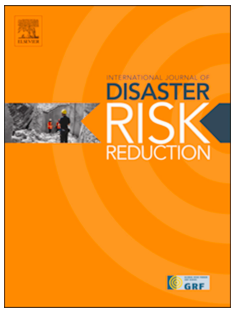

From promise to practice: A cross-institutional analysis of design trends, enablers and challenges in blockchain-enabled cash and voucher delivery

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From Promise to Practice: A cross-institutional analysis of design trends, enablers and challenges in blockchain-enabled cash and voucher delivery

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Abstract

This research paper provides a cross-institutional analysis of design trends, enablers, and challenges in blockchain-enabled cash and voucher delivery in humanitarian programs. The study examines six pilot projects led by three prominent international NGOs across four countries to identify obstacles to innovation, adoption, and scalability that may arise in this context. The research applies human-centered design theory, combined with the multiple case study method, to generate a cross-case synthesis, revealing common threads, specific trends, key reflections, angles of analysis, and design approaches that can facilitate this work in the future. The findings and conclusions from this study aim to be useful and relevant to practitioners, private sector actors, and researchers. The research aims to address existing research gaps and promote a more informed, coordinated, responsible, and rigorous research agenda and community of practice for the use of blockchain applications in the humanitarian sector. Throughout the discussion, this study highlights the frictions related to variables such as context, agency, and participation. A framework for analysis, focused on four key variables: process, people, program and product, is proposed to provide a basis for comparative analysis, and eventually, a series of propositions for interested stakeholders. The study concludes that blockchain technology has the potential to address cost and time inefficiencies in cash and voucher assistance, but success of implementation is highly dependent on design, context, and stakeholder engagement. The paper recommends continued research in this area to further validate findings and expand the use of blockchain technology in humanitarian and development programs. It also emphasizes the significance of integrating these variables into novel approaches to uphold ethical and professional standards in humanitarian work.

Key Words

Blockchain, humanitarian aid, innovation, cash and voucher assistance, human-centered design, web3, emerging technology

Acronyms

CVA: Cash and Voucher Assistance
HCD: Human-Centered Design
INGO: International Non-Governmental Organization
UN: United Nations
DFAT: Australian Department of Foreign Affairs and Trade
MFAT: New Zealand Ministry of Foreign Affairs and Trade
EU H2020: European Union Horizon 2020 fund.
VSLA: Village Savings and Loan Association

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1. Introduction

A growing number of humanitarian and development organizations have begun to explore the use of blockchain technology and digital currencies to facilitate the delivery of cash and voucher assistance (CVA). Evidence continues to mount around the utility of using blockchain platforms to trace, process and generally improve the efficiency of financial transactions [1]. As blockchain technology continues to advance, it is important to recognize the well-established evidence supporting the efficiency and effectiveness of cash and voucher assistance (CVA) compared to in-kind aid, such as food, hygiene kits, or building materials. When implemented in locations where market capacity is sufficient, direct payments to crisis-affected households consistently lead to better outcomes, lower costs, and foster dignity, choice, and support to local markets in humanitarian and development efforts [2].

There are substantial global commitments backing the use of cash and voucher assistance (CVA). These commitments include the 2016 World Humanitarian Summit's Global Grand Bargain commitment, the European Commission's (ECHO) target of 35% for cash-based assistance, and organizational commitments from entities like World Vision and IFRC, aiming to deliver up to 50% of assistance in the form of cash [Ibid]. These initiatives have increased pressure on donors and international agencies to mainstream and scale the use of CVA [Ibid.] Moreover, cash and vouchers have also been shown in many contexts to be a more preferable form of assistance for households, with up to 80% citing a preference for cash, and up to 70% selling in-kind assistance in order to access cash instead [3] (Maghsoudi et. al., 2023) It is generally expected that humanitarian organizations will utilize CVA in a manner that is context-appropriate, cost-efficient, and that provides adequate transparency to ensure that funds can be delivered to a maximum number of target communities, and that the impact of these interventions is measurable.

Nonetheless, even organizations that have prioritized these approaches continue to face a number of delivery challenges linked to the speed and cost of distributing bulk payments, often to remote or high-risk locations and underserved communities. Each of these interventions relies heavily on the financial infrastructure available in the respective locations [ibid.], and the extent to which financial services prioritize access for the target communities in question. Another crucial and recurring concern is the availability of specialized skills and expertise required for delivering cash and voucher assistance (CVA). Depending on the country context, this approach sometimes demands complex financial, accounting, and data management processes, along with technical standards that might not always align with the existing capacities [4]. Consequently, smaller, local organizations may be excluded from implementing CVA due to these challenges. Financial service providers (FSPs) can sometimes be contracted to manage some or all of these complex processes; however, this is entirely dependent on the capacity of the FSP to do so, which is not necessarily the case in locations where financial infrastructure (and hence the capacity to deliver efficiently) is poor or underdeveloped. Similarly, organizational context also plays a role, as humanitarian procurement processes face their own challenges – even for CVA – and can be complex in practice [5-7] (Kian et al., 2022; Wankmuller & Renier, 2021; Moshtari et al., 2021). The combination of international donor pressure, shortages of technical expertise and contextual delivery challenges are logical drivers for agencies to pilot and explore innovative technologies that can offer an improved level of automation, cost-efficiency and transparency in the delivery of CVA.

The following study will explore this problem through a case study of six (6) blockchain-enabled CVA pilots led by three international NGOs across four countries. The aim is to identify barriers to innovation, adoption, and scalability that may arise in this specific context. Additionally, the study will highlight enablers and propose potential approaches that can lead to effective designs for long-term outcomes. The findings and conclusions from this study strive to offer practical insights beneficial to practitioners, private sector actors and researchers. Specifically, practitioners stand to gain valuable insights when considering the feasibility of designing pilot

projects as a means to integrate, institutionalize, and scale the use of blockchain applications for cash and voucher assistance in humanitarian and development programs. For the private sector, this study hopes to provide key insights that are specific to the challenges of introducing decentralized finance products in humanitarian settings. This should also prove useful to inform the design of these products and the ways in which they are piloted in partnership with humanitarian organizations. In so doing, this research aims to bridge existing knowledge gaps and promote a more informed, coordinated, responsible, and rigorous research agenda and community of practice for the use of blockchain applications in the humanitarian sector.

1.1. The Need for an Evidence Base

Blockchain technology has garnered growing attention across various sectors due to its potential to revolutionize traditional processes. In the field of humanitarian assistance, its potential applications are being explored to enhance transparency, efficiency, and accountability. Described as a decentralized and transparent digital ledger system, blockchain facilitates the secure registration and verification of transactions across a network of participants. It comprises interconnected blocks, each containing a set of transactions, linked sequentially to form an immutable chain. This decentralized structure ensures that transactions are verified by consensus among network members, and once recorded, they cannot be altered without consensus agreement, making the system highly secure and resistant to tampering [8] (Gaikwad, 2020). This technology is being adopted by an increasing number of industries to enhance data integrity, traceability, and accountability of transactions and processes.

Despite a growing trend of agencies utilizing blockchain applications for CVA and the apparent utility of this technology in improving delivery of assistance, the real-world evidence supporting the use of this technology as a modality in such programs remains extremely limited [5]. Without sufficient research and evidence available to articulate (and interrogate) results, the majority of practitioners and staff across agencies lack the information necessary to be able to assess the efficiency and value of this technology, and thereby use it in existing CVA interventions where it may be of significant benefit. In fact, there are virtually no cross-comparative studies across multiple countries and organizations using this technology to demonstrate trends or common challenges and outcomes related to CVA programming [9, 10].

These shortcomings amplify the risks of testing blockchain technology without sufficient learning, methodology, and continuity, resulting in a missed opportunity for everyone who may benefit from more efficient CVA delivery: communities, staff, implementing organizations, and donors. At worst, the lack of evidence results in a net effect of reduced efforts and investments in digital finance innovations across all program areas [11], whilst simultaneously increasing ethical concerns about "testing" technology with vulnerable groups [12]. As with any industry, the lack of empirical research results in a failure to demonstrate consistent outcomes, and thus the possibility of, and justifications for replicating them. Similarly, the paucity of evidence has a secondary effect on the development of consistent design methods and processes for implementation, learning and capacity building that are necessary to institutionalize the use of the technology in a manner that is more inclusive, transparent and less costly – but also, more sustainable and consistent. Efforts to-date have arguably resulted in the creation of unique staff skills gained in the process of selecting blockchain applications and putting these to the test in a safe pilot environment. Without a clear research agenda and community of practice, these skills are not adequately made visible or built upon as a means of expanding this area of work, both within and outside the organization.

Here, a first step is taken to close the evidence gap by utilizing documentation and insights from Oxfam, Mercy Corps, and CARE, agencies that have been exploring this innovation through multiple pilot experiences in six (6)

countries with ongoing CVA programs. The research applies human centered design theory, combined with the multiple case study method [13] (Yin, 2012) to generate a cross-case synthesis, revealing common threads, specific trends (both positive and negative), key reflections, angles of analysis, and design approaches that can facilitate this work in the future. As the subject matter remains relatively novel, this research and concluding propositions remain exploratory in nature, and would benefit from continued research in this area to further validate findings.

1.2. Blockchain Applications in Humanitarian Action: A Review of the Literature

A review of the literature on the relevance of blockchain technology to humanitarian action is relatively limited, but has evidently grown as the technology has matured and become more mainstream. As such, information on this topic is far more prevalent in grey literature rather than in peer-reviewed academic journals. Scholars who have explored the linkages between blockchain technologies and humanitarian action have made similar observations on the paucity of data-driven research on the matter, pointing out the need for deeper insights so as to better understand the impacts of this technology on how humanitarian assistance is delivered [14-189 (Monich et al, 2023; Agi et al, 2022; Dubey et al.,2022; Barhamand, H. et.al., 2020 & 2021, Coppi, 2019). Likewise, a number of actors within the humanitarian sector have called for the establishment of clear monitoring and evaluation standards and an accessible repository of evidence, which is necessary to disseminate knowledge and learning across the sector [1] (Zwitter et al, 2018).

Within the available body of research on the utility of blockchain technology in humanitarian action, most studies explore this topic from the angle of institutional relevance, systems and processes, with little research on the use of the technology within the context of humanitarian program implementation specifically. For example, a significant number of studies have focused specifically on the relevance and potential benefits of this technology in enhancing coordination, information alignment, transparency, traceability and process efficiency in humanitarian supply chains [20, 21, 17, 18] (Ozdemir et al, 2020; Rodriguez-Espindola et al, 2020; Barhamand et al, 2021;2022). Studies that move beyond the topic of supply chains have presented findings focused on documenting existing and potential humanitarian “use cases” and assessing (or contesting) the relevance of the technology to the sector at large [22, 19, 1, 23](Zhang & Verity, 2022; Coppi & Fast, 2019 & 2021; Zwitter & Boisse-Despiaux, 2018; Tylin & Duarte, 2019).

Across both topics (sector relevance & supply chains), virtually all have acknowledged a common set of potential benefits and risks specific to the humanitarian context. Transaction transparency, accountability, automation and cost/time efficiencies are commonly highlighted as the most prominent benefits [1] (Zwitter et al., ibid.), while concerns are voiced around risks related to data privacy, interoperability with existing systems, energy consumption, technical capacities and regulatory frameworks [24] (Sahebi, 2020). At this level, existing research often remains theoretical or lacks concrete case studies demonstrating successful integration. Additionally, more research is required to assess the socio-economic implications of blockchain adoption, particularly in terms of its impact on marginalized populations and local economies. Furthermore, the ethical considerations and trade-offs associated with blockchain technology in humanitarian operations require in-depth exploration.

There are several exceptions to this characterization, in the form of more focused research. Barhamand (2021) in particular has touched on design-related aspects, and Hunt et. al., have assessed the operational challenges of applying and implementing the technology at the field level, acknowledging the need for intentional design and proposing a potential framework to guide the implementation of humanitarian blockchain projects, and benchmarking the same against case studies from the field, with expert interviews supporting this analysis [18, 10] . This is also an early mention of a clear linkage between blockchain technology, cash and voucher assistance, and program design. The design focus of Barhamand’s 2021 work also highlights some of the

contradictions that characterize the more business-focused motivations and actions of private sector technology providers, versus the more "people-focused" priorities inherent to the humanitarian principles that organizations must abide by. Others, such as Agi et al.(2022) [15] have identified the most prominent drivers and barriers to adoption at the organizational and user level. Interestingly, the latter finds that, although cost-efficiencies represent the most eminent enabler of organizational adoption, customer (user) interests and "perceived usefulness" has a far more significant overall impact and net effect on participant interest in adopting the technology. Both scholars Barhamand and Maher evnetually conclude that an objective understanding of the potential value of blockchain technology, however optimistic, does not automatically generate adoption; it is still subject to organizational context, location, and the interests of end users.

While this research represents some crucial aspects of practical implementation, it also highlights how shortcomings in pilot design can result in a failure to place the technology as a tool that is placed within the hands of participants, who in turn are actors in the real-time context of program implementation itself. To do so requires an understanding of the human experiences and interactions with the technology at the user level, as well as an interrogation of the suitability and appropriateness of approaches to engage users and adapt the application to the context of the country and culture in which it might be used. Case study findings from Baharmand (2021) and Sahebi (2020) highlight this as a critical gap in both research and implementation of blockchain applications in the humanitarian sphere, calling for "further studies to identify barriers, motives, and drivers that can increase beneficiary participation". On this subject, the scope of available studies and evidence becomes extremely narrow: the closest example of research in this vein is the work done by Cheesman, who adopts an ethnographic approach to understand the perspectives of participants in humanitarian blockchain projects, as those focused on digital identity [25] (Cheesman 2022a) flagging the implications around power and control of institutional priorities over the needs, rights, and self-determination of the individual. Even here, Cheesman points out the marked "lack of critical scholarship on how the promises of blockchain are playing out in practice" [26] (Cheesman, 2022b).

By comparison, literature exploring the complexities, successes and challenges of cash and voucher assistance is far more abundant, comprising a range of systematic reviews [28, 29, 3] (van Daalen et al, 2022; Doocy & Tappis, 2017; ; Maghsoudi et al, 2018), in addition to more in depth, country-specific studies that have been consistently produced over the years [30-32] (Ali & Gelsdorf, 2012; Masterson & Lehmann, 2019; Hızıroğlu et. al., 2022) . In addition, the availability of documentation evidencing lessons learned, recommendations, and the effectiveness of this approach is also available and supported by a community of practice, in the form of the CALP Network (formerly the Cash Learning Partnership), where research efforts and a library of over 2,000 works [33] (CALP, 2023) is hosted and supported by a network of humanitarian agencies and donors.

Studies that tie together the topics of CVA, digital innovation, and the use of blockchain technology and/or distributed ledger technology are difficult to find, having only emerged recently, despite the fact that organizations have been piloting blockchain-enabled CVA as far back as 2016 [34] (WFP, 2016). Digital innovation within the context of CVA programming has been misaligned with the pace of adoption of CVA as a program modality, despite calls for the digitization of financial services and, by consequence, the delivery of humanitarian cash [35, 36] (Amer et. al., 2020; CALP & IARAN, 2019). The diffusion of innovation theory adopted by Monich (2023) [14] and others [15, 37] (Agi et al, 2022; Rush et. al., 2014) describes trial, error, and failure as necessary and indispensable steps in the innovation process, and how these are resisted by the organizational culture of most humanitarian organizations. Specifically, this is characterized by the omission of critical analysis and lessons on failed innovations, resulting in "a selection bias in industry reporting" that "jeopardizes cross-learning and keeps certain challenges hidden and under-analyzed" [14] (Monich, 2023). However, many experts also see opportunities to advance the localization agenda and recognize the importance of private sector participation as an innovation enabler. Monich concludes that the utilization of blockchain and

digital currencies in CVA delivery is not only relevant, but may be an inevitable consequence of the dependency of humanitarian actors on the private sector to deliver. Eventually the analysis concedes that the CVA community "welcomes innovation, but is not necessarily well-equipped to implement it" (ibid).

Evidently, there is a consensus amongst concerned scholars that considerable research gaps on the topic of blockchain in humanitarian action persist. To a certain extent, this is understandable given the nascent nature of the technology and the inevitable lag between the advent of a new technology and its eventual adoption, especially in the case of "industry 4.0" technologies such as blockchain (Saghafian et al, 2021).

Consolidating the literature on the subject illuminates three critical research gaps:

1) A critical analysis of the design and piloting of blockchain applications in practice, at the program level, with a focus on "real world" and field-based aspects of CVA design and implementation;
2) Deeper exploration and insights on how stakeholder and "end user" perspectives, participation and local context might influence drive or inhibit the adoption of blockchain applications in CVA programs;
3) The use of mixed-method research and detailed investigations of pilot projects across a diversity of contexts and stakeholders in order to better understand variations in "downstream" barriers and drivers of adoption.

In order to respond to these research gaps, several key research questions have been formulated to guide the following analysis:

- What common findings emerge across contexts to indicate key signals of success and/or pain points intrinsic to the use of this technology in CVA programs, at the implementation level?

- Do certain methods or approaches enable or inhibit the task of exploring stakeholder perspectives and experiences related to the piloting of blockchain applications in the CVA context?

- To what extent does field implementation demonstrate and/or differentiate between positive and negative outcomes associated with the technology itself, as opposed to the people, place and purpose for which it is used?

- To what extent do variations in country and program contexts affect the successful use of blockchain to enable CVA interventions?

2. Materials, Methods & Analysis

The exploration of this topic employs the multiple case study method, with the intention of generating a cross-case synthesis [9]. This approach helps in identifying some of the repetitive and/or converging patterns [Ibid] across the pilots conducted by three organizations. Following Yin's (2012) methodological guidance [1], Human Centered Design (HCD) is selected as the theoretical foundation, thus providing an analytical lens to draw out key findings and guide the following discussion. Case study analysis is guided in particular by HCD theories that explore intrinsic motivation [40](Krippendorf, 2004); contradictions in technological versus human design perspectives[41] (Giacomin, 2014); and the use of frame creation in design thinking (Dorst,2015). The latter is used as the basis to propose an analytical framework, the "4Ps" (people, process, program and product), as a means of teasing out specific design variables for comparative analysis across each pilot, where the pilot is the primary unit of analysis. It is important to note that due to the novelty of the subject matter, this work takes on

an exploratory lens which may not take into account emergent information generated as the pace of technological development accelerates.

In order to achieve this, four categories of data are utilized to build an evidence base for the arguments explored in this paper:

1) *Semi-structured interviews*, used as primary data, were conducted with individuals at each organization to understand the perspectives, motivations and reflections of participants in each pilot implementation.
2) *Secondary data,* captured in the form of six (6) selected case study reports of pilots using blockchain platforms to deliver CVA, provided by three international non-governmental organizations (INGOs): Oxfam International, CARE, and Mercy Corps. Two pilot case study reports were selected from each organization. Additional pilots were classified as outliers by design, or with data unverified and/or insufficient in comparison to the others selected. [43-58]
3) *A literature review* of relevant evaluation, standards, trends and methods specific to humanitarian cash and voucher assistance and uses of blockchain in the humanitarian sector were examined in order to situate the purpose of these pilots within a broader programmatic and sectoral context.

In addition to the above, it should be noted that the author has gleaned some insights, based on direct participation (in a professional capacity) in pilots conducted in Vanuatu (Oxfam, January 2018- June 2021) [46-49], and Ecuador (CARE, July 2021- March 2022) [50,51]. Although this admittedly does not fit the formal definition of participant observation, these experiences inevitably color some of the analysis and findings presented herein.

In the interest of brevity, it is important to point out that this study does not cover some additional topics, despite their relevance. Specifically: this does not include any in-depth description or analysis of blockchain technology (including its infrastructure and applications); the historical and cultural context of the countries where each pilot occurred; and any organization-specific strategies, priorities and goals existing at a level higher than the pilot context itself. As much of this information exists in public fora, it is expected that the reader may explore these topics independently as they see fit.

2.1. Primary Data Collection: Semi-structured Interviews

Interviews were conducted over the course of several months with individuals who were involved in the pilots examined in this research. Two individuals per organization were selected for semi-structured, open-ended interviews, with the agreement that interview responses may be cited but that direct quotations would remain anonymous. Selection of respondents was self-evident; due to high rates of turnover within each organization; respondents were therefore the only remaining staff with direct pilot experience. There is a noted limitation, however, in the case of the pilot occurring in Vanuatu – staff in-country did not respond to requests for interview. However, this pilot and ensuing scale-up has been extremely well-documented by the organization, including the availability of participant testimonials, qualitative and quantitative evaluations, monitoring data and several videos documenting the experience, available on YouTube. Any remaining information gaps have been filled by the Author, who was present in country and involved over the course of all design and implementation phases (in Vanuatu). This positional reflexivity, specific to the analysis of the Vanuatu case studies, has been carefully considered in the course of the research process so as to mitigate the possibility of bias. Nonetheless, the interpretation of this data is inevitably subject the Author's own ontological assumptions and perspective as a humanitarian practitioner.

The process of anonymizing interview data has been completed according to EU Guidelines (see: https://ec.europa.eu/justice/article-29/documentation/opinion-recommendation/files/2014/wp216_en.pdf) in order to ensure compliance with General Data Protection (GDPR) regulations. Each key informant interview is therefore presented as a pseudonymous code composed of the first letter of the organization, followed by the order in which the individual was interviewed. A "role type" was assigned to each respondent to specify whether each individual worked at the global level (such as a Director or Advisor) or at the country level (as an implementer). Specific professional titles for each individual are deliberately not cited so as to avoid any risk of identifiability. In order to further prevent potential identifiability of direct quotations, the table presented in the *Framework Analysis* section of this paper presents direct quotations in a generalized manner, without association to each respective individual or organization.

Table 1: Interview Summary

Summary: Semi-Structured Interviews					
Organization	**Pseudonym**	**Role Type**	**Date (DD/MM/YY)**	**Duration**	**Pilot Country**
Oxfam International	OX 1	Global	1/20/23	47 min	Vanuatu, Zimbabwe
	OX 2	Country	1/6/23	65 min	Zimbabwe
CARE International	CA 1	Global	5/1/23	55 min	Ecuador, Kenya
	CA 2	Country	5/1/23	56 min	Kenya
Mercy Corps	MC 1	Country	8/12/22	75 min	Uganda
	MC 2	Country	7/12/22	60 min	Uganda

Each interview was structured according to Yin's (2012) [13] guidelines and methods for open-ended interviews. Although each interview was relatively open-ended to allow respondents space to reflect and expand on their reflections, interviews have been qualified as "semi-structured" because in each case the discussion was intentionally structured according to four specific topic areas: people, process, program, and product. For each topic, the respondent was asked to reflect on the implementation of each pilot, for example: "*Describe the people involved and/or excluded during pilot implementation".* In some cases, follow-up questions were asked to fill gaps in information that could not be gleaned from the pilot case study report provided by each organization, for example: *"This pilot mentions that X number of vendors were involved in this pilot, can you tell me a bit more about who these people are and elaborate on their roles?".* Discussions were thus structured in order to provide adequate and consistent data to support the framework analysis method used for this study, whilst also ensuring space for open-ended discussion (including on topics that respondents felt were important to mention or explore).

2.2. Secondary Data: Pilots as a Unit of Analysis

At the core of this research are the pilot projects in which blockchain applications were used for the purpose of determining the value of this tool in improving the efficiency of delivery of assistance. The primary units of analysis in this study are therefore the pilots themselves, with a focus on their actions and feedback [42-58]. A summary case study of each pilot describing location, timeframe, design and key results is the basis for this analysis, and is further complemented by semi-structured interviews with professionals from each organization involved in pilot implementation. Despite this concentration, there is also a wide range of characteristics to consider that add complexity to the analysis. This includes the cultural contexts of the multiple countries where the pilots examined were conducted (6 countries included in this analysis); the three organizations responsible for implementation - each with their unique organizational culture and procedures; the three different

blockchains used as the underlying technological infrastructure in each pilot; and the four blockchain applications tested across all pilots [Table 2].

As per the table below, the pilots selected for the analysis conducted herein are not the only examples from each organization seeking to explore the uses of blockchain technology; case study reports from these pilots were reviewed for context, but were ultimately excluded from the study for several reasons: due to an incomplete implementation (Mercy Corps, Colombia; Oxfam, Venezuela); were ongoing at the time of writing (Oxfam, Solomon Islands); or because the pilot was not situated within the context of a CVA program (Mercy Corps, Kenya).

Table 2: Summary of Blockchain Pilots

Case Study Summary							
Org	Location	Blockchain Infrastructure	Blockchain Application	Donor	Pilot Participants	Included / Outlier	If excluded, why
CARE	Ecuador	Celo	Umoja	Celo Foundation	250 women 10 vendors	Included	n/a
	Kenya	Binance	Trust Wallet	Binance Charities	50 VSLAs* 10 Vendors 1,217 individuals	Included	n/a
Oxfam	Vanuatu	Ethereum	Sempo	DFAT, MFAT	4,493 households 358 vendors	Included	n/a
	Zimbabwe	Ethereum	Sempo	European Union (EU)	457 households 17 vendors	Included	n/a
	Venezuela	Ethereum	Sempo	European Union (EU)	100 households ~15 vendors	Excluded	Interrupted before completion
	Solomon Islands	Ethereum	Sempo	European Union (EU), DFAT	124 households 6 Vendors	Excluded	Ongoing validation of results
Mercy Corps	Uganda	Binance	Trust Wallet	Binance Charities	5 Vendors 366 Households	Included	n/a
	Uganda	Ethereum	Basic Needs Wallet (Sempo)	Internal	7 Vendors 250 Households	Included	n/a
	Kenya	Celo	Valora, KotaniPay	Celo Foundation	200 Young Adults	Excluded	Microwork: varies from CVA program models
	Colombia	Reserve	Valiu	Internal	111 households	Excluded	Interrupted before completion
	*VLSA: Village Savings and Loan Associations. All 1,217 individual participants were members of one of these groups.						

The ensuing analysis adopts two methods, both of which draw heavily from HCD theory, concepts and methods, to identify which key challenges and shortcomings emerge repeatedly. The first method employs an adapted version of Dorst's (2015) "frame creation" [42] for problem analysis in order to develop four standard indicators. These indicators are then used in a graphical comparison of pilots to plot and comparatively assess indicator

variance across pilot contexts. The second method is a thematic analysis, intended to capture more qualitative findings and deeper insights. This multi-angle analysis acknowledges that "success" and "failure" are often oversimplifications; negative outcomes in specific pilot components do not necessarily equate to total failure, and vice versa. The cyclical and iterative approaches seen in human-centered design and design innovation practice effectively address this level of complexity.

2.3 Frame Creation as Analysis: Product, Process, People and Program

A human centered design lens is used to inform the thematic analysis of the blockchain pilots implemented across each organization. However, drawing conclusions and useful findings across these pilots requires a method to account for the multiple variables at play: contextual variables (country, culture, program, organization), nominal variables (blockchain infrastructure, product/application, user interface), discrete variables (number of stakeholders, pilot participants and locations) and continuous variables (timeframe, capacity/knowledge, satisfaction). In addition to this, there are clearly dimensions of intrinsic motivation and extrinsic motivation unique to each pilot, such as pilot funding from a blockchain charity (extrinsic motivation) and levels of trust among pilot participants (intrinsic motivation). Finding a clear way to cross-analyze the six pilots, so as to achieve a cross-case synthesis therefore requires an approach that can break down and organize this information according to a set of patterns or characteristics that are common across all pilots. To achieve this, a frame creation methodology is used to develop a framework for analysis, presented in Section 5.1.

Dorst (2015), proposes “frame creation” as human centered design method to address problems of this nature; the method is articulated as a 9-step, structured design analysis process [Figure 1] suitable to address the multifaceted nature of today’s “open, complex, dynamic, and networked” design challenges [42, 59,60]. This study adopts the first seven steps of this approach here to assist in breaking down the multi-contextual and multi-dimensional nature of the pilots examined. The last three steps (*futures, transformation, integration*) have informed the conclusions of this paper, but can only implemented fully through future research efforts. Dorst presents this method as a means of collective problem-solving that caters to the needs of multiple “networked stakeholders spread throughout society and beyond a single organization” [42] (Dorst 2015, p. 9). This is precisely the nature of the actors in the pilots we treat as units of analysis – the technology being piloted perhaps even more so, considering the decentralized and distributed architecture of blockchain infrastructure.

Figure 1: Dorst's Frame Creation Design Process [42]

However, it should be noted that the analytical approach here does not represent all steps of frame creation. The first three steps in frame creation are covered in sections 1-2 of this paper : *archaeology* as INGO; *paradox* as the

pressure to innovate in a sector that struggles with it; *context* as CVA programming in the humanitarian sector. This and the following sections apply Dorst's subsequent steps: *field* (pilot description); *theme* (thematic analysis); *frame* (indicators and graphical analysis). The conclusions in this paper provide a very loose consideration of the final three frames: *futures; transformation;* and *integration.* This light touch is justified considering the use of blockchain for CVA programming beyond the pilot stage has yet to be achieved by many organizations, and certainly hasn't reached the point where the application of the technology is either transformative or integrated into organizational structure, capacities and CVA practice. However, this provides some insight on the directions of future research and areas of focus for interested stakeholders.

To create a minimum of standardization, each pilot was examined through four (4) contextual frames corresponding to the sixth step of frame creation in order to guide analysis (also referred to in this paper as the '4Ps'). These serve a dual purpose: first, each frame represents a common factor existing across all pilots, regardless of contextual considerations; second, each pilot exhibits distinct differences within the context of each frame, making it possible to examine pilots relative to one another within a single frame. Using this framing method, we identify the repeating patterns across all pilots, and then examine positive and negative aspects from each frame. By broadening the context of analysis in this manner, we are also able to re-frame the original focus on function, and begin to understand some of the deeper issues, needs, aspirations or decisions [62] (NADI Framework, van der Bijl-Brouwer & Dorst, 2017) that may need to be addressed in order to expand, sustain, and scale this particular innovation into the future, and in the meaningful and impactful way intended by humanitarian action [32].

These four frames are:

1. **Product:** the blockchain applications selected for use and their core features, any particular justifications or factors involved in selection, functionality and usability as reported by different participants, and any associated product development processes;
2. **Process:** actions taken to plan, design, implement, and learn from the pilot, as well as duration and decision making
3. **People:** the nature and character of participants in the process, internal (staff) and external (service providers, community members and recipients), as well as the level of inclusion, choice, and agency of participants
4. **Program:** the programmatic context, objectives, design, modality, desired impact and the extent to which these are aligned with the use of the selected blockchain application.

In the ensuing thematic analysis, the '4Ps' are used to categorize various quotations from interview respondents, so as to color the analysis with participant insights. As such, these quotations are intended to give voice to participants, and provide additional perspective for the reader and are therefore subjective. However, it is important to note that these quotations were recorded during the discussion of each "P", or topical area with the respondent in question, and have been classified accordingly. In the graphical analysis, for each theme, two indicators associated with clear positive/negative trends have been selected. Results are then represented in the form of X/Y quadrant matrices, as a means of positioning each pilot relative to one another, and to identify where convergence between both indicators occurs. A focus on these four factors also allows for a visual cross-comparison, where we can begin to see the variations across pilots within each frame. It should be noted that this analysis is not mathematical or statistical, but is thematic and qualitative in nature. Table 2 provides a definition of indicators per frame of analysis.

Table 2: Indicator Descriptions - 4 frames of analysis

Indicator Descriptions: 4 Frames of Analysis			
	Indicator name	Positive (+)	Negative (-)
Product	*Usability (x)*	Easy to use by participants (intuitive)	Difficult to use by participants (not intuitive)
	Influence (on product development) (y)	Intrinsic influence (driven by pilot context and participants)	Extrinsic influence (driven by external actors not present in pilot context)
Process	*Participation (x)*	Inclusive (pilot participants play a role in determining process)	Exclusive (particiants do not play a role in determining process)
	Implementation (y)	Easy (no issues)	Difficult (many challenges & obstacles)
People	*Choice (x)*	High (level of input to pilot actions, product)	Low (no input to pilot action)
	Satisfaction (y)	High (very satisfied)	Low (not satisfied)
Program	*Alignment (x)*	Aligned (with existing program)	Not aligned (with existing program)
	Community engagement (y)	High (many, diverse community members engaged/consulted)	Low (few or no community members engaged/consulted)

For each pilot, we assign scores per indicator on a scale of 0 (low/negative) to 5 (high/positive) in order to plot the location of all pilots, relative to one another, within the context of each frame, and by comparing results across both indicators (one as x value / the other as y value) that correspond to that frame. Higher scores indicate a correspondence with human-centered design and humanitarian principles and presumably fewer implementation challenges; lower scores are indicative of areas that may have been particularly problematic in each pilot. A breakdown of the scoring matrix can be found in **Annex 1**; each score has been developed based primarily on qualitative feedback from individual interviews, and triangulated with secondary data from pilot case study reports containing monitoring data (when available).

3. Human(itarian) – Centered Design & Innovation

A key priority of this research is to present a more nuanced view of the positive and negative aspects of the pilots, through the lens of human centered design. This analysis utilizes Krippendorf's definitions of intrinsic vs. extrinsic influences [40] to highlight issues around inclusion (participation) vs. exclusion (non-participation) of participants in each pilot/case study. By doing so, the case study analysis demonstrates the importance of shifting focus from functional and organizational considerations to empathetic factors central to HCD (previously known as "empathic design"). These more human-centered considerations include agency, choice, and satisfaction of both organizations and pilot participants. Understanding these factors is essential to "step into the user's world" [30] (Mattelmaki et. al., 2014), which is important given the dearth of literature on participant experience in humanitarian blockchain projects [9, 10, 17, 18].

For the purpose of this analysis, human-centered design is defined as "a problem-solving technique that puts real people at the center of the development process" [39] (Landry, 2020). Giacomin [41](2014) describes how HCD can be distinguished from traditional design practices.

> *Human centered design is thus distinct from many traditional design practices because the natural focus of the questions, insights, and activities lies with the people for whom the product, system or service is intended, rather than in the designer's personal creative process or within the material and technological substrates of the artifact."* (Giacomin 2014, p.3) [14].

Giacomin effectively suggests that process and function are not the only drivers of success; rather, success might be better defined by the individuals who are engaging with a specific project or product. This design analysis permits a definition of commonalities across a variety of contexts that may shed light on what "key ingredients" could be needed to drive this innovation in a way that nurtures learning, skills development, and the meaningful engagement of communities at the last mile.

This approach also resonates with Baharmand's (2021) [18] proposal for designing humanitarian blockchain projects where two critical aspects must be considered: first, "the importance of humanitarian principles, namely humanity, neutrality, impartiality, and independence" and second, "the importance of considering beneficiaries' dignity". Grey literature specific to the humanitarian sector also promotes the utilization of human centered design approaches. A case in point is the "humanitarian parameters box" proposed in ELHRA's Humanitarian Innovation Guide [64] (ELHRA, 2023), as well as the guidebook offered by START Network's regarding "Human Centered Design and Humanitarian Innovation" [65] (START Network & CDAC, 2019). For CVA practitioners, the CALP Network's review of CVA in Humanitarian Response Plans (HRPs) identifies two core characteristics of a "quality response", one of which is being "people-centered and mindful of the all the experiences people will go through as they receive support" [66](CALP Network Blog, 2021).

The tenets of HCD align well with the principles and priorities inherent to humanitarian assistance. When HCD approaches are applied inconsistently or inadequately, challenges inevitably arise that undermine individual interest, and thus organizational adoption. These oversights result in a move away from the mutual, people-centered focus of both HCD and humanitarian work, and a thus, a disproportionate focus on extrinsic, rather than intrinsic motivators.

Krippendorf (2004) [40] provides apt definitions of intrinsic versus extrinsic motivations: extrinsic motivation "justifies one's doing as a means to reach ends, achieve goals, or obtain results"; for example, in assessing efficiency or performance, where an action is defined as failed or successful according to externally defined performance criteria. When this occurs, the individual person and his/her empathic needs and priorities are deprioritized in comparison to external or higher goals, or what an external actor deems to be most important. Intrinsic motivation, on the other hand, "justifies one's process of engagement on its own terms" and "concerns feelings that are experienced *while* doing something". In other words, intrinsic motivation is much more personal and complex, and therefore more difficult to measure. However, it is also more meaningful for the individual: some examples of intrinsic motivation may include an individual's sense of trust, satisfaction, self-worth, their culture, personal relationships, opinions, and interests.

Put differently, "humans do not respond to the physical qualities of things, but what they mean to them" (ibid.). For humanitarian organizations seeking to integrate blockchain applications into programs, an approach that situates the technology within the broader context of human experience is essential. The standpoint in this research emphasizes the significance of human-centered design is principles and practice. These principles not

only drive successful innovation but also foster inclusive and context-appropriate program implementation, and the development of user-centric products , all of which align with humanitarian priorities.

Considering the key role that HCD methods play in successfully creating, iterating, and adopting innovative approaches by both individuals and organizations, and given that these methods align closely with the priorities of INGOs and other humanitarian agencies, it could be reasonable to infer that the humanitarian sector provides a fertile ground for innovation. However, the reality is quite the opposite: innovation has consistently faced challenges in the humanitarian space [14, 68, 69]. This phenomenon was well articulated in a 2018 report by the Humanitarian Innovation Fund, entitled "Too tough to scale: Challenges to scaling innovations in the humanitarian sector." [39]. Starr & Miers (2022) comment on the difficulties in scaling innovations and attribute this to inherent structural flaws specific to the sector, such as time-limited, project-based funding and the skewed influence of “big aid” donor ideas and priorities [68]. Taken together, these studies suggest that the main constraints to innovation in the sector are in majority extrinsic (project structure, funding), and function-specific (bureaucracy and systems), and that a preoccupation with these competing priorities detracts from a focus on intrinsic motivators (organizational values, buy-in, staff capacity building & autonomy, community participation).

Critical analysis of the case studies at hand is useful in illustrating some thematic trends that emerge from these processes of piloting blockchain applications as a CVA modality, and where human centered design approaches are adopted or neglected. These trends are proposed as follows:

A. ***HCD and inclusive humanitarian approaches share the same principles:*** When these are not applied (intentionally or unintentionally), challenges arise more frequently and are significant, and are often related to human-design interactions, rather than object-specific or functional factors.

B. ***Success requires more than function:*** Function is defined by extrinsic motivators, metrics and pre-conceived technical outcomes, within a fixed and non-continuous time frame. However, if success is solely defined in this way, it diverts focus from vital design aspects essential for long-term success: namely, intrinsic motivations like local participation, inclusion, and capacity development [40].

Following these trends in a multiple case study analysis of pilots implemented in a diversity of contexts is central to the identification of successful uses of HCD and other people-centered practices that can be replicated in future pilots and scalable initiatives seeking to employ the use of blockchain applications to enhance CVA delivery. Highlighting how these play out in “real-world” implementation hopefully lends more dimension in interpreting results in a manner that expands beyond the short-term vision of function, into the longer-term vision needed to achieve institutional adaptation, adoption and scale. Adoption requires an approach that will encourage sustained use of the technology in the manner required to build familiarity, knowledge, skills, and the adaptation of institutional processes that are required to fully integrate blockchain-based applications with CVA programs.

The following analysis of blockchain pilots therefore questions whether the absence of a consistent, value-aligned design method (HCD) in this case might inhibit rather than enable efforts to adopt the use of innovative and emerging technologies generally, and the use of blockchain application in CVA, in particular. Identifying inhibitors might explain the trend of humanitarian organizations implementing repetitive, (often) disconnected actions (pilots) that yield the same, function-focused results (speed, cost-efficiency) without progressing beyond the proof-of-concept stage, thus resulting in a “stagnation of innovation”[14] (Monich, 2023). The interrupted nature of these actions prevents humanitarian organizations from progressing through the iterative processes needed to build meaningful purpose, motivation, interaction and ownership, all of which are essential

components of organizational adoption [15] (Agi et al, 2021). This phenomenon would seem counterproductive when the stated intention of each organization is to integrate the use of successfully tested blockchain applications into the variety of modalities used for CVA delivery, and therefore into full-scale programs that achieve a maximum of impact.

4. Case Study Insights: Blockchain-for-CVA Pilots

The following is a summary of the selected country pilots included in this case study, highlighting stand-out successes and challenges. In order to provide context, a brief description of the organizational environment and scope of these pilots is also covered. This information has been drawn from archival material, including case studies and evaluations conducted by each organization. Nonetheless, this data is admittedly limited in several ways. First, the quality of archival material produced by the implementing organizations may contain some inherent bias and/or omissions. Second, these cases represent only 6 out of the 10 possible pilots introduced in Section 2.2; the 4 remaining pilots have been omitted for a variety of reasons, each of which would have likely impacted the quality of data gleaned from each. This includes incompletion (pilot suspended), implementation in progress (no data available at the time of this study), and classification (not occurring within a CVA or other humanitarian program). Third, there is also a high level of variability in methodology, that is to say, how each pilot was assessed and documented by the organization. In some cases, pilots were followed with an in-depth evaluation including qualitative and quantitative data; in others, the pilot reports are purely qualitative and include limited or no quantitative data.

4.1 Oxfam International: The Unblocked Cash Project in Zimbabwe and Vanuatu
Blockchain infrastructure & application: Ethereum Blockchain, Sempo

Oxfam's "Unblocked Cash Project" began with a 2019 pilot in Vanuatu to verify improvements in speed, cost reduction, and transparency by utilizing blockchain technology[16]. It has since been implemented on a larger scale in a humanitarian operation in Vanuatu and replicated in 5 pilots across 3 regions. The platform used is Sempo, which consists of blockchain-enabled digital vouchers for households, smartphones used as POS devices for vendors, and a dashboard for transaction analytics which includes tracking of disbursement, and account management for staff. The same application was used in all pilots, including those not covered here [43-48].

Oxfam Case Study A: Zimbabwe (Unblocked Cash)
Blockchain infrastructure & application: Ethereum & Sempo

In Zimbabwe, a 2-month pilot involving 457 recipients (households) and a variety of 14 vendors was implemented with a local NGO partner, as well as a local remittance company for payments to vendors. The location selected for the pilot was in a relatively rural area, and participants were selected as those most vulnerable to food insecurity, and thus requiring support in purchasing power to meet basic household needs. Of special note is the fact that e-vouchers had already been used in Zimbabwe using SCOPE, a proprietary e-voucher system developed by UN WFP, so assumptions around the benefits of a digital, cashless modality were already confirmed [44, OX2]. However, high rates of currency hyperinflation in Zimbabwe posed significant challenges for conventional digital voucher implementation.

This UBC pilot sought to go a step further via the intentional use of a USD stable coin (digital currency) to test whether this was an aspect of the technology that could improve program impact in a hyperinflationary environment. In addition, the use of the Sempo platform was intended to improve efficiency, monitoring, and

ease of use for staff, participating vendors and households. An extensive stakeholder decision-making process was highlighted as being critical to success by generating community buy-in and trust: *"We did a whole market assessment to understand the context…hearing from vendors really helped with the identification of cash out mechanisms"* (OX 2). However, some challenges included difficulties in user support and troubleshooting for the platform due to the distance from and capacities of the service provider, concerns around the security and verification of card owners, and friction between Oxfam's "legacy" back-office procedures and the digital system [ibid., 43].

Oxfam Case Study B: Vanuatu (Unblocked Cash)
Blockchain infrastructure & application: Ethereum & Sempo

Oxfam's Unblocked Cash Project in Vanuatu is relatively unique compared to others in this study, in the respect that the project has moved to a post-pilot phase, but is not yet formally adopted as a standard method for CVA delivery. The same platform was scaled up for use to face the concurrent impacts of a Category 5 cyclone, COVID-19, and a volcanic eruption. This intervention involved 4,493 households and 358 vendors across 3 provinces, with the support of additional "users" represented by over a dozen partners operating across affected areas. The Sempo solution was selected due to the high cost and poor coverage of financial services, and the value of a card-based system in providing rapid and secure scalability across a geographically complex and dispersed area (13 islands covered) [46, 47].

Time and cost efficiencies that might have been offered by the use of the blockchain application were counteracted by Oxfam's role in coordinating, training, and providing technical and financial support to partners. On the other hand, this was one of the most appreciated aspects of the program expressed by the network of 25 partners who supported the project's scale-up[47]: " *Partners were already there to help scale and really appreciated how capacity & skills were being shared*" (OX1). On the technical side, activities were occasionally interrupted by system outages and errors as the load capacity of the platform was stress-tested; Oxfam also created and staffed a call center for user support and complaints, as the scale of the response exceeded the support capacities of the service provider. Additional reporting and compliance requirements were also imposed by Vanuatu's regulators, leading to a more time- and cost-intensive reporting process. [47]

Common Trends
Commonalities across both contexts included a sense of security by recipients (the card is safer than cash); ease of use reported by vendors; appreciation by Oxfam staff of the monitoring and financial transparency of the dashboard, and extensive community and partner consultation in the design and implementation phases. Similar challenges were experienced providing user troubleshooting quickly and consistently (and the corresponding burden on field teams to do so); trouble checking card balances, and observations that vendor business skills and training is needed as a complementary activity to improve outcomes. In both cases there was limited involvement of local technology providers and Oxfam teams at the global level.

4.2 CARE: Support to Village Savings & Loan Associations in Kenya & improving women's health access in Ecuador

Beginning in 2021, CARE began implementing a series of pilots designed to test the suitability of using blockchain applications in different country and program environments. Both of the pilots studied are part of a larger innovation agenda to "identify low-risk opportunities to test and learn about cryptocurrencies and blockchain, prior to developing a more detailed organizational position and strategy", as stated by interview

respondent CA1. Both pilots were funded by charitable organizations affiliated with the blockchains upon which the applications tested were built. [50,51]

CARE Case Study A: Kenya
Blockchain infrastructure & application: Binance blockchain & Binance Trust Wallet

In 2021, a pilot was conducted in Kenya, in partnership with and funded by Binance Charities, the non-profit arm of the Binance blockchain. As part of the agreement with the donor, the Binance Trust Wallet was required, rather than selected, as the application used. Implementation occurred over a 9-month period, disbursing US$ 114,000 to 50 selected Village Savings and Loan Associations (VSLAs) (consisting of 1,217 members) within CARE's existing VSLA network, as well as local traders of good standing as locations for spending vouchers. In this design, digital transfers were issued to the group rather than to individuals. The majority of groups chose to invest funds from the vouchers into collective businesses, following a process of group consultation and discussion. VSLA members had full control and led this aspect of the decision-making process. VSLAs then selected and partnered with local vendors as service/supply providers for the selected business activity.

Drivers of success included the selection and participation of VSLA groups and vendors with a relatively high level of digital literacy; autonomy and collective participation in decision-making, community-based resource persons for technical support, and an appreciation for the safety of the vouchers (versus cash), as well as the immediacy and transparency of funds transfer from one wallet to another [51] (CARE 2021). Respondent CA2 also described this dynamic:

> *"It was easier because we already had the (VSLA) groups in place, the women knew each other, and were ready to work together...even those who had phones were supported by others who had (smartphones) and knew how to use them."* (interview, CA2)

The use of a USD-equivalent stable coin was also a highly positive point, shielding vendors and VSLAs alike from currency fluctuations. Skepticism, unfamiliarity, and the perception of risks associated with the use of cryptocurrency by vendors created a significant challenge for the CARE teams, resulting in vendor dropouts; related to this was limited time allocated to address and mitigate concerns and address questions or issues. From a usability perspective, it was clear throughout the pilot that the Trust Wallet's user interface was not very well suited to the profile of participants, and was not considered user friendly by everyone, although all participants noted an appreciation for the speed and ease of transactions. For example, the application was not available in Kiswahili, only in English [ibid.]. According to CARE, this observation was a standout lesson that is now informing organizational policy: "*for crypto to be used, the user experience needs to be easier and more simple for participants*"(CA1).

CARE Case Study B: Ecuador
Blockchain infrastructure & application: Celo blockchain, Umoja

CARE's pilot in Ecuador began in late 2021, with the purpose of confirming whether the use of "crypto vouchers" could add value by replacing a paper voucher system. Over the course of 3 months, 250 women received vouchers of US$100-US$150 to spend at 10 local health providers consisting of a mix of clinics and pharmacies. CARE staff unanimously agreed that the use of digital vouchers in the pilot showed significant improvements in time-efficiency: "*it saved the finance team a lot of time, they appreciated seeing the data on the dashboard*" (CA1). Vendors were paid weekly, compared to a payment cycle of 3-6 weeks previously. Recipients expressed a sense of appreciation for, and security in, the card-based spending system: "*For users, it really was no different*

than using a debit card". CARE staff also considered this "an inclusive means of payment", as many participants did not have smartphones [50]. Real-time transaction monitoring was a "huge advantage", resulting in more responsive project management and support to participants, as well as supporting accurate and less costly monitoring and evaluation [Ibid].

Wariness and reservations associated with the use of digital currency were expressed by all stakeholders, resulting in 2 vendors dropping out of the program. Challenges in setup and configuration occurred due to language, location, and translation gaps with the U.S.- based service provider. Some product-specific issues also arose: some cards malfunctioned, payment at the counter took longer than using cash, and there was some confusion around application features. Recipients reported that vendors could charge them more than other customers; they had no independent way of checking the balance on their card to interrogate how much they were charged. Redundancies and misalignment also emerged between new (digital) and existing (paper-based) administration and finance procedures. [51]

Common Trends

In both pilots, negative and/or misplaced perceptions around the use of blockchain and digital/cryptocurrencies were expressed by participants, leading to a certain level of participant attrition. The actions needed to mitigate concerns led to extended or rushed pilot inception and design periods. The role of CARE staff was key in leveraging existing relationships with participants and surrounding communities, and building trust through in-person support and communication. Across participants in Ecuador and Kenya, a feeling of enhanced autonomy and safety in the use of digital cash, rather than cash in hand, was also highlighted.

4.3 Mercy Corps: Basic Needs Wallet and Binance Trust Wallet in Uganda

The two pilots selected form part of a much larger portfolio of blockchain projects within Mercy Corps; the organization has been engaging with this technology beginning earlier, and for a longer period than the other organizations in this study. These efforts are often supported by Mercy Corps Ventures, serving to identify suitable service providers, funding, and partnerships with the tech sector. The pilots in Uganda described below are complemented by similar pilot projects in countries such as Kenya and Colombia, as well as a "Crypto for Good Fund" launched in 2022 to further encourage partnerships and innovation in the sector. [52-57]

Mercy Corps Case Study A: West Nile, Uganda
Blockchain infrastructure & application: Binance blockchain, Binance Trust Wallet

366 households (consisting of 2,200 Sudanese refugees) and 5 Ugandan micro-entrepreneur households were selected to participate in this pilot. The assumptions driving the pilot were that the use of the Trust Wallet application would reduce costs and improve auditing and compliance difficulties. Participants had the option to purchase goods in-store and to cash out a portion of funds provided to each household via monthly transfers for a period of 4 months. For reimbursement of goods and services, vendors were assisted in creating accounts on the Binance Exchange and cashing them out via a local mobile money provider. This pilot was a standalone project, and was not integrated into any existing programs.

A secondary criterion for participant selection was access to a smartphone to receive funds, a requirement that also applied to vendors. This admittedly resulted in some "selection bias" (MC2) and other adjacent issues linked to digital inclusion and access. Training sessions were used to address suspicions and distrust around the use of cryptocurrency, where there was some initial pushback from participants and the public. The Trust Wallet

proved to be incompatible with older and lower-capacity smartphones, a characteristic that disproportionately affected recipient households in terms of who participated in the pilot. As one respondent described:

> *"The donor chose the application we used…but without knowing the specs (sic) of smartphones needed to actually use the application. We found out that it didn't work on some cheaper smartphones, so that created a selection bias. That meant that we were not targeting the most vulnerable."* (interview, MC2)

The smartphone requirement created other issues, such as accidental application deletion and loss of pin/passwords by users unfamiliar with smartphone devices. A key observation by staff was the need for more local team and participant involvement in decision-making so as to improve the process and play a more direct role in product selection to ensure a better alignment to context. In the office, finance teams in particular were impressed with the detail of transaction data available in real time, and the ways in which this reduced paperwork and the complexity of financial reconciliation. [55]

Mercy Corps Pilot B: Kampala, Uganda
Blockchain infrastructure & application: Ethereum, Basic Needs Wallet (Sempo)

From March to July 2022, 250 refugee and host family households were selected to participate in a pilot, receiving two rounds of monthly transfers to address gaps in assistance for refugees and host families. Recipients were provided with an e-voucher (digital voucher) card. Funded by internal resources, the objective was to demonstrate how the use of e-vouchers and digital wallets might provide "the most promise" of providing ease of funds disbursement and access, transparency and traceability [54]. The Basic Needs Wallet (BNW), a generic version of the Sempo platform (see 4.1) was selected for use.

Seven (7) vendors participated in the pilot, located in close proximity to participating households. All vendors and participating households were provided with training on how to use the system. However, staff noted the prevalence of negative perceptions and distrust in the use of digital and cryptocurrencies: "*The (community) skepticism and suspicion around cryptocurrencies was really negative…it made us a bit uncomfortable to deal with that*" (interview, MC2). In addition, the team was under significant implementation pressure given the limited timeframe of the pilot (reasons for this are unclear). The safety and security of transacting digitally was appreciated by participants, and all found the card to be easy to use, regardless of varying levels of digital literacy.

The BNW application lacked detail (itemization) to monitor price variations, creating a lack of transparency for recipients, thereby reducing bargaining power. A series of technical issues arose and were resolved over the course of the pilot that contributed to difficulties in implementation, especially given time constraints . Intermittent and slow internet connectivity resulted in slow transaction time. A system outage resulted in the failure of a bulk disbursement, and a series of transfer errors on e-voucher cards occurred. Despite the rapid resolution, this still resulted in delays and additional work for staff involved, adding to the challenge of maintaining trust within a crypto-skeptical environment. [Ibid.]

Common Trends

Inadequate implementation timelines and the need to address negative public optics around the use of blockchain and cryptocurrencies in both pilots was especially felt by field staff. A common observation was the sentiment that the customer support burden is placed on the NGO more than the product partner or service provider. Despite using two completely different applications, a remarkable highlight was the ability of

participating households to access a portion (20%) of digital funds in the form of cash. Recipients had highly positive feedback for this feature, which was seen as providing great flexibility while also being convenient. This is also a distinctive innovation, as it is a rarity to be able to deliver a multi-modality cash intervention with the use of a single payment system. Real-time transaction feeds improved monitoring and remediation by monitoring, evaluation, accountability and learning (MEAL) staff; verification of transaction reports was easy and quick for finance teams; and the disbursement process was rapid and conducted remotely by program staff, saving time on distribution logistics.

5. Discussion & Key Findings

5.1. Analysis of 4 Frames: Process, Product, People and Program

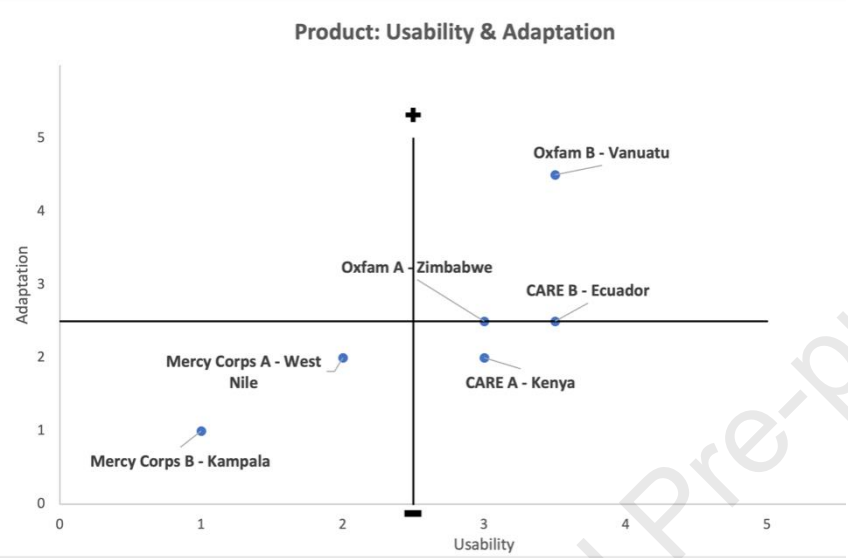
As each pilot description demonstrates, contextual differences across pilots require an acknowledgement that this analysis of the innovation's design and implementation process is situated within multiple, overlapping realities: *first*, the underlying purpose of the innovation in question is positioned within the professional context of humanitarian cash and voucher programming, seeking optimization and efficiency of the same. *Second*, the innovation's process is implemented by people and with processes occurring within the institutional context of a humanitarian organization (in this case, the INGO). *Third,* the blockchain technology and applications used were universally developed on a decentralized network infrastructure situated within the competitive market context of emerging technologies, fintechs and startups. Most importantly, an overarching country, cultural, and community context surrounds and influences all of these factors.

The frame creation method presented in Section 2.3 provides an HCD-informed framework to conduct the following analysis using a mixed-method approach, referred to from here on as the "4Ps Framework". The 4Ps represent frames of analysis that allow for a cross-comparison of pilots using a set of common themes and/or indicators: Product, Process, People and Program. These frames lend themselves to two types of analysis. First, a qualitative comparative analysis (QCA) that breaks each "P" down into a set of two indicators, with each indicator calibrated using a 5-point scale (see Table 3, Section 2.3). This effectively *quantitizes* [70] (Driscoll et al, 2007) the data in the form of quadrant graphs, so as to better visualize the extent to which the 6 pilot cases are different or similar, depending on what frames (P) of analysis are applied. As explained previously, high scores (upper right quadrant) indicate that the pilot in question is closely aligned with humanitarian and HCD principles, with fewer implementation challenges, and low scores indicate more complications in implementation due to a lack of design (HCD or other) overall, or a more "technology-driven" design [41] (Giacomin, 2014).

Beginning with the *Product Frame* (Figure 2), a mapping of positive and negative indicator scores across each organization illustrates a few distinct patterns. The scattering and divergence of results strongly implies that there is no single, standard method or process for product identification, selection, and subsequent adaptation to country and program context. This may or may not have contributed to the variety of applications piloted, but

may equally be attributed to the desire to witness the different features of and reactions to each selected application “in action”, and to build familiarity with the technology.
What is important to point out is this: when by stepping back from individual organizational contexts, value emerges despite method inconsistencies. Collectively, it signifies a step-by-step innovation process using diverse new applications, all driven by organizations aiming to enhance CVA delivery.

Figure : Product Frame Matrix



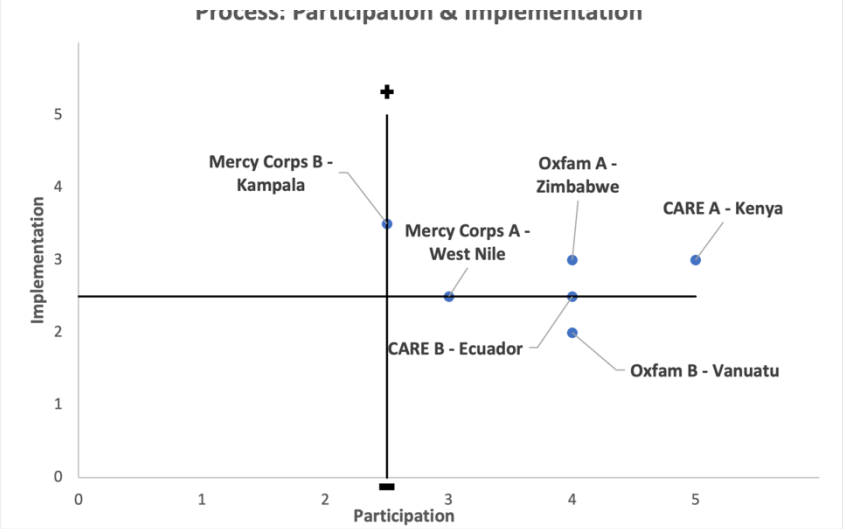
Another clear trend is the placement of pilots where a product adaptation and customization process occurred during the design phase of each intervention (Vanuatu, Zimbabwe, Ecuador), versus those pilots that adopted the use of a pre-selected product (West Nile/Uganda, Kampala/Uganda, Kenya). This is especially significant considering the organizational context for pilots represented in the lower quadrants; 2/3 were funded by the same entity that provided the application to be used, divesting the NGO of control over the extent and cost of customization .

The conflicting priorities and level of control of the blockchain charity and app developer versus the NGO and pilot participants is an example of where extrinsic motivations can negatively influence pilot implementation. This creates a a very real impact on participants, who were unable to choose the product based on their own needs, capacities and preferences, thus influencing usability. Notably, products designed with some level of context-based customization are positioned in the upper-right quadrant, indicating positive traits in both aspects. More than just functionality, the customization process allowed teams to engage in, and inform product adaptation to context, enhancing usability as a result.

The CARE Kenya pilot stands out as a rather unique outlier. Even though the application was dictated and selected by the donor (blockchain charity) without considering context or user input, the pilot's design intentionally emphasized group collaboration and decision-making, as seen in the VSLA. This emphasis on collective participation might have fostered sufficient level of agency, discussion, negotiation and allocation of responsibilities across the group to generate enough intrinsic motivation to counteract usability challenges. For instance, by allowing members who were more tech-savvy to operate the application based on others' feedback.

The positioning of pilots in the *Process Frame* matrix (Figure 3) suggests a very positive trend – high levels of participation, albeit in varying forms, were a common feature across all pilots. Although this was generally the case, a carryover of product-related issues is also evident: participation levels were lower for two out of the three pilots where a pre-determined product was used, and where usability was low. We know from qualitative

Figure : Process Frame Matrix



feedback that this necessarily introduced implementation difficulties that were linked to a lack of familiarity with the technology, skepticism, and a certain level of discomfort in advocating for its use.

Conversely, we also see cases where a high level of participation did not necessarily translate into ease of implementation as with Oxfam's UBC project in Vanuatu. On the one hand, this was by far the largest implementation with the highest number of involved stakeholders (high participation), but was conducted less as a pilot and more as a response action to a triple-disaster scenario, which increased the complexity of the implementation environment, independently of the modality or technology used.

This situation potentially hints at a broader implication concerning scalability: once a project surpasses a certain size or duration, the benefits of participatory methods may diminish. While these methods might be crucial during smaller pilot stages for introducing innovations and encouraging adoption, their impact might be less significant as projects grow.

The People Frame (Table 5) analysis highlights an intriguing trend: high participant satisfaction can be achieved even with limited choice agency. While there seems to be a slight correlation between reduced choice and satisfaction, it is not consistent. Viewing this through a Human-Centered Design (HCD) lens, it becomes evident that the concept of choice is multifaceted, particularly when urgent needs or specific contexts come into play, such as meeting basic necessities, dealing with remoteness (Vanuatu), displacement (West Nile), or hyperinflation (Zimbabwe). Simply put, choice is multi-dimensional and highly influenced by contextual and personal circumstances.

This observation prompts a deeper look into the "people" frame, emphasizing the need to differentiate between who gets to make choices and which choices are most pertinent to the pilot's objectives. For instance, in the Oxfam Zimbabwe pilot, an in-depth consultation with local vendors provided room for input and choice, but this process was geared towards a specific group. Conversely, voucher-based strategies, like in Care Ecuador and UBC, limit recipients' choices to a predetermined set of vendors by design. However, satisfaction levels consistently remained high in both contexts – perhaps indicating that vendor selection was well-aligned with participant needs and preferences.

The consistently high level of satisfaction and the semblant dissociation with choice implies depth and dimension – and contradicts the design assumption that people are most satisfied in situations where the ability to exercise choice is high. This also interrogates the definition of "satisfaction": oftentimes satisfaction in one situation is relative to dissatisfaction in another, and these situational perspectives vary across individuals. In

addition, there is admittedly a clear power dynamic at play that is specific to the humanitarian context and that may influence participant responses to monitoring surveys. In a state of acute need, satisfaction may be easier to achieve once that need, however basic, is addressed. Alternatively, stating "satisfaction" may be false – for fear that expressing dissatisfaction could affect access to assistance. Abdelmagid et. al (2014)'s [71] work on the ambiguities of defining and measuring the appropriateness (including monitoring 'satisfaction') highlights these issues in detail. Even so, this serves to validate how complex issues of choice and satisfaction are in practice; HCD offers methods that acknowledge the importance of accounting for these "empathetic" factors [63].

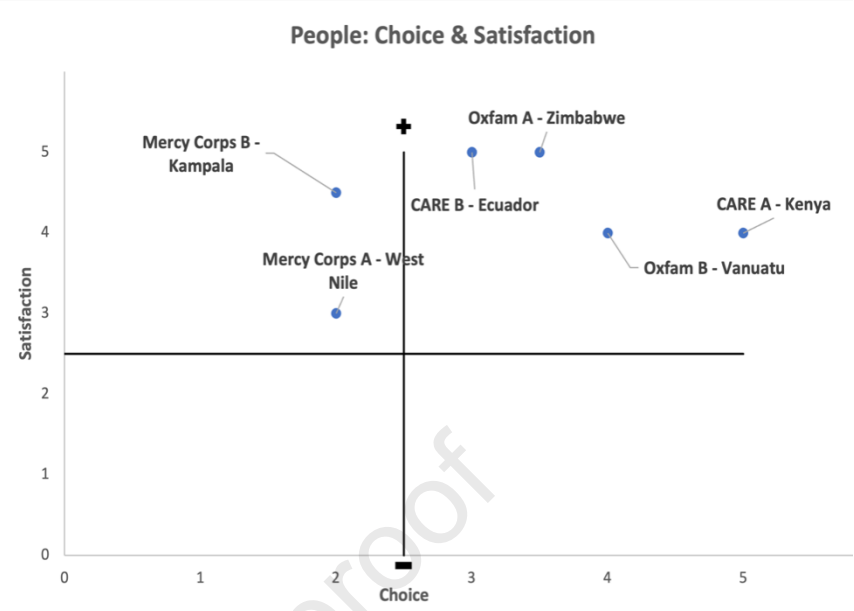


Figure : People Frame Matrix

CARE Ecuador received notably positive feedback from staff and vendors, but this praise was often juxtaposed against a particularly slow and cumbersome paper-based system. Conversely, the few negative complaints from recipients expressed a feeling that they were subject to the decisions and honesty of vendors, eroding a sense of agency and choice. Feedback linked to a sense of satisfaction, in all pilots, was consistently related to speed and ease of use; this might indicate that user satisfaction in using a new technology is dictated by functionality (it works better), rather than emotional factors (it makes me happy). This also suggests that satisfaction may need to be measured differently to distinguish between situational and functional satisfaction, and between personal and emotional satisfaction. Theoretically, this could be valuable in situations where an application works well and is easy to use, but where the organization or tech provider has a poor or adversarial relationship with the user community.

Such findings reinforce the need for the development of clear and consistent pilot metrics, including comparative analysis with previous interventions, in part to determine (amongst other things) satisfaction gains for each stakeholder group, relative to a previous (similar) situation. Overall, the high levels of satisfaction suggest that there exists a positive basis supporting further exploration of these innovations. This could serve to fuel intrinsic motivations going forward, especially if the same staff, communities and/or application developers are engaged on a consistent basis. Nonetheless, the dimensionality of "satisfaction" across groups merits attention in future design, so as to situate what role the satisfaction of stakeholders might play in longer-term adoption.

Turning finally to the *Program Frame* analysis, there is a considerable divergence of results, which is most likely due to the influence of the underlying program design and context wherein each pilot was situated. The highest level of program alignment is observed in instances where a pilot was integrated or treated as a sub-component of an existing program. In most (3/4) cases, community engagement was high, which may have been due to existing trust and familiarity with the program (and staff) in question. This finding does imply that the use of a "piggybacking" approach that leverages existing program presence and community relationships could be a strong enabling factor in future pilots. Embedding the pilot within an ongoing program as a means of improving it can serve to clarify a clear purpose and focus for participants and potentially, improve chances of scalability through program integration (ongoing use of the application in that program).

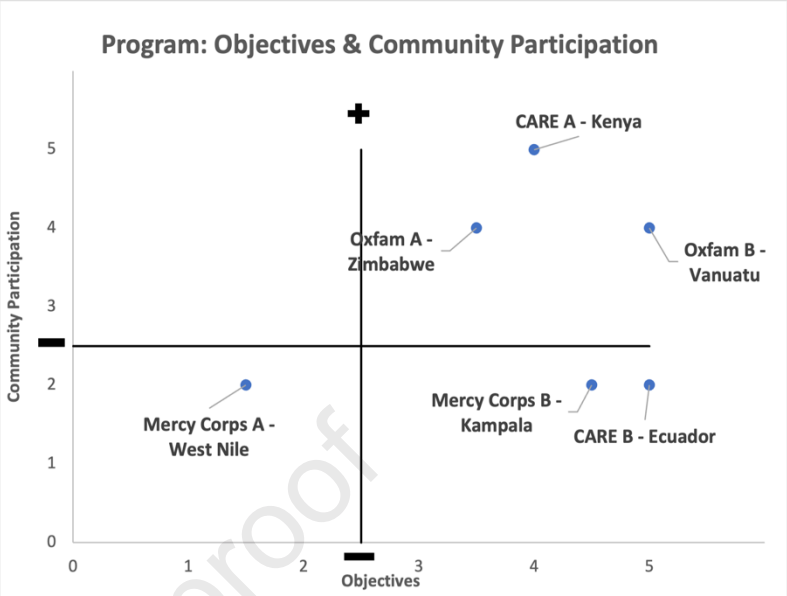


Figure : Program Frame Analysis

Program alignment did not necessarily translate into engaging with communities, with a difference of several points between those with higher versus lower engagement levels. This might be revealing of the program design itself, where it is common in humanitarian programs to adopt pre-set objectives based on organization or donor preference, rather than community input – this echoes some of the barriers to innovation mentioned previously [68,69] Might this also beg the question of whether this is a viable approach when seeking to try, develop and adopt an innovation? If so, might a human-centered innovations approach provide an opportunity to course-correct and enhance community-engaged design?

Half of the pilots in question exhibited difficulties with and/or a limited level of community engagement. Interestingly, these were the same pilots where:

(a) a predetermined, application not adapted to context was employed, and
(b) participants were skeptical of cryptocurrencies.

In both cases, these conditions required significant time to train users and address user errors and to clarify the technology and how a digital currency (stable coin) could be used safely. Despite efforts by organization staff to increase trust and assuage concerns, some pilots still witnessed participant dropouts attributed to these factors.

5.2. Thematic Analysis: Successes, Challenges and Feedback

The commonalities across pilots within each organization have been included in the presentation of case studies for ease of reference. Clearly, despite numerous variables – different countries, timelines, groups of people, and blockchain applications – certain patterns and commonalities consistently emerge across all pilots. The 4Ps framework helps to capture these variables, whilst also creating space to consider the idea that success and challenges occur across a complex spectrum where human interaction and technological function are closely

intertwined. In addition to the perspectives offered in the previous analysis, this spectrum also becomes visible when the 4Ps are used to map qualitative feedback from interview respondents (Table 3).

As to the program-related question concerning the value-add of these applications as a viable modality to improve CVA delivery: without a doubt, the presumed advantages of using blockchain applications to deliver CVA, even when accounting for multiple variables, are consistently confirmed: case by case, place by place, all participants from back and front office staff, to vendors, to recipients, regardless of gender, confirmed that the use of these applications made the process of sending, receiving and spending money significantly faster, and significantly cheaper. In other words, these extrinsic metrics have been met and sometimes exceeded. However – there is a similar repetition across pilots that suggests that although this question has been answered to the satisfaction of country teams, it has yet to be measured. This suggests more of a design or methodological issue related to the ways in which pilots are planned, implemented, monitored and reported. Rather than being treated as "new" interventions, blockchain pilots in CVA should always be positioned against the backdrop of pre-existing delivery modalities and processes, so as to better document and demonstrate the benefits of using the technology. Without this evidence, it is difficult to make the case for adoption as a way to evolve and improve CVA delivery. Likewise, in contexts where CVA programs are operating efficiently and effectively using local mobile or financial service providers, the introduction of a blockchain application may not be necessary or appropriate.

From a *programmatic* perspective, there is very clearly a shared ambition to determine whether blockchain technology can enhance delivery efficiencies and tackle persistent challenges in CVA delivery. These challenges include a number of paper-based processes, the administrative load of intricate financial reconciliations and the logistically demanding and time-consuming post-distribution monitoring processes required to align demographic data with purchasing trends, and transaction logs. However, some findings and feedback echoed in interviews (see Table 4) suggest that programs that could benefit from the use of blockchain applications will also require additional skills and capacities to do so. This includes staff knowledge and ability to explain the application being used; training techniques adapted for people with varying levels of digital literacy, and the careful selection of solutions (products) that are best adapted to the country, culture, and community context.

From a *functional* perspective , it's clear that this technology is still relatively new, and that pilots play a key role in stress testing blockchain applications in field-based humanitarian settings, and with users that vary significantly from what might be the assumed profile of a blockchain "user". In these environments, familiarity with and access to digital devices might be limited, but ultimately, in all pilots, participants were able to learn and use the application or platform effectively to enhance efficiency. Likewise, the field context where many humanitarian activities are implemented often have limited or intermittent network connectivity, and therefore require the selection of blockchain applications that are low-bandwidth and able to process offline transactions. A concrete example in the selection of pilots studied here: card-based applications functioned well in remote areas (Vanuatu) due to the features of an NFC card, which is able to store transaction data even when offline, and a smartphone app that requires minimal bandwidth and phone storage capacity to process transactions, even when offline. By comparison, the use of applications such as the Trust Wallet require full connectivity, significantly more bandwidth, and can only run on specific types of smartphones due to heavy storage requirements (West Nile, Uganda).

From a *design* perspective, there are also recurring challenges that can be linked to a disconnect between how and by whom these applications have been designed, and where and by whom they are being used. Lastly, from a *relational* perspective, we learned an old lesson – that success in most forms is deeply based in trust, perception, and mutual collaboration. Note the differences in program/function versus design/relational themes across pilots. We see clearly and repeatedly that the former reflects successes that are of primary benefit to the

organization, whilst the latter reflects challenges that are primarily emotive, and felt by staff and pilot participants.

Table 3: Interview Feedback Mapped Against 4Ps Framework

Product	Process	People	Program
"We had a lot of issues with the cards, 5 beneficiaries almost left the pilot (because of it)"	*"The finance team wasn't comfortable with the way we selected vendors, so we had to do it all over again to meet FP3 (organizational) compliance requirements"*	*"The staff were really overstretched…this created disruptions to other activities"*	*"We chose not to run the pilot separately, but to add it to the existing Unconditional Cash Transfer (UCT) program"*
"User issues affected the time it took to transact, so vendors prioritized people paying in cash"	*"We didn't have a choice; the implementation timeframe was really tight…we would have preferred 6 months"*	*"It was easier because we already had the groups in place, the women knew each other and were ready to work together"*	*"pilots went well enough…(that) we definitely want these tools in our toolbox"*
"choosing product…our primary driver was the opportunity for partnership & collaboration in the tech space"	*"we had a lot of good vendor feedback, too little time for customization"*	*"The (community) skepticism and suspicion around cryptocurrencies was really negative…it made us a bit uncomfortable to deal with that"*	*"we chose low risk operations (for pilots), to test and learn first"*
"one idea could be to have a user-focused 'starter pack' (for apps) to get started more quickly"	*"we're looking at this at the policy level now"*	*"we need to lower the technical skills barriers to entry"*	*"country (program) teams expressed curiosity…a willingness and desire to learn and test"*
"for crypto to be used, the user interface needs to be easier and more simple for participants"	*"We tried to select pilots based on digital literacy and access…it helped define geographic focus"*	*"even those without phones were supported by others who had and knew how to use them"*	*"it's clear that this (technology) can be more appropriate in some situations and programs than others"*
"real-time transaction monitoring is a huge advantage"	*"potential applicability (of the technology) definitely requires revisiting internal systems…to do that consistently, an organizational process is required"*	*"youth definitely have a role here because of their familiarity (with the technology), but we don't have the programming to support that"*	*"it was a pretty strong validation of using the technology (for CVA programs) in hyperinflationary environments"*
"system/ customer support for user errors got better over time, but we need a better troubleshooting process - this is a concern at scale"	*"we did a whole market assessment to understand the context….hearing from vendors really helped with the identification of cash out mechanisms"*	*"some smaller and more vulnerable vendors were selected too…so the vendor pool was balanced"*	*"program continuity with this technology is dependent on the ability to develop systems support capacity and run at a lower cost than pilots"*
"the tap and pay cards are so simple…people loved it"	*"there's still a disconnect…we really need to rethink structures…and think through changes in old processes, like finance and logistics"*	*"the community approach…made a difference. Even though the tech was new, people could still find someone or call and just talk to another human"*	*"we need to focus on value for the program and the people, like how well does it fit into that program and country context?"*
"The donor chose the product we had to use…we found out it didn't work on some cheaper smartphones, so that created a selection bias"	*"I honestly don't know why we were chosen for a pilot, but it was still very interesting"*	*"We were actually surprised at the knowledge of cryptocurrencies…some young vendors chose to hold/trade crypto instead of cashing out"*	*"NGOs shouldn't focus on trying to be experts with this technology, we should focus on programs and the right partnerships with service providers"*

To varying degrees across pilots, the majority of players also expressed an appreciation for the transparency provided, with differing perceived benefits across stakeholder groups – in each case, transparency is not a benefit in and of itself; it is a benefit because it influences the ease, comfort, and choice of the user. The consistency of this feedback was articulated via multiple perspectives, and for different reasons: for Oxfam partners in Vanuatu, this provided a clear vision of the results of their work in real time, and clarity on what others were doing; in Kenya, members of each VSLA liked the visibility this provided to everyone, thereby reinforcing trust (and reducing doubt) in the group decision-making model. In all cases, INGO staff responsible for monitoring and financial processes were pleased and relieved to find that this made their work much easier, and in some cases, more effective.

These findings also illustrate an inherent complexity of intersecting perspectives and interests: transparency for whom, why, and for what purpose? Who benefits from blockchain pilots and how? This is an excellent demonstration of a common concept in human centered design – oftentimes, a single, one-dimensional (assumed) outcome might refract into multiple positive impacts for a variety of people, in different ways and for different reasons. Hence, focusing on these subtleties is crucial for grasping and fostering intrinsic motivations, which in turn promotes acceptance and enthusiasm for a novel tool or method [72] (Weibel, 2013). When an innovation can create positive meaning and impact for a diversity of actors involved in a collective action, the potential for adoption increases significantly. Likewise, when an innovation is resisted – either because it is not inclusive, does not have a clear purpose, or benefits some over others – these critiques deserve to be heard and can be entirely justified. Staying true to a human-centered approach also requires a recognition of the right to refuse, and where goals of "scaling" may not be necessary or appropriate to context. "Innovation for innovation's sake" [73] (Ramalingham et. al., 2010) inevitably fails, both because it implicitly disempowers the individual and because innovation should be treated as a process. Processes in HCD and humanitarian action alike prioritize participation and choice [74, 75] (Hillhorst, 2002).

More importantly, when an innovation process occurs within the context of multinational and multicultural organizations, the need for a multidimensional perspective is not optional or beneficial, it is mandatory. In fact, many of the methods in human centered design require multidimensional processes, such as co-creation, cross-cultural and multilingual design, and design thinking within multi-tiered organizations (like INGOs) [76, 77]. Ultimately, the central concept of collaboration requires the integration of multiple perspectives, and therefore requires multidimensional design methods, especially in the case of complex and advanced service structures, if humanitarian systems and programs might be qualified as such [61].

Innovation builds on, and can benefit from, existing practice. Most innovations are not intended to completely replace existing actions, but to improve them. Each pilot represents an action that should eventually be integrated into a program in the case of long-term adoption. Alongside this attribute are recurrent findings that relate to a limited sense of decision-making by staff – for example due to a pre-set timeframe, or a pre-selected blockchain application. From the HCD design perspective, this outcome represents a considerable shortcoming in contextual analysis – not just of the physical environment and infrastructure, but the people operating within it [75]. For humanitarian and development partners, the program is intrinsically linked to context, and people are integral to these programs. Hence, pilots and other innovations are always nestled within this interplay. Overlooking this interplay means failing to account for the skills, knowledge, and feedback of individuals engaged in every facet of the program. Even if unintentional, such oversight can be palpable and challenging for those involved, potentially diminishing their sense of agency, motivation, and enthusiasm in the long run.

From a design standpoint, the emergence of a majority of common and recurrent challenges definitely reflects HCD-specific design gaps that are associated with *intrinsic* factors, such as the needs, desires, emotions and motivations of the people involved in the pilot action. Although there is a distinct convergence of commonly stated objectives in virtually all pilots, these focus consistently on *extrinsic* factors, such as function (speed, transparency, cost) and object

(the technology and its features). Yet, this emphasis also introduces an external bias in gauging success, overlooking other dimensions of results and impact, especially those concerning participants' feelings of empowerment or disempowerment, happy or sad, and their levels of motivation or discouragement throughout the process. Incidentally, this is very similar to Cheesman's findings from ethnographic research with women participating in a blockchain pilot in Jordan (WFP/UN Women). Adopting more human-centered design approaches and phases within the pilot and implementation process can help to prevent these types of repetitious mistakes and reconcile the divergence this represents from the people-centered, participatory approaches recommended in CVA practice .

A high-level summary of repeated successes and challenges across all pilots is represented in Table 7, according to whether each can be characterized as intrinsic (HCD-aligned) or extrinsic (functional/non-HCD) factors, according to the data available. There are considerably more common factors, positive and negative, that can be characterized as intrinsic. In other words, these are patterns that emerge from within the personas of participants in each pilot – expressed as personal perceptions, emotions, needs, and motivations.

Table 7: Common Successes (+) & Challenges (-)

Method Map: Common Trends		
	Positive (Successes)	**Negative (Challenges)**
Intrinsic (HCD)	Consultative approach with partners, community	Lack of choice in application used
	Digital (cashless) created sense of safety	Few local tech providers involved
	Trust in staff and partners	Insufficient knowledge of digital devices
	Learning new skills and knowledge	Burden on staff to address negative perceptions
	Cards were easy to use, "inclusive" of everyone	Burden on staff to troubleshoot user issues
	Flexibility in spending (especially dual modality).	Application not suited to context/profile of users
	(eventual) ease of use	Distrust in crypto
	"Hands on" use resolved skepticism/trust issues	No control over timeframe
		Smartphones not available to everyone
		Poor/ communication with provider
		No familiarity of application = long training & set up
TOTAL	**8**	**11**
Extrinsic (Not HCD)	Speed of transfer	Insufficient user support
	Automation - fewer manual processes	Frequent user errors
	Transparency facilitates monitoring by staff	System outages & errors
	Lower cost/transaction fees	Slow/intermittent connectivity
	Easier & quicker financial reconciliation	Misalignment of existing 'analog' and digital office processes
		Provider not available in country
TOTAL	**5**	**6**

This breakdown highlights a misalignment between the objectives of each pilot and the outcomes observed as a result of the pilot action. Even where a blockchain solution may offer efficiency gains or improved transparency, it may still also result in a negative experience for participants. An organization may successfully use blockchain to cut down the cost of delivery, the job of field staff may become more stressful. This calls into question the overall benefit

of adopting a blockchain application if quantifiable benefits are counteracted by qualitative difficulties. Secondly, the focus on function evidently makes it more difficult to design the pilots and the products appropriately, so as to anticipate some of these challenges. For example, this plays out in the tension between short, fixed pilot implementation timeframes, and the significant time invested in building trust, mitigating concerns, and building the skills and experience necessary to use the technology at hand.

Beyond addressing the mismatch in program alignment and design methodologies, an emphasis on the technology's performance often overshadows the recognition of the individuals driving its success. In every pilot, across all stakeholder groups (including staff, recipients, vendors, communities, mobile & financial service providers), there is a valuable increase in new skills and competencies taking place. This observation is especially pronounced among field staff, who also display an intuitive and contextualized approach to problem solving and participatory implementation. These are the skills that are indispensable in the process of iterating and scaling an innovation – groups that incrementally get better at what they do, and share and integrate that experience into their professional environment. Blockchain aside, the process of introducing, adopting and diffusing innovation hinges on iterative processes that depend on the cultivation of skills and capacities of this nature, alongside the development of knowledge over time to identify and solve problems, prevent redundant mistakes, and constructively assess progress and improvement over time. When design flaws and a preoccupation with efficiency and function obscure these capacities, participation, ownership and motivation inevitably suffer.

The emphasis on function illustrated in the design and reporting of these pilots also speaks to a trend of adopting a "technology push" process. This method prioritizes technological innovation and optimization [41], rather than centering on the culture, context, expectations, needs, and desires of the "users" or "customers" – which, in this scenario, are country staff, communities, vendors, and recipients. While these approaches may be appropriate to corporate settings, profit-driven entities, and technology companies, they tend to clash with the priorities embedded in humanitarian principles and participatory programming. As one interviewee put it, "We always need to put people at the center of what we do" [OX1].

However novel and groundbreaking a new approach or technology is, it is always important to make sure that the culture of the creator does not unduly influence interpretations on how it might be used, especially by people and in settings that were not initially part of the creation in the first place. While the financial backing from blockchain-related charities have played a significant role in propelling many of these innovations one cannot overlook the possibility of competing interests and misaligned incentives. This also underlines a risk to humanitarian organizations that may be persuaded to implement blockchain pilots or scale the adoption of an application by an external actor that does not necessarily share the same values – say, a tech company seeking mass adoption and market expansion, rather than inclusive innovation or improved humanitarian delivery. Unfortunately, the trend of chronic under-investment that underpins the challenges associated with humanitarian innovation likely exacerbates this risk [14, 69, 73].

6. Conclusions

With a series of findings that conclusively indicates that this technology does provide significant efficiency gains as a CVA modality, there is arguably a need to move away from the extrinsic focus on function, or "product" and to begin focusing on human-centered approaches to design that emphasize intrinsic motivation and meaningful participation. This research provides one of the first comprehensive, cross-case analyses of humanitarian blockchain pilots across multiple years, countries, organizations, applications and cultural contexts to arrive at the following conclusion: Humanitarian organizations that aspire to progress beyond one-off pilots must balance three objectives: seeking out and selecting blockchain solutions that are adaptable and appropriate to country and program context; prioritizing

field capacities and knowledge of participatory and community based approaches (akin to HCD) to innovate inclusively; and providing consistent and quantifiable results comparing these efficiency improvements (speed, cost, transparency) to more conventional methods. From a decision-making viewpoint, setting these priorities will better position organizations to determine where and in what situations these solutions will or will not offer a maximum value-add, why, and to what degree. Blockchain technology and its applications, like all other forms of technology, does possess any intrinsic impact or value; understanding how to place technology comfortably in the hands of users who need it is the most predictable pathway to utility. Understanding and applying this in practice may well make the difference between improved CVA delivery and pilots without progress.

Although this research represents a valuable first step, it is also important to acknowledge its many limitations, most of which are articulated throughout the paper. The documentation and comparison of 6 pilots exceeds prior research attempts, but remains a very limited sample size. The quality and consistency of data documenting these pilots is also highly variable and subject to the priorities and resources of each organization. At the same time, we know that blockchain technology and its applications developed rapidly over the course of these pilots, and remains an emerging technology that continues to evolve – what was not possible in a pilot implemented in 2019, for example, may be possible now, and therefore would affect functionality and the experience of pilot participants. These are significant limitations that will require future research to confirm whether findings are consistently supported as more data is made avaialble. These limitations also provide useful lessons for future researchers and implementing organizations, underlining the need for more consistently rigorous assessment methods and the development of clear and measurable indicators of pilot success (or failure).

To design, define and present pilots in a manner that illustrates results relative to conventional practice would also land this work more suitably within the broader body of evidence and community of practice supporting CVA in humanitarian action, alongside the assortment of studies comparing the use of digital modalities to one another [Ibid.]. Doing this would also build familiarity and access to information for interested organizations, and would also serve to situate this area of work better within the broader context of this work, rather than treating it as an outlier or exception to the norm.

The following research propositions are proposed in order to support scholars, policymakers, and humanitarian organizations in applying the findings herein:

1. The successful implementation of blockchain technology in cash and voucher assistance programs requires careful consideration of design variables, including people, process, program, and product. The 4Ps framework provides a foundation that can be used to improve pilot design, select appropriate blockchain solutions, and enhance monitoring and evaluation of efforts to integrate this technology into CVA programs.

2. The use of blockchain technology has the potential to address cost and time inefficiencies in cash and voucher assistance programs, but its implementation requires stakeholder engagement and context-specific design.

3. The implementation of blockchain technology in cash and voucher assistance programs can lead to the creation of unique staff skills and valuable community contributions to the development of blockchain applications, but without a clear research agenda and community of practice, these skills are not adequately made visible or built upon.

4. The use of human-centered design theory, combined with the multiple case study method, can facilitate the identification of common threads, specific trends, key reflections, angles of analysis, and design approaches that can inform the implementation of blockchain technology in cash and voucher assistance programs.

5. Continued research *and* implementation in this area is necessary to further validate findings and risks and understand the most impactful and human-centered way to expand the use of blockchain technology in humanitarian and development programs.

In the timespan that the pilots considered in this study occurred, there has been an exponential expansion in the availability and variety of blockchain applications available for use. It is now feasible to select options that are more appropriate to context, and that may have been developed in, or closer to the implementation environment. Next steps for the evolution of this innovation within the context of CVA must move forward with the reassurance that human-centered design provides a variety of methods to guide innovation design and development in a manner that is evidence-based, people-focused, context-sensitive, participatory, and better aligned with sectoral priorities and practice. This unlocks the potential for sustainable and scalable adoption, and hopefully also neutralizes some of the more persistent challenges specific to innovation in humanitarian action.

It is also worthwhile to emphasize that many gaps still remain in research on the utility and relevance of blockchain applications for humanitarian delivery. For now, a human centered design lens introduces new inquiries and considerations that are paramount for both the tech and humanitarian arenas. The urge to innovate is situated within the context of an increasingly and undeniably digitized world. Bringing inclusion, consultation and meaningful participation into the process of exploring innovation at the last mile, especially in atypical and difficult contexts, is urgently needed. Humanitarian actors have a role to play in ensuring that these communities are afforded the opportunity to influence and participate in digital innovation. There is a need for a very intentional focus on the creation of applications that are appropriately adapted to, and accessible in the location and communities where they might be used. Bridging the digital gap involves more than just offering access. It necessitates fostering participation through inclusive design approaches, understanding cultural nuances, promoting individual agency, ensuring dignity, and creating avenues for local leadership.

This research effort prefaces a stronger narrative around the role that humanitarian stakeholders play on a grander scale. Understanding how to engage with emerging technology offers a chance to reshape current approaches to digital innovation and to mitigate the (increasing) risk tech innovations are selected, promoted and created by a select few and imposed upon the many. Advocates and leaders need to set an example that steers the pace of digital development in a direction that does not replicate existing legacies of inequality. Engaging with new technologies can and should be a collaboration characterized by a diversity of cultures, perspectives, and preferences of communities that, historically, have been excluded from technological innovation altogether. Underlying the questions of design, function and adoption explored in this study is a need to develop clear goals and a purposeful role for the humanitarian community, as well as the methods and motivations needed to get there.

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ANNEX 1: Frame Matrix Data

Values per Indicator (Table)

		Product		Process		People		Program	
		x	y	x	y	x	y	x	y
Org	Country	Usability	Adaptation	Participation	Implementation	Choice	Satisfaction	Objectives	Community Engagement
Oxfam A (OA)	Zimbabwe	3	2.5	*4*	3	3.5	5	3	4
Oxfam B (OB)	Vanuatu	3.5	5	*4*	2	4	4	5	4
CARE A (CA)	Kenya	3	3.5	5	3	5	4	4	5
CARE B (CB)	Ecuador	3.5	2.5	4	2.5	3	5	5	2
Mercy Corps A (MCA)	Uganda (West Nile)	2	2	3	2.5	2	3	5	2
Mercy Corps B (MCB)	Uganda (Kampala)	1	1	2.5	3.5	2	4.5	3	2

Table 2, Page 10:

Table 2: Summary of Blockchain Pilots

Case Study Summary							
Org	Location	Blockchain Infrastructure	Blockchain Application	Donor	Pilot Participants	Included / Outlier	If excluded, why
CARE	Ecuador	Celo	Umoja	Celo Foundation	250 women 10 vendors	Included	n/a
	Kenya	Binance	Trust Wallet	Binance Charities	50 VSLAs* 10 Vendors 1,217 individuals	Included	n/a
Oxfam	Vanuatu	Ethereum	Sempo	DFAT, MFAT	4,493 households 358 vendors	Included	n/a
	Zimbabwe	Ethereum	Sempo	European Union (EU)	457 households 17 vendors	Included	n/a
	Venezuela	Ethereum	Sempo	European Union (EU)	100 households ~15 vendors	Excluded	Interrupted before completion
	Solomon Islands	Ethereum	Sempo	European Union (EU), DFAT	124 households 6 Vendors	Excluded	Ongoing validation of results
Mercy Corps	Uganda	Binance	Trust Wallet	Binance Charities	5 Vendors 366 Households	Included	n/a
	Uganda	Ethereum	Basic Needs Wallet (Sempo)	Internal	7 Vendors 250 Households	Included	n/a
	Kenya	Celo	Valora, KotaniPay	Celo Foundation	200 Young Adults	Excluded	Microwork: varies from CVA program models
	Colombia	Reserve	Valiu	Internal	111 households	Excluded	Interrupted before completion
	*VLSA: Village Savings and Loan Associations. All 1,217 individual participants were members of one of these groups.						

Table 3: Indicator Descriptions - 4 frames of analysis

Indicator Descriptions: 4 Frames of Analysis			
	Indicator name	Positive (+)	Negative (-)
Product	*Usability (x)*	Easy to use by participants (intuitive)	Difficult to use by participants (not intuitive)
	Influence (on product development) (y)	Intrinsic influence (driven by pilot context and participants)	Extrinsic influence (driven by external actors not present in pilot context)
Process	*Participation (x)*	Inclusive (pilot participants play a role in determining process)	Exclusive (particiants do not play a role in determining process)
	Implementation (y)	Easy (no issues)	Difficult (many challenges & obstacles)
People	*Choice (x)*	High (level of input to pilot actions, product)	Low (no input to pilot action)
	Satisfaction (y)	High (very satisfied)	Low (not satisfied)
Program	*Alignment (x)*	Aligned (with existing program)	Not aligned (with existing program)
	Community engagement (y)	High (many, diverse community members engaged/consulted)	Low (few or no community members engaged/consulted)

Figure 2 : Product Frame Matrix

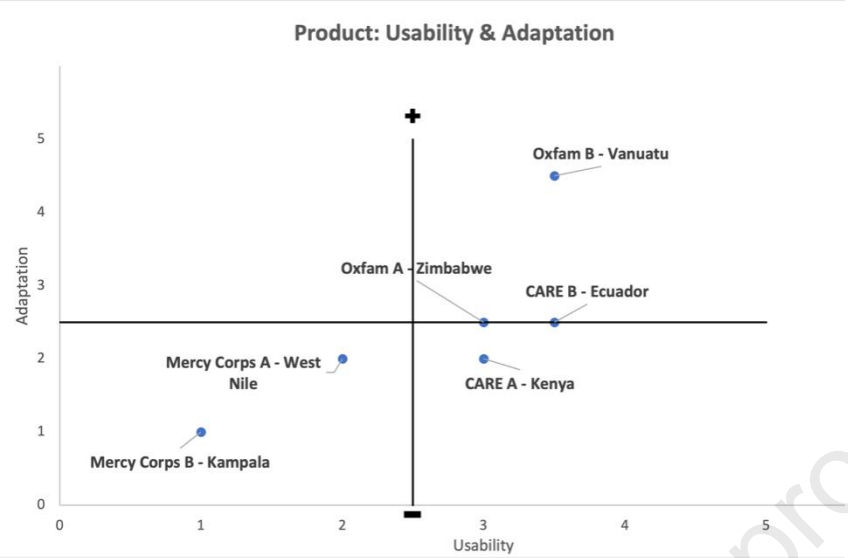
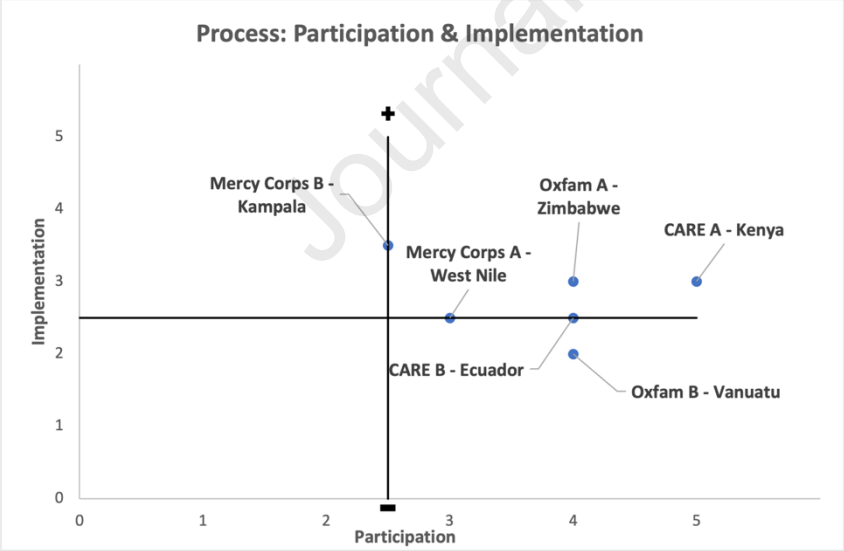


Figure 3: Process Frame Matrix



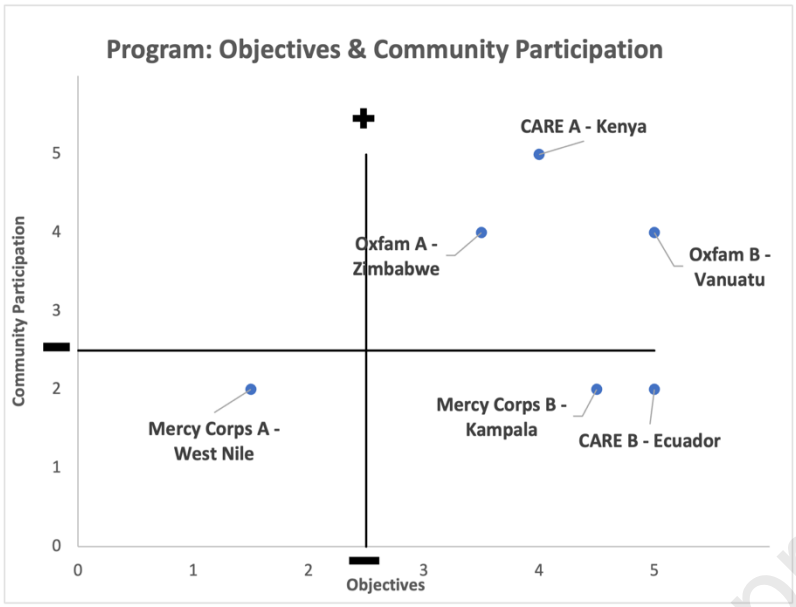


Figure 4 : Program Frame Matrix

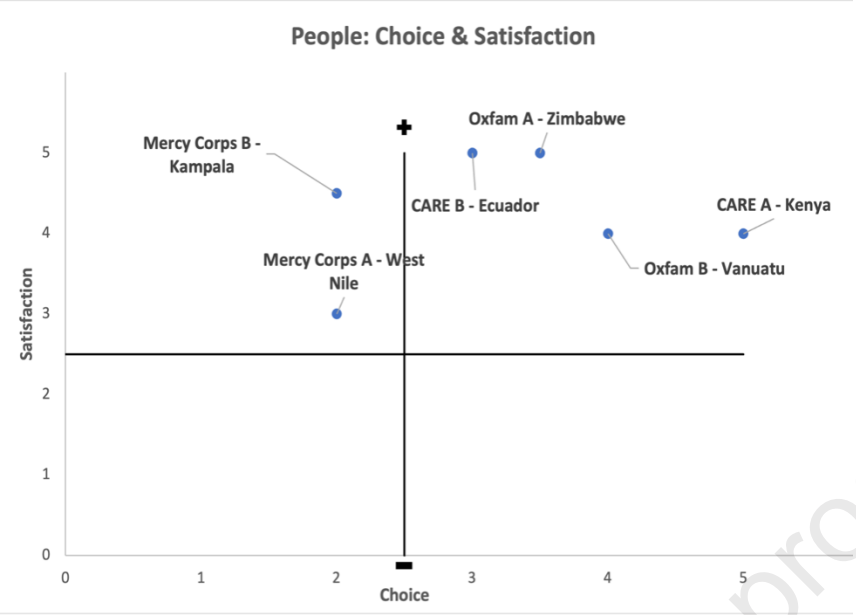


Figure 5 : People Frame Matrix

Declaration of interests

☐ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☒The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

The author is an independent consultant who has been commissioned by Oxfam to conduct this research and write this article. In addition, the author held previous roles managing the implementation of two pilots referenced in this study: Oxfam (Vanuatu, 2019-2021); and Umoja Labs (CARE, Ecuador, 2020-2022).

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