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Responsible Digital: Co-Creating Safe, Wise and Secure Digital Interventions with Vulnerable Groups

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Abstract
The notion of "Responsible Digital" emphasises the ethical and responsible design and use of digital technologies. Having the knowledge and skills to navigate the digital world safely, wisely and securely becomes critical when digital literacy and access to technologies are limited and livelihood possibilities are precarious such as in the context of vulnerable migrants. We use the Responsible Research and Innovation (RRI) framework in its operationalised version called AREA Plus as a lens to reflect on our research-practice in relation to two projects in sensitive contexts that were designed with vulnerable groups to co-create digital interventions aimed at improving their lives. In so doing, we introduce a new 'sustainability' dimension to AREA Plus to develop what we term the AREAS framework. We contribute to knowledge by using the AREA Plus framework in the context of Africa, South East Asia and South America migration and by further enhancing it; to methodology by highlighting the procedures followed when working with vulnerable groups; and to practice through the promotion of responsible digital practices.

Keywords Responsible digital · Digital intervention · Co-creation · Migration · Vulnerability

1 Introduction

This paper reflects on the use of digital technologies by two different groups of vulnerable migrants and their families through the lens of the Responsible Research and Innovation (RRI) framework: those from Nepal, especially those working in Malaysia; and those from 11 African countries currently living and working in South Africa. It is crucial to ensure the safe and responsible use of digital technology, especially when working with vulnerable groups. While common online risks include cybersecurity threats, digital harassment, bullying, and fake news, vulnerable individuals such as labour migrants who are subject to exploitation and abuse (IOM, 2019), may face additional risks (Maclellan, 2019; Mancini et al., 2019). The use of digital technology poses heightened risks for vulnerable populations, especially those with limited digital literacy, low-cost devices, or urgent needs that can compel risky behaviour. Such risks are part of the 'unintended impacts' that Owen et al. (p.27, 2013) refer to during the innovation adoption processes. In the sensitive context of healthcare, Trocin et al. call them 'unfair outcomes' (p. 2150, 2023) which can 'undermine ethical principles, and diminish people's rights and dignity' (p. 2139, 2023). The rise of new technologies such as generative artificial intelligence has led to renewed interest in responsible digital innovation that takes account of the social and ethical consequences of digital technologies (Okolo et al., 2023; Sambasivan & Holbrook, 2018). The literature is sparse, though, in relation to responsible digital interventions when working with people who have limited digital skills, resources, and access (Wakunuma et al., 2021). Moreover, the contexts of South Africa and Nepal are less researched than are digital interventions in Western countries with socio-economic, cultural, and infrastructural differences. The unique challenges faced by the populations we worked with are linked to their migration status alongside other intersectional inequalities and low levels of digital literacy, connectivity, and socio-cultural discrimination. For vulnerable migrants, such as undocumented individuals, asylum seekers with pending procedures and women, these risks include violence, human trafficking and exploitation (Guadagno, 2020), underscoring the need for tailored, protective interventions.

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Our research-practice[1] was part of a large UK government-funded project on South-South migration, inequality and development. Our work package on digital technologies, inequality and migration brought together migrants, civil society organisations, tech developers and researchers to craft digital interventions that addressed migrant-defined inequalities and thereby would improve migrants' lives. The overall project was based on six migration corridors consisting of twelve countries of departure and destination for migrants. Our own work involved three research phases: first, online surveys to understand migrants'use of digital technology; second, interviews with Nepali migrants and family members (online), and interviews and focus groups with migrants in South Africa (in-person) to explore migration experiences and digital needs; and third, we created digital interventions together in the two selected countries, using insights from the previous phases to help improve the lives of migrants and their families. This paper reflects on the third phase of our intervention work involving the co-creation of digital solutions with migrants and local tech developers in the contrasting contexts of South Africa and Nepal.[2] In both cases, we, the researchers, took the role of facilitators (Sanders & Stappers, 2008) adopting a local-centric, non-techno-deterministic approach that supports local values and aspirations (Dutta, 2021) and a responsible digital stance. This stance was underpinned by fundamental principles: that digital technologies can be used to do both good and harm, that it has unintended consequences, that context matters and an overarching belief that we must work in partnership 'with' people affected by the research practice. We helped design the interventions with a strong focus on the vulnerabilities and unique needs of the groups we worked with, as well as being very aware of the above-mentioned risks associated with the use of digital technologies. Responsible digital practices and ethical considerations were at the heart of our approach, guiding both our choices of methodology and the interventions we supported.

Much existing literature on digital technologies and migration focuses on issues of digitalisation and technocratic control over migrants (Witteborn, 2022), and there is a notable gap when it comes to discussions on responsible digital interventions tailored specifically to their needs. Insufficient attention has yet been given to the design of ethically and socially responsible digital tools that support migrants rather than regulate or monitor them (Either & Irscheid, 2024). This highlights the need for a shift towards approaches that prioritise migrants' rights, agency, and digital well-being. Furthermore, most research on migration and digital technology emphasises its benefits rather than its potential harms. We used the AREA Plus Framework (Jirotka et al., 2017) to reflect on all the steps taken during our intervention phase to examine what responsible digital means in the context of vulnerability, thereby demonstrating the functionality and use of the framework in a real intervention scenario. This paper then expands the framework adding the new dimension of "Sustainability" explicitly to bring to the fore questions around the sustainability of interventions in relation to precarious groups and resource-starved contexts. Our enhanced framework, which we refer to as AREAS (with the added 'S' denoting 'sustainability') is our contribution to methodology. The intervention activities we carried out with migrants and analysed with the AREA Plus framework, served as catalysts for deeper reflections and practical insights, which represent our contribution to practice shared as recommendations for other researchers. By reflecting on our own initiatives, we identify key aspects that are critical to effective outcomes while answering the research questions: is it possible to achieve Responsible Digital with vulnerable groups, and how can we do so knowing the higher risks they are faced with?

The next section discusses responsible digital innovation and presents the Responsible Research and Innovation (RRI) framework (Owen, 2014; Stilgoe et al., 2013), and its operationalised version, AREA Plus, as our interpretative lens. The paper then presents our research and intervention contexts as well as the methods we used for our research and practice. This is followed by the findings and analysis of our two cases using AREA Plus leading to its further development as the AREAS framework through the addition of the new dimension of 'sustainability'. We end with reflections on responsible digital for vulnerable groups and identify implications of our work for theory, methods and practice.

2 Digital Technology and Migration

Much of the research on digital technology and migration is dominated by positive narratives around the role of digital technologies in migrants' lives including their capacity seamlessly to connect them with family and friends left behind back home (Madianou & Miller, 2012), to access news and cultural content from home societies (Lim & Pham, 2016), and fostering migrant solidarity (Hussain & Lee, 2021). There is relatively limited focus on harms from digital technology use such as surveillance by states (Molnar, 2023) and family members (Acedera & Yeoh, 2018), and inequalities related to digital access and skills (Marchetti-Mercer & Swartz, 2020). This is particularly so in relation to the context of migration between countries in Africa, Asia and South America (Harindranath et al., 2024; Harindranath and Unwin, 2024), which are characterised by some of the largest migrant flows in the world and particularly refugees and asylum seekers.

[1] https://www.mideq.org/en/impact/impact-resources/digital-tech-inequality-and-migration/

[2] https://ict4d.org.uk/technology-inequality-and-migration/

Governments, corporations, international organisations, and NGOs, despite their aim to improve service access, are increasingly using digital identity technologies to track and verify migrants via systems that can reinforce biases, discrimination, and power imbalances. Migrants often share identity data without meaningful consent, raising privacy and data protection concerns (Latonero et al., 2019). While some progressive movements around responsible AI seek to make technology more ethical and inclusive—such as by addressing algorithmic bias—this approach is unlikely to work in the context of migration as migration management is often authoritarian and governments and institutions make decisions without including migrants in the process (Collins, 2023). As a result, the idea of participatory governance, where migrants have a say in how digital technologies affect them, is largely absent.

Many well-meaning digital initiatives aimed at supporting migrants fail due to a lack of shared understanding of the desired social outcomes. Several such 'migrant tech' interventions have focused on designing applications specifically for migrants. However, our studies (Harindranath et al., 2023) reveal that these dedicated 'migrant apps' are not widely used. Instead, migrants tend to rely on mainstream applications, such as WhatsApp and Facebook, to stay informed and connected. Many migrants gravitate toward familiar platforms that serve multiple purposes, highlighting the need for a deeper understanding of their preferences and needs. Our research has also identified digital risks faced by vulnerable migrants against a backdrop of poor digital skills and urgent needs that often lead them to underestimate the potential for harm especially connected with social media and 'online presence' (Unwin et al., 2021, 2022). Limited digital skills prevent migrants from accessing essential services, such as renewing documents or finding relevant information and support. Urgent needs make them more vulnerable to scams, data theft, and, in the worst cases -particularly for young people, especially girls- human trafficking.

3 Responsible Digital

Responsible digital encompasses the study of ethical and responsible design and use of digital technologies (safety and privacy, cybersecurity, laws and regulation) as well as digital well-being and environmental responsibility (Burr & Floridi, 2020). As noted by Pappas et al. (2023), responsible digital transformation involves the use of digital technology in ways that are "ethical, sustainable, and respectful of human values and society. It involves considering the potential consequences of technological change on individuals and communities and taking steps to minimise any negative impacts" (p. 946, 2023). Key principles of Responsible Digital behaviours include digital literacy, online safety and privacy, cybersecurity, respectful communication, digital well-being, critical thinking, environmental responsibility, online reputation management, and digital citizenship (Burgess-Wilkerson et al., 2019; Trier et al., 2023). Responsible Digital behaviours are crucial for fostering a safe and positive online environment, requiring both individual responsibility and collective efforts to benefit everyone in the digital ecosystem through socially desirable interventions (Stahl et al., 2013) that aim to 'make the world a better place' (Walsham, 2012). However, the literature largely overlooks crucial issues related to the design, deployment and implementation of digital interventions in a responsible way to support marginalised communities (Ahuja et al., 2023). Responsible Digital provides a framework to examine both the development and evaluation of digital interventions. It aims to engage as many relevant stakeholders as possible to ensure the contextual relevance of digital systems and reduce the value tensions that often arise from their deployment (Anand & Brass, 2021).

3.1 The Responsible Research and Innovation Framework and its Operationalisation (AREA Plus)

Responsible Research and Innovation (RRI) covers multiple disciplines including 'computer science, robotics, informatics, and ICT' (Information and Communication Technology) (Jirotka et al., 2017, p.64), and aims to ensure that research and innovation processes serve the public interest and involve more inclusive and democratic decision-making by including stakeholders affected by new technologies. Proponents of RRI seek to transform existing processes, making research and innovation more acceptable, desirable, and risk aware. Recent research initiatives emphasise the need for innovative perspectives and the development of RRI theories supported by relevant and practical case studies (Owen et al., 2021) as well as the design and deployment of society driven RRI solutions (Foley et al., 2016). While studies such as that by Ahuja et al. (2023) examine responsible innovation in the context of marginalised communities thereby going "beyond the established contexts of most RI literature" (p.80), our contribution takes a further step in examining how the marginalised groups themselves can be the innovators in a digitally responsible way rather than being passive recipients of digital innovations that impact them.

A widely used approach to operationalise RRI is the framework developed by Stilgoe et al. (2013) and adapted into a more actionable framework by the UK's Engineering and Physical Sciences Research Council (EPSRC) (Jirotka et al., 2017; Owen, 2014) as the AREA Plus framework which emphasises the following key stages in relation to RRI: Anticipation, Reflection, Engagement, and Action. Anticipation is the proactive assessment of innovation's

potential impacts, engaging stakeholders to explore challenges, alternatives, and ethical considerations for responsible development. Reflection involves ongoing assessment of intervention's impacts, requiring organisations to examine participants assumptions, values, and activities. It ensures that the process aligns with social and ethical standards through continuous reflection and stakeholder input. Engagement emphasises participatory approaches that integrate diverse voices in both the goals and processes. Bottom-up, grassroots, frugal and open innovation models have demonstrated transformational impacts through clear participation methods, defined purposes, and evaluation criteria. Action involves adapting the process based on emerging knowledge, recognising that initial understanding may be incomplete and needs to evolve with new insights (Table 1).

We chose this framework to reflect on our interventions for two main reasons: (1) it is one of the most widely cited systematic RRI approaches in the literature, and (2) while it provides a structured method for assessing the social and ethical implications of digital innovations, we believe it has not yet been sufficiently operationalised. This paper demonstrates how the framework can be applied in practice, fostering further reflection and improvement of its implementation. Digital interventions are complex and context-dependent, with many competing interests and uncertainties, and the aim of RRI/AREA Plus is to create a dialogue between different stakeholders to make them mutually responsive to each other when undertaking digital innovation activities (Jirotka et al., 2017). Informed discourses need to be at the base of responsible innovation where participatory approaches with relevant stakeholders create discursive processes that can represent ethically sound solutions. This framework is well suited to support the analysis of our interventions due to their complex and sensitive research contexts and the involvement of multiple stakeholders. While the RRI/AREA Plus framework can be applied to any population, it is particularly useful in the context of precariousness and vulnerability where missteps in interventions can have major negative implications for already vulnerable groups in terms of digital harms as well as wastage of precious resources.

4 Research-Practice Context and Methods

Our research-practice had three phases, each with specific objectives and methods (Table 2).

Phase 1 involved online surveys in six countries which took migrants around 15 minutes to complete. These focused on the types of technology used by migrants for different

Table 1 The AREA Plus Framework (Jirotka et al., 2017, p.67)

Figure 1 The AREA Plus framework

	Process	Product	Purpose	People
	Rhythm of ICT	Logical malleability and interpretive flexibility	Convergence and pervasiveness	Problem of many hands
Anticipate	Is the planned research methodology acceptable?	To what extent are we able to anticipate the final product, future uses, and impacts? Will the product be socially desirable? How sustainable are the outcomes?	Why should we pursue this research?	Have the right stakeholders been included?
Reflect	What mechanisms are used to reflect on process? How might we do it differently?	How do we know what the consequences might be? What might be the potential use? What do we not know? How can we ensure social desirability? How might we do it differently?	Is the research controversial? How might we do it differently?	Who is affected? How might we do it differently?
Engage	How can we engage a wide group of stakeholders?	What are the viewpoints of a wide group of stakeholders?	Is the research agenda acceptable?	Who prioritizes research? For whom is the research being done?
Act	How can your research structure become flexible? What training is required? What infrastructure is required?	What needs to be done to ensure social desirability? What training is required? What infrastructure is required?	How might we ensure the implied future is desirable? What training is required? What infrastructure is required?	Who matters? What training is required? What infrastructure is required?

Table 2 Stages of our research-practice (February 2019 to February 2024)

Phase	Objectives	Methods
Phase 1 (2019—2021)	Understanding how migrants currently use digital technologies	Initially planned: interviews, focus groups, qualitative methods in four migration corridors. Adapted due to COVID-19: online surveys (2020–21), online interviews, and discussions with country teams in Brazil, Haiti, Ghana, Malaysia, Nepal, and South Africa
Phase 2 (2021—2022)	Exploring migrants'perceptions of migration-related inequalities and how digital tech can address them	Interviews and focus groups (online and in person) to gather insights from migrants and those working for migrant organisations in Nepal and South Africa
Phase 3 (Sept. 2022-Feb. 2024) *(Focus of this paper)*	Facilitating collaboration between local tech developers and migrants to create digital interventions	Co-design methods used to coordinate interactive sessions between migrants and local tech developers and/or experts to co-create (discuss, design and implement) solutions aimed at reducing identified inequalities in Nepal and South Africa.

purposes and the nature of such use so as to gain an understanding of the overall idea of the use of digital technologies by migrants in our study contexts. These data were not used for this paper but form part of our background knowledge and understanding. Working papers with all the results and statistics were published during 2021–2022.

Phase 2 involved interviews which took place online for Nepal (due to COVID-19) and later on an in-person, three-day sandpit, and in case of South Africa in-person interviews and focus groups. The different approaches were necessitated by the challenges posed by the COVID-19 pandemic, local context, and ways of working in relation to the migrants and migrant organisations in the two countries. However, the combination of the largely quantitative surveys and the qualitative interviews and focus groups provided a rich source of data that underlay our subsequent digital interventions.

The interviews were based on a semi-structured template developed by the authors in 2021 in collaboration with local partners. Each interview lasted around 1.5 hours. In the case of Nepal, they involved a translator and, on occasion, a social mobiliser who connected us to the interviewee. We prepared a set of questions related to reasons for migration, living conditions, and use of technologies. Questions included positive and negative experiences about both migration and use of technologies. The interviews were analysed using thematic analysis and not through any pre-determined framework. The face-to-face interviews as well as the focus groups were aimed at deepening our understanding from the literature and the survey data as well as a means to generate ideas for concrete digital interventions based on the priorities and suggestions by the migrants.

Phase 3 involved the implementations of digital interventions in Nepal and South Africa and forms the focus of this paper.[3] While our research spanned multiple countries, for logistical reasons our digital interventions focused mainly only on two of the 12 countries involved in the larger project, namely Nepal and South Africa. Nepal is a major country of departure for labour migrants with 7.5% of Nepal's population living abroad (Thapa, 2024). According to IOM Nepal (2022) 74% are unskilled and 24% are semiskilled and the "majority of them are doing 3D jobs (difficult, dirty, and dangerous)". South Africa is a major destination country for diverse migrants mainly from other African nations who make up 5% of the total population with many in the undocumented and irregular migration categories (Moyo, 2021); most are concentrated in low-skilled employment and the informal economy (Halstein, 2021).

Our review of the literature and our work in the field of digital tech in the migration context during phases one and two suggested that responsibility must feature centrally in any interventions for migrants, particularly vulnerable ones. While a responsible digital approach underpinned all our intervention activities (see Section 1), we did not use a formal RRI framework to structure our work. The central purpose of this paper is to use the AREA Plus framework as a means to reflect on our research-practice and to analyse our phase three intervention activities, so that we can share our lessons learnt for the benefit of other researchers. Specifically, the questions and dimensions from the AREA Plus framework were used to inquire and evaluate all the material and activities carried out between September 2022 and January 2024. This included our field notes, the learning materials produced together with the migrants for the interventions, the video material produced by the migrants, the reflections over the methods used to co-create the material and the panel discussions and interviews with the participants and other stakeholders during and after the interventions.

4.1 Nepal

The first phase of our work in Nepal centred on understanding the challenges faced by Nepali migrant families and

[3] The previous phases are reported only in so far as to explain the process and the supporting data for the intervention activities.

migrants abroad, particularly in Malaysia which receives the highest number (24.1%) (ILO, 2021). Given the COVID-19 restrictions in 2020–21, all interviews with migrants and family members during this initial phase were conducted online, ensuring safety while enabling us to gather insights remotely. During the second phase, we worked extensively on the ground in Nepal with migrant organisations—Pravasi Nepal Coordination Committee (PNCC), Pourakhi Nepal, and Aprabasi Mahila Kamdar Samuha (AMKAS); National Network for Safe Migration (NNSM), the umbrella body for all Nepali migrant organisations; local tech organisations -National Innovation Centre (NIC) and AuraEd; government organisations and agencies -Foreign Employment Board (FEB), Department of Foreign Employment (DOFE), National Migrant Resource Centre (NMRC) and the local Migrant Resource Centre (MRC) at Pokhara, Gandaki Province of Nepal; and a group of female and male returnee migrants to reflect and decide on a potential project which could support migrants before their departure. With the exception of the MRC at Pokhara, all other organisations were based in Kathmandu, Nepal's capital city. In our efforts to work with migrants in Nepal, we recognised the critical importance of collaborating with a diverse range of partners. Our work focused on male and female returnee migrants, aspiring migrants, and coordinating organisations, all of which played essential roles in this multifaceted landscape.

By engaging with organisations such as PNCC that are dedicated to male migrants and returnees, we gained insights into the unique challenges they faced upon returning home. Similarly, our partnerships with those working with female migrants and returnees, Pourakhi Nepal and AMKAS, allowed us to address specific gender-related issues, ensuring that our approach was as inclusive as possible. Our collaboration with local organisations that assist aspiring migrants provided us with valuable knowledge of the aspirations and concerns of individuals contemplating migration. This grassroots perspective was invaluable in shaping our intervention strategies. Moreover, our connection with NNSM, an umbrella body for all Nepali migrant organisations, enhanced our capacity to coordinate efforts among various stakeholders, creating a more cohesive response to the approach. This collaboration ensured that our initiatives were not only effective but also sustainable in the long term.

In addition to local partnerships, our engagement with international organisations (UNESCO's Kathmandu office and the International Organization for Migration, IOM) and government representatives (from DOFE, FEB and NMRC) responsible for pre-departure orientation workshops for migrants enriched our understanding of good practices and regulatory frameworks. This network broadened our reach and strengthened our capacity to advocate for migrants' rights and needs. Local tech developers also emerged as essential partners in our mission and included both large scale companies and small entrepreneurs. Through conversations that evolved into collaborations, we aimed to leverage technology to create reliable and contextually relevant solutions for migrants.

In September 2022, we organised a three-day sandpit event to convene all these stakeholders, discussing existing resources, identifying service gaps, and establishing potential partnerships to streamline support for outgoing migrants. This event sparked collaborative discussions on each organisation's role and fostered connections that could amplify resources for potential migrants in Nepal. Several of the representatives present had never met each other beforehand, and this in itself was a valuable outcome, providing an opportunity for sharing knowledge and exchanging ideas. Subsequent workshops explored issues that migrants faced in using digital technologies, beginning with online mind-mapping sessions on digital risks and in-person discussions culminating in two proposals for the creation of (i) a one-stop-shop web platform with authenticated information on all aspects relevant for Nepali migrants and their families and (ii) training resources for migrants on the safe, wise and secure use of digital technologies. Subsequent online and in-person engagement with these stakeholders aimed to enhance migrants'access to relevant information and resources through these interventions, facilitated by local organisations committed to their well-being.

4.2 South Africa

Our overall approach was different in South Africa, not only because of the very different context, but also because of the lead author's 14 years of previous experiences based in the country, working with non-governmental organisations (NGOs), academic institutions, and migrant initiatives. Her knowledge of migrant organisations and local stakeholders facilitated our work directly with migrants and enabled some limited logistical support from external organisations. In particular, we collaborated with two well-respected NGOs, one focusing on in-house training for migrants and providing essential legal support, the Scalabrini Centre of Cape Town, the other specialising in outreach activities, employing facilitators who connect with community leaders and groups to raise rights awareness and facilitate access to resources, Adonis Musati Project. The Scalabrini Centre of Cape Town's affiliated research institute, the Scalabrini Institute for Human Mobility in Africa (SIHMA), facilitated our activities in Johannesburg where we collaborated with local organisations such as the Movement of Advocacy Group in Southern Africa (MAGSA). Additionally, we partnered with University of Cape Town (UCT) and University of South Africa (UNISA) to develop learning materials tailored to the specific needs of migrants. Working alongside migrant researchers, who have a deep understanding of the

difficulties faced by this community, we again co-created contextually relevant interventions driven by the stated needs and aspirations of the migrants themselves: (i) training in video making skills and (ii) educational resources for the safe, wise and secure use of digital tech.

This research involved immigrants from 11 African countries, reflecting the diversity of the country as a major hub for migration across the continent. Starting in February 2022, we conducted face-to-face interviews, re-establishing connections with the migrant community post-COVID. This direct engagement provided us with insights into their experiences, needs, and aspirations, allowing us to discuss potential initiatives that would be representative of their perspectives.

We prioritised direct engagement with migrants, conducting every phase of the initiative with them while also maintaining positive relationships with the local organisations for regular discussions, presentation of results and products created by the migrants and follow up meetings for further collaboration. This approach offered a firsthand understanding of migrants' lived experiences and informed our collective decision-making processes that led to the co-creation of our interventions with migrants.

Through workshops and collaborative discussions, two groups of migrants in the two principal cities of the country identified potential activities, co-created the process, and made decisions about follow-up steps. We organised workshops during 2022–2024 that lay the groundwork for subsequent initiatives, from the initial request for digital skills training to video content creation, and from technical skills development to product promotion and distribution. The migrants engaged actively in video production, facilitation of workshops for other migrants and created new learning materials ensuring that these resources are contextually relevant and reflective of their realities.

4.3 Migrant Determined Research

Crucially, the migrants themselves shaped our initiatives. Table 3 summarises the key methods used in the two countries with their timelines.

5 Digital Harms

This section summarises the key findings mainly relating to digital harms drawing on our interviews in order to provide essential context and rationale for the digital interventions that followed, and which form the core focus of this paper. In these interviews, we explored how migrants used digital technologies, the inequalities and challenges they faced, and whether digital technologies could help, if at all, in addressing some of these challenges. While all migrants encountered various forms of discrimination, distinct challenges emerged in each location. In South Africa, many migrants struggled to secure proper documentation, as most were asylum seekers or refugees with limited work permit access, a reality compounded by high crime rates and recurrent xenophobic attacks that contributed to a heightened sense of insecurity. Nepali migrants in Malaysia reported frequent police scrutiny and rigid work permit restrictions tied to their employment, which limited their mobility and autonomy. We now examine the risks and challenges migrants identified in relation to their use of digital technologies within the broader context of their experiences of discrimination and other inequalities they faced in host societies. Given the structure of the interviews which included specific questions regarding digital challenges and risks, the vast majority of the interviewees expressed some concerns regarding their use of digital technologies. Five key themes emerged representing the most commonly mentioned concerns by the

Table 3 Methods and timeline

Nepal	South Africa
• Online surveys with Nepali migrants, returnees and family members of migrants (547 responses—281 in Malaysia, 266 in and from Nepal) in 2021 • Analysis of the survey (using JISC Online Surveys with its built-in analytical tools for further statistical analysis) • 20 online interviews (1–1.5 h each) with Nepali migrants in Malaysia and 10 migrant family members in Nepal—April/July 2022 • Thematic analysis (iterative reading of transcripts, critical reflection, and collaborative discussions, manual coding) • Intervention (phase 3 of the project, see sec. 6 for details) following co-design and participatory design methods from September 2022 to December 2023 • Analysis of the intervention using AREA Plus Framework • Post-project follow-up meetings in January 2025	• Online surveys with migrants in South Africa (297 responses) in 2021 • Analysis of the survey (using JISC Online Surveys with its built-in analytical tools for further statistical analysis) • 15 in-person interviews with migrants from Sub-Saharan Africa (1.5–2.0 h each) – February 2022 • Thematic analysis (iterative readings, critical reflection, and collaborative discussions, manual coding) • Intervention (phase 3 of the project, see sec. 6 for details) following co-design and participatory design methods from February 2022 till January 2024 • Analysis of the intervention using AREA Plus Framework • Post-project follow-up meetings in October 2024

majority of interviewees: data privacy, personal and financial security, family pressure, online harassment, and digital risks for minors.

5.1 Data Privacy

The safety of personal data was a pressing concern for many digital users. A Nepali migrant in Malaysia commented, *"When I venture on Facebook for information, I make sure to carefully select the pages because I am aware that there are a lot of scams happening regarding the information I need to tutor myself about."* (Malaysia, 1). This awareness underscored the necessity of being discerning about the sources of information migrants engage with online.

Another Nepali migrant expressed a more personal approach to online security, stating, *"I am not comfortable. I have to be secure first. That is why I use different email addresses and long passwords. Nobody knows my passwords."* (Malaysia 5). This sentiment resonates with many interviews and feedback received from migrants some of whom recognise that maintaining privacy is critical in today's digital landscape. However, the risks persist, as another Nepali migrant pointed out, *"[I am] aware that there are hackers who can hack your FB and release your personal information or just misuse Facebook."* (Malaysia, 7). These concerns were shared by other migrants, like this one in South Africa who stated, *"There is really fraud on the other side, and there are also other people who can post in your account, even things that you haven't posted. …any person can take your number, and where you live"* (South Africa, 2). This highlights the vulnerability of personal data online, the ease with which hackers can misuse them.

The threat is not just theoretical; as another migrant recounted, *"They even started contacting other people as if it was me."* (South Africa, 3). Such experiences emphasise the real dangers of identity theft and the misuse of personal information online. By adopting strong security measures and remaining vigilant, migrants can better protect their personal data, safeguarding both their online presence and peace of mind.

5.2 Personal and Financial Security and ICT

For migrants in countries with high rates of criminality, such as South Africa, the personal risks associated with technology can be daunting. A migrant in South Africa shared, *"We are in neighbourhoods where there are locations a bit far away, and sometimes you are afraid of your problems with your phone because you can be seen, [it] can be stolen."* (South Africa, 8). The underlying fear of theft and personal attack remains significant and was witnessed also by migrants residing in more secure countries such as Malaysia; as one Nepali worker residing there said, *"Something to worry about is if the phone got stolen"* (Malaysia, 6).

This fear is compounded by the challenges of using technology for financial transactions. A migrant in South Africa expressed concern about internet banking, stating, *"When I do internet banking, one mistake and the money is in another account. Or one mistake and the scams are too much on internet banking."* (South Africa, 4). This concern was also shared by migrants in other part of the world. A Nepali migrant in Malaysia said, *"There is an underlying fear because it is the internet and sometimes the website might not work … and because it's a transaction of money. Because it is a money matter, [I] prefer to have a physical contact with a person so if there is anything that goes wrong, he can immediately find a person to fix the situation; because if it is on the Internet it will take a while; sometimes the application might not properly respond to [my] request"* (Malayisa, 7). Many migrants preferred face-to-face interactions for financial matters, as one Nepali migrant stated regarding his search for a job: *"[I] felt more confident addressing, talking with an agent rather than looking on the internet"*. (Malaysia, 10).

These sentiments highlight a pervasive anxiety that affects migrants' financial security, their sense of responsibility towards their families who are economically dependent on them back home, as well as their sense of safety in daily life, particularly when they need to move around carrying their phones and money to send home.

These challenges are often aggravated by other factors such as the lack of digital skills and the quality of the products they can afford. One migrant noted, *"At that point, I didn't know how to protect my data. I've been struggling."* (South Africa, 7). The wife of a Nepali migrant in Malaysia admitted, *"[I] use Facebook. […] [I]have [my] own profile but [I] do not know how to use it that much"* (Nepal, 3). Many migrants often do not have "good enough" smartphones to effectively access essential applications. One Nepali worker in Malaysia revealed, *"[I don't] have an advanced phone; whenever [I] want to see [my] payslip, it was difficult for [me] to access the application because it was very heavy"* (Malaysia, 6).

These limitations can hinder migrants' ability to manage finances and access vital services underscoring the pressing need for accessible technology and training tailored to the unique circumstances of migrant communities.

5.3 Family Pressure 'Over the Phone'

For many migrants living abroad, family pressure can create a profound sense of conflict. One Nepali migrant shared, *"Now it is already 5 years and they are telling [me I] need to go back and take care of the family."* (Malaysia, 2). This

sentiment reflects a common expectation among families that those who migrate for work should return home to fulfill familial responsibilities. Similarly, another Nepali migrant described how her parents frequently called her, saying, "*Just come back, just come back.*" (Malaysia, 3). Such persistent demands can make it challenging for individuals, often leading to feelings of guilt and obligation when pressed with questions like, "*Why are you not calling every day? Why you are not receiving the call?*" (Malaysia, 15). As one Nepali woman reflected on her eight years away, she faced comments such as *"You have been in Malaysia way too long; why don't you come back now in Nepal?"* (Malaysia, 20). These pressures can weigh heavily on migrants, making it difficult to navigate the balance between familial expectations and their lives abroad.

The disconnect between migrants' realities and their families' perceptions further complicates these pressures. One Congolese migrant in South Africa noted, "*When it comes to uncles, aunties, they don't understand that. They just think there is money there, there are opportunities; [South Africa is] a developed country.*" (South Africa, 9). This idealised view can overshadow the actual struggles migrants face. Another migrant shared, *"Because I think the technology didn't help them on that side. Maybe they can see a picture of you, and you're happy, but they don't really know the reality that we are living. I think the technology didn't help them to understand better. It's like if they see a photo on Facebook that is good, they think you are all well"* (South Africa, 8). Despite efforts to explain their difficulties, many migrants felt their families dismissed their experiences as exaggerated or false, like this Nepali migrant who stated, *"Still people think like in FB, whatever, people they don't believe because they didn't come here. They don't know; they follow only. Even if you explain, like me, I explain to my family, they think I am just lying to them"* (Malaysia, 9).

5.4 Online Harassment

The digital realm poses significant risks of harassment for migrants, particularly as they navigate social media platforms that can expose them to harmful content. The wife of a Nepali migrant expressed her concerns, stating *"[I have] seen all these sorts of videos gone viral and because vulgarity is very much existent in YouTube and in all the social media, and even Facebook is no exception to the vulgarity"* (Nepal, 4). This observation highlights the prevalence of inappropriate and explicit content that can negatively influence young users and contribute to a culture of harassment. As migrants engage with these platforms, they often experience not just the risk of encountering vulgarity as emphasised also by a migrant in South Africa, *"I don't like TikTok because people start exaggerating. People start exaggerating and putting anything there. Even information that is not edifying"* (South Africa, 5), but also the potential for targeted harassment from strangers.

In South Africa, the issue of xenophobia adds another layer of risk, with many migrants expressing concern over the impact of racist comments on social media. One migrant noted, *"That has to be part of your secret. You cannot publish it on the media. People can attack you in many ways"* (South Africa, 12). This fear of backlash can stifle open dialogue and discourage individuals from sharing their experiences. Another migrant pointed out, *"Other people, they don't understand… they just write and they don't know that it's going to hurt somebody's feelings"* (South Africa, 14). Hate speech contributes to a hostile online environment that can further marginalise migrant communities. The combination of exposure to inappropriate content, the threat of xenophobic harassment, and a lack of possibilities to share experiences for fear of backlash underscores the need for better digital literacy and protective measures within migrant communities to foster safer online environments.

5.5 Digital Risks for Minors

The digital landscape presents significant risks for minors, prompting concerns among parents about the potential negative impacts of technology. The wife of a Nepali migrant in Malaysia, who was also a mother, expressed her worries, saying, *"[I am] worried that [my] daughter might be wasting time on game applications and such"* (Nepal, 8). This concern extended to social media, where another Nepali mother noted, *"[I] worry especially using social media, because if [my] son is online doing unnecessary activity, [I] worry that he will get too attached"* (Nepal, 9). The ease with which children can access various platforms can lead to unhealthy habits and distractions, diverting their attention from educational and personal development. Moreover, as technology becomes more integrated into daily life, the emotional connection within families can suffer. A young man, who was the son of a Nepali migrant in Malaysia, reflected, *"Since everybody in [my] home is using technology, [I] felt a little bit more distant with [my] family, because everyone is using their own mobile phone and there was a gap distance, and the connection in [my] own family was lost"* (Nepal 1).

Moreover, the prevalence of technology can lead to more serious issues, such as sexual harassment as expressed by a migrant in South Africa, *"Stuff like friendship for a stranger. The next thing he'll ask you, send me your pic. The next thing, send me your naked picture. Because anything can happen with this technology"* (South Africa, 10). There was fear that online interactions at a young age might also lead to early marriages. A Nepali migrant in Malaysia, worried for his daughter back home, highlighted this risk, stating,

"Because technology is so diffused, early marriages occur. Girls communicating with people on the internet end up marrying at a very young age" (Malaysia, 1). Parents are often concerned about the content their children encounter. A Congolese migrant in South Africa remarked, *"There are some programs that are not appropriate for kids… sometimes inappropriate videos just pop up"* (South Africa, 1). This reflects the challenges of monitoring what children see online. Another migrant mother in South Africa voiced her fears about her child's exposure to the internet*: "I was afraid… she can see anything even if it's not for her age."* She added another concern related to her limited skills *"they do things that even myself, I don't understand. A lot is happening there [Internet]. And if you don't have control on that, it's a disaster. There is even too much information around, but you don't know how to select, who to trust"* (South Africa, 9). As technology continues to evolve, the importance of parental guidance and effective content filtering becomes increasingly critical to protect minors from potential dangers.

6 The Digital Interventions in Nepal and South Africa

Drawing on the evidence shared in the previous section, we worked with migrants to identify what they thought were the most likely and feasible digital interventions they could craft with the help of local tech developers that would improve their lives. As proposals emerged from the participants, our role as facilitators was to highlight the potential risks associated with the suggested solutions. Two main ideas for interventions emerged from the initial activities that gathered migrants, migrant organisations and tech developers together (see Table 4):

- Information sharing via a digital portal in Nepal that provided links to relevant, updated and verified information for migrants, returnees, and their families, as well as the need for migrants to develop better digital skills; and
- Information sharing via videos in South Africa (informative videos made by migrants for migrants, covering various topics) alongside workshops to improve digital skills, including communication, video editing, and online safety.

Most of the discussions during our initial sandpit in Nepal in September 2022 with migrants and migrant organisations related to the positive impact of digital tech on migrants, although we had also raised the often underestimated negative impacts and the need for safe, wise and secure use of digital tech. Given our research findings on the limited digital literacy among migrants and risks such as online scams and surveillance, we also explored in a collaborative ideas generation workshop (online) with migrants and their organisations in December 2022 what might be included in a one-hour training session on digital risks and the importance of safe, secure and wise use of digital tech. This mind mapping exercise led to a collective understanding of the digital risks faced by migrants and their information needs. This subsequently formed a central plank of the co-design of our responsible digital interventions in Nepal,[4] resulting in the creation, involving multiple stakeholders, of free and open resources (Creative Commons license BY-SA) on digital preparedness for migrants. These training resources, available in six Nepali languages along with guidance notes, can be used by anyone to train migrants on the safe, wise and secure use of digital tech. We tried to encourage the Government of Nepal to integrate elements of this within their regular pre-departure orientation programme for all migrants. We also facilitated a collaboration between migrant organisations and the Association of Community Radio Broadcasters of Nepal (ACORAB) to develop and broadcast public service messages and radio content on responsible digital approaches including the safe, wise and secure use of digital tech by migrants.

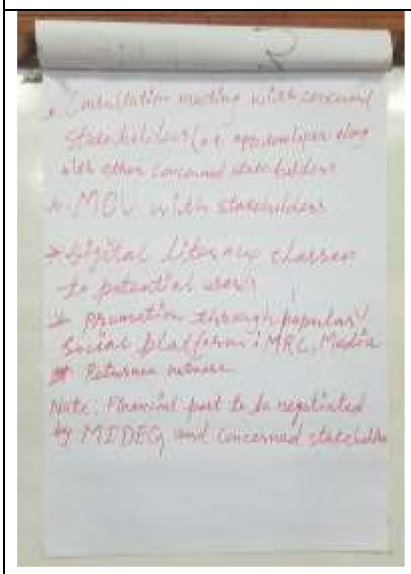
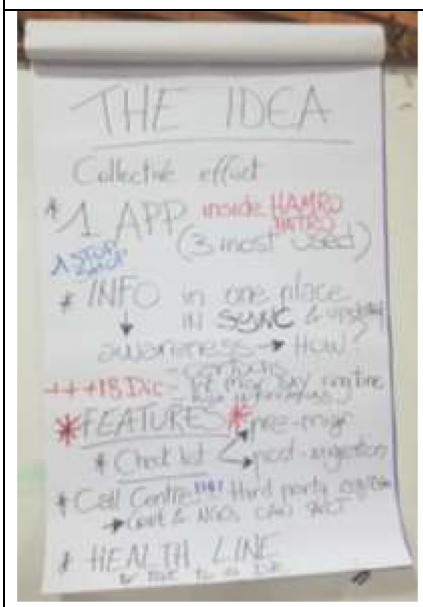
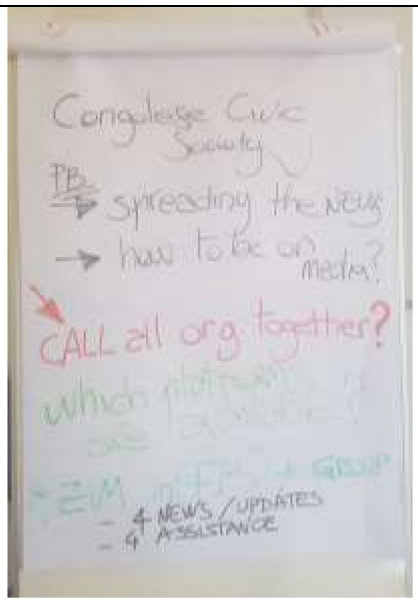
In South Africa, while the issue of digital safety emerged during the focus groups, it only became a priority for our interventions during a week-long workshop on digital skills which began with a collaborative digital body mapping exercise (Jager et al., 2016) that led to the emergence of responsible digital behaviours and digital risks based around the participants' lived experiences. Here, participants created visual representations of their personal online information highlighting concerns around privacy, child safety, misinformation, online risks and data security. Given the participants'interest in short-form video making, the workshop emphasised key topics such as the importance of protecting personal information, addressing online harassment, and recognising and managing hate speech[5]. During the second week of workshops, participants received training in storytelling, video production, and editing. Initially, their intention was to create videos to share information that could support new migrants. However, they eventually also produced content reflecting their newly acquired knowledge of responsible digital behaviors[6]. Some participants even began teaching online safety in their communities. Support, including a 'train the trainer' programme, was provided by members of our team as well as by external consultants. Across all the workshops, the responsible use of digital tools to protect vulnerable individuals from online harassment was central, particularly when dealing with social media and use of images and videos.

[4] https://ict4d.org.uk/technology-inequality-and-migration/nepal/

[5] https://ict4d.org.uk/2023/09/09/empowering-migrants-through-training-in-video-production/

[6] https://www.youtube.com/@FusionAvenueOfficial/videos

Table 4 Co-creation workshops in Nepal and South Africa: Idea generation for digital interventions

Nepal	South Africa
	
	

In both country contexts, all subsequent activities with migrants, including training and dissemination, have featured the safe, secure, and wise use of digital tech as a key part of the interventions. By actively engaging with participants and responding to their concerns, we adapted our approach to address the specific digital risks and vulnerabilities identified during the interventions. In one case, for example, the migrants themselves adapted the learning material to incorporate the trafficking risks for girls. We also planned for sustainability by bringing together diverse stakeholders within each context who can continue to support the interventions beyond our project timeline. Table 5 summarises the activities undertaken in Nepal and South Africa that ultimately led to the design and implementation of the digital interventions.

Our project encountered two significant challenges: (i) the tension between bottom-up approaches and the need for organisational support during the intervention, and (ii) the difficulties in securing post-project funding for subsequent monitoring and evaluation. In relation to the first, while engaging participants directly allowed for co-creation, it also presented challenges in ensuring that all necessary resources and strategic decisions were adequately managed. Participants took ownership and voiced their needs and decisions, fostering their agency

Table 5 Project Phase 3 – Interventions in Nepal and South Africa

Nepal	South Africa
• Three-day sandpit with migrant NGOs and returnees—September 2022. Decisions: ○ Common decision to develop a one-stop-shop migrant information website, and ○ To incorporate safe, secure, wise use of digital tech in migrant training programmes • Online mind-mapping to design a slide deck/training resource on the safe, wise and secure use of digital tech by migrants – December 2022 • In-person discussions/meetings on the slide deck with migrant NGOs – January 2023 • Testing of the slide deck within the region—2023 • Translation of the slide deck into six local languages – 2023 • In-person workshop to co-design the *Pardesi* platform (local NGOs and tech developers)- January 2023 • Creation of numerous short videos promoting key messages on the safe, wise and secure use of digital tech by migrants and disseminating the *Pardes*i platform • Launch of the new platform with all relevant stakeholders– December 2023 • Meetings with Government agencies regarding Pre-Departure orientation programme and possibilities for including our training resources—2023 • Creation and broadcast of public service messages based on our training resources on the safe, wise and secure use of digital tech by migrants and dissemination of the *Pardesi* platform through 300 + community radio stations that are part of the Association of Community Radio Broadcasters of Nepal (ACORAB) reaching 6.7 million people across Nepal as well as You Tube live streams of the programmes reaching tens of thousands.—January–February 2024 • Ongoing updating of the platform – 2024-25 • Migrant Resource Centres commit to using our training resources as part of their training programme - 2025 • Ongoing multiple virtual communications after the official end of the project (February 2024) during 2024 and 2025 • Post-project meetings with main local stakeholders in January 2025	• Four focus groups with migrants – March 2022. Discussions over: ○ Migrants' knowledge and difficulties and fears regarding online sharing (due to lack of skills and online xenophobia) and ○ Decision to develop 'video production training' to raise voices, share advice, and support related activities always emphasising online safety • Development of a two-week intensive workshop on digital skills and video making with two local universities and local tech developers – August/September 2022 • Workshops with two groups of 22 migrants in Johannesburg and 14 migrants in Cape Town – November/December 2022 and two panel discussions with relevant stakeholders (legal advisors, video makers, NGOs) for feedback on early videos developed by migrants • Deployment of the courses by the people trained to new groups (marginalised communities and teenagers – more than 150 people trained)—2023 • Co-design of new learning materials to meet the needs of new groups (particularly for young people); two new slide-decks designed by migrants in two cities and revised by supporting organisations and researchers – 2023 • Creation of 30 + videos by the people trained to highlight the main lessons learned and to address some of the challenges faced by migrants- 2023 • Creation of and presentation of a 30-min documentary to launch the migrants' YouTube Channel, *Fusion Avenue* – January 2024 • Scalabrini Centre of Cape Town commits to using our training resources as part of their training programme on digital skills • New collaborations with three local NGOs to deploy courses managed by people trained during the intervention and production of new videos – 2024 • Ongoing training by migrants for other migrants, supported by local organisations – 2024 • Ongoing multiple virtual communications after the official end of the project (February 2024) during 2024 and 2025 Post-project meetings with main local stakeholders in October 2024

and trust. However, without sufficient organisational backing, some decisions that could have streamlined the process were delayed or overlooked. While the grassroots involvement was invaluable, it sometimes left participants without the structured support they needed to implement their ideas effectively. For instance, in Nepal a migrant information portal[7] was created and managed by a group of organisations ensuring the different viewpoints and expertise to be represented and actively involved. However, this choice slowed progress on delivery and further updates of the portal. In the same way, the choice to work directly with migrants in South Africa enabled the possibility to reach out to diverse migrant communities and have their voices represented directly without mediation by any specific organisation. However, the decision also implied a risk of dispersion of the efforts and difficulties in monitoring the results achieved by small groups of migrants. The monitoring and evaluation of the activities carried on beyond the project timeline was limited to the people trained by us. For the hundreds of migrants trained by our trainees we had to rely on feedback forms, attendance registers and pictures. While establishing partnerships with organisations that can provide ongoing resources and support is important, it can sometimes come at the expense of being fully bottom-up in approach.

The second challenge related to post-project funding for continued monitoring and gathering impact evidence for sustainability. Many grants and funding opportunities lack financial backing for monitoring, evaluation and learning activities beyond the project timeline. The absence of funds for this not only hampers the ability to assess the long-term impact of the interventions but also restricts opportunities for continued collaboration and innovation among stakeholders. Our work has benefited from follow-on funding streams that have allowed us to continue to engage with stakeholders in both countries and to examine the impact of our interventions with a view to ensuring sustainability.

[7] https://pardesi.org.np/

7 Reflection

In this section, we use the AREA Plus framework to reflect on our intervention projects and evaluate the co-creation activities undertaken. To aid our analysis, we use Jirotka et al.'s (2017) guidance on the application of the AREA Plus framework through a series of questions aimed at exploring and evaluating the activities we carried out during the third phase of our project. Table 6 summarises our responses to the questions posed by the framework in Table 1, and the following sub-sections draw on our intervention phase experiences to reflect on the four dimensions of the framework.

7.1 Anticipate

Our approach to the interventions was one of working *'with'* the migrants and all relevant stakeholders in the context of use. There were two sides to these co-creation activities: the migrants prioritised information sharing activities while our facilitation focused on mitigating the unintended harmful consequences of digital interventions particularly for vulnerable groups. Collectively the co-creation process guided by principles of responsible digital behaviours led us to integrate aspects relating to the safe, wise and secure use of digital tech. While we anticipated the importance of discussing digital risks and safety among vulnerable groups through our research findings, we also felt strongly that this key dimension needed to emerge through our activities so that migrants themselves recognised its value and owned the resulting interventions. Only then might such interventions have any chance of becoming sustainable.

7.2 Reflect

Our approach was one of facilitation and co-creation which involved a continuous cycle of action and reflection and further discussions with all relevant stakeholders. We obtained feedback not only through traditional approaches such as feedback forms but also through video feedback and informal conversations. The decisions of migrants in both countries to create videos and broadcast messages on digital safety proved the validity of our concerns. We found that co-creation processes, when conducted in alignment with principles such as care, attentiveness to participants, balanced power dynamics, and a willingness to teach, learn, guide, and follow, naturally supported and were conducive to the emergence and reinforcement of responsible digital practices.

However, on further reflection, we could have developed our formal monitoring, evaluation and learning (MEL) processes more systematically and earlier in our practice with the direct involvement of other relevant stakeholders. Although we did conduct some MEL processes in every phase with participants followed by detailed de-brief sessions by the project team, ideally, we could have done more, particularly encouraging the migrants to reflect on their own progress. In both Nepal and South Africa it proved quite difficult to get them to do this without our guided sessions or forms, possibly because they lacked the time, were focused on delivery of products and lacked experience in such reflection. The reflections that we did have nevertheless allowed for new opportunities to emerge during the dissemination phase for both contexts as well as opportunities in new contexts with new partners (e.g., extending our work to Brazil with a broader range of marginalised groups). In addition, we have since created new opportunities to return to both our intervention contexts for further evaluation and learning from those involved including examining outcomes of our research-practice.

7.3 Engage

We chose to prioritise the relationships between local migrant organisations, tech developers and researchers to ensure that the resulting interventions were not imposed from above or outside (us) but rather emerged from the context of use. The responsible digital principles that guided the process arose from our attentiveness to the needs and particularities of each context. We created a core team of migrants/migrant organisations and tech developers in each country who we encouraged to drive forward the interventions locally while also facilitating wider networks of local and international organisations that could help amplify our collective efforts. Due to a lack of funding, we were unable to have a dedicated on-site manager for each intervention, which led to challenges in coordination between the various stakeholders. Throughout the project's timeframe (2019–2024), it was essential for us to maintain a strong collaborative relationship with our partners and pertinent organisations to ensure that they are adequately prepared to support, build on and develop subsequent interventions to enhance the lives of migrants. This was done through periodic in-person meetings, frequent online calls and WhatsApp messages and discussions. Indeed, these contacts have continued even after the project was concluded.

7.4 Act

Our co-design approach was inherently flexible to ensure that the interventions were context-relevant and emerged from our collective activities to develop ownership and

Table 6 The AREA Plus Framework applied to digital interventions in Nepal and South Africa

	Process	Product	Purpose	People
Anticipate	• Good pre-existing knowledge among researchers about the use of digital tech by marginalised communities • Co-design methods not just desirable but essential for trust building between migrant groups and tech developers and to ensure appropriate outcomes that the migrants want and value	• Being prepared to support and facilitate what emerges during the co-creation process • Co-creation as a route to social desirability as opposed to individual objectives • Research-practice facilitator to highlight and help retain focus on sustainability of any resulting interventions beyond project timeline	• Supplementing limited existing literature and awareness on South-South migration and inequalities • Limited awareness on digital harms and how these might be mitigated • Given the pervasiveness of digital technology use by migrants, what can digital tech do to help address inequalities migrants face and how can we mitigate risks?	• Bringing together relevant migrant groups, migrants and tech developers alongside local researchers and other supporting civil society organisations for co-design workshops • Liaising with government and international agencies (especially, IOM, UNESCO) with a view to gaining support for sustainability of interventions and for policy impact
Reflect	• Frequent online and in-person meetings with migrants, tech developers and supporters • Expert conversations in academic and policy fora to reflect on research and practice • Blogs and videos for wider engagement and reflections • Better focus on in-country monitoring and evaluation	• Social desirability expected due to consensus established through co-creation • Migrants better informed of digital harms and opportunities and ways to mitigate risks • Limited opportunity to know every possible outcome at the individual level	• Non- controversial given the pervasive use and necessity of digital technologies in migrants' lives • Controversial in relation to our challenging existing perspectives on 'migrant tech' • Prioritising feasible interventions given limited resources and time	• Migrants and family members, migrant organisations, tech developers, local researchers as well as local and international organisations • Better engagement and perseverance with government departments
Engage	• Facilitating the coming together of migrants, tech developers and other contextually relevant stakeholders • Learning mindset essential for all stakeholders including migrant participants and researcher-practitioners • Research-practitioners to show humility given migrants know migration best and local organisations understand better their context • Challenges in 'getting through' to government departments	• Nepal sandpit and South African panel discussions as vehicles for multiple viewpoints and consensus to emerge • Intervention outputs represent multiple voices	• Research and practice agenda seen as not only acceptable but also desirable and contextually relevant by all the stakeholders involved • All relevant stakeholders continued to remain involved throughout the interventions and beyond the project end date	• While the research-practice originated from the researchers, the key principle that drove the work was 'working *with* migrants' and therefore the intervention priorities came from collaborative efforts with all relevant stakeholders • Challenges in relation to shared ownership of interventions (as opposed to individual organisations taking responsibility)
Act	• Our 'working *with* migrants' approach and co-design methods allowed for flexibility and created a more inclusive and diverse environment from which the intervention ideas emerged • Tension between shared ownership and organisational responsibilities • Varied training requirements for migrants depending on context • Funding, collaborative agreements and commitment from local organisations essential for sustainable interventions	• Working *with* migrants essential for social desirability of any interventions affecting migrants • Ongoing training efforts to ensure interventions are utilised • Funding, collaborative agreements and commitment from local organisations essential for sustainable interventions	• As digital technologies are pervasive among migrants, there is a clear need to mitigate risks so the potential benefits can be harnessed • Ongoing training efforts to ensure interventions continue to evolve as needs change • Funding, collaborative agreements and commitment from local organisations essential for sustainable interventions	• Commitment of researcher-practitioners, participants (especially the migrants) and relevant stakeholders key to ensuring the collective scope of interventions • Tension between shared ownership and organisational responsibilities • Initiatives to train those who will train others • Flexibility to keep developing and reversion training materials for different groups • Commitment from local organisations essential for sustainable interventions

sustainability. This required us, the 'researchers',[8] to listen and to be ready to challenge assumptions based on the literature. At each stage, we chose to prioritise what the migrants wanted while at the same time considering potential harmful consequences and mitigation. While the migrants' desire to be seen and heard is important, it must be carefully balanced against the need to safeguard personal data. Developing responsible digital interventions with vulnerable groups in resource-constrained contexts also require researchers to think carefully about the practicalities of working with such groups and the resources that might be required to enable them to participate despite various work-life challenges, especially in the longer term once the project funding had finished.

7.5 Enhancing the AREA Plus Framework with the Sustainability Dimension: the 'AREAS' Framework

The AREA Plus framework is a valuable tool to frame responsible research and practice, but our experience suggests a missing element, namely sustainability. In the context of responsible digital interventions, sustainability is not optional, it is essential. It must be considered from the beginning, as it directly influences the long-term value and integrity of the work. While the concept of sustainability usually covers economic, social, environmental and institutional dimensions, our focus was on co-created interventions that were economically viable beyond the project timeline and potentially affecting institutions and culture while we tried to ensure social responsibility over the long term. The intervention activities we carried out with migrants and analysed above using the original AREA Plus framework served as a catalyst for deeper reflection and practical insights. This led us to developing additional questions under what we term as the new 'Sustain' dimension in Table 7. By examining our own initiatives, we identified key aspects that proved critical to effective impact. Drawing from our lived experiences, we offer these insights to enhance the original AREA Plus framework into what we now call the 'AREAS' framework with the additional dimension of 'sustainability' (hence, the 'S' in 'AREAS') and encourage others to recognise and address similar factors affecting sustainability in their future work.

Although sustainability appears in the earlier 'Anticipate' stage of AREA Plus in relation to the 'product', our evidence suggests a stronger focus is essential on 'sustainability' across all of the dimensions (product, process, purpose and people). Hence, the addition of the 'Sustainability' dimension in our adapted AREAS framework (Table 7) is more than rhetorical; it is normative because the messy issue of sustainability beyond project timelines should be a key factor in all research and practice interventions, and particularly those relating to digital interventions for migrants and other vulnerable groups. Including the sustainability dimension as a core element can help ensure that it is not an afterthought or a one-off consideration but a central concern across the process, product, purpose and people dimensions and at every stage of the intervention.

In relation to the 'process' dimension, concerns relating to sustainability must be addressed upfront and processes established, including mechanisms to fund the monitoring and evaluation of outcomes. In the case of our project, we instituted a process to ensure that monitoring of outcomes took place at regular intervals during the project and well beyond the project timeline.

The 'product' dimension requires stakeholders to set up realistic expectations that can transform interventions from the 'possible' to the 'desirable and feasible' within the project and geographic contexts. Here, sustainability requires the careful monitoring of outcomes, including any unintended consequences, not least to ensure that the interventions can swiftly be revised if necessary. In our case, the interventions relating to the safe, wise and secure use of digital technologies were central to the process and the product dimensions as digital technologies have the potential for unintended harmful consequences.

The 'purpose' dimension requires the alignment of competing interests for the sake of social desirability and interventions that are adaptable to changing contexts. In the case of our digital interventions in Nepal and South Africa, there were tensions between the goal of collective ownership and individual organisational goals and responsibilities. We chose to prioritise the collective approach, thus emphasising inclusivity and diversity. However, collective ownership became less stable beyond the project timeline, as the priorities of individuals and organisations became realigned to new sources of funding for different projects. Nevertheless, given our focus on sustainable outcomes, we have continued to remain in close contact with our participants and stakeholders more than a year after the original funding ceased, with a view to ensuring that interventions can carry on without our central co-ordination.

In relation to the 'people' dimension, while bottom-up approaches can help address issues of inclusivity and relevance, they may also suffer from lack of organisational structure and support that are essential for sustainability. As this became evident in both Nepal and South Africa, our efforts focused on balancing our 'working *with* migrants' approach with facilitation and support from local organisations.

Table 8 presents our reflections on the new sustainability dimension and related questions we added to the

[8] Although all of the migrants with whom we were working were themselves also, in a sense, researchers.

Table 7 The AREAS Framework with the addition of the sustain component

	Process Rhythm of ICT	Product Logical malleability and interpretive flexibility	Purpose Convergence and pervasiveness	People Problem of many hands
Anticipate	Is the planned research methodology acceptable?	To what extent are we able to anticipate the final product, future uses, and impacts? Will the product be socially desirable? How sustainable are the outcomes?	Why should we pursue this research?	Have the right stakeholders been included?
Reflect	What mechanisms are used to reflect on process? How might we do it differently?	How do we know what the consequences might be? What might be the potential use? What do we not know? How can we ensure social desirability? How might we do it differently?	Is the research controversial? How might we do it differently?	Who is affected? How might we do it differently?
Engage	How can we engage a wide group of stakeholders?	What are the viewpoints of a wide group of stakeholders?	Is the research agenda acceptable?	Who prioritises research? For whom is the research being done?
Act	How can your research structure become flexible? What training is required? What infrastructure is required?	What needs to be done to ensure social desirability? What training is required? What infrastructure is required?	How might we ensure the implied future is desirable? What training is required? What infrastructure is required?	Who matters? What training is required? What infrastructure is required?
Sustain	**How can the research process prioritise sustainability?** **What monitoring and evaluation processes can be instituted for sustainability?** **How can funding mechanisms allow for monitoring and evaluation beyond project timeline?**	**How can we ensure that the interventions are sustainable?** **What resources might be required to monitor and evaluate the consequences and outcomes of use?** **How can we check for unintended consequences of the interventions?**	**How do we ensure sustainability as a core focus in addition to social desirability?** **How can conflicting interests and aims be aligned?** **How can the interventions be monitored so that they remain socially desirable and relevant to changing needs and priorities?**	**Have all the relevant stakeholders been involved?** **How can we ensure that they remain involved as the interventions evolve?** **What mechanisms exist for monitoring and evaluating behaviour changes among key stakeholders?**

AREAS framework. This addresses the questions on sustainability based on our experience, reflecting on both the most effective approaches and the ideal strategies we wished we could have implemented under perfect conditions. In our reflections presented in this section, we share what we planned and aspired to achieve, alongside the practical realities and challenges we faced.

8 Conclusion: Implications for Research-Practice

Our research and practice showed that migrants use digital technologies in different ways in varying contexts; applications specifically designed for them by others are largely unknown to them or not used; the knowledge of the potential of digital technologies, and specifically of the most frequently used device, the smart phone, is limited; and there is limited understanding of the risks related to the use of digital technologies and their potential mitigation. Literature on these issues from Africa, Asia and South America is limited and we gained deeper insights into these challenges through our extensive quantitative and qualitative work. Throughout the project, we continuously refined and adapted our activities based on our findings and inputs from the migrants and organisations with which we were working, ensuring that our approach remained responsive to the evolving needs and experiences of migrants in different contexts. These findings combined with the chosen co-design approach of 'working *with* migrants' led us to our digital interventions in the two countries reported in this paper.

Table 8 Addressing sustainability issues within the AREAS Framework as applied to our digital interventions in Nepal and South Africa

	Process	Product	Purpose	People
Sustain	• Sustainability to be considered from project inception and to be at the forefront throughout the project timeline • Sustainability integrated into design and methods • Regular review to ensure relevant outcomes • Follow-up (meetings, evaluation forms, impact assessments, discussions with external stakeholders) at regular intervals to sustain focus and/or adjust approaches, scope, and ways of working • Allocating dedicated resources for post-project evaluations and creating flexible funding structures to support long-term impact assessments	• Co-designing interventions to ensure desirability, commitment, and ownership by the participants • Budgeting to ensure the viability and sustainability of the interventions beyond the initial funding timeline • Nurturing and maintaining a relationship with all stakeholders, ensuring the availability of financial support and appropriate and safe technologies, clear timelines for regular impact data collection and analysis • Ongoing stakeholder engagement, iterative feedback mechanisms, and comprehensive impact assessments that include both qualitative and quantitative measures	• Balancing immediate social appeal with long-term goals through inclusive planning, ethical considerations, and impact assessments • Alignment of priorities and scope for the benefit of all interested groups through transparent dialogue, participatory decision-making, and finding common ground • Incorporating adaptive monitoring systems, regular stakeholder feedback, and periodic reviews to align with evolving contexts • Flexibility and adaptability in the scope and methods to facilitate long-term sustainability	• Potential stakeholders identified and included through comprehensive mapping, early engagement, and fostering collaborative partnerships • Trust and shared ownership through open communication and participatory approaches • Surveys, interviews, focus groups, and longitudinal studies to track shifts in stakeholder attitudes, practices, and engagement levels

8.1 Limitations

While our research-practice was underpinned by a responsible digital perspective right from the start, we only introduced a specific framework, the AREA Plus framework, at the end of the third phase of the project to analyse our intervention work. Had we adopted such a formal framework from the outset, it might have helped structure the co-design process more explicitly and further strengthened both the results of the research and the framework itself. Such an approach might have shaped and potentially enhanced the co-design process itself, offering a structured pathway to embed responsible principles more explicitly. However, we sought above all to be migrant-led throughout, and we had not wanted to constrain our collaborative work by insisting on an externally imposed structure. As we continued to reflect on and expanded the framework into our AREAS framework, we suggest its use as a valuable tool for guiding co-creation interventions from the outset so as to create a mutually reinforcing virtuous cycle of co-creation and responsible digital principles.

From a practical standpoint, constraints related to time and available resources during the early phases of the project limited our ability to engage with a broader audience, generate additional outcomes, and expand the reach of the interventions. However, it is worth noting that at least two of the authors have continued to work with stakeholder groups more than a year after the official end of the project. This ongoing engagement enabled by new impact-focused funding streams and personal commitment has allowed for continued relationship-building and additional activities to support the sustainability of the interventions. Such follow-up is rare once a project concludes, and this experience has highlighted the importance of dedicated funding mechanisms that support intervention-oriented research beyond its initial phase. We strongly advocate for structures that allow for sustained evaluation and amplification of research impact, ensuring longer-term benefits for the communities involved.

8.2 Contributions

Our contribution to knowledge lies in the application of the RRI/AREA Plus framework in a different and sensitive context, providing valuable reflections into the dynamics of digital responsibility among vulnerable populations. While the RRI/AREA Plus approach offers one template for the responsible design of digital interventions and a tool for reflection, we also suggest that its application in resource-constrained contexts with vulnerable groups requires researchers to take a sensitive approach that constantly emphasises the potential of any interventions to do more harm than good. In such contexts, researchers may need to be brave and call off digital interventions that may exacerbate or create digital risks and further inequalities. Where there are the conditions to proceed

in responsible ways and implement socially desirable digital interventions, the issue of sustainability becomes paramount, and particularly so in resource-constrained contexts. For this reason, we extended AREA Plus into the AREAS framework with the additional 'sustainability' element that should be dealt with across all stages and dimensions of the framework along with a series of questions to guide reflection and interventions.

Our research emphasises the need to prevent the harm that interventions can cause, even unintentionally, and to protect participants from the risks associated with digital tech use. This concern is particularly acute when engaging with vulnerable groups, who may be more susceptible to risks such as data breaches, cyberbullying, privacy violations, online harassment and hate speech and even human trafficking. Vulnerable populations, including migrants facing documentation challenges in foreign countries as well as their children or family members living in remote areas with limited infrastructure, basic devices and sometimes limited digital literacy, face unique challenges in online environments. Their lack of familiarity with digital platforms can lead to unintentional disclosure of personal information or exposure to harmful content. It is imperative that researchers not only recognise these vulnerabilities but actively work to mitigate associated risks. Emphasising ethical considerations, clear communication regarding participants' roles and rights, protection of personal and sensitive information, identification of potential threats, readiness to adapt chosen methods of working to suit the context, and networking activities to engage with community organisations and relevant stakeholders can all enhance the social desirability and sustainability of interventions. Therefore, from a methodological perspective, we would recommend, when possible, to adopt co-design approaches and encourage flexibility from the very beginning of any intervention to optimise the resources and meet evolving needs. Furthermore, we suggest the introduction of training in the safe, wise and secure use of digital tech as a necessary part of any digital toolkit not only for intervention participants but also for the researchers and practitioners active in this field. To this end, all the cybersecurity materials developed during this research-practice are freely available under a Creative Commons BY-SA licence.[9]

Following the conclusion of our five-year project, we have continued to build on the extensive data collected, the networks established, and the expertise developed during that time. The essential cybersecurity resources for migrants we developed since 2020, in collaboration with partners worldwide and with support from the UK's research councils, with a particular focus on Nepal and South Africa, have recently been reformulated in other countries and languages through additional funding. One of the initiatives to emerge from these efforts has been the collaboration in Brazil which has adapted the original training materials into Brazilian Portuguese, with a focus on providing practical advice tailored to communities living '*nas periferias*'. Additionally, our work in South Africa in January 2024 highlighted an urgent need for small, under-resourced civil society organisations to improve their basic cybersecurity practices, and to support them we have developed a short guide on good practices.

By anticipating, reflecting, engaging, acting and focusing on sustainability (AREAS) in relation to the challenges associated with digital technologies, our ongoing interventions are an attempt to mitigate digital risks, particularly affecting vulnerable groups who could benefit from the ability to leverage the opportunities presented by digital technologies.

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Data Availability Anonymised primary data upon which this paper is based are available on request from the authors.

Declarations

Ethics Approval and Consent to Participate The submitted work builds on our previous Research-in-Progress paper presented at the UKAIS 2024 conference. This paper is an extensively revised and extended manuscript. Study-specific approval by the appropriate ethics committee for research was obtained as well as informed consent by all involved human participants.

Consent for Publication All authors approved the version to be publicised. For the purpose of open access, the author has applied a Creative Commons Attribution (CC BY) licence to any Author Accepted Manuscript version arising from this submission.

Competing Interests The authors declare that they have no financial interests.

[9] https://ict4d.org.uk/sws/

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