

Co-designing with engineers for community engagement in rural Uganda

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Abstract

Co-design is seen as crucial for designing solutions for resource-constrained people living in developing countries. To best understand their needs, user engagement and co-design strategies need to first be developed. In this Design Practice Brief, a process of co-design was created and used to understand ways telecommunication engineers could engage with rural communities in Uganda. It reports and reflects on (i) the experience of co-designing with nondesigners and (ii) creating a co-design structure and developing co-design methods of engaging with community members living in developing countries. In doing so, it offers a format and case study for future practitioners facilitating and conducting co-design with nondesigners and contributes to a knowledge gap in the reporting and reflection of co-design practice. This case study is unique as the co-design practice was achieved remotely (online), crossed disciplines (designers and telecommunication engineers) and cultural boundaries (European and African). It finds that in co-designing with nondesigners, preparation and structure are key, with acknowledgement and management of cultural and discipline differences.

Keywords: co-design, digital divide, design methods, developing countries, co-design facilitation

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1. Introduction

Co-design is seen as crucial for designing solutions for resource-constrained people living in developing countries (Jagtap 2022). To best understand people's needs, first, user engagement and co-design strategies need to be developed. Through a co-design process to understand ways engineers could help reduce a digital divide and engage with rural communities in rural Uganda, this brief will (i) report on the experience of co-designing with nondesigners and (ii) reflect on creating a co-design structure and developing co-design methods of engaging with community members living in developing countries. In doing so, it will

- offer a format and case study for future practitioners conducting co-design with nondesigners or members unfamiliar with the process.

- Contribute to a knowledge gap in the reporting and reflection of using methods in the practice of co-design in research. For example, Slattery, Saeri & Bragge (2020) state that although research co-design appears to be widely used, it is rarely described in detail. Borgstrom & Barclay (2019, p. 19) state that the methods and the quality of reporting vary, and ‘more could be done to document what is being done, how collaboration is being achieved, and in the evaluation of the changes’.
- This brief also contributes to the need for creating co-design methods in the context of communities living in developing countries (Jagtap 2022).

This Design Practice Brief is unique as the co-design practice was achieved remotely (online) across disciplines (designers and telecommunication engineers) and cultural boundaries (European and African). In this Design Practice Brief, design researchers at South East Technological University, Ireland worked in partnership with the research team in netLabs! Uganda to explore the use of co-design in understanding ways engineers could engage with rural communities. Co-design practices were also used to facilitate this understanding through a workshop and planning.

1.1. Background context

‘With Almost Half of World’s Population Still Offline, Digital Divide Risks Becoming “New Face of Inequality”...’.

(United Nations 2021)

There is an acute digital divide between developed and developing countries, with rural areas in need of immediate attention in the creation of digital services. In rural areas, many factors such as cost, low-income populations, population density and access to infrastructure result in either reduced or nonexistent connectivity to digital services (Najjuuko *et al.* 2021). netLabs! UG based in Makerere University, Uganda, is conducting research to address this issue by piloting a scalable model for sustainable rural broadband connectivity; this research is being conducted in Apac, a rural district of Northern Uganda (Lukanga *et al.* 2021).

The purpose of the project is to help local government and civil society groups to improve service delivery. It seeks to target a wide range of broadband applications, for example, within agriculture, women and youth, education and health facilities and other community sectors (Okello 2020; Lukanga *et al.* 2021).

Although the information and communication technology (ICT) revolution in Uganda has been strong, many rural communities remain underserved due to challenges including lack of or expensive infrastructure, expensive energy costs and high tariffs for ICT services and applications. netLabs! UG proposes to pilot a scalable model for sustainable rural networks through rural community broadband networks comprised of shared or community wireless networks. Communities can benefit from cheaper and easier access to information by sharing the costs of Internet access within the community. Affordable Internet connectivity is very important to local communities and can significantly improve service provision and access in agriculture, education, government, gender equity, trade, etc.

To best understand the needs of these groups in terms of broadband applications, user engagement and co-design strategies needed to be developed.

2. Methods and process

In choosing appropriate methods and processes for this research, limitations emerged that offered both restrictions and opportunities. Due to COVID-19 restrictions, co-design activity that was intended to be conducted on location in Uganda was conducted remotely. Onsite visits to Apac to understand how co-design could be implemented in practice were cancelled. The lack of technology and online access at the time restricted the inclusion of members of rural community members. However, all members of the research team had a deep knowledge of Apac, the communities and participants involved and the cultural conventions and contexts. We used this as an opportunity to reflect on the positive and negative use of online co-designing. Co-designing was facilitated by two experienced design practitioners and facilitators in Ireland and a research team in Uganda. The facilitators were from product design and design engineering disciplines. The research team ($N = 15$) were a mix of engineering researchers at different career stages, from Research assistants to principal investigators (PIs). Two PIs from the research team took the lead in organising the co-design process with the facilitators.

Involving the intended beneficiaries of the solution (Harder, Burford & Hoover 2013), co-design is the ‘creativity of designers and people not trained in design working together in the design development process’ (Sanders & Stappers 2008, p. 6). Staying true to this within limitations presented with COVID-19 restrictions required a review of similar interdisciplinary co-design case studies conducted online during the COVID-19 period. The case studies of White *et al.* (2021) and Zallio *et al.* (2022) illustrate a balance of structure and openness in online co-designing. Adapting a similar approach to these studies, co-design was conducted in the following four stages with engineers; the following is a description of these stages:

1. Pre-co-design meetings
2. Co-design methods seminar
3. Co-design workshop
4. Postworkshop analysis and reflections on the process

2.1. Pre-co-design meetings

A series of pre-co-design meetings (4×1 hour) were conducted to understand the needs of the research team concerning co-design and to relate these to the overall objectives of the project. These meetings were held between the facilitators and research team PIs. Central to these discussions was how best co-design can assist the project and the team, and what design tools could be provided. As the co-design activity was due to occur online rather than in person, a suitable format for conducting co-design was discussed. As a result of this discussion, questions (e.g., design challenge questions/‘how might we’ questions) were formulated to frame and guide the co-design activity.

Agenda items of the pre-co-design meetings were as follows:

- Discuss the background and work to date on the project and future schedule of research.
- What is intended to be achieved at the end of the project?

- What is the role of co-design in the project?
- Discuss how best to assist the project/team, and what tools can be provided.
- Who is the co-design specifically aimed at?
- What online co-design formats are achievable?
- Formulation of questions to frame and guide the co-design activity.

Findings of this stage

Pre-co-design meetings were invaluable for the facilitators to understand the need and context of use and create a specific programme of co-design for the research team. As many of the research teams were new to the co-design approach, it was agreed that an ‘Introductory Design Methods Seminar’ delivered by the facilitators would provide much-needed context and offer a basic understanding to the research team. In terms of an online facilitation platform, it was decided that Microsoft Teams provided the best access to all research team members. Questions to frame and guide the co-design activity were decided as follows:

1. How can we use design to engage rural community members in Apac to better understand their needs and ensure voices are being heard?
2. What tools, processes and environments do we need/need to create to facilitate this?
3. What is feasible? How can we create these tools/processes?

Based on the pre-co-design meetings, an agreed schedule (Table 1) was created for a co-design workshop and seminar.

2.2. Co-design methods seminar

To offer the research team an overview of design methods, processes and context to co-design, a seminar was created and delivered by the facilitators. This seminar offered the researchers practical methods that could be used during fieldwork together with an insight into what could be achieved through co-designing. This seminar was delivered before the co-design workshop, so the team could engage in

Table 1. Co-design workshop and seminar schedule

Time allocated	Stage
20 minutes	Welcome and introduction: Overview outlining the objectives and structure of co-designing. Quick introductions and expectations of co-designing
30 minutes	Co-design methods seminar: Full Title: ‘ <i>Introduction to Co-design, History, Methods Processes and Case Studies</i> ’
10 minutes	Questions and answers
15 minutes	Break
45–60 minutes	Co-designing will be interactive and collaborative using online collaboration tool <i>InVision</i>
15 minutes	Break
30 minutes	Discuss the next actions to progress

a collaborative discussion as to what methods could work for them during fieldwork. Throughout the seminar, relevant case studies were selected to inspire and make the process relatable.

The format of the seminar presentation was as follows.

History evolution of design research and design thinking

To start the seminar, the researchers were offered a historical overview of the evolution of design research. Selected with relevance to the study at hand and disciplinary audience, an overview of the important timestamps of historical evolution was mapped out over 100 years, together with the key texts in this evolution. This evolution was plotted across time, starting with the founding of the Bauhaus School in Germany in 1919 through to the emergence of mainstream design thinking and the Stanford D School in the 2000s. It was explained that design research was an interdisciplinary composite that is continually evolving; in the last 50 years, this has been a movement from design practice to design thinking (White 2012; Gaynor, Dempsey & White 2018). Key texts in this evolution were discussed such as Nigel Cross's 'Designerly ways of knowing' (Cross 2001) and Donald Schön's 'The Reflective Practitioner' (Schön 1983).

Design processes and methods: positives and limitations

An overview of design methods and processes was detailed. Design as a means to address social complexity was introduced, together with the positives of design and limitations in the approach. Process frameworks such as the Double Diamond (Design Council 2019) and the acts of Divergence and Convergence of the framework were explained. The Discovery Stage of the framework was discussed concerning the research project, and the human and qualitative skills of empathy and understanding, listening, observation and participation were outlined in context to this.

Co-designing

Co-design was put into focus and detail. The various means of co-designing and acts of creating and engaging with others were explained. These ranged from sharing ideas, listening, observing, participating, sketching, prototyping, journey mapping, ethnographies and cultural probes. As distinct from general design thinking processes, the depth and breadth of participation and user involvement in specific co-design processes were discussed (Harder *et al.* 2013). Practical case studies were offered to add additional context; these case studies were specifically selected as they related to co-design in Uganda and other developing countries. Case study 1 was by 'Professors without Borders' and discussed the use of design in Uganda. In this project, co-design was used to empower young women of rural Ugandan communities through education (Professors Without Borders 2019). Case studies 2 and 3 were projects by IDEO. 'Design Technology and Soil' used co-design with farmers to understand the use of low-cost sensor technology (Collery 2015). In a similar case study, Schiller (2015) reports on the use of design with farmers using low-tech tools to increase productivity on their farms. Other literature and cases were discussed with a focus on co-designing with remote rural communities. For example, Wang, Bryan-Kinns & Ji (2016), outline the practical challenges designers have in immersing themselves in local cultures such as limited

time to live in local communities, unequal involvement of participants and creating deep engagements). Bryan-Kinns, Wang & Ji (2022) add the limited availability of local communities. In overcoming challenges, Wang *et al.* (2016) suggest using probes prototypes and toolkits. Bryan-Kinns *et al.* promote the value of having ‘in-situ maker spaces’ to support cross-cultural co-design engagement.

Questions and answers

A questions and answers session was provided for the participants. For discussion, participants were invited to comment on the similarity to any previous experience or methods they might have used and challenge the methods outlined. At this point, researchers reinforced the importance of the inclusion of community members, especially by building a rapport and building trust through informal discussions with the community members.

2.3. Co-design workshop

The seminar served as inspiration for further discussion at the co-design workshop stage. Preparing them for the co-design workshop challenge is to find ways to understand community members needs and to think about various means of conducting co-design before fieldwork.

The workshop sought to find practical means for the research team of engineers to engage community members to better understand their technology needs through co-design. It was facilitated by two experienced facilitators in Ireland and research participants in Uganda. To ensure equality of participation, gender balance was ensured in the facilitation and research team. In the research team ($N = 15$), a mix of netLabs researchers from a range of career stages (research assistants to PIs) were involved. Because of the remote nature of the co-designing, an appropriate means of conducting the activity online was required. In Vision™ collaborative software was chosen due to its flexibility, ease of use and open access. It offered audio and video collaboration with an interactive ‘canvas’ function to allow for sharing of ideas in real time. The process of co-designing in groups benefits from being visual and interactive allowing participants to communicate and understand each other (White & Deevy 2020). Therefore, a canvas was designed for the participants to openly and visually collaborate and to facilitate the flow of questions.

When designing the canvas, various constraints were necessary. First, the canvas needed to facilitate a logical and structured workflow, completed under a time constraint of 1.5 hours. The canvas also needed to allow for divergent thinking, allowing participants to put forward several creative ideas. It also needed to be easy to use and navigate. Figure 1 shows the blank final canvas design (before co-designing). The questions are placed in sequential order with sufficient room on the canvas to present ideas on virtual post-it notes. To keep participants on topic and prevent digression off questions, a ‘car park board’ was provided for additional items arising during co-design.

Overview of co-designing

To commence the co-design process, the participants were offered an overview outlining the objectives and structure of the workshop. Following this, there was a clarification of the function of the online canvas and tools. An important caveat

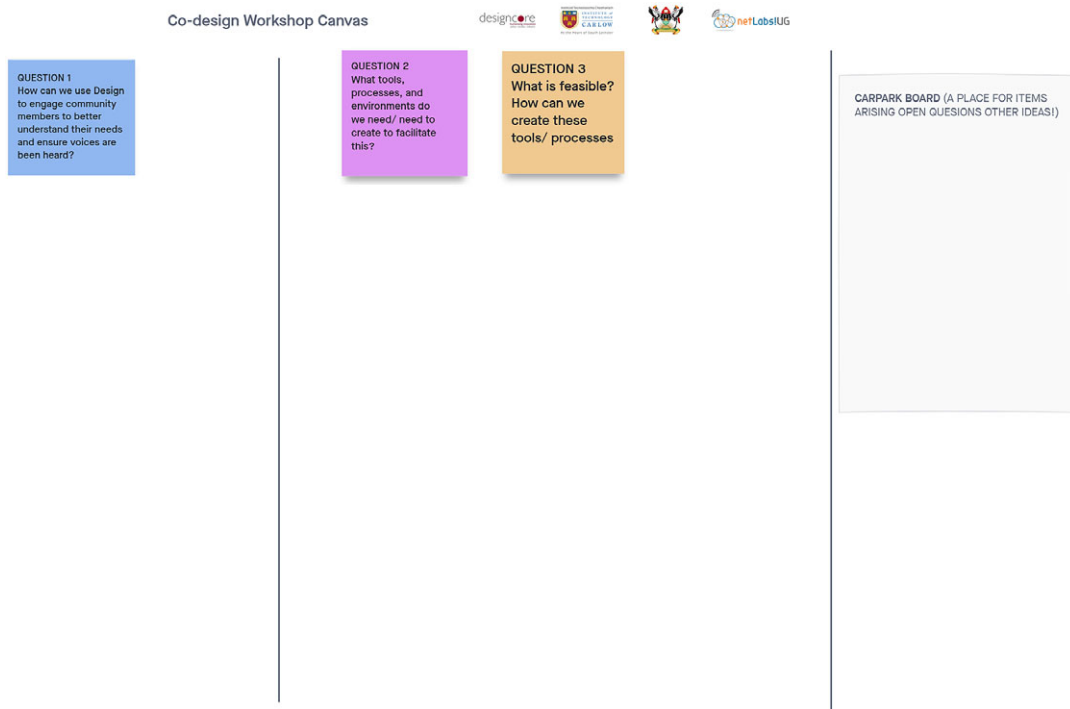


Figure 1. Blank workshop canvas before co-designing.

was discussed at this point, recognising that the cultural context of design thinking evolved through Western corporate culture and that the cultural context (rural Uganda) of the design work was critical to its success. The participants were advised to keep this in mind throughout co-designing.

The participants were briefed that the process was open and discursive, conversational, to spark creativity, build and exchange ideas, and share solutions. The session commenced by asking the first question:

1. How can we use design to engage community members in rural Uganda to better understand their needs and ensure their voices are being heard?

This question allowed the participants ownership of the process from the start, taking inspiration from methods and case studies discussed in the seminar. All participants were asked to contribute, understanding that it was an open question with no wrong answers. Following question one, participants were asked:

2. What tools, processes and environments do we need/need to create to facilitate this process?

Ensuring that there were actionable outcomes from co-designing, the final question asked:

3. What is feasible? How can we create these tools/processes?

When the three questions were exhausted on the canvas, the facilitators created a broad overview of emerging themes from the session. The categories were

discussed with the participants to ensure there was a shared understanding of emerging themes. The car park board was referred to for additional or off-topic items that arose and any open questions that occurred during the process. To finish the co-designing session, the next actions to progress and items to follow-up on were discussed, followed by final questions and answers.

2.4. Post-workshop analysis

Over 60 ideas were produced by participants through co-designing. At this point, the canvas required deeper analysis to understand reoccurring themes and to produce findings. This analysis occurred postworkshop by the facilitators. Co-design data are qualitative and therefore require a process of 'coding' to analyse. To code the data on the canvas, the text within each note was read and re-read line by line and interpreted for meaning. In the process of doing so, notes were placed into themes iteratively (White *et al.* 2021; White & Devitt 2021; Finegan, White & Casey 2022). Analysis was complete when each note was positioned into a specific theme. Figure 2 shows the completed canvas postanalysis with each note under a theme. The final analysis was communicated back to participants via email with a link to view the updated canvas. Participants were asked to review and validate themes by adding comments to the board or by sending comments by return email.

3. Results

3.1. Results of co-designing

1. How can we use design to engage community members to better understand their needs and ensure voices are being heard?

Summary: design methods can assist in understanding cultural values, and environments for positive change; however, the approach needs to be structured accordingly into the project under timeframes and workflow.

Participants thought that the use of design methods and processes could provide an understanding of the environment and society they wanted to impact to create positive change (described below). They also felt that design could allow them to understand challenges and cultural values around certain technologies. However, for this to work, design approaches needed to be structured under timeframes and workflow, be as inclusive as possible from start to finish and needed to be an understanding of previous interventions in rural Uganda.

2. What tools, processes and environments do we need/need to create to facilitate this?

Summary: Multiple ideas were generated here (i) using existing surveys and (ii) conducting workshops/co-designing and ethnographic methods. Community gatekeeper involvement is key to this.

This question created many ideas and suggestions. These ranged from using and adapting existing surveys to creating ethnographies and focus groups with different community groups. The importance of community gatekeepers was discussed in this regard together with working with local community leaders

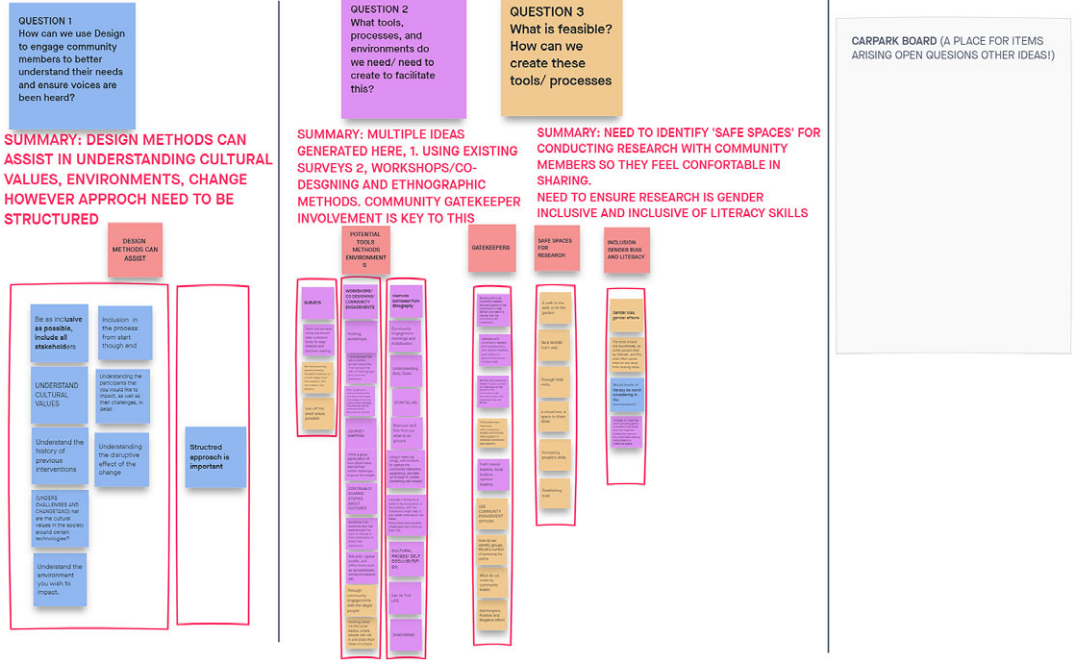


Figure 2. Completed workshop canvas post analysis.

and participants to help inclusively develop and deliver ideas. Working with local community leaders and participants to help deliver ideas in a manner that the community could understand.

3. What is feasible? How can we create these tools/processes?

Summary: The need to identify ‘safe spaces’ for researching with community members so they feel comfortable sharing. There is also a need to ensure research is gender-inclusive and inclusive of literacy skills.

Ideas were shared to create natural research environments during fieldwork and provide spaces to establish trust with community members and gain a deeper understanding of the need to address the digital divide. The engineers suggested broad everyday insights to capture needs. These ranged from walking and talking in familiar environments or sitting for a drink in the local public house to making a video log (vlog), to capture the community interactions and experience of digital needs in everyday life. This relates to similar findings by Bidwell *et al.* when co-designing in rural Africa (Bidwell & Winschiers-Theophilus 2012; Bidwell *et al.* 2013). It was noted that any tool or method should not discriminate and be inclusive, ensuring all voices are being heard. Particularly as some people may be illiterate, this would often cause them to shy away from sharing ideas. Also, in terms of gender-inclusive outcomes, it was suggested to group ‘...gents and ladies individually and then together, in case they may not be comfortable sharing some ideas in a collective space’.

3.2. Reflection on process

The Gibbs 6-step cycle of reflection was used to gather conclusions from the co-design process. This reflective cycle explored the experiences in the stages of description, feelings, evaluation, analysis, conclusion and action plan (Gibbs 1988). An evaluation and analysis of the positive and negative aspects were created with conclusions about what was learned (Gibbs 1988). First, the reflections of the facilitators were discussed postworkshop and were captured by journaling in bullet point format. Feedback was also collected from participants on the co-design process by the facilitators via email. This feedback was both positive and negative responses, to inform future research.

The following points were concluded about the process of co-design with nondesigners or those unfamiliar with the process.

Preparation for co-design is key

Pre-co-design meetings are invaluable to understanding the researcher's needs, the context of use and creating a specific programme of co-design for the team. These meetings are important to decide on the co-design format and questions to frame and guide the process. The Introductory Design methods seminar provided much-needed context and offered a basic understanding of co-design to the researchers, particularly as many of the team were new to the approach.

Acknowledge and manage cultural and discipline differences with design

When preparing to co-design with participants, any cultural or disciplinary differences between participants or facilitators need to be acknowledged and managed. Discussing this at pre-co-design meetings and throughout the project is key to understanding perspectives and ensuring the process is suitable and equitable. It also needs to be recognised that the cultural context of some design processes, for example, design thinking evolved through Western corporate culture, may not apply or translate as a whole to some contexts.

Co-designing needs to be structured to allow for divergent thinking

When designing co-design workshops, various constraints are necessary. First, the basics of workflow and time constraints should not be overlooked. Even though co-design is an exploratory, creative, divergent process, to get the best use of the participant's time, the workshop needs to facilitate a logical and structured workflow. Workshops need to allow for divergent thinking, allowing participants to put forward several creative ideas (White & Kennedy 2022). The co-design process must be easy to use and navigate; therefore, a schedule and wayfinding of the process need to be provided. Providing a 'carpark board' allows participants to document any off-topic matter that may or may not be relevant for the future and allows participants to stay on schedule. As a result of constraints, it must be noted that this approach to co-designing is more structured than more exploratory practices, such as co-design used in design ethnographic studies such as Brereton *et al.* (2014) and in White (2012, 2022) where a longer period was spent with participants and with semistructured questions.

Validation with participants

A phase of validation should occur during co-design with participants. Emerging themes from co-designing can be discussed with participants to ensure there is a shared understanding of emerging themes. This validation process also assists with postworkshop analysis.

Online and remote co-designing

Online co-designing offered positive results with real-time sharing of interdisciplinary ideas across continents. However, although all the engineers had the required access to technology to co-design this way, this led to restrictions for key community members without access; therefore, onsite co-design would have been more effective and inclusive.

No unique differences were noted between participant comments and overall, these were positive. The participant's feedback did mention that the online workshops came across as 'theoretical' and 'hard to put into practice'. This could be a limitation in this instance of co-design due to time constraints and the high level of questions being posed. Follow-up discussions and debriefing sessions in the future will be conducted to address this, we will seek to understand if this is a limitation of online co-designing.

3.3. Feedback from participants on the co-design process

'I think the co-design session content and questions made us think more in-depth about how the project could be implemented better in a way to ensure that the users of the final product (network) yield the most benefits out of it'

- Research Assistant (Uganda)

'The workshop was a welcome opportunity to introduce the team to human-centred design principles to enhance the potential for impact of the project'.

- Principal Investigator (Uganda)

'As much as the design process made us think more in-depth, the process is quite theoretical, and it can be hard to put into practice what is discussed'.

- Research Assistant (Uganda)

4. Conclusions and future work

- In this brief, co-design was used to understand ways telecommunication engineers could engage with rural communities in rural Uganda. It found that co-design methods can assist in understanding cultural values, and environments for positive change. Multiple ideas were produced as to what tools, processes and environments were needed to facilitate this, and it was identified that there was a need for 'safe spaces' for researching with community members to share information.
- For co-design with nondesigners or those unfamiliar with the process, preparation and structure are key, with an acknowledgement and management of cultural and discipline differences. When preparing to co-design with participants, discussing any cultural or disciplinary differences at pre-co-design

meetings is key to understanding perspectives and ensuring the process is suitable and equitable.

- The practical application of the co-design methods in the field with community members will offer a clearer understanding of the positives and negatives of use and assistance will need to be offered to researchers through the process.
- Online co-designing offered positive results with real-time sharing of interdisciplinary ideas across continents. However, without access to appropriate technology, this led to a restriction on community member involvement.
- As much as the design process was welcomed by participants, the online process was seen as quite theoretical and difficult to put into practice. Continued onsite practical application and the reflection of co-design method use are needed in Uganda. Follow-up discussions and debriefing sessions in the future will also be conducted to address this, we will seek to understand if this is a limitation of online co-designing.
- Currently, COVID-19 restrictions have delayed fieldwork; however, work will soon be progressing with community engagement. Future and continued research will be conducted to reflect and report on co-design practices within communities in rural Uganda with a focus on education and entrepreneurship.

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