaluation of the Field School has been an essential step in the operationalization of the technology stewardship approach for agricultural communities of practice. Our initial phase of study suggests that cohorts trained in a common set of skills and techniques provide a basis for collaborative inquiry and knowledge co-creation through the capping project activity.

Submitted capping project reports from cohorts in Sri Lanka and Trinidad help us to better understand the value of a technology stewardship role in relation to the Capability Approach as embodied in the TaCA model and its contribution to program design and policy for rural development involving agricultural extension and advisory services. As we continue to revise the training materials, the next significant step for the project will be to introduce more support for

the capping project activity that will enable us to carry out longitudinal and in-depth study of technology stewardship in practice.

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