UNBLOCKED CASH: PILOTING ACCELERATED CASH TRANSFER DELIVERY IN VANUATU

RESEARCH REPORT
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Cover image: Pango, Vanuatu: Jamison Kaltabang, a recipient with a disability, is registered and given a payment card by Tevita Gideon, Oxfam staff during the Oxfam UnBlocked Cash Blockhain Pilot. Photo: Keith Parsons/OxfamAUS

Images: Keith Parsons, Oxfam Australia

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About this report: The UnBlocked Cash pilot is one in a series of Oxfam-initiated examinations of cash and voucher assistance in Vanuatu. This pilot builds on the Pacific Cash Preparedness Partnership, which aims to increase awareness, capacity, and expertise in cash and voucher assistance in the Pacific. The UnBlocked Cash pilot has been funded by the Australian Department of Foreign Affairs and Trade (DFAT) through the Australian NGO Cooperation Program (ANCP).

Oxfam encourages readers to comment on this report so that we can improve future research, design, and implementation of our cash and voucher assistance.

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CONTENTS

ACRONYMS

AML	Anti-money Laundering
ANCP	Australian NGO Cooperation Program
API	Application Programming Interface
AUD	Australian Dollar
AWS	Amazon Web Services
BSP	Bank South Pacific
BTC	Bitcoin
CaLP	Cash Learning Partnership
CCT	Conditional Cash Transfer
CCV	Crypto Collateralised Voucher
CTF	Counter-Terrorism Financing
CTP	Cash Transfer Programme/Cash Transfer Programming
CVA	Cash and Voucher Assistance
DFAT	Department of Foreign Affairs and Trade
DLT	Distributed Ledger Technology
DLTs	Distributed Ledger Technologies
DRR	Disaster Risk Reduction
ETC	Emergency Telecommunications Cluster
FGD	Focus Group Discussion
FSP	Financial Service Provider
IC	Integrated Circuit
ICT	Information and Communications Technology
ID	Identification
IIT	Intra-institutional Transfers
KII	Key Informant Interviews
KYC	Know Your Customer
MoU	Memorandum of Understanding
NFC	Near-field Communication
NGO	Non-government Organisation
OAU	Oxfam Australia
ODI	Overseas Development Institute
OiV	Oxfam in Vanuatu
P2P	Peer-to-peer
PDM	Post-distribution Monitoring
PIN	Personal Identification Number
PoS	Proof-of-stake
PoW	Proof-of-work
QR	Quick Response
RFP	Request for Proposal
SCP	Supply Chain Performance
TVL	Telecom Vanuatu Limited
UCT	Unconditional Cash Transfer
UI	User Interface
UID	Unique Identifier
UN	United Nations
URL	Uniform Resource Locator
USD	U.S. Dollor
UX	User Experience
VNSO	Vanuatu National Statistics Office
VUV	Vanuatu Vatu
WFP	World Food Programme

1. EXECUTIVE SUMMARY

OVERVIEW OF PROJECT AND FINDINGS

During the UnBlocked Cash pilot, Oxfam in partnership with Sempo and ConsenSys distributed 966,443 Vanuatu Vatu (VUV) or 11,896.91 Australian Dollars (AUD) to 187 heads of households and 29 vendors, which was estimated to have directly benefited some 1,209 individuals in two urban communities in one of the world's most at-risk countries.

Over the course of a month, Oxfam and its partners were able to successfully deliver a first-of-its-kind Distributed Ledger Technology (DLT) based solution employing the Dai (DAI) stablecoin.[1] Additionally, the system piloted in Vanuatu saw the successful deployment of a novel near-field communication (NFC) card, which in tandem with a 'side-channel' developed by Sempo, allowed the system to cope with poor internet connectivity while ensuring double-spends were impossible despite offline transactions.

Oxfam set out to determine whether DLTs can reduce the cost and transaction time of cash and voucher assistance (CVA), while improving transparency, security, and overall user experience (UX) within the urban context of Port Vila, Republic of Vanuatu.

With the support of Sempo, the UnBlocked Cash pilot has shown modest cost-savings and significant time-savings related to operational activities. Onboarding recipients to the platform was reduced to an average of 3.6 minutes per individual compared to over an hour during the Ambae volcano response in 2018. Additionally, the tested system eliminated slow identity (ID) verifications and reduced dependency on post offices or banks to deposit cheques.

However, there is little evidence that the direct time and cost of financial transaction between programme stakeholder accounts has been reduced. This is due to the reliance on existing financial service providers (FSPs) for foreign exchange and cashing-out vendors in this particular implementation. In contrast, the indirect time and cost appear to have fallen due to the efficacy gains promoted by the Sempo platform. Fortunately, the unexpected challenges with the existing FSP in Vanuatu created an opportunity to test a more community-integrated hub-and-spoke cash-out mechanism via the 'Super Vendor' model.

The quality of the tested solution, which encompassed transparency, security, and user experience indicators, was found to be extremely high. Recipient and vendor feedback alike indicates an overwhelming preference for assistance of this type.

1 Stablecoins are "cryptoassets that are developed with the aim of minimising price volatility by embedding a stability mechanism" (Berentsen and Schär 2019, p65). DAI is a collateralised stablecoin with on-chain collateral pegged to the U.S. Dollar (USD). This is distinct to algorithmic stablecoins or collateralised stablecoin with off-chain collateral.

Figure 1: Pango Village, Vanuatu: Kalua Salerua, Cash Transfer Coordinator, leading a focus group discussion with recipients.
Photo: Keith Parsons/OxfamAUS

2. INTRODUCTION

Distributed ledger technologies (DLTs) are among the most promising innovations to have emerged during the last decade, with the potential to fundamentally transform existing economic, institutional and social systems. Often referred to as 'Blockchains' in honour of the first example developed by Satoshi Nakamoto, these distributed ledgers present enormous social and commercial potential across a range of sectors and have been broadly applied by several of the largest humanitarian actors, including Oxfam.

The promise of these technologies to deliver aid at low cost while reducing transaction times and streamlining reporting has obvious appeal at a time where humanitarian budgets are under increasing pressure. However, DLTs have also been used to enhance the transparency of supply chains, ensure wages and working conditions meet acceptable standards, and deliver tamper-proof voting systems among many other applications.

In recent years, DLTs have seen increasing support among non-government organisations (NGOs) as a means of delivering financial assistance in place of traditional in-kind support, especially among the unbanked.[2] Many of these DLT-based interventions build on an upswell of support for cash and voucher assistance (CVA), which also promise to change the way aid is delivered. Unlike in-kind support, market-based interventions like CVA stimulate local economies and promote personal agency.

Initiatives like the Grand Bargain, drafted during the World Humanitarian Summit in 2016, called for signatories to "increase the use and coordination of cash-based programming", which coincided with a reported 40 per cent increase in cash and voucher-based humanitarian assistance by local and international NGOs together with the United Nations (UN) through 2015–2016 (Smith 2018, p6).

This workstream continued to perform well in 2018 according to an independent report by the Humanitarian Policy Group. "The two largest UN humanitarian agencies scaled up their use of cash and vouchers in 2018: WFP's cash and voucher programming increased by 21%, to $1.7 billion, reaching 20 million people in 2018, compared to $1.4 billion and 19.2 million people in 2017; UNHCR programmed $568 million in cash in 2018, up from $502 million in 2017 (an increase of 13%). UNICEF programmed $184 million to 2.4 million households in 2018" (Metcalfe-Hough et al 2019, p38).

Overall, 44 per cent of signatories report 'Good Progress', however, CVA accounted for only 10 per cent of humanitarian assistance in 2016, up by 2.5 per cent from 2015 (Metcalfe-Hough et al 2019, p38; Smith 2018, p3).

Despite the advantages of CVA, these interventions can incur significant costs associated with transferring value through financial incumbents and often exclude the unbanked. Voucher systems that intend to address financial inclusion are nevertheless slow to distribute and reconcile, which in turn drives high operational costs for the issuing donor or NGO. This is particularly true of paper-based systems as e-vouchers and pre-paid debit card solutions are typically faster than their paper-based equivalents. Even so, it is important to note that no matter the delivery method, CVA is generally less costly than in-kind assistance (Smith 2018, p.80).

DLT-based CVA offers the potential to not only reduce transfer fees by eliminating incumbents, but also by streamlining recipient onboarding and automating reporting. Additionally, an appropriately designed DLT-based intervention can function independently of financial service providers (FSPs), which allows for total inclusion of unbanked recipients.

DLT-based solutions represent an enormous opportunity for disaster responders and development actors to drive social impact and improve quality of life in alignment with the United Nations' Sustainable Development Goals (SDGs), while also meeting several Grand Bargain commitments concerning transparency, reduced management costs, and simplifying reporting.

Given this potential, Oxfam sought to explore the flexibility and applicability of DLTs for CVA in the Pacific to build on the existing Pacific Cash Preparedness Partnership.[3]

The design of the UnBlocked Cash pilot and the objectives of this subsequent research was explicitly informed by the 'Commitments for Cash Transfer Programming' as proposed by Cash Learning Partnership (CaLP). This includes actions related to capacity building, ensuring programme quality, strengthening coordination, and inventing in research and innovation. See section 3.2. 'Guiding frameworks' for more information.

The UnBlocked Cash pilot was designed to address challenges of CVA in the Pacific region while evaluating the transformative characteristics and social impacts of DLTs on communities at risk from disasters. Ultimately, this pilot set out to determine whether DLTs can reduce the cost and transaction time of CVA while improving transparency, security, and overall user experience (UX) within the urban context of Port Vila, Republic of Vanuatu.

To that end, Oxfam in partnership with Sempo and ConsenSys distributed 966,443 Vanuatu Vatu (VUV) or 11,896.91 Australian Dollars (AUD) to 187 heads of households and 29 vendors via a sub-currency of the Ethereum platform designated DAI, 'wrapped' in a Crypto Collateralized Voucher (CCV), and issued on near-field communication (NFC) card designed for low-connectivity environments.

This report will address some of the most common assumptions surrounding DLT-based cash transfers and present the most potent findings from the four week UnBlocked Cash pilot in Pango and Mele Maat on the island of Efate in the Republic of Vanuatu.

2 The unbanked are those without a formal account issued by an FSP. While financial inclusion is on the rise globally, "1.7 billion adults remain unbanked, yet two-thirds of them own a mobile phone that could help them access financial services" (The World Bank 2018).

3 Pacific Cash Preparedness Partnership, is an effort by Oxfam, Save the Children, and the World Food Programme (WFP) and others, to raise awareness of cash and voucher assistance in Vanuatu, Fiji, and Solomon Islands, while increasing the capacity and expertise in the area over four years between 2017–2020.

3. BACKGROUND & CONTEXT

In March 2018, Oxfam Australia (OAU) established OxLabs, an innovation hub designed to challenge the traditional ways of working within the organisation, while pursuing new solutions to address development and humanitarian challenges. The cross-disciplinary team was assembled from across the organisation with support from volunteers and external specialists. This process brought together humanitarians, disaster risk reduction advisers and cash programming experts alongside technologists and finance professionals.

In addition to its own activities, the OxLabs team has supported a number of initiatives across the Oxfam confederation and developed partnerships across the humanitarian sector related to DLT-based solutions, most notably as a member of the 'Identity Alliance' with TypeHuman and Australian Red Cross. This aim of this partnership is to develop a DLT-based self-sovereign identity solution to quickly and safely deploy and manage humanitarians, ensuring that they hold the necessary qualifications and safety checks (Australian Red Cross 2018).

Among Oxfam's own initiatives globally are the BlocRice project and the OxChain 'Smart Donations' app, which holds value in escrow to allow programmable donations to trigger the release of value when particular donor-defined conditions are met (OxChain n.d.).

The BlocRice project works with small-holder organic rice farmers in Cambodia's Preah Vihear province to verify the conditions of their contracts with the Agricultural Cooperative. Additionally, BlocRice tracks the rice from farmer to retailer via all the intermediates and ensures the farmer is paid the correct amount in a timely fashion (Oxfam in Cambodia 2019).

During the early stages of the UnBlocked Cash initiative, the OxLabs team observed that CVA was typically slow to set up, and the delivery of payments to participants endure long lead times. Additionally, CVA often incurs high staff costs related to monitoring and reconciliation, payments processing, and recipient registration. Finally, the team noted a lack of transparency regarding the redemption and use of 'cash' by recipients. According to a report by the WFP (2015), operational costs for food distribution following Severe Tropical Cyclone Pam in Vanuatu during 2015 were as high as VUV 79.61/AUD 0.98 for every VUV 81.23/AUD 1 of food delivered where food costs represented USD 1,779,399 of a total USD 3,521,037 spent. By comparison, Oxfam's 2018–19 Ambae volcano response delivered multipurpose grants at an operational cost of VUV 27.62/AUD 0.34 per VUV 81.23/AUD 1 provided to recipients. These observations lead OxLabs to research the investigations covered in this report via the UnBlocked Cash pilot.

Note: The WFP's operational costs were converted from USD at a mid-market-rate of 1 USD = 1.39902 AUD for the purposes of this comparison. VUV costs are based on the mid-market-rate of 1 VUV = 0.01231 AUD. Both rates were captured from XE on 22 April 2019, the day the pilot commenced.

Figure 2: Port Vila, Vanuatu: Sempo working alongside the Oxfam in Vanuatu team on the pilot design. (L-R) Nick Williams (Sempo), Sandra Hart (OiV), Melanie Hardman (Sempo) and Vivian Fischer (OiV). **Photo:** Keith Parsons/OxfamAUS

3.1. UNBLOCKED CASH PARTNERS

3.1.1. SEMPO

Sempo is an Australian-based start-up co-founded by Nick Williams and Tristan Cole in July 2017. Since then, Sempo has delivered cash to 150 Syrian families in Lebanon and helped distribute aid to refugees in Athens and Iraqi Kurdistan. Its mission is to efficiently distribute relief funds to at-risk communities across the globe while increasing financial inclusion. Sempo is a privately held for-profit company backed by early-stage investors in Australia and US, including SOSV, Blackbird Ventures, H2 Ventures, Startmate, and dLab.

Sempo was one of six shortlisted companies invited by Oxfam to propose a technical solution to help evaluate the cost, quality, and time efficiency of DLT-based humanitarian CVA in Vanuatu. Sempo submitted a joint submission with ConsenSys, which was also among the six. Sempo was then engaged as a service provider for the UnBlocked Cash pilot in February 2019.

Sempo provided its existing software platform, including a 'Dashboard' and Android app. The platform was modified to respond to Oxfam's requirements, which included a new distribution model incorporating DAI and a novel NFC card designed to function in low-connectivity environments. During the four weeks of the UnBlocked Cash pilot, Sempo's co-founder Nick Williams and head of humanitarian operations Melanie Hardman travelled to Vanuatu to oversee the implementation and maintenance of the Sempo platform. They supported Oxfam staff in Vanuatu in participant registration and onboarding. They trained Oxfam staff in Vanuatu and pilot participants on the platform and contributed to programme monitoring.

Figure 3: ConsenSys staff (L-R) Brianna Davis, Kris Randall and Rosa Thompson pictured during the UnBlocked Cash pilot.
Photo: Keith Parsons/OxfamAUS

3.1.2. CONSENSYS

ConsenSys was founded by Joseph Lubin in 2015. It self-describes as a "... global blockchain technology company building the infrastructure, applications, and practices that enable a decentralized world".

ConsenSys joined Sempo in response to Oxfam's request for proposal. ConsenSys staff included researchers and media specialists charged with the task of reporting on the UnBlocked Cash pilot and making recommendations for future scale-up.

Both companies contributed to an Oxfam-led programme workshop and post-pilot learning session. Members of the team also joined an Oxfam film crew in Vanuatu during the pilot's first round to document and learn from the pilot process.

3.2. GUIDING FRAMEWORKS

The UnBlocked Cash pilot addresses a number of the Grand Bargain commitments, while also fostering Oxfam's alignment with the Global Framework for Action defined by the Cash Learning Partnership (CaLP). In particular, these pilots have been developed to address the humanitarian sector's appetite for greater transparency and accountability to both donors and communities, while also increasing the amount of cash-based programming and simplified reporting requirements. Both the Grand Bargain commitments and CaLP framework are included below for reference.

The Grand Bargain Commitments:

1. Greater transparency
2. More support and funding tools for local and national responders
3. Increase the use and coordination of cash-based programming
4. Reduce duplication and management costs with periodic functional reviews
5. Improve joint and impartial needs assessments
6. A participation revolution: include people receiving aid in making the decisions which affect their lives
7. Increase collaborative humanitarian multi-year planning and funding
8. Reduce the earmarking of donor contributions
9. Harmonise and simplify reporting requirements
10. Enhance engagement between humanitarian and development actors

Global Framework for Action:

A Consolidated Summary of Commitments for Cash Transfer Programming

1. Ensure sufficient funding is available for cash transfer programming
2. Ensure cash is routinely considered, alongside other tools
3. Build sufficient capacity for cash transfer programming
4. Ensure the quality of cash transfer programming
5. Strengthen coordination of cash transfer programming
6. Strengthen the evidence base and invest in innovation

3.3. COUNTRY CONTEXT

The Republic of Vanuatu is an archipelago of volcanic origin composed of 82 islands in the South Pacific some 1,750 kilometres east of northern Australia (The Logistics Cluster n.d.). Its population of 272,459 comprises primarily Ni-Vanuatu people of Melanesia ethnicity speaking Bislama, an English-based creole language, which is first of three national languages followed by English and French. Nonetheless, there are more than 80 different language groups among the islands and a great diversity of social structures (VNSO 2016, p.1; The Logistics Cluster n.d.).

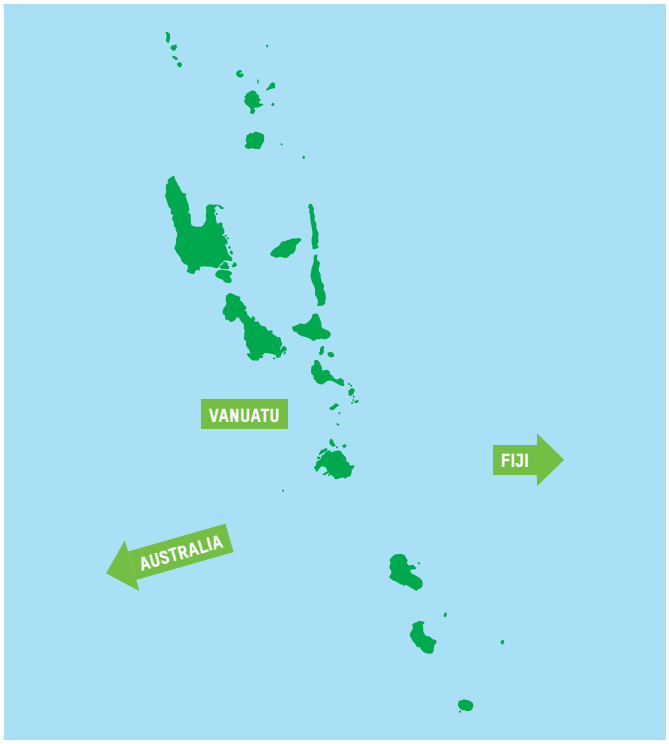

Figure 4: Map of Vanuatu.

Roughly 75.13 per cent of the population are based in rural areas, while the remaining urban populace primarily occupies Luganville on Espiritu Santo island and the nation's capital Port Vila on Efate island (VNSO 2016, p.1, 18, 38). Vanuatu's three largest islands—Espiritu Santo, Malekula, and Efate—accommodate more than half of the total population (VNSO 2016, p.1).

Six provincial councils administer Vanuatu; Torba, Sanma, Penama, Malampa, Shefa, and Tafea. Municipal governments administer the provincial capitals of Port Vila in Shefa province, Luganville in Sanma province, and Lenakel in Tafea province. Meanwhile, the National Council of Chiefs upholds matters of custom and tradition.

The World Risk Index considers Vanuatu as the country with the highest disaster risk of the 172 countries included in the report (Heintze et al 2018, p.6, 53). Situated on the infamous Ring of Fire and within the Cyclone Belt, Vanuatu experiences many geophysical and hydro-meteorological hazards, including earthquakes, volcanic eruptions, tsunamis, landslides, cyclones, floods and droughts.

This high disaster risk and the vast distance between markets on each of the islands restrict economic development. Economic activity is concentrated in the two most populous urban centres of Port Vila and Luganville. While the islands of Tanna and Malekula also boast commercial centres, economic activity is hampered by the absence of international cargo ports.

Much of the country's food is produced locally by way of own-account production, resulting in generally very low levels of extreme poverty. However, sea-based imports are critical for fuel, manufactured goods and non-perishable foods, which fill the shelves of many of the UnBlocked Cash vendors. The quality of transport infrastructure limits the movement of these goods. Many remote areas rely on small vessels with outboard motors or light aircraft capable of operating on grass airstrips.

Vanuatu is predominately a cash-based society, with an average of 68 per cent of an individual's total income derived from cash sources (VNSO 2010, p.vi). The Household Income and Expenditure Survey (2010) reports that 90 per cent of households had some form of cash income—with 99 per cent of urban households and 91 per cent of rural households having 'cash' sources of income (p.27). Wages and salaries account for 39 per cent of household income; meanwhile, 59 per cent of urban households and 92 per cent of rural households received income from own-account production (p.26). This includes goods produced and consumed in the home, such as food and firewood.

Population growth is estimated at 2.3 per cent nationally, and the average household is estimated to represent 4.8 members (p.1). However, the combined average of Pango and Mele Maat is estimated to be closer to 5.6 members based on data collected for this report.

According to Vanuatu's National Population and Housing Census (2009), 12 per cent of the total population reported a disability and the proportion of females with a disability was marginally higher than that of males.

"Gender-based inequality is deeper in urban areas, compared to rural areas, and, to some extent, reflects wage inequality. Women's share of the benefits from economic growth has been less than men's with more of the growth being in male-dominated jobs such as construction. More women are vulnerable to falling below the poverty line than are men. The unemployed poor, elderly and people with disabilities are more vulnerable in urban areas than in rural areas" (VNSO and UNDP 2010, p.17).

In Port Villa, 23.3 per cent of people with disabilities are living below the 'Basic Needs Poverty Line', although there is no gender gap reported, which is not the case in other parts of the country (p.57).

Regulations governing CVA in Vanuatu are the same as those that apply to any financial transaction, which is overseen by the Financial Intelligence Unit under the Reserve Bank of Vanuatu.[4] Generally, these include anti-money laundering (AML), counter-terrorism financing (CTF) and know-your-customer (KYC) statutes requiring due diligence and record-keeping of the recipients' ID, the transferred amount, and intended use of the transferred amount.

3.3.1. PANGO

Pango is located some seven kilometres south of downtown Port Vila at the mouth of Erakor Lagoon. It is one of five peri-urban villages, including Mele-Maat, Mele, Ifira, and Erakor "along with significant settlements of migrants from other areas of Vanuatu who have relocated on the outskirts of town" (Rawlings 1999, p.72).

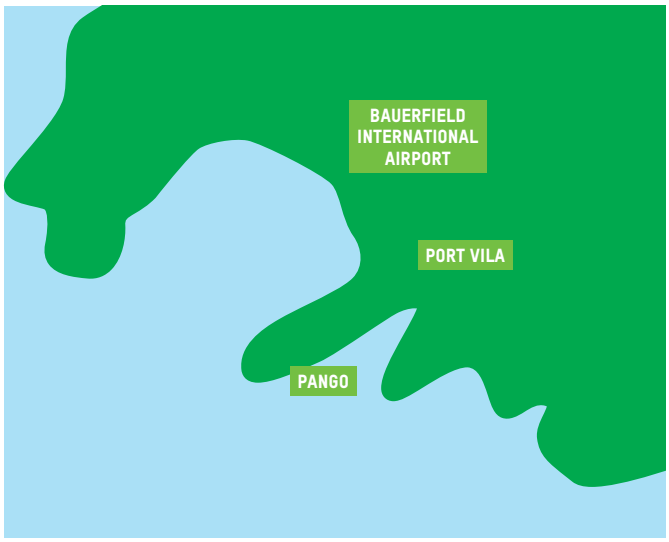

Figure 5: Map of Pango on the island of Efate.

Just 3 per cent of Efate's population lives in Pango, approximately 2,326 people, in contrast to 50,944 in Port Vila (VNSO 2016, p.38). Pango reports 460 heads of households, which prominently cater to 6–9 people. These people primarily live in one family house detached from any other house (p.156). Approximately 73 per cent of household heads own their home (p.166), and 61 per cent holds a customary land title, only 10 per cent occupy with informal arrangements (p.164).

Table 1: Household size

NAME	TOTAL	1	2	3	4	5	6–9	10+
Pango	460	20	45	69	80	80	137	29

Source: Vanuatu National Statistics Office (VNSO) (2016) *Mini - Census Report.*

49.37 per cent of the 1,513 people surveyed hold a bank account with a commercial bank, while 7.93 per cent holds an account with a non-commercial bank (p.141–142). This leaves a significant number of residents unbanked.

The vast majority of residents, 98.23 per cent of the 2,322 surveyed, hold a birth certificate which served as identification for the UnBlocked Cash pilot (p.125).

4 More information on the Financial Intelligence Unit and its polices are available at: https://fiu.gov.vu/

Figure 6: Registration site in Pango pictured with a shuttle that is used to transport a community member with a disability.
Photo: Keith Parsons/OxfamAUS

3.3.2. MELE MAAT

Mele Maat was established in 1952 by Ambrymese relocating the village of Maat from Ambrym after the eruption of the island's volcano—evidence of Vanuatu's volatile state (Rawlings 1999, p.75). The village is located west of the Bauerfield International Airport and approximately 20–25 mins by car from downtown Port Vila.

Data on Mele Maat is scarce as it is not disaggregated in the national census data. According to data collected by Oxfam staff in Vanuatu, the average household is composed of roughly six people.

56.98 per cent of households in Mele Maat own a phone compared with 70.30 per cent in Pango. Similarly, fewer people hold bank accounts—only 39.53 per cent of household heads surveyed reported having a bank account in the family in contrast to the 47.52 per cent in Pango. These finding may indicate slightly lower household income in Mele Maat compared with Pango.

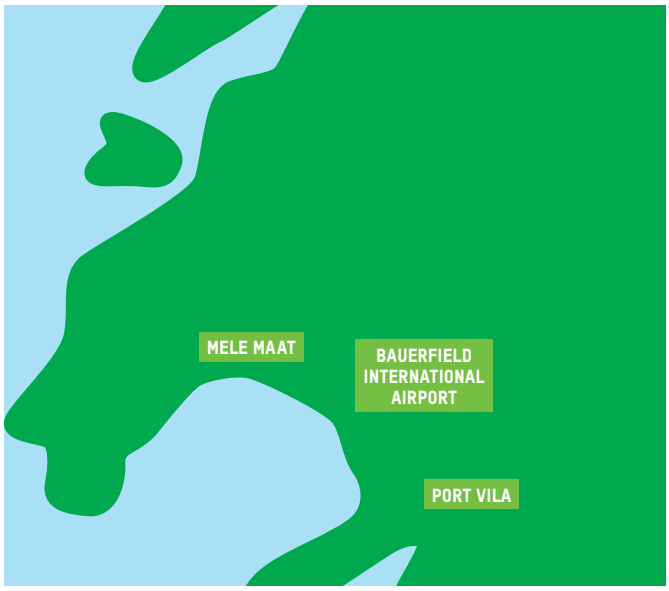

Figure 7: Map of Mele Maat on the island of Efate.

3.4. CASH AND VOUCHER ASSISTANCE

Cash and voucher assistance (CVA) are mechanisms by which cash, vouchers, or alternative representations of value are provided directly to recipients to be exchanged for goods or services. CaLP insists that this term is only used to describe "... the provision of cash transfers or vouchers given to individuals, household or community recipients; not to governments or other state actors." This form of assistance excludes remittances and microfinance, although microfinance and money transfer institutions may be used for the provisioning of value. It is also important to note that, CaLP only supports the use of the terms 'cash' or 'cash assistance' when referring specifically to unrestricted assistance in the form of physical currency or e-cash.

These mechanisms are often considered recent innovations, and yet Red Cross is recorded as having employed CVA as early as the Franco-Prussian war in 1870–1871, and in response to famine during 19th-century India and Botswana in the 1980s (Harvey and Bailey 2015, p2). In recent years, however, CVA has become an increasingly common tool in emergency response and recovery efforts (Harvey and Bailey 2015, p.2; Mercy Corps n.d., p.1–2).

Compared to in-kind assistance that is typically food, household goods, medical supplies, building materials, and education—a market-based approach, as represented by CVA—can be more dignified and empowering for recipients who are free to define and respond to their own needs with locally available resources (OCHA n.d.). Some within the humanitarian sector consider CVA a complement to the provision of in-kind assistance (OCHA n.d.). Meanwhile, others argue that when appropriate and in the right context, where local markets are functioning well and can meet demand, market-based approaches are preferable to in-kind assistance, which has until recently accounted for the vast majority of international aid (Harvey and Bailey 2015, p.3; Mercy Corps n.d. p.1–2).

This approach also ensures foreign assistance does not undermine local human or market capacity, hereby, promoting local economies to recover more quickly (Mercy Corps n.d., p.1–2). This is especially important for signatories to the Charter for Change and the Grand Bargain such as Oxfam.

The Overseas Development Institute (ODI) (2015, p.8) estimates that "cash transfers are among the most well-researched and rigorously-evaluated humanitarian tools of the last decade". GiveWell (2012), the U.S. based nonprofit dedicated to effective altruism, largely agrees, but argues that evidence drawing a direct connection to particular humanitarian outcomes is sparse. Nevertheless, it states: "cash transfers have the strongest track record we've seen for a non-health intervention, and are a priority program of ours".

The acceptance of such mechanisms is further exemplified by one practitioner quoted in the Mercy Corps 'Cash Transfer Programming Toolkit' (n.d., p.2), who commented that "the discussion is no longer about whether cash transfer programming is a legitimate intervention type, but about how best to use cash assistance". Meanwhile, within Oxfam, "If not market-based, why not?" is a common refrain (Oxfam in Vanuatu 2017).

While Oxfam's experience with market-based approaches dates back to the 1990s, its commitment has increased sharply from 2005 to now, during which time it has implemented programmes in more than 40 countries. Today, Oxfam favours aid delivered through local markets, while also working to support and strengthen local capacity by improving access to credit, and rehabilitating infrastructure (Oxfam 2015).

In contrast to traditional non-market-based assistance or conventional nonfungible aid, CVA is delivered in a fungible form, which is easily exchangeable with other assets. However, some limitations may be applied depending on whether or not the assistance is conditional or unconditional. A conditional cash transfer (CCT) places restrictions on how a recipient can spend their assigned value. This might include where the value can be spent or on what, i.e. food, healthcare, or education (OCHA n.d.). Unconditional cash transfers (UCTs) or multipurpose grants are provided to recipients without any obligations or limitations (OCHA n.d.). The second provides greater agency to recipients, and is the most market-based approach. While users showed a preference for multipurpose grants during the Ambae volcano response in 2018, Vanuatu's government voiced a preference for the use of vouchers instead of unconditional cash in past consultations with Oxfam staff in Vanuatu.

Regardless of the mode by which CVA is delivered, all programmes generally share the same objectives of providing timely, cost-effective assistance to crisis-affected populations, while supporting local economies (CaLP n.d.). Where programmes differ is in the amount of value transferred, the means and frequency of the transfers, and the duration of the programme. These differences are the focus of this report.

3.5. DISTRIBUTED LEDGER TECHNOLOGIES

When Lehman Brothers filed for Chapter 11 bankruptcy protection in September 2008, it signalled the beginning of a worldwide collapse of the banking sector at an unprecedented scale. Within months of this event, a mysterious person or persons named Satoshi Nakamoto retaliated with a digital currency believed to be impervious to unpredictable monetary policies or political influence (Tapscott 2016; Davis 2011).

In the case of Nakamoto's Bitcoin (BTC), the underlying technologies are unified by the name Blockchain, which was the first of many distributed, append-only ledgers, generically known as Distributed Ledger Technologies (DLTs). Among the most notable DLTs to emerge since Blockchain is Ethereum, first made publicly available on July 30, 2015. Ethereum is the DLT on which the UnBlocked Cash pilot relies.

As with traditional ledgers, DLTs allow users to enter and retrieve data within a database. However, unlike conventional ledgers, the entries of a distributed ledger are spread among a series of nodes or participants in which the data is cryptographically and immutably stored in every copy as a series of 'blocks'. Once data is assigned to a block, it cannot be altered retroactively except by colluding with the network majority to simultaneously change all subsequent blocks. This characteristic is only true of 'append-only' ledgers like that of the Ethereum 'mainnet', not all DLTs necessarily behave this way.

It is also worth noting that app developers have the freedom to choose what is coded onto the chain or merely referenced by off-chain code. The former creates greater degrees of immutability, while the latter allows for a degree of changeability or mutability.

DLTs can be described in many ways; however, there are three characteristics that are particularly important in the context of this pilot; these are transparency, immutability, and disintermediation.

It is important to note that no two DLTs are exactly alike by design and even less so in deployment. As such, transparency, immutability, and disintermediation are not inherent to all DLT-based solutions. The UnBlocked Cash pilot revealed some limitations of these properties under certain conditions. While transparency was important, participants could not easily check their balances. Meanwhile, disintermediation was undermined by the reliance on incumbent FSPs related to unforeseen complexities of actors cashing out of the system. See section 6. 'Stories' for a more detailed explanation of these limitations.

3.5.1. TRANSPARENCY

Oxfam believes, at minimum, transparency for the UnBlocked Cash pilot means "anyone with access to the network can view a history of transactions in real-time" (Galen 2018, p.8). Oxfam acknowledges that not everyone served by the Sempo platform has access or the literacy to comprehend the information stored on the network. Nevertheless, by deploying the solution to the Ethereum mainnet, Sempo ensures that the platform meets Oxfam's definition.

The mainnet is the primary public network whereby transactions are entered into Ethereum's distributed ledger. The mainnet is contrasted by the 'testnet', where applications can be developed, and virtual currencies with no actual value can be traded to test systems in a safe environment.

Unliked the mainnet, which is a distributed computer spanning thousands of nodes, a testnet can be installed on a single server or on a group of servers under centralised control. As such, only applications running on the mainnet can take full advantage of Ethereum's robust decentralisation and transparent public record.

The decentralisation of computing power and record-keeping creates redundancies, which reduces the risks associated with single-point dependency.

Since Ethereum is a permissionless DLT, trust is established by way of contracts embedded in digital code and stored in transparent, tamper-resistant shared databases. Without decentralisation, this trust mechanism does not work.

3.5.2. IMMUTABILITY

Entangled with transparency is immutability. This characteristic speaks to the tamper-proof nature of the typical public distributed ledger. Data committed to the distributed ledger cannot be altered retroactively, except by colluding with the network majority to simultaneously change all subsequent blocks. This is practically impossible with current technology.

This characteristic is both powerful and potentially harmful depending on the nature of the information committed to the distributed ledger. Since data cannot be deleted, storing personal information is in tension with right-to-be-forgotten laws. As such the UnBlocked Cash pilot does not store any personally identifiable information on the Ethereum mainnet.

It is important to note that immutability is not guaranteed on private deployments of a DLT like Ethereum. Immutability is ensured by many different participants acting on the network, allowing the system to compare one actor's copy of the ledger to that of the others. If a single actor owns a network, no number of nodes ensures immutability, as that one actor is free to delete or modify data on each node.

One such example is the World Food Programme's (WFPs) Building Blocks project. Like UnBlocked Cash, Building Blocks is built on Ethereum with the aim of making voucher-based cash transfers more efficient, transparent and secure, while also improving collaboration across the humanitarian system. While the World Food Programme (WFP) should be commended for the excess of USD 11 million worth of entitlements processed through the system to date, it is questionable whether just four nodes with one controlling entity can promote greater transparency and security. To WFPs credit, the agency has announced an ambition to onboard UN Women as the first non-WFP participating entity on the platform (Coppi and Fast 2019, p11). See section 3.5.5. 'The Importance of Trust' for more information.

3.5.3. DISINTERMEDIATION

Disintermediation is the process of removing entrenched third-party intermediaries from an exchange. Since DLTs can stand-in for the traditional agents of trust like banks and governments, they are able to facilitate peer-to-peer (P2P) exchanges at a low financial cost. This is key to the assumption that DLTs can reduce the time and cost required for a transaction.

However, if actors are not directly connected by the DLT, disintermediation is also not guaranteed.

3.5.4. DEGREE OF PARTICIPATION

Broadly speaking, DLTs can fall into one of four quadrants defined by the degree of participation, see Figure 8. On one axis a DLT can either be public (open) or private (closed). The former often provides the option for pseudonymity, while the latter emerges as the preferred approach for enterprise implementations (Mercy Corps 2017, p.11). The second axis relates to the degree to which a participant is allowed to interact with the functions of the distributed ledger. On the permissioned end, users are only given access to the parts of the distributed ledger that a higher authority deems appropriate. While on the permissionless end, every participant enjoys the same level of read/write access (Mercy Corps 2017, p.12). This is typical on public distributed ledgers like the Ethereum mainnet used by Sempo for the UnBlocked Cash pilot.

It is important to note that the UnBlocked Cash pilot issued NFC cards to recipients on account of the low connectivity

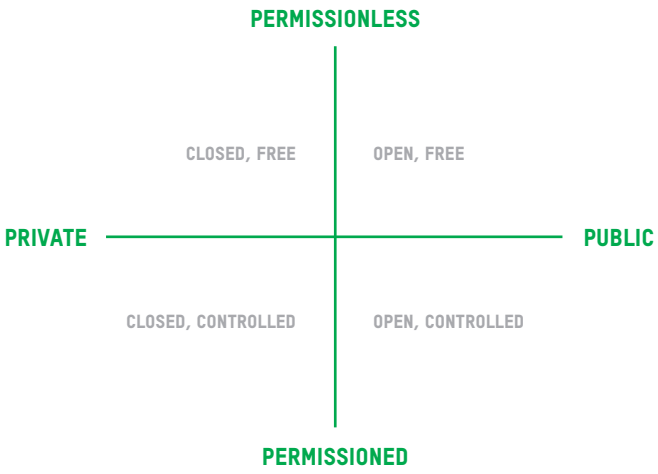

Figure 8: The degree of participation allowed by a DLT depends on the two axis of this diagram.

and technical literacy in the target area. This limits the degree to which the participants can interact with the platform. The question of participation is a conceptual point that bears mentioning, but in the context of this pilot, it was considered more important to address the low connectivity, ease of use, and recipient dignity. The NFC cards, described in a later section, allow previously unbanked recipients to make contactless transactions familiar to anyone who has used a conventional payment card.

3.5.5. THE IMPORTANCE OF TRUST

To understand how disintermediation is possible, it is essential to understand how DLTs stand-in for trusted intermediaries. First, consider the elements required to establish trust in a typical exchange—a valid identity and a record of ownership, both of which must be verifiable.

To verify identity, DLTs rely on public-key or asymmetric cryptography. This technology depends on a set of keys issued to each user, one private and the other public. Galen (2018, p.9) draws the comparison of a public key with an account number and the private key as similar to a password.

Meanwhile, to prove ownership, DLTs employ a technology called cryptographic hashing, a process by which data is algorithmically shortened. Here the immutable quality of a DLT comes to bear, since each new block contains a hashed representation of the data stored in the previous block. "Once a piece of data is hashed, any change to the data causes the hash value to change. By comparing hash values, any observer can easily detect whether an alteration has been made to the original data" (Mercy Corps 2017, p.10).

Finally, the network must arrive at 'distributed consensus'. This process begins with one or more nodes in the network receiving and inspecting transaction data. If the data is found to be incomplete or flawed, the transaction will be rejected; otherwise, the validated transaction data is broadcast to the nodes in the peer-to-peer network. Once the nodes receive the data, they must agree on which "... transactions will be added to the block and in which order" (Mercy Corps 2017, p.9).

Neither asymmetric cryptography nor hash technology is by any means new, but it is the unique way that DLTs combine these concepts with P2P networked ledgers/databases that enable previously impossible applications.

3.6. ETHEREUM

Unlike Nakamoto's Blockchain, which was designed to transmit and store its native cryptocurrency designated BTC, Ethereum is better characterised as a decentralised global computer on top of which developers can program decentralised applications.

There are principally three types of applications described in the Ethereum Wiki (2019), these are: financial, semi-financial, and non-financial. The Sempo platform is a financial application that provides Oxfam with a more powerful way of managing aid distribution with the support of ERC20 smart-contracts. Generally, smart-contracts are stores of value that only unlock if certain predefined conditions are met.[5] On the Sempo platform, they are used to record transfers of value between pseudonymous addresses, which are reconciled with identities using an internal database. The ERC20 designation refers to the technical standard for smart-contracts running on Ethereum.[6] It guarantees consistent access to several vital functions, which facilitate the transfer of tokens from one address to another and the approval of a third-party address to transfer a specified amount of tokens from an address.

Just like the Blockchain, Ethereum produces a native cryptocurrency named 'Ether' (ETH) following a proof-of-work model.[7] ETH shares many of the same fundamental features as BTC, including decentralisation, scarcity, and an absence of government control (Ethereum, n.d.). It is an entirely digital asset, which is available to anyone with a sufficiently advanced internet-connected device to make payments, store value, or use as collateral.

In some contexts, including Vanuatu, the use of cryptocurrencies like ETH and BTC are not permitted. As such, the solution developed for the UnBlocked Cash pilot holds value in a sub-currency designated DAI, which is 'wrapped' in a Crypto Collateralised Voucher (CCV) to be used in-country. See section 3.7. 'Stablecoins and Dai' for more information.

5 Smart-contracts define a set of actions that will automatically trigger a new series of actions (Coppi and Fast 2019, p.vi).

6 The Ethereum token API is currently debated as an ERC (Ethereum request for comment) and may be outdated. Information on Ethereum Standardized Contract APIs is available at: https://eips.ethereum.org/EIPS/eip-20

7 In proof-of-work (PoW) based DLTs, the algorithm rewards participants who solve cryptographic puzzles to validate transactions and create new blocks (Ethereum 2019). This computationally demanding and thus energy-intensive process is referred to as 'mining', which is a critical component of Nakamoto's Blockchain and the current implementation of Ethereum. However, more secure and energy-efficient proof-of-stake (PoS) DLTs, such as Ethereum's forthcoming Casper implementation, trade puzzle-solving for a turn-based voting system in which the weight of each validator's vote depends on the size of its deposit (Ethereum 2019).

The CCV ensures that only pre-approved participants of the UnBlocked Cash pilot are permitted to access value, which is a critical component of the AML considerations made by Sempo. It also insures that donor funds are tied to the programme, which protects against poor budget management or re-allocation by the NGO.

To create a CCV token during the UnBlocked Cash pilot, Sempo would issue 1 DAI to the governing smart-contract, which held the DAI in escrow. To release DAI from escrow, one must provide the smart-contract with a CCV token. However, to make this trade, one's address must be on a whitelist defined by Sempo and stored in the smart-contract. As a result, only selected participants could access the underlying value of a CCV token, which can theoretically be sold at an exchange for fiat currency. This limitation ensures that no cryptocurrency was traded in Vanuatu and the CCV token was not in violation of AML regulations.

As mentioned in section 3.5.2. 'Immutability', Ethereum can be privately deployed to servers accessible to only a small number of users. In Oxfam's experience, this is the common configuration among DLT-based CVA providers. The UnBlocked Cash pilot was proudly deployed to the Ethereum mainnet, which ensures that no single entity controls the data associated with the pilot.

By running the UnBlocked Cash pilot on Ethereum, Oxfam joined the largest and most active DLT-based community in the world, one that actively maintains and improves the technology over time—which is essential as Ethereum has no centralised control over the platform.

3.7. STABLECOINS AND DAI

According to the Ethereum Wiki (2019), "One of the main problems with Bitcoin is the issue of price volatility. The value of a Bitcoin often experiences very large fluctuations, rising or falling by as much as 25% in a single day and 3x in a month". Since the price of many cryptocurrencies is directly proportional to demand, which is unpredictable, volatility is common among these digital assets, including Ethereum's own ETH. This makes the use of cryptocurrencies a risky prospect for aid delivery.

One solution to this problem is to create a cryptocurrency that tracks a specific asset. This kind of collateral-backed cryptocurrency is commonly known as a stablecoin since the value is 'stable' relative to a trusted asset.

The UnBlocked Cash pilot takes advantage of the Dai Stablecoin System, which was specifically designed to address the stable exchange of value in the Ethereum ecosystem (MakerDAO n.d.).[8] DAI's creator, MakerDAO, achieves 'stability' in part by setting a 'Target Price' for the cryptocurrency of USD 1, translating to a 1:1 USD soft-peg. This relationship is significant as USD is widely accepted as the global reserve currency.

It is important to note that DAI can be sold for fiat currency on a digital exchange. This high degree of tradability means that distributing DAI directly to recipients who have not passed KYC checks would violate AML regulations. As such the UnBlocked Cash pilot distributed DAI 'wrapped' in a CCV that could only be 'unwrapped' by pre-approved participants.

To Oxfam's knowledge, the UnBlocked Cash pilot is the first instance of a stablecoin being used in CVA.

3.8. NEAR-FIELD COMMUNICATION

Near-field Communication (NFC) is a standardised contactless communication technology based on a radio frequency (RF) field defined and maintained since 2004 by the not-for-profit industry association 'NFC Forum' (Ortiz 2008; NFC Forum n.d.; Francis et al n.d.).[9] This global consortium of hardware and software companies, governments, financial institutions, and network-providers works to share development, application, and marketing expertise to advance the technology.

The technology uses a base frequency of 13.56 MHz, with a typically low data transfer rate or Baud (Bd) of between 106–424 kilobits per second (kbit/s). It is designed to exchange data between two NFC-compatible devices, or between an NFC-compatible device and an NFC-compatible card, tag or token when they are brought within close proximity (Ortiz 2008; NFC Forum n.d.). The first scenario, which might include two smartphones communicating via NFC, is described as an 'active' or P2P mode, while the second scenario mirrors a more conventional contactless system, sometimes described as 'passive'.

In the Oxfam-Sempo system, the data stored on the NFC-compatible card could only be modified by an NFC-compatible smartphone, which powered the card when held nearby—two cards could not interact.

Since the transmission range is so short, approximately four centimetres or closer, NFC-based transactions are considered by some to be inherently secure (Ortiz 2008). However, Francis et al (n.d.) warn that the computational capabilities of smartphones coupled with the capabilities of NFC-compatible devices to behave as both reader and token does put NFC cards at risk of contactless 'skimming' and 'cloning'. With a few exceptions, "... the NFC specifications and standards leave application security in the hands of the developer" (Francis et al n.d.).

8 More information on DAI is available at: https://makerdao.com/en/whitepaper/

9 A full list of NFC Forum members is available at: https://nfc-forum.org/about-us/our-members/

Figure 9: An NFC card as distributed to members of the Pango community. **Photo:** Keith Parsons/OxfamAUS

Figure 10: An NFC card being scanned with an NFC-compatible device. **Photo:** Keith Parsons/OxfamAUS

The NFC cards used during the UnBlocked Cash pilot relied on the MIFARE Ultralight EV1 contactless integrated circuit (IC), which included a cryptographic module not to be confused with the more significant cryptographic process implemented by Sempo.

When the entitlements were loaded onto a card, that amount was recorded locally and signed with Sempo's private key. This signing process employed asymmetric key cryptography, which allowed anyone with access to Sempo's public key to verify that Sempo deposited the amount recorded on the card.

The entitlements are held on the card as a sequence of deposits and withdrawals. Each time a recipient makes a purchase, the amount spent is recorded by incrementing a one-way counter, creating an irreversible record of the total amount deducted. Entitlements were added to a separate counter, which only Sempo could add value to using its private key. The balance of a recipient can then be calculated as: balance = [amount loaded on] - [amount deducted]. Since this process occurred locally, double-spending was impossible even if the ledger had not been synced between vendors.

Each card's unique identifier (UID) was stored securely and could not be tampered with, and was mapped one-to-one with a corresponding Ethereum address that was whitelisted by the admin account to which all the addresses belong. This made the aforementioned 'skimming' exceptionally difficult if not impossible as only pre-approved addresses could transact within the pool.

As a security precaution, the NFC cards were not attributed value until they were assigned to a recipient in country; as such field staff required a mechanism by which to assign a card's UID to a participant. To this end, quick response (QR) codes were printed on the NFC cards, which revealed the cards UID used in the aforementioned signing process. This also ensured that field staff would not require an NFC-compatible device to onboard participants. When onboarding a participant, the Sempo platform recorded which UID was assigned to which participant and the value of their entitlement.

Figure 11: A QR code printed on the reverse side of an NFC card. **Photo:** Keith Parsons/OxfamAUS

Figure 12: A QR code being scanned during recipient registration in Pango. **Photo:** Keith Parsons/OxfamAUS

4. DLT-BASED CASH TRANSFERS IN VANUATU

UNBLOCKED CASH SYSTEM DESIGN

The DLT-based CVA deployed in Pango and Mele Maat built on Oxfam's experience with market-based responses in the Pacific and the specialised technological expertise of Sempo. At the heart of the system was the Sempo platform, which had been previously tested in Lebanon, Greece, and Iraqi Kurdistan. The UnBlocked Cash pilot introduced untested and novel features to the platform in response to the low connectivity in the region and government-imposed limitations on cryptocurrencies.

The Sempo platform was composed of five key elements. The first was an NFC card issued to all 187 recipients as the exclusive means by which to exchange VUV 4,000/AUD 49.24 per card of tokenised value for goods and services offered by approved vendors. Each NFC card was mapped one-to-one with an address on the Ethereum mainnet, where the recipient's balance was held—these might otherwise be described as 'cold' digital wallets. Recipients were encouraged to exhaust their assigned value within one week of disbursement. In practice, some flexibility was exercised to ensure that all recipients had sufficient spending opportunity.

The second element was the Sempo app, which was preinstalled onto Android devices provided to each of the 29 vendors. These NFC-compatible devices allowed vendors to interact with recipients via the NFC cards. A recipient tapped the NFC card against the device to complete the desired transaction.

The third was Sempo's dashboard, which was used by both Oxfam and Sempo to register participants, monitor the programme, and manage disbursements. In addition to the functions of the dashboard, Sempo's platform verified transactions locally and updated a local database before committing transaction records to Ethereum. A single account held by Sempo submitted the records. This account was authorised to commit transactions on the recipient's behalf during the initial disbursement. The smart contract stored this approval notice, and checked to ensure it was valid every time Sempo attempted to process a transaction on behalf of that user.

The two remaining elements of the system relied on Ethereum. First, the flow of value was verified on the mainnet. Second, the DAI stablecoin was 'wrapped' in a Sempo-developed CCV, which was theoretically tradable between community members and represented the 'token' used to purchase goods from local vendors. Given many recipients lacked the adequate documentation to pass KYC checks, and the local government's strict regulatory requirements, direct distribution of cryptocurrency was not possible. The DAI that underpins the Sempo CCV or 'token' was only directly accessible by parties that met the government's regulations. These approved parties were recorded on a whitelist stored in the smart contract. As a result, virtually any party who met local requirements could act as a guarantor of value for the programme.

Vendors were encouraged to 'cash-out' twice per week via direct bank transfers to reimburse their sales. However, this was not possible on account of a two-day settlement period for each transfer found between banks in Vanuatu. As a result of these long bank transfer times, a Super Vendor was commissioned to allow smaller vendors to exchange their tokenised value currency for fiat currency. The Super Vendor was financially incentivised with a cash advance in anticipation of the transfer fees they would incur. See section 6.2. 'Hub-and-spoke funds flow' for more information on the Super Vendor.

5. APPROACH AND METHODS

To determine whether DLTs can reduce the cost and transaction time of CVA while improving transparency, security, and overall UX, Oxfam partnered with Sempo and ConsenSys Solutions to distribute VUV 966,443/AUD 11,896.91 to 187 households of non-fungible value from OAU to recipients in Pango and Mele Maat on the island of Efate in the Republic of Vanuatu.

Field research conducted by Oxfam staff in Vanuatu has been aggregated with data captured from Sempo and ConsenSys Solutions to inform a supply chain performance (SCP) measurement. This measurement evaluated the pilot against three key dimensions: time, cost, and quality.

While for-profit supply chains and humanitarian relief chains differ in many ways, Beamon & Balcik (2008, p.5) suggest that: "Effective performance measurement systems would assist relief chain practitioners in their decisions, help improve the effectiveness and efficiency of relief operations, and demonstrate the performance of the relief chain, thereby increasing the transparency and accountability of disaster response".

Research activity carried out by Oxfam staff in Vanuatu included detailed participant registration and real-time monitoring, surveying of the entire participant pool, six key informant interviews, and four focus group discussions.

The team collected over 520 surveys across a range of activities including:

- Preliminary analysis for vendors (prior to the programme commencement)
- Registration/baseline vendors
- Registration/baseline recipients
- Onsite monitoring recipients
- Post-distribution Monitoring (PDM)/Endline for vendors
- Post-distribution Monitoring (PDM)/Endline for recipients
- Focus group discussion (FGD)
- Key informant interviews (KII)
- Internal staff interviews (after the first and the second round)

The extent of the monitoring during the UnBlocked Cash pilot is not typical of a humanitarian programme — ordinarily only a statistically representative number of randomly sampled participants are monitored. Given this pilot was examining entirely new technology in this context, it was essential to thoroughly observe the communities' experiences and gather feedback from as many participants as possible to catalogue their experiences and understanding of the product.

5.1. EXPECTED RESEARCH OUTCOMES

This research set out to deliver the following outcomes:

1. Demonstrate the capabilities of the Sempo platform.
2. Understand existing transfer mechanisms and the associated organisational processes within Oxfam.
3. Time and cost comparison of DLT-based solutions with existing transfer mechanisms.
4. Comparison of stakeholders' ratings concerning transparency, security, and user experience between DLT-based and existing solutions.
5. Develop an understanding of potential risks and mitigation measures.
6. Develop an understanding of DTL infrastructure and deployment consideration.
7. Evaluation of platform endpoints, i.e. time and cost of distributing and reconciling NFC cards.

Figure 13: Oxfam's Kalua Salerua, discusses proceedings with Pango community members ahead of registrations for the UnBlocked Cash pilot on the island of Efate. **Photo:** Keith Parsons/OxfamAUS

Figure 14: Local Pango store owner Melika Kaluat at her store during the first round of the UnBlocked Cash pilot in Pango.
Photo: Keith Parsons/OxfamAUS

5.2. RESEARCH PARTICIPANTS

Participants were engaged in two rounds over four weeks. Each round lasted two weeks from participant registration to completion. The first round was conducted in the Pango community located in the south-eastern part of Efate in the Republic of Vanuatu. The second round was conducted in Mele Maat, north-west of Bauerfield International Airport.

Since the UnBlocked Cash pilot was not a needs-based intervention, the selection criteria for these communities were not typical of an Oxfam humanitarian programme. The following criteria was used:

1. Communities must be based in a location prone to disasters but not currently experiencing a disaster.
2. Communities must be in close proximity to the Oxfam office.
3. Communities must be based in province with a high feasibility score based on Vanuatu Cash Transfer Feasibility Assessment (2019).
4. Communities must be based in an urban or peri-urban area in which mobile networks and electricity supply are consistent and likely to be rapidly restored after an event.
5. Oxfam must have a pre-existing partnership with the local government responsible for the community.

These five criteria ensured that the participants were of low variability and the pilot could proceed rapidly with maximum logistical simplicity. Oxfam had an existing memorandum of understanding (MoU) with Shefa Province, in which Pango and Mele Maat are based, for the implementation of disaster preparedness interventions. According to Holt and Hart (2019), Shefa province on the island of Efate is the most feasible location for CVA interventions.

Secondary criteria were applied in the selection of recipients to ensure that those most likely to be marginalised post-disaster were included in the pilot. These include: single mothers, widows, people with a disability, and LGBTIQ+ members.[10]

Participants were registered in the mornings, based on community preference. Initially, both rounds were to be run in immediate succession. However, due to a wedding in Mele Maat, Oxfam delayed deployment in that community out of respect and also to ensure that spending patterns were not affected by the event. Within these communities, Oxfam defined two participant types: Vendors and Recipients.

5.2.1. VENDORS

Vendors were existing store owners operating in Pango and Mele Maat at a variety of scales, with a varying selection of items. Some small vendors stocked a minimal number of items and did not necessarily hold a business licence or bank account designated explicitly to their business.

Initially, the UnBlocked Cash pilot sought 10 vendors based on the minimum number required for a total recipient population of 200. The total number of vendors increased to 29 based on an eligibility survey conducted two weeks before Sempo's arrival.

Vendors were selected on the basis of where they operated, their willingness to participate, bank account ownership, access to the internet, and compliance with KYC requirements.

10 The LGBTIQ+ acronym is intended to encompass the full spectrums of sexuality and gender which include but are not limited to lesbian, gay, bisexual, transgender, intersex, and questioning.

Table 2: Business Accounts in Pango

ACCESS	COUNT	PERCENTAGE
Yes	11	73.33
No	3	20
Not Recorded	1	6.67
SUM	**15**	**100**

Table 3: Business Accounts in Mele Maat

ACCESS	COUNT	PERCENTAGE
Yes	14	100
No	0	0
SUM	**14**	**100**

It was considered essential to onboard as many vendors as possible to ensure recipients have greater freedom of choice. Ultimately, 29 were included in the pilot: 15 in the first round and 14 in the second. Vendors were 65.5 per cent female with an average age of 41. While male vendors averaged 54 years of age, the combined average age of the vendors participating was 44. Further demographic data is provided below:

Table 4: Vendors by Gender in Pango

GENDER	COUNT	PERCENTAGE
Female	10	66.67
Male	5	33.33
Transgender	0	0
SUM	**15**	**100**

Table 5: Vendors by Gender in Mele Maat

GENDER	COUNT	PERCENTAGE
Female	11	78.57
Male	3	21.43
Transgender	0	0
SUM	**14**	**100**

5.2.2. RECIPIENTS

Recipients were represented by 187 heads of households: 101 in Pango and 86 in Mele Maat; 81.28 per cent of whom identified as female. Oxfam intended that only women would be issued cards. However, in a country where only 18 per cent of households are headed by females, according to 2016 census data, this did not necessarily ensure that the most vulnerable people were being included.

The same census reported that nationally the average household is composed of 4.8 individuals. Meanwhile, the combined average of Pango and Mele Maat, determined by surveying 157 heads of households, is composed of 5.6

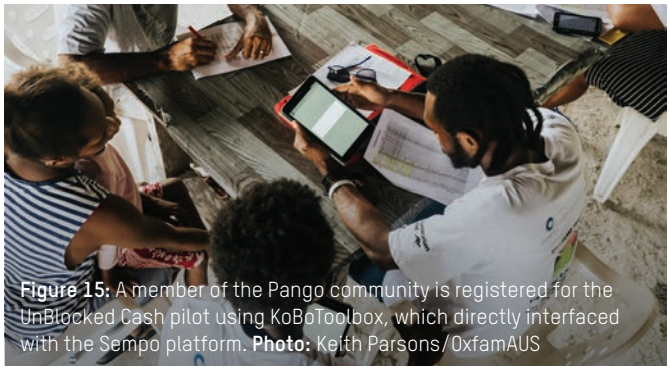

Figure 15: A member of the Pango community is registered for the UnBlocked Cash pilot using KoBoToolbox, which directly interfaced with the Sempo platform. **Photo:** Keith Parsons/OxfamAUS

individuals.[11] As such, it is estimated that the UnBlocked Cash pilot directly benefited 1,210 individuals. This estimation was made by combining 187 recipients, 29 vendors, and their respective families. Further demographic data is provided below:

Table 6: Recipients by Gender in Pango

GENDER	COUNT	PERCENTAGE
Female	83	82.18
Male	17	16.83
Transgender	1	0.99
SUM	**101**	**100**

Table 7: Recipients by Status in Pango

STATUS	COUNT	PERCENTAGE
Single mama	34	33.66
Person with disability	33	32.67
Widows	33	32.67
Transgender	1	0.99
SUM	**101**	**100**

Table 8: Recipients by Gender in Mele Maat

GENDER	COUNT	PERCENTAGE
Female	69	80.23
Male	17	19.77
Transgender	0	0
SUM	**86**	**100**

Table 9: Recipients by Status in Mele Maat

STATUS	COUNT	PERCENTAGE
Widows	31	36.05
Person with disability	28	32.56
Single mama	27	31.4
Transgender	0	0
SUM	**86**	**100**

11 The number of recipients surveyed for the PDM data set was calculated based on a 5 per cent error margin and 99 per cent confidence level. This calculation was made because the activities of the pilot were carried out across two communities at different times. At the time of the calculation, 200 recipients were expected to take part, which yielded a recommended sample size of 154. Oxfam staff in Vanuatu conducted three more interviews than required for that number, which resulted in a total of 157. With only 187 recipients taking part in the UnBlocked Cash pilot, the sample size became much larger than the 147 required. These calculations were made using Raosoft's 'Sample size calculator' available at: http://www.raosoft.com/samplesize.html

Each of the 187 recipients was issued with an NFC card holding VUV 4,000 of tokenised value, which on 22 April 2019, the day the pilot commenced, exchanged to 49.24 AUD at the mid-market-rate of 1 VUV = 0.01231 AUD according to XE.

According to the Household Income and Expenditure Survey (2010), this amount was not a significant value for social support. However, it allowed recipients to make multiple purchases, which helped to conduct a more sophisticated test of the Sempo platform. Oxfam placed no limitations on how recipients could spend the allocated value with the 29 vendors onboarded. However, taboo items such as kava, alcohol, and cigarettes were defined on the platform to determine if recipients would 'misuse' the value and to reduce the burden of vendors that might have to argue over these items with insistent recipients.

Misuse is rare—in a comparison of 11 studies representing programmes in eight countries: six in Africa, one in Asia, and another in the Middle East, the World Bank found the median proportion of households that spent some or all of their entitlement on taboo items was 1.2 per cent. While some interviewees in a study from Malawi had "heard of four men" or knew "certain men" that had spent entitlements on alcohol, these numbers appeared very low, which suggests that "... on average, there is no positive impact of transfers on alcohol expenditures" (Evans and Popova 2014). There was no recorded misuse reported in vendor or recipient interviews, or in the expenditure data from this pilot.

It is important to note that it was not the intention of the UnBlocked Cash pilot to understand temptation spending in the target communities, instead to demonstrate that capturing such spending patterns in real-time is possible; in contrast to relying on post-distribution monitoring (PDM), which does not allow NGOs to adapt to this behaviour during the distribution.

5.3. COMMUNITY ENGAGEMENT

The involvement of the communities of Pango and Mele Maat was essential to the pilot's success. Through consultation with these communities, Oxfam staff in Vanuatu and Sempo were able to understand and respond to community attitudes and expectations.

Early survey responses indicated that both communities were curious about the UnBlocked Cash pilot and willing to participate. Many of the community's questions during these early interviews centred on pilot eligibility criteria, which Oxfam staff in Vanuatu determined based on an individual's reported vulnerability, and the type of identifiable information that might be associated with the NFC cards. There were also concerns regarding the loss of NFC cards and supplied Android devices, which triggered a policy change in which vendors agreed to pay a penalty if the devices were not returned to Sempo.

Among the most potent examples of community involvement were the referrals made by the Area Secretary and the relatives of the would-be participants. Approximately 62.76 per cent of participants learned about the pilot via non-Oxfam sources.

Table 10: Source of Programme Referral

TYPE	COUNT	PERCENTAGE
Area Secretary	59	40.69
Oxfam staff	54	37.24
Relatives	28	19.31
Community Focal Points	2	1.38
Chief	1	0.69
Other	1	0.69
SUM	**145**	**100**

Note: 12 of the 157 PDM respondents did not answer this question.

Early consultation during recipient registration informed the initial product categories programmed into the Sempo dashboard, which allowed vendors to contribute to a better understanding of the communities' spending patterns. Additionally, Oxfam staff in Vanuatu facilitated 'inception workshops' to enhance community support.

Following this, Sempo and Oxfam staff in Vanuatu jointly facilitated an information session with community leaders representing local councils and women's committees during which three people in Pango were elected 'Community Focal Points'. These community members supported the pilot by checking the balance of recipients' NFC cards as required.

Oxfam staff in Vanuatu developed awareness campaigns within the communities to encourage participation and provide instructions for transactions in-store. Posters describing the pilot and instructional material was distributed in the national creole language of Bislama. However, the Area Secretary felt that Sempo should have offered further instructions on the working of the app in the form of a booklet.

The Area Secretary was a notable supporter of the UnBlocked Cash pilot. He spoke of his plans to introduce Business Education training for local vendors after observing varying competencies in bookkeeping, which results in varying degrees of financial success. In contrast, he spoke highly of the general financial literacy among vendors. His influence and ongoing presence during the pilot was a significant factor in the willingness of Pango's vendors to participate in the UnBlocked Cash Pilot.

Figure 16: Pango Area Council Secretary, Alan Sope, during an interview. **Photo:** Keith Parsons/OxfamAUS

6. STORIES

The stories in this section draw on both empirical data and anecdotal evidence collected during the UnBlocked Cash pilot to illustrate some of the strengths and weaknesses of the tested system as observed by Oxfam staff in Australia and Vanuatu.

6.1. COMPLEX FUNDS FLOW

To address government-imposed limitations on the use of cryptocurrency in Vanuatu, Sempo developed a unique distribution model. In this design, there were six major steps.

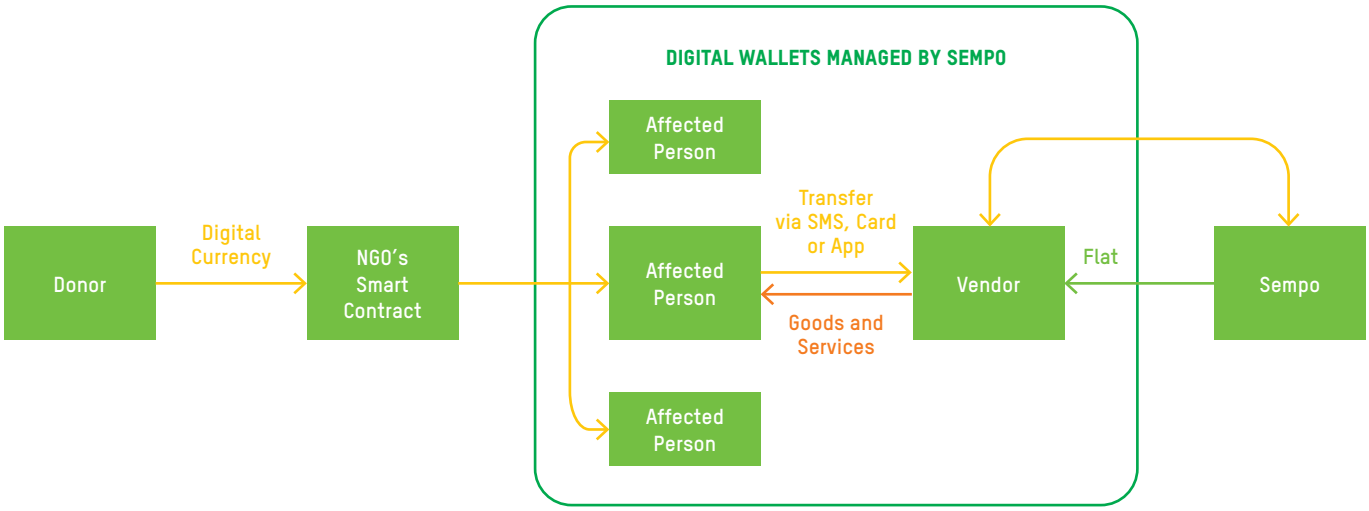

Figure 17: UnBlocked Cash pilot system design as proposed by Sempo.

First, the donor or NGO, in this case Oxfam staff in Australia, purchased DAI to the equivalent value of the total amount to be distributed. In practice, Oxfam staff in Australia engaged Sempo to purchase the DAI and distribute the balance of the programme to vendors and recipients. This arrangement would not be necessary for future implementations if DFAT and Oxfam could approve the direct purchase of cryptoassets such as DAI.

In the following step, the DAI was sent to an escrow contract where the CCV was created.[12] For each unit of DAI deposited into escrow, the programme administrator is permitted to distribute an equivalent number of CCVs to recipients.

Thirdly, administrators distributed CCVs to recipients on the Sempo dashboard. While the holder of each CCV was recorded on the Ethereum mainnet, the value could not be exchanged for fiat currency. These CCVs were tokens in an accounting process managed by the administrator to record debt within the programme.

After the value had been assigned to the recipient address on the Ethereum mainnet, which were mapped to an NFC card, the recipients exchanged their assigned value for goods and services at approved vendors.

The programme administrator or another approved party such as Sempo then reimbursed vendors for the goods and services they had exchanged with recipients for tokenised value. This cash-out process relied upon Sempo or Oxfam to exchange CCV tokens for fiat currency held within their respective bank accounts. The actual transfer of funds occurs off-chain between existing FSPs held by either Sempo or Oxfam and the vendors. This fiat currency was necessary for vendors to trade off-chain for goods. At this point, the CCVs were recorded as spent, or in possession of an approved party.

Finally, the approved party was reimbursed by using the CCV to trigger a release of funds from the escrow contract.

At the expense of complexity, this approach allowed Oxfam, and its back donors, to engage with a highly traceable flow of value using a recognised cryptoasset, without the cryptoasset being distributed in-country.

See section 6.7. 'DLT-based CVA durability in an urban context of Vanuatu' for additional features of the Sempo platform as tested during the UnBlocked Cash pilot.

12 Escrow: an agreement between two people or organisations in which money or property is kept by a third person or organisation until a particular condition is met. Definition available at: https://dictionary.cambridge.org/dictionary/english/escrow

6.2. HUB-AND-SPOKE FUNDS FLOW

THE SUPER VENDOR

Among the most significant issues to emerge in the early days of the pilot was the slowness of cash-outs from Sempo to vendors. Initially, it was expected that cash-outs would be made to vendor bank accounts at regular intervals from Sempo's Australian bank account, which held the total amount of fund to be distributed. These twice-weekly cash-outs, in which tokenised value was exchanged for fiat currency, were anticipated to provide adequate liquidity for vendors to restock as required during the pilot. To facilitate these transfers, Sempo obtained bank details and documentation required for KYC compliance during vendor enrolment.

However, the cost of such transfers was unsustainably high for Sempo to bear. This method also added unnecessary complexity to the system and did nothing to remove incumbent intermediaries. During field testing ahead of the pilot, Sempo discovered that the minimum allowable amount for international transfers from its Australian account was VUV 10,000/AUD 123.10, which was far higher than the volume of business smaller vendors were conducting before needing to restock. During vendor registration and surveying, most vendors reported an anticipated weekly revenue of between VUV 5,001–10,000/AUD 61.56–123.10 and not one expected in excess of VUV 10,000/AUD 123.10, this created an acute problem for the liquidity of participating vendors.

Additionally, these international transfers included an entirely unacceptable receiver's fee of VUV 1,000–1,200/AUD 12.31–14.77, and often took days to process, depending on the receiving vendor's FSP. This delay was considered inconvenient for vendors needing to restock during the pilot. This reported slowness, in addition to the high fees to both sender and receiver, reinforced the assumptions made during the design phase of the UnBlocked Cash pilot.

In response to these early difficulties, Sempo and Oxfam staff in Vanuatu identified three potential solutions. The first was that Sempo would cash-out from a newly established bank account based in Vanuatu. The second was to enlist Oxfam staff in both Australia and Vanuatu to facilitate the process. Finally, it was decided to pursue a hub-and-spoke model by which the hubs, called a 'Super Vendor', would offer cash-out services to smaller vendors. Within the space of roughly two hours, Sempo and Oxfam staff in Vanuatu had workshopped the concept, identified a candidate based on the vendor's inventory and liquidity, and formalised an agreement with the candidate, a vendor in Pango Village. This nimble response illustrated the flexibility of the platform and the applicability of this DLT-based CVA solution in the context of an emergency response. This flexibility allowed the implementing agent to improve its practices incrementally, by learning from the outcomes of decisions made during previous stages in the programme; in this way, the platform promoted an adaptive project management approach.

Figure 18: 'Super Vendor' Loid Albert pictured at her store during the first round of the UnBlocked Cash pilot in Pango. **Photo:** Keith Parsons/OxfamAUS

This model was not without its challenges. During an interview with Oxfam staff in Vanuatu, the vendor explained that "it took too long to get repaid and I had to use my own money to restock". She went on to say that "I also had to take out my own savings to pay out the small vendors…". She felt that there needed to be a clearer understanding that the cash-out process will take time, but she appreciated the extra interest and financial bonuses with each small vendor cash-out. Her incentives included a VUV 30,000/AUD 369.30 advance, in anticipation of the demand for cash-out services and the transfer fees they would incur. Additionally, she was offered 5 per cent of the amount cashed-out to small vendors.

While this improved the rate at which smaller vendors could restock, this approach compromised the Super Vendor's user experience, as the Sempo app distributed to vendors did not delineate between income from product sale and income from cash-out services. This distinction between income from product sale and income from cash-out services is only visible on the dashboard by Oxfam and Sempo staff. The Super Vendor's positive relationship with Oxfam staff in Vanuatu helped bolster her confidence in the system and willingness to proceed in her role as a Super Vendor despite the app's limitations.

Due to the lack of clarity surrounding the role of the Super Vendor in Pango, in addition to UX challenges and the smaller scale of vendors in Mele Maat, Oxfam opted not to retest the Super Vendor model in Mele Maat. In its place, Oxfam cashed-out vendors once per week from accounts held in Vanuatu to reduce the time and direct cost of bank transfer.

When a vendor in Mele Maat was asked if the Super Vendor model could have worked in Mele Maat, she answered with an emphatic "Yes!". She felt that the model would have helped owners of small and medium shops who were prone to running out of goods within 1-2 days to cash-out faster and, therefore, restock sooner. Unfortunately, she felt no shop in her community was large enough to fulfil the role of a Super Vendor. See section 8.4. 'More Super Vendors for post-disaster scenarios' for potential considerations for future CVA programmes.

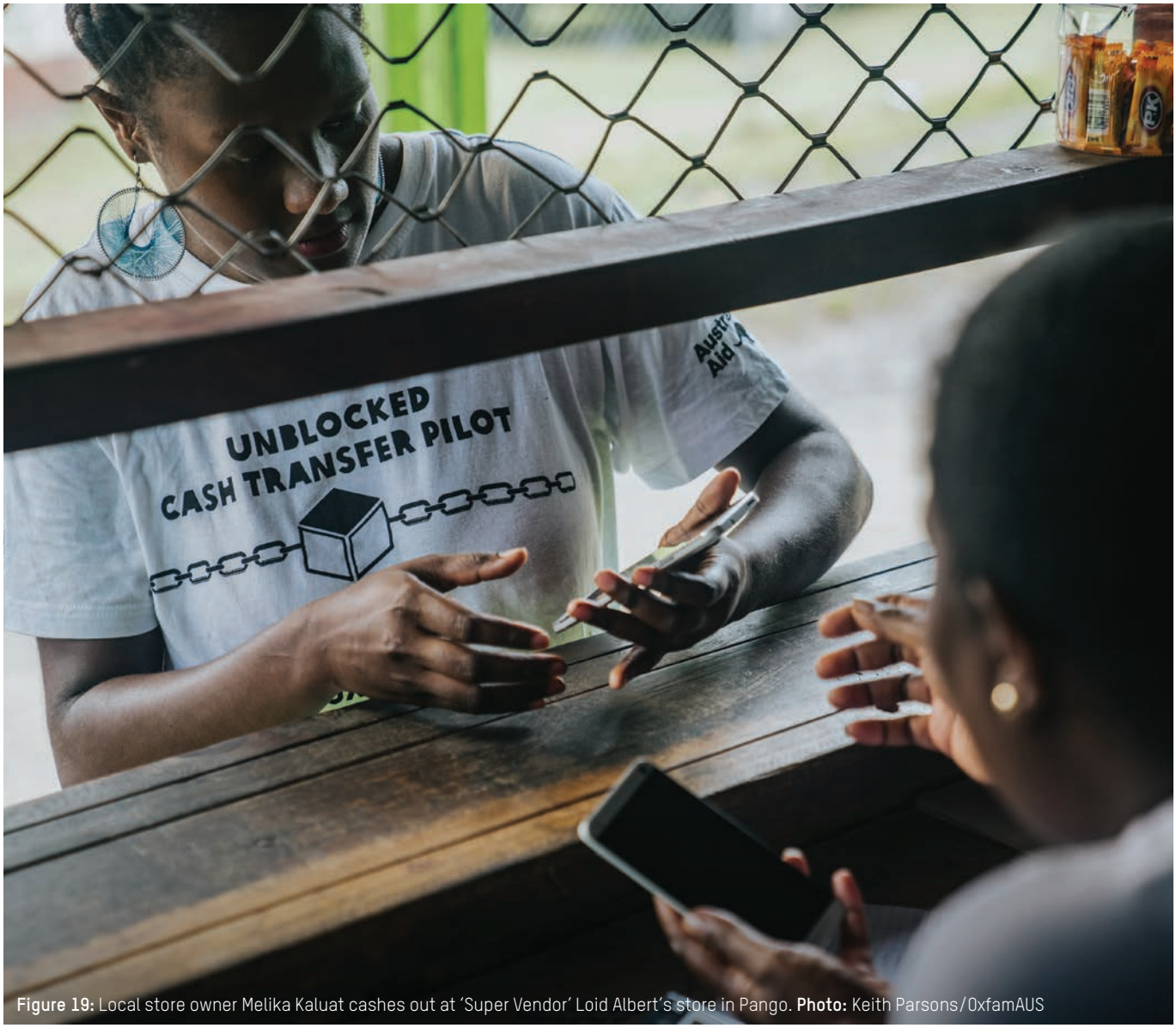

Figure 19: Local store owner Melika Kaluat cashes out at 'Super Vendor' Loid Albert's store in Pango. **Photo:** Keith Parsons/OxfamAUS

Figure 20: A small cross-section of goods available at Loid Albert's store in Pango. **Photo:** Keith Parsons/OxfamAUS

In the context of an emergency response, the ability to restock quickly is crucial. When compared to the conditions of the pilot, the inability to meet demand during a crisis has significant effects on the health and wellbeing of an affected population. 65.5 per cent of Vendors reported running out of goods during the pilot; of those 78.95 per cent were able to restock. It is conceivable that if a solution like that piloted in Pango and Mele Maat were to be scaled up in response to a disaster, the rate at which stocks depleted might increase with greater demand and the ability to restock might be significantly affected.

According to the 'Vanuatu Cash Transfer Feasibility Assessment', "... smaller markets lack the capacity for CTP due to their size and reduced variety of goods. They are then unable to scale up quickly in response to a rapid increase in demand due to the lack of warehousing and credit agreements with suppliers, which reduces shopkeepers' ability to replenish or purchase stock ahead of time. As such, they then have to rely on shipments that are subject to regular delays, and may need to limit purchase orders and frequency due to the cash resources that they have available". The authors Holt and Hart (2019) point out that the inadequate infrastructure at local seaports can create further delays due to the increased risk of damage to goods during handling.

Therefore, the authors report a considerable risk of inflation attributed to CVA in remote locations, particularly where significant population movement has occurred. In this context, inflation could be attributed to a shortage of supply, which drives higher prices or as a consequence of vendors increasing prices because they are aware of a majority shift in purchasing power regardless of supply.

Despite its drawbacks, support for the Super Vendor solution was strong among programme stakeholders. While it lacked refinement, this hub-and-spoke model could be developed to put more control into the hands of the community to self govern and further help to stimulate the local economy. This solution could also help unbanked vendors participate in the economy, which could be particularly important in emergency response and recovery efforts where informal markets are likely to emerge.

6.3. HOW VALUE IS SPENT

By strict definition, the UnBlocked Cash pilot is a CCT programme due to the small pool of 29 vendors with whom recipients could transact, and the discouraging of taboo items such as kava, alcohol, and cigarettes. These conditions notwithstanding, the programme intended to provide as much choice and agency as possible within the context.

During recipient registration, Oxfam staff in Vanuatu consulted with community members to determine the types of items they hoped to purchase during the pilot. The resulting data informed the categories programmed into the Sempo platform. These included: Food, Household Items, Hygienic Items, Clothes, Medical Services, School Fees (added in the second round), Transportation Fares, Building Material, Phone Credit, Smart Meter Refill, and 'Other' for taboo items which included alcohol, kava and cigarettes.

Within the Food category, Sempo recorded long-life and fresh foods despite the overwhelming bias toward shelf-stable products present in the inventory of most vendors, see Figure 20. Later, the 'cash-out' category was added in support of the Super Vendor.

Roughly 94 per cent of recipients in Pango and 99 per cent in Mele Maat planned to purchase food during the pilot period. In both communities, hygienic items were the second most desired category, with approximately 62 and 83 per cent of the population nominating this category respectively. Both communities demonstrated that 'priority needs'[13] and 'planned purchases' followed the same trend with food, hygienic items, and household items holding the first three positions. The remaining categories were sorted by percentage in descending order in the tables below.

Table 11: Priority Needs in Pango

TYPE	COUNT	PERCENTAGE
Food	95	36.82
Hygienic Items	58	22.48
Household Items	37	14.34
Other	21	8.14
Medical Services	16	6.2
Clothes	14	5.43
Phone Credit	7	2.71
School Fees	4	1.55
Transportation Fares	3	1.16
Building Materials	3	1.16
SUM	**258**	**100**

Table 12: Planned Purchases in Pango

TYPE	COUNT	PERCENTAGE
Food	95	39.92
Hygienic Items	63	26.47
Household Items	37	15.55
Medical Services	16	6.72
Clothes	10	4.2
Other	10	4.2
Phone Credit	5	2.1
School Fees	1	0.42
Transportation Fares	1	0.42
Building Materials	0	0
SUM	**238**	**100**

Table 13: Priority Needs in Mele Maat

TYPE	COUNT	PERCENTAGE
Food	86	36.75
Hygienic Items	73	31.2
Household Items	32	13.68
Phone Credit	11	4.7
Clothes	8	3.42
School Fees	8	3.42
Medical Services	7	2.99
Transportation Fares	4	1.71
Other	3	1.28
Building Materials	2	0.85
SUM	**234**	**100**

Table 14: Planned Purchases in Mele Maat

TYPE	COUNT	PERCENTAGE
Food	85	36.96
Hygienic Items	71	30.87
Household Items	38	16.52
Phone Credit	12	5.22
Clothes	9	3.91
Medical Services	6	2.61
Other	6	2.61
School Fees	2	0.87
Transportation Fares	1	0.43
Building Materials	0	0
SUM	**230**	**100**

Of the 80 recipients in Pango surveyed during PDM, 100 per cent purchased food, which represented approximately 40 per cent of total purchases in that community. 86.25 per cent bought hygienic items, and 43.75 per cent bought household items. These figures demonstrate that the recipients' spending patterns roughly matched their reported intentions. In this community, the in-country team was surprised to find 6.25 per cent of recipients purchased electricity via a smart meter refill. This became the fourth largest spending category. The complete list of categories is sorted by percentage in descending order in the table below.

Table 15: Reported Purchases in Pango

TYPE	COUNT	PERCENTAGE
Food	80	40.2
Hygienic Items	69	34.67
Household Items	35	17.59
Smart Meter Refill	5	2.51
Medical Services	4	2.01
Clothes	3	1.51
Phone Credit	3	1.51
School Fees	0	0
Transportation Fares	0	0
Building Materials	0	0
Other	0	0
SUM	**199**	**100**

Data captured by the Sempo platform indicates that of the 582 transactions, excluding cash-outs, made in Pango between 22 April and 17 May 2019, 87.97 per cent contained food items. Long-life food represented 59.3 per cent of all items purchases in Pango. In contrast to the recipient reported figures, hygienic items represented just 15.07 per cent of items purchased compared to 34.67 per cent reported. Similarly, household items represented just 13.12 per cent of items purchased compared to 17.59 per cent reported by recipients.

In Mele Maat between 20 May and 6 June 2019, food items appeared in 78.95 per cent of all 708 transactions. As in Pango, long-life food was the most dominant item, representing 56.43 per cent of all items purchased.

13 Priority needs are items a household or individual requires to survive or recover during or following a humanitarian crisis. For this pilot, recipients were asked to estimate which categories they considered a 'priority need'. Planned purchases, on the other hand, relate only to the items the recipients intended to buy in the context of the UnBlocked Cash pilot.

Table 16: Recorded Purchases in Pango

TYPE	COUNT	PERCENTAGE
Long-life Food	488	59.3
Hygienic Items	124	15.07
Household Items	108	13.12
Fresh Food	44	5.35
Bills	22	2.67
Clothing	15	1.82
Medicine	14	1.7
Taboo	8	0.97
School Fees	0	0
SUM	**823**	**100**

Table 17: Recorded Purchases in Mele Maat

TYPE	COUNT	PERCENTAGE
Long-life Food	522	56.43
Hygienic Items	149	16.11
Household Items	148	16
Fresh Food	50	5.41
Bills	22	2.38
Medicine	17	1.84
Clothing	15	1.62
Taboo	1	0.11
School Fees	1	0.11
SUM	**925**	**100**

The influence of item availability on both reported and recorded purchases is impossible to conclusively assess without a complete inventory from each vendor and a record of where recipients transacted. Of the 34 vendors evaluated by Oxfam, 38.24 per cent provided a basic inventory. The data presented in the table below indicates a bias toward food items, particularly in the long-life category followed by hygienic items. In both cases 100 per cent of the thirteen vendors stocked items in these categories.

Table 18: Stocked items in Pango and Mele Maat

TYPE	COUNT	PERCENTAGE
Canned Food (fish, tuna, chicken, beef, or pork)	13	11.21
Crackers and/or Biscuits	13	11.21
Hygienic Items (soap, or women's hygiene products)	13	11.21
Rice	12	10.34
Products for Babies and/or Infants (diapers, powder, or formula)	11	9.48
Drinks (bottles or cans, excluding water)	10	8.62
Phone Credit	10	8.62
Bread	7	6.03
Bottled Water	6	5.17
Household Items	6	5.17
Cooked Food	5	4.31
Fresh Food (vegetables and/or fruits)	4	3.45
Kitchen Set	3	2.59
Slippers (shoes)	2	1.72
Clothes	1	0.86
School Materials	0	0
SUM	**116**	**100**

Given the dominance of food items in the inventories of surveyed vendors, it is little surprise that vendors report food as the most bought items in both Pango and Mele Maat as see in the tables below.

Table 19: Most bought items in Pango

TYPE	COUNT	PERCENTAGE
Food	13	92.86
Building Materials	1	7.14
SUM	**14**	**100**

Table 20: Most bought items in Mele Maat

TYPE	COUNT	PERCENTAGE
Food	13	92.86
School Fees	1	7.14
SUM	**14**	**100**

Additionally, it is essential to acknowledge that the context of the UnBlocked Cash pilot was expected to affect spending patterns, when compared with those during an active crisis such as the Ambae volcano response. As in the UnBlocked Cash pilot, recipients in the post-disaster scenario of Ambae spent the majority of their allocation on food items: 32.51 per cent in the first month and 30.72 per cent in the following (Oxfam 2019). This compares with 40.2 per cent in Pango during the UnBlocked Cash pilot. While significant, this is also the only similarity between the UnBlocked Cash pilot and the Ambae volcano response. It is somewhat unsurprising that in the post-disaster scenario, building materials and transportation fares were much more critical than during the UnBlocked Cash pilot where no money was spent in either of those categories. Clothes and medical services were also far more significant in the former than in the latter.

Table 21: Reported Purchases During Ambae Volcano Response

TYPE	PERCENTAGE (JAN)	PERCENTAGE (FEB)	COMBINED
Food	32.51	30.72	31.77
Building Materials	7.78	12.9	9.89
Transportation Fares	14.69	11.83	13.51
Savings	5.62	9.83	7.36
Clothes	13.82	8.91	11.79
Medical Services	7.56	5.99	6.91
Gifts	2.7	3.53	3.04
School Fees	1.19	2.92	1.9
Water	5.18	2.46	4.06
Agricultural Inputs	2.38	2.46	2.41
Electricity	1.08	2.3	1.59
Buy Land	1.3	2	1.59
Rent	0.54	1.69	1.01
Recharge Cards	1.73	0.92	1.4
Firewood	0.97	0.92	.0.95
Business Investment	0.65	0.46	0.57
Livestock	0.32	0.15	0.25
SUM	**100**	**100**	**100**

Note: Above data was captured during the second PDM of the 'Multipurpose Cash Transfer' to Evacuees from Ambae from 10-16 January 2019.

From this comparison, it is apparent then when contrasting CVA with in-kind support, food distribution provides the most relevant comparison. Therefore, it stands to reason that future CVA programmes could be optimised for food purchases.

6.3.1. HOW VALUE WAS NOT SPENT

During on-site monitoring, an elderly widow in Pango commented: "It is helpful..." referring to the pilot, "... but if cash was given to me, I could go to the market and buy for fresh food".

This reflection raises an important limitation of the pilot's design. Even with 29 vendors, it was not possible to cater to all needs. Many of the foods available in these relatively small stores are long-life, shelf-stable, and imported products. Many of these items are like those that might be dispatched during an emergency response. While this is appropriate in the context of this pilot, it illustrated how a closed-loop economy promotes inherent conditionality even if it is market-based. By expanding the pool of vendors and encouraging product diversity, it is conceivable that a 'true' economy might emerge.

6.3.2. TRANSACTION DETAILS

During the UnBlocked Cash pilot, Sempo distributed VUV 966,443/AUD 11,896.91 in value by way of 1,572 individual transactions. This number is the aggregate of Disbursements, Payments, and Withdrawals, which are defined in the follow way:

- **Disbursement:** refers to the NGO or Sempo transferring funds to a recipient or vendor digital wallet.
- **Payment:** refers to a recipient making a payment at a vendor, or a vendor making a payment at a vendor.
- **Withdrawal:** refers to a vendor requesting a reimbursement of digital tokens for fiat.

Table 22: Total Value

NAME	AMOUNT (VUV)	AMOUNT (AUD)
Value Distributed	966,443	11,896.91
Value Spent	816,497	10,051.08

Note: Discrepancy between value distributed and value spent includes payments to vendors who immediately cashed-out without recirculating their funds, including their VUV 4000/AUD 49.24 entitlement, among other vendors.

With a slightly larger number of participants, Pango also boasted a larger number of transactions when compared with Mele Maat. On average, the pilot participants in Pango made 75.5 transactions per day with each transaction averaging VUV 2,286/AUD 28.14 in value. In total VUV 541,602/AUD 6,667.12 was distributed across its 101 participants.

Table 23: Transaction Breakdown in Pango

TYPE	AMOUNT
Disbursements	196
Payments	619
Withdrawals	12
SUM	**827**

The participants in Mele Maat are considered by Sempo to have been more comfortable with the platform, evidenced by the greater number of lower value exchanges. In this community of 86, VUV 424,841/AUD 5,229.79 was spent across 745 transactions with an average of 106.4 per day. The average value per transaction was VUV 1,320/AUD 16.25 or roughly 42.26 per cent lower than Pango.

Table 24: Transaction Breakdown in Mele Maat

TYPE	AMOUNT
Disbursements	124
Payments	593
Withdrawals	28
SUM	**745**

Mele Maat notably reports a greater number of withdrawals, which may reflect the smaller scale of the vendors in this community. Oxfam observed that smaller vendors required more liquidity to maintain stock.

6.4. RESPONDING IN REAL-TIME

6.4.1. OUTCOMES OF TRANSPARENCY

Often when transparency is presented in relation to aid delivery, especially where DLTs are concerned, it is presented as a donor feature to eliminate misappropriation/misspending or tampering of allocated funds. In the case of the World Food Programme (WFP) intervention in Jordan, as reported by Reedy (2017), the agency "...was immediately able to track and verify the way families used these funds". This feature was also central to the UnBlocked Cash pilot, but its greatest strength was not verification and oversight, but rather cost savings and support.

The transparency provided by the Sempo platform eliminated some of the time-intensive manual checks and balances required to comply with KYC, AML, and other donor requirements. Additionally, the reconciliation of value occurred in real-time, as opposed to the weeks and months reported by Oxfam staff in Vanuatu during the Ambae volcano response. "As a result of this transparent and efficient reporting, some predict financial reporting costs could shrink by 70%." (Myler 2017).

6.4.2. RESPONSIVENESS

Personalised response to unused funds

It is the support that responders could render recipients that was most valuable. Rather than merely tracking and verifying what recipients were purchasing, the UnBlocked Cash team would also consider instances where recipients were failing to make purchases. In this way, the team could quickly identify if an NFC card had been lost or stolen, or was simply unused due to misunderstandings or confusion. While there were no instances of either, one recipient reported a stolen card, which Sempo was able to trace to a local vendor, based on its activity, where it was discovered that the recipient's sibling had used the card. In another case, a woman with a disability had appeared not to have used her entitlement by the third day of the pilot. When Oxfam staff in Vanuatu identified the anomaly, they found that she not only did not understand how to use the NFC card, but she had also misplaced it. The team re-issued the NFC card and assisted her shopping twice that week.

In another case, a card showing no activity was traced to a recipient who was unsure of how to access their allocated funds. When questioned, the holder confessed that they had not completely understood the instructions during the onboarding procedure and was too embarrassed to ask for clarification. After a quick explanation, the recipient was able to use the NFC card as intended hereby unlocking its value. It is important to note that this real-time response comes at the cost of some degree of privacy, see section 8.14. 'Addressing risks' for more details.

6.4.3. EFFICIENCY

In traditional CVA, it might have taken weeks for this situation to be identified, if at all. In the worse case, this may have resulted in that household not receiving the aid to which they were entitled.

It is worth noting that during the PDM surveys, all but one of the 157 recipients reported that the solution tested was easier than "other forms of assistance" they had experienced. In this group, only 16 of these survey respondents felt that they did not receive enough support on how to use the NFC card.

However, during on-site monitoring of 120 recipients, 12 required support with the NFC card. Five were not sure how to use the card, another five were afraid to use the card, and two were not sure if there was enough value on their card. The on-site monitoring revealed that precisely 10 per cent of the population reported a problem, while roughly 6 per cent reported an issue during the PDM surveys. Neither is insignificant; however, it is anticipated that if this same system were to be used in these communities again in the context of emergency response and recovery effort, the communities' familiarity would mitigate some of the 'teething' issues.

6.5. COMPETING WITH EXISTING TECHNOLOGIES AND ACTORS

How the system interacts with existing banks

It is sometimes claimed that DLT-based CVA represents a good alternative to traditional CVA programmes where ATMs or banks do not exist or are not functioning (Smith 2018, p.91). However, like traditional CVA programmes which rely heavily on existing FSPs and voucher providers, Oxfam observed no disintermediation of financial incumbents during the UnBlocked Cash pilot.

Despite this observation, the Sempo platform competed with a number of similar platforms that promised to reduce the time and costs associated with financial transactions. Oxlabs alone evaluated AID:Tech, Disberse, and Everest as potential partners while planning the UnBlocked Cash pilot. Of those, Disberse presented promising results in its pilot with the START network, during which it reported no leakage of value and reduced costs (Ibid). Meanwhile, World Vision International helped develop a DLT-based digital asset transfer platform in Nepal called Sikka, while the WFP in Jordan has been providing assistance to refugees in Azraq camp using an Ethereum testnet since 2017 (Ibid).

Many of these solutions, including Sempo, rely upon existing FSP to hold funds or as foreign exchange providers. Others rely on third-party online payment service providers such as Stripe.

Smith (2018) reports that during a CaLP 'Learning Event' partners, donor, governments, and service providers came together to address operational challenges related to cash-based programming. The author notes that: "In the end, partners had to use a variety of delivery mechanisms and rely on direct cash distributions through banking service providers and their own staff". Ultimately, direct cash distribution represented 87 per cent of transfers made during USAID/Food for Peace-funded interventions, of which 30 per cent were made via traditional banks, compared to just 13 per cent via e-transfers, which are defined as a "digital transfer of money or vouchers from the implementing agency to a programme participant" (p.16, 130).

This example illustrates the infancy of market-based solutions, DLT-based or otherwise, which despite some rhetoric, are still tethered to financial incumbents. In Oxfam's experience, some of this tendency toward these well-established methods of transferring value relates to the internal struggle with existing business processes. Unless the technology can be designed to fit the process or the process is adapted to the technology, the friction may drive the implementing agency to run 'belt and suspenders' solutions, which promote inefficiency.

See section 6.2. 'Hub-and-spoke funds flow' for details on how Sempo and Oxfam modified the tested system in response to limitations imposed by existing FSP.

6.6. HARDWARE DELAYS & FAILURES

To complete a transaction on the Sempo platform, vendors must use an NFC-compatible Android device loaded with Sempo's proprietary app. Since mobile phone penetration was presumed low in the target communities, Sempo planned to distribute their own for the duration of the pilot. No data was collected on mobile phone ownership during the first round in Pango. Realising the importance of this data, Oxfam staff in Vanuatu asked vendors in Mele Maat to report on whether they owned a 'Smart Phone' or a Feature Phone. Only 28.57 per cent of the vendors in that community owned a Smart Phone, which reinforced the decision to issue Android devices as a component of the platform deployment.

Table 25: Cell/Mobile Phone Ownership in Mele Maat

OWNERSHIP	COUNT	PERCENTAGE
Smart Phones	4	28.57
Feature Phones	10	71.43
SUM	**14**	**100**

However, as the number of vendors was increased two weeks before Sempo deployed in the county, from 10 to 29, Sempo did not have a large enough inventory of mobile phones. This change was considered appropriate by all stakeholders including Sempo to ensure the recipients would not have to alter their behaviour significantly when using the cards; i.e. they could continue using vendors with whom they already had a relationship.

Additional phones were ordered on 16 April 2019. Despite being held in customs, they were available to the team for the scheduled programme commencement date of 22 April 2019, on which Sempo arrived. This scenario illustrates the low friction setup of the Sempo platform and might bode well in a post-disaster scenario.

The most significant hardware issue was not the perceived delay, but the unanticipated variation in the supplementary devices. Despite sharing the same model designation with

previously tested devices, Sempo unverifiably suggested that 80 per cent of the HTC M7 that arrived in Vanuatu were installed with a different microprocessor to that of the tested model. This variation was estimated to increase the login time to the Sempo app by 30 seconds.

6.7. DLT-BASED CVA DURABILITY IN AN URBAN CONTEXT OF VANUATU

Summary:

- Connectivity was not an issue in the first community
- Connectivity was poor in the second community

The system deployed for the UnBlocked Cash pilot was a one-of-a-kind DTL-based solution co-designed by Sempo and Oxfam to test such technologies in a low-connectivity environment. This is essential for the future of DLTs as a tool for emergency response and recovery efforts or as a component of a Disaster Risk Reduction (DRR) programme.

Central to this is an NFC card developed by NXP Semiconductors with two counters, one which only counts up and the other which only counts down. With this configuration, Sempo can keep track of spending even when the vendor device is offline. It is critical to note that the 'amount loaded' counter is only editable by Sempo or another trusted party. This mechanism prevents recipients from double-spending during network outages. When connectivity returns, the vendors' devices sync with the Sempo servers and the Ethereum mainnet. This mechanism also allows vendors to confidently accept payment from a recipient, knowing that the recipient has money to spend.

In practice, Sempo estimated that the system in its current design can endure roughly 24 hours of downtime, but added that no connectivity was easier for the system to resolve than low connectivity. Among other services, the Emergency Telecommunications Cluster (ETC) provides voice and data connectivity in post-disaster scenarios within 24 hours after activation. This service offers basic IEEE 802.11b/g compatible WLAN and internet connectivity distributed from a single location, where possible using portable high-speed data satellite terminals or local broadband links. While this initial service may not be suitable to run a system like that offered by Sempo, coverage provided by the ETC progressively expands over 4–7 days to a point where the requirements of the Sempo platform could be met (ETC n.d.).

Since Sempo's servers run in Docker containers[14], it estimates that the entire platform could be run without internet connectivity if the community was connected to a central server using long-range mesh or an ad-hoc network on an array of WIFI hotspots distributed for the intervention. It should be noted that in this scenario, some of the benefits of the system would not be available in real-time. In particular, Sempo's co-founder suggested that "... a lack of connectivity made responding to problems slower".

During the second round in Mele Maat, the system's resilience was put to the test when Telecom Vanuatu Limited (TVL) announced scheduled maintenance in the area, which would guarantee internet outages over the opening weekend.

The internet connection became extremely slow, which prevented Sempo's devices from synchronising. Sempo reported that some vendors called the support hotline and asked "why does the transaction say it is pending?". When the situation was explained and the vendors were reassured that the transactions were still valid, they replied, "oh, okay that's fine".

Three days later, Sempo still had not seen some devices synchronise. Since this was the first extended test of the offline mode in a non-simulated environment, Sempo was not sure if these few unsynchronised devices were suffering from poor connectivity or bugs in the system. Regardless, Sempo was ultimately pleased with the performance of the platform.

6.8. THE INDISPENSABLE EXPERT

A single point of failure

A key component of Sempo's ideology is acknowledging the "unknown unknowns". Sempo insists that the solution it deploys must be tailored to the particular context in which its platform is assigned to operate. Many of the novel solutions tested during the UnBlocked Cash pilot, such as the NFC card for offline transactions and the CCV 'wrapped' stablecoin, have never been tested in a humanitarian context in the Pacific or elsewhere.

A consequence of these complexities was Oxfam's immense dependence on Sempo's core staff, who travelled to Vanuatu for the duration of the pilot. The co-founder turned out to be an indispensable asset for even the smallest technical support queries. One Oxfam staff member based in Vanuatu anecdotally estimated that the co-founder was the only person able to solve the problem at hand in all but a few occasions. When asked if Oxfam staff could be trained to respond to these issues they replied, "Yes, but we didn't know what they would be until they emerged".

Unless Oxfam staff are indeed able to respond to hardware and software issues in-country without Sempo support, this indispensable expert represents a single point of failure, and, therefore, a significant risk for future implementations. It also restricts the scalability of the platform to a number of participants within an area that a single expert can service.

One Oxfam staff member in Vanuatu reported that, among other things, the Sempo co-founder added additional spending categories to the dashboard, addressed transaction lag due in part to TVL's scheduled maintenance in Mele Maat, and fixed a bug that produced duplicate transactions.

Despite this, Sempo claimed that no technical changes, including project-responsive code, were made during the second round in Mele Maat.

14 "A container is a standard unit of software that packages up code and all its dependencies so the application runs quickly and reliably from one computing environment to another. A Docker container image is a lightweight, standalone, executable package of software that includes everything needed to run an application: code, runtime, system tools, system libraries and settings". More information on Docker available at: https://www.docker.com/

Figure 21: Pango village, Vanuatu: Catharine Patunvanu, Oxfam Staff, describes the registration process to a recipient. Photo: Keith Parsons/OxfamAUS

7. ANALYSIS OF THE DATA INFORMED BY THE STORIES

7.1. TIME

Linear time, measured in seconds, minutes, and hours, is a significant marker of operational efficiency.

The UnBlocked Cash pilot was an opportunity to evaluate whether DLT-based CVA via Sempo's platform could deliver humanitarian aid faster than in-kind support or conventional CVA programmes. Initially, the project was concerned with the end-to-end speed of aid delivery from a donor in Australia to a recipient in Vanuatu. Due to human resources constraints in Vanuatu, the research objective focus shifted to onboarding time.

This study is not concerned with the set-up time of the Sempo platform. As this product matures, the set-up is expected to simplify and quicken. To compare like scenarios, this study assumes both the banking system and the DLT-based applications are operational in a disaster-affected site at the time of transfer. In this scenario, we expect DLT-based CVA will deliver support in a more timely manner than by traditional means.

That data collected during the UnBlocked Cash pilot is sufficient to make partial claims against the hypothesis. However, Oxfam cannot unconditionally claim that the system tested during the pilot is unconditionally faster than other CVA programmes.

7.1.1. BASELINE TIME

When considering the time it takes for funds to be transferred from donor to recipient, Oxfam considered two factors: banking time and internal processing time.

The amount of time it takes for a value to be credited to Oxfam's Australian bank accounts varies depending on when a donation is made. Donations made on a weekday before 6PM are credited on the same day, while those made after that time are processed the following working day. Meanwhile, bulk transfers from Australia take roughly 1.3 working days to be received by Vanuatu.

Taking into account these typical processing times, Oxfam assumes the transfer takes an average of two working days from an Australian donor to Oxfam's bank accounts in Vanuatu, excluding internal processing time. As a proxy for the time required to transfer back donor funds to a country office, this report draws on Oxfam's internal processing time for monthly bulk transfers in Australia and Vanuatu in addition to the 'processing' time incurred by the Oxfam's FSPs. While these bulk transfers are only used for salaries and, therefore, not relevant to an emergency response or recovery effort, Oxfam's Pacific Cash and Livelihoods Lead suggests that for CVA, bulk transfers should be adopted as they are more efficient and less costly. According to research conducted by OxLabs, the FSPs processing time is relatively efficient; most bulk transfers are completed on the same day or within 1–2 working days.

By contrast, the Oxfam accounts team typically took 5.6 working days to process a transfer. At worst, the process could take 12 working days. One explanation for this delay is the tendency for the accounts team to process monthly bulk transfers during the first week of that month. This process was developed to mitigate accounting issues that arise if it is processed earlier. Even if the bulk transfer request form is passed to the accounts team one month earlier than the approved transfer date, it is not processed until the month of. An alternative explanation is that the finance department based in Vanuatu enforces a policy of only three payment days per week: Monday, Wednesday, and Friday. As such, a payment prepared on Tuesday or Thursday would be delayed by one day. However, in the context of an emergency response, neither situation would apply as alternate policies are put into place during emergencies.

For the purpose of this report, the total time for funds to transfer from an Australian donor to a Ni-Vanuatu recipient is 7.3–8.3 working days, excluding internal processing. See section 8.11.2. 'More comprehensive baseline studies' for recommendations regarding the limitations of the baseline data presented in this section.

7.1.2. RESPONSE TIME

In Vanuatu, "communities reported that the average wait time for disaster assistance was 21 days after impact" (Holt and Hart 2019).

However, the authors report some inconsistencies in the collective memory of the households, "with answers ranging from one week to more than four weeks for the same location". Subsequently Hart notes that variations in reports "... may be due to the fact that the distribution and access to assistance for households also tends to be inconsistent, i.e. households close to a main road may receive assistance while those living away from the road may not; male headed households are more likely to receive assistance than female-headed households; households with a family affiliation with the local chief or government representative are also more likely to receive assistance".

Nevertheless, it should be noted that these inconsistencies are an exception—the data collected sufficiently demonstrates the 21-day average waiting period to receive assistance in Vanuatu.

7.1.3. ONBOARDING TIME

Oxfam's Pacific Cash and Livelihoods Lead equated the onboarding process of the UnBlocked Cash pilot with the registration and distribution process of a typical CVA programme. During registration, Oxfam records an individual's information and issues a record of their entitlement. The entitlement is typically made available on a subsequent day.

By their estimation, registration takes a "minimum of 10–15 minutes", usually after waiting in line and the same again

on a following day to receive an entitlement in the form of a cheque or voucher. This process incurs a heavy travel burden on recipients who must make at minimum two trips to receive their entitlement. By combining registration and distribution, which on aggregate costs a recipient between 20–30 minutes in addition to the time required to make two trips, the UnBlocked Cash pilot was considerably more time-efficient.

Additionally, the KoBoToolbox integration offered by the Sempo platform allowed Oxfam staff in Vanuatu, already trained in the use of this tool, to move around the target community registering programme participants into a database that directly linked to the system of tracking entitlements. This eliminates the time typically required to transfer registration data from one platform to the other. See section 7.5.2. 'Integrations' for more information.

Theoretically, additional entitlements could be distributed remotely, which eliminates the need for the recipient to collect an additional cheque or voucher. The recipient could exchange their assigned value immediately, which represented another significant efficiency gain.

It is important to note that during an emergency response, Oxfam staff do not record onboarding time in the same way as it was recorded for the UnBlocked Cash pilot. Full onboarding to an existing CVA platform during the Ambae volcano emergency response from the identification and registration of individuals to recording and verification of beneficiary data and distribution took place over 2–3 dates.

The following information is an approximation of this process based on the operational experience of Oxfam's Pacific Cash and Livelihoods Lead. They note that these figures are the minimum time required per recipient during the Ambae volcano response. Meanwhile, the entire process of registration to distribution for Oxfam is typically much longer.

Table 26: Registration Day

ACTIVITY	TIME (MINS)	DESCRIPTION
Site Set-up		Division of lines and desks according to area council of origin: east, west, south, north Ambae.
Community Awareness Presentations	20	Located at the registration site.
Line-up for Registration	20	
Registration	10	Individual provides name, existing ID, and testimony from another member of the same household that the family agrees to the individual being designated as beneficiary. A registration slip is provided at this stage.
Post-Registration		This step is not included in the estimated one-hour wait time for an individual recipient and not required when using the Sempo platform.
Download Data from Database	5	Download collected data from SurveyCTO.
Verify List	45	The database is verified by chiefs from each area council.
Remove Duplicates	60	The database is cross-checked in Excel for duplicates.

Table 26: Registration Day (continued)

ACTIVITY	TIME (MINS)	DESCRIPTION
Generate Family ID	5	Family ID numbers are generated in Excel for all registered individuals.
Filter List for Eligibility	15	The database is filtered according to eligibility criteria: evacuee (VUV 17,000/AUD 209.27) or host family (VUV 7,000/AUD 86.17), and entitlement is added to the list.
Divide List	60	The database is divided according to the recipient's financial service provider, residents, and distribution site.
Schedule Distribution	120	Distribution schedule is created.
Print	45	Final distribution lists printed according to schedule.
SUM	**405**	

Note: If a recipient does not have a valid ID—40 per cent of individuals did not—they are sent to have a picture taken and have a card printed, which takes 5 and 10 minutes respectively, 15 minutes in total.

Table 27: Distribution Day

ACTIVITY	TIME (MINS)	DESCRIPTION
Site Set-up		Division of lines and desks according to area council of origin: east, west, south, north Ambae
Community Awareness Presentations	20	Located at the registration site.
Line-up for Registration	20	
Present ID & Registration Slip	10	
Identify Cheque		The recipient's name is checked against the distribution list and the family ID number is written on the registration slip. The recipient's name is crossed off the list and the corresponding cheque is identified.
Issue Cheque		The cheque is issued in a plastic sleeve with registration slip and ID.
Cash-out Cheque	20	The recipient visits a bank to cash-out their entitlement.
SUM	**70**	

Note: If a recipient does not have a valid ID, an additional 5 minutes is added to the process to accommodate the time of an Oxfam staff member to find and issue an ID card.

During the UnBlocked Cash pilot, Oxfam staff in Vanuatu timed onboarding of vendors and recipients in Pango and Mele Maat. By comparing the average time of these groups between rounds, the team was able to estimate their staff performance. It is assumed that the lower average time in the second group is due to greater familiarity with the process on the part of Oxfam staff in Vanuatu and not some other conflating factor.

Vendor onboarding was 5.88 per cent faster in Mele Maat, while recipient onboarding was an astonishing 33.33 per cent faster. The average time of each round are documented below in fractions of a minute:

Table 28: Onboarding Time (mins)

LOCATION	RECIPIENTS	VENDORS	KYC
Pango (first round)	5.4	8.5	5.6
Mele Maat (second round)	3.6	8	5
AVERAGE	**4.5**	**8.25**	**5.3**

Additionally, the KYC process was also timed; here too a significant efficiency gain was observed: 10.7 per cent faster in the second round when compared to the first. Oxfam acknowledged the possibility of a 'learning effect' in these figures, so it crucial that both rounds be considered especially in regards to the KYC processing time.

Oxfam's Pacific Cash and Livelihoods Lead noted that while vendors were slower to onboard than recipients during the UnBlocked Cash pilot, they are also issued with entitlement and, therefore, are concurrently being registered as both vendors and 'recipients'.

On average, vendors were onboarded in 8.25 minutes per business owner, while recipients took just 4.5 minutes per person.

While this staff member's experience during the Ambae volcano response—as outlined above in the Registration Day and Distribution Day estimations—cannot be directly compared with the UnBlocked Cash pilot, it serves as a potent example of the time-intensive nature of existing CVA processes. Many incremental improvements could be made to such processes to make significant efficiency gains. Many of Sempo's time-saving features are independent of the underpinning DLT and are, therefore, easily replicable. Based on the information presented in this section, it is impossible to say a DLT-based solution is more timely than a non-DLT-based solution. However, it is clear that a well-designed platform, such as Sempo's, can indeed save staff time, which in turn reduces operational costs.

7.2. COST

Cost is a significant performance metric in light of an increasingly competitive funding landscape and greater scrutiny from donors.

The UnBlocked Cash pilot set out to capture transaction and set-up fees associated with the Sempo platform in addition to ongoing programming and operational cost incurred by Oxfam. The former are identified as 'direct costs' in the report, while the latter are referred to as 'indirect costs'.

It is presumed that the set-up costs of the technology underpinning the UnBlocked Cash pilot relative to the sum being transferred would negatively affect the cost dimension of this study. However, due to Sempo's relatively immature business model, Oxfam cannot conclusively comment on the set-up costs associated with the UnBlocked Cash pilot.

Even so, it might be assumed that cost savings would likely be much more significant if set-up expenses were not amortised into the programme. When measuring the cost of a market-based programme backed by existing FSP, one does not typically factor the cost of setting up the banking system which has been amortised across countless transactions over many years.

As with the previous dimension, see section 7.1. 'Time', Oxfam cannot unreservedly claim to have tested a comparatively more cost-effective solution during the UnBlocked Cash pilot. Data indicates that the tested system required significantly fewer human resources than previous CVA programmes tested in Vanuatu. This suggests that the indirect costs of the pilot should also be significantly lower. Direct costs on the other hand are lower only if on-chain activities are considered. Otherwise, many of the costs associated with transferring fiat currency between incumbent FSPs remain the same.

7.2.1. BASELINE COSTS

When considering indirect costs, the most significant contributor is the cost of salaries of both existing staff and additional personnel required for reconciliation. During the Ambae volcano response in 2018, reconciliation required the support of an external accounting firm at the approximate cost of VUV 6,000,000/AUD 73,860 to account for the approximately VUV 98,000,000/AUD 1,206,380 transferred, against a total operational cost of AUD 1,985,987. This was in addition to an estimated four finance staff with an approximate salary of VUV 236,000/AUD 2,905.16 per month. Given the operational efficiency observed during the UnBlocked Cash pilot, it is presumed that indirect cost savings were significant to the point that even a slight increase in direct costs would be moot.

For direct costs, Oxfam considered four different scenarios to establish a baseline; these were:

- Donors transferring funds to Oxfam Australia (OAU)
- Oxfam Australia (OAU) transferring to Oxfam in Vanuatu (OiV)
- Oxfam in Vanuatu (OiV) transferring to partners
- Partners transferring to beneficiaries or other partners

The cost of transferring funds across a range of FSPs are summarised in the table below.

Table 29: Transfer Costs Compared

TRANSACTION	COST TO SEND (WESTPAC)	COST TO SEND (WESTERN UNION)	COST TO SEND (ANZ)	COST TO RECEIVE (AVERAGE)	COST TO RECEIVE (ANZ)	COST TO RECEIVE (BRED BANK)	COST TO RECEIVE (NBV)	COST TO RECEIVE (BSP)
Donors to OAU	$0.50							
OAU to OiV	$15.00	$0.00		VUV 1,200				
OiV to Partner			VUV 20	VUV 0	$0.00			
Partners (or OiV) to Recipients			VUV 20	VUV 75	$0.00	VUV 150	VUV 100	VUV 30
AVERAGE	**$7.75**	**$0.00**	**VUV 20**	**VUV 425**	**$0.00**	**VUV 150**	**VUV 100**	**VUV 30**

On average, it costs Oxfam AUD 0.50 to transfer funds within Australia; it is, therefore, presumed that the same is true for a back donor. Meanwhile, in Vanuatu, it costs Oxfam VUV 20/AUD 0.25 to transfer funds to a partner, and the same amount for a partner to transfer funds to a recipient. Therefore, a transaction that leaps from Oxfam's accounts in Vanuatu to a partner and on to a recipient incurs a total cost of VUV 40/AUD 0.50. Given the average cost to recipients to receive funds equates to VUV 93.33/AUD 1.15, the total cost of transactions in Vanuatu alone can amount to VUV 133.33/AUD 1.64.

One of Oxfam's goal for the UnBlocked Cash pilot was to reduce the overall cost of transactions, but most importantly eliminate the cost to recipients entirely; therefore, Oxfam bears all receiver costs.

$$(0.50+15)+((20+20+93.33)*0.01231)=17.14$$

From the figures above, it is estimated that to complete a chain of transaction from an Australian donor to recipient in Vanuatu, Oxfam would incurred transfer fees amounting to VUV 1,392.36/AUD 17.14.

7.2.2. SEMPO COSTS

Based on data from SendMoneyPacific[15] Oxfam's Australian FSP, Westpac, charges a fee of AUD 10 for an account-to-account transfer that takes 3–5 days to process. Under some conditions, the fee can exceed AUD 20, but receivers are never charged. In contrast, Western Union charges between AUD 2.90–35 depending on the transfer method. Given the higher exchange margins, Western Union can cost the sender upwards of AUD 56 in some instances. In the best case, SendMoneyPacific reports that a transfer of AUD 200 via Westpac attracts a 10 per cent fee, while Western Union attracts just 4.77 per cent.

In contrast to both, the average cost of an individual transaction on the Ethereum mainnet during April and May, according to Etherscan, was just ETH 0.04, which equates to USD 0.12 during the same period. Based on the mid-market-rate according reported by XE on 22 April 2019, the day the pilot commenced, each transaction on the mainnet can be said to have a direct cost of roughly AUD 0.17.

7.2.3. TOTAL DIRECT COST ESTIMATION

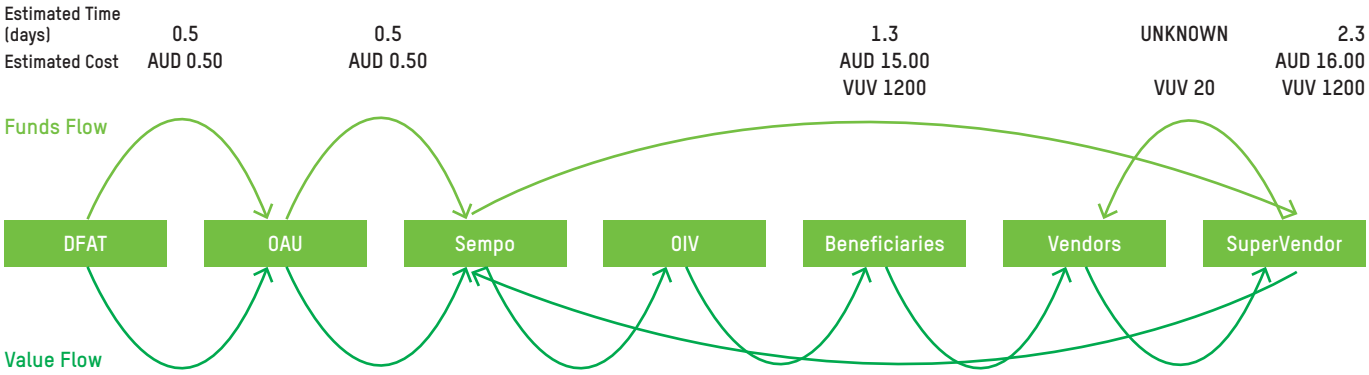

Figure 22: The flow of value relative to the flow of funds and the associated direct costs incurred by FSPs during the first round of the pilot in Pango in which the Super Vendor was tested.

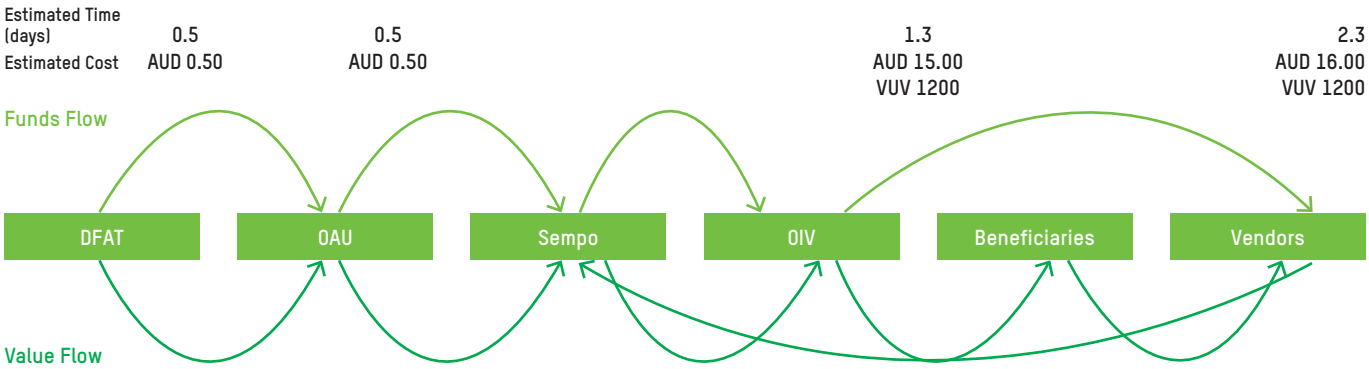

Figure 23: The flow of value relative to the flow of funds and the associated direct costs incurred by FSPs during the second round of the pilot in Mele Maat in which the Super Vendor was removed.

15 SendMoneyPacific's most current data on transfers between Australia and Vanuatu is available at: https://www.sendmoneypacific.org/compare/list/200/australia-to-vanuatu.html

Figure 24: Oxfam Australia's view of the Sempo dashboard captured at 12:55pm on 10/05/2019.

By combining the findings from section 7.2.1. 'Baseline costs' and section 7.2.2. 'Sempo costs', it is possible to estimate the total direct cost of a transaction during the UnBlocked Cash pilot. Figures 22 and 23 represent the estimated cost of transactions for the Unblocked Cash pilot in both rounds.

The following equation represents the direct cost to complete a chain of transactions from a donor in Australia to a recipient in Vanuatu in addition to cashing out a vendor during the first round of the UnBlocked Cash pilot.

$$(0.50+0.50+15)+5*0.17=16.85$$

Note: In addition to this direct cost, the Super Vendor was offered 5 per cent of the amount cashed-out to small vendors. Also, this equation assumes a cash-based exchange between the Super Vendor and the vendor, which incurs no charge.

The following equation represents the direct cost to complete a chain of transactions from a donor in Australia to a recipient in Vanuatu in addition to cashing out a vendor in the second round of the UnBlocked Cash pilot.

$$((0.50+15)+((20+93.33)*0.01231))+3*0.17=17.40$$

At best, the direct costs of the tested system was 1.69 per cent lower than a traditional series of transfers; at worse, the tested system was 1.52 per cent more costly.

7.3. TRANSPARENCY

7.3.1. PLATFORM TRANSPARENCY

Oxfam observed three critical layers to the transparency of the UnBlocked Cash pilot, which was defined as the state in which everything is apparent and accessible.

The first is the Sempo dashboard, which allowed programme stakeholders to watch transactions in real-time provided vendors had internet connectivity at that moment. The dashboard was anecdotally praised by Oxfam staff; however, some staff who had not been formally onboarded complained that the terms 'Payment', 'Disbursement' and 'Withdrawal' were not immediately clear.

During PDM with Oxfam staff in Vanuatu, 60 per cent, or three out of five, felt that learning to use and understand the dashboard was their most difficult task during the first round. In the second round, one of these staff members continued to feel this way. In an interview with one staff member, it was suggested that some of these difficulties might have stemmed from the lack of time dedicated to fully exploring the dashboard during training.

This tool was not available to everyone from the outset as the Sempo dashboard requires login credentials composed of a username and password. Stakeholders and staff were granted permissioned access at the discretion of Oxfam's Pacific Cash and Livelihoods Lead and project manager in-country. Every one of the aforementioned staff members stated that the reason they found the dashboard so difficult to understand is that they either had no access or very limited access to it. Therefore, it is arguable that the information provided via the dashboard was not sufficiently accessible. Figure 24 shows the landing page of the Sempo dashboard as seen by a user with 'view' permission.

Given the transaction records were stored on the Ethereum mainnet, technologically savvy stakeholders could follow the pilot using an aggregator like Etherscan.[16] This makes a great deal of pilot data highly accessible, but it is not expected to be apparent to those without a good understanding of Ethereum or DLTs.

16 More information on Etherscan is available at: https://etherscan.io

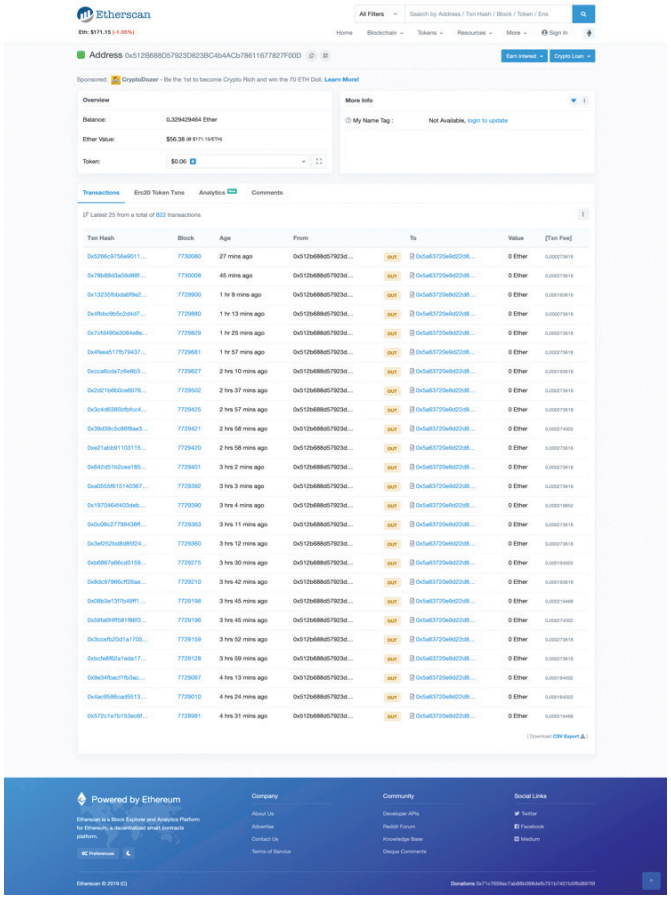

Figure 25: Public view of UnBlocked Cash transactions via Etherscan captured at 12:56pm on 10/05/2019.

Finally, there is the attitude of UnBlocked Cash pilot participants. The position of Sempo, in particular, tended towards presenting apparent and accessible information so long as it did not threaten its business interests. This is perhaps the most important feature as merely making information available 'on-chain' does not guarantee transparency for all parties. If the transparency is to serve everyone, all observations must be allowed to flow freely without pretence or deceit, and presented in a readily understandable form. Since DLTs are inherently complex and require a high degree of technological literacy, an asymmetric power relationship emerges between participants of a DLT-based intervention. Humanitarians should not assume that the mere existence of open information is sufficient.

Recipients were at a particular disadvantage, exemplified by one recipient who was afraid there might not be any funds on their NFC card. This illustrates that sometimes, information must be actively shared rather than simply made available to be truly transparent. The onboarding process could be modified to include an opportunity to check one's balance or make a dummy transaction.

This anxiety was present despite the Community Focal Points in Pango, whose role was to check the balance of recipients' NFC cards as required. These community members were issued with phones and announced to the community as points where one's balance could be checked without completing a transaction with a vendor. Although these roles were allocated, Oxfam staff in Vanuatu felt that more time should have been taken to ensure Community Focal Points were playing a more active role in the pilot and that recipients were regularly reminded to check their balances with them.

During the pre-pilot training, most recipients had the opportunity to make a dummy transaction using a test card, rather than their own. A small number were able to make a small VUV 1/AUD 0.012 transaction using their own card.

In Mele Maat, Oxfam and Sempo staff were appointed as 'touchpoints' to ensure that every recipient had the opportunity to see the balance of their NFC card. Previously, Sempo was not certain that this process would improve confidence in the system among recipients.

7.4. SECURITY

7.4.1. PERSONAL SECURITY

During the pilot there were no known instances of theft, violence, or other behaviour that might have threatened the safety of participants. During the PDM, all but four of the 157 recipients surveyed—which equates to 97.45 per cent of the population—communicated that they felt safe using the NFC card, and all but five felt safe with their information being stored. It is worth noting that only 39.47 per cent of those 96.81 per cent reported knowing what information was being stored. All those who knew what data was being stored, felt safe.

No personally identifiable information was stored on the NFC cards; they only carried the amount loaded, the amount spent, Sempo's cryptographic signature for verification, and the UID. Personal data was stored in a central off-chain database that included: name, age, gender, location, eligibility status, and participant type, i.e. vendor or recipient.

For vendors, Sempo stored bank account details and a passport or driver's licence photo for KYC compliance. These details will be held for seven years and are not accessible to Oxfam.

It should be noted that Oxfam informed each participant of the information that would be collected for the pilot at the time of onboarding.

7.4.2. CYBER SECURITY

Sempo stored four types of data between Amazon Web Services (AWS) infrastructure and the Ethereum mainnet, these are:

- Application Source Code
- Application Access Keys
- Database Contents
- Blockchain Transaction Records

The two major security risks for any digital service provider are a loss of data and unauthorised access. Much of the way Sempo manages these issues is private information; however, an Oxfam review of the technical documents revealed that Sempo takes these matters seriously.

Furthermore, there was no evidence of unauthorised access to the system, according to Sempo platform logs. The logs

recorded a small number of attempts to connect to Sempo's servers from unfamiliar Internet Protocol (IP) addresses. Sempo describes these attempts as the equivalent of turning a doorknob to see if the door will open. While these failed attempts do not constitute a real threat, they nonetheless illustrate Sempo's due diligence.

7.5. USER EXPERIENCE

In this section, Oxfam is concerned with the quality of all interactions between recipients, vendors, operational staff, and the Sempo platform. This includes but is not limited to onboarding, troubleshooting, transferring value and redeeming value.

This study's examination of UX abides to the Norman & Nielsen (n.d.) definition of usability as a quality attribute of the user interface (UI). Unlike UX, which captures all components of a user's journey with a product or service, usability is only concerned with the experience within a product's interface. Usability is a measure of intuitiveness, pleasantness, and efficiency.

Based on participant feedback, support for the solution trialled during the UnBlocked Cash pilot was immensely high. 100 per cent of the 157 participants questioned during the pilot reported that their overall experience of the NFC card was positive; and all but one felt it was easier to use than other forms of assistance. Only two of the participants surveyed in this group claimed to have had an issue with the NFC card, which they reported to Oxfam staff in Vanuatu at the time of the incident.

Meanwhile, during onsite monitoring of 120 participants, 40 chose to describe the system as 'easy' or 'very easy'; of those, 19 also described it as 'fast' or 'quick'.

Three recipients in this pool commented on their initial experiences with the system, stating that:

"The first time that I have been shopping, I was afraid that there was no money on the e-voucher, but after the first time I think it was just easy."

"The first time I used the system, it was not really flexible, but the second time I felt it was very easy. It has helped us all in the community, especially me as a single mama."

"At first, when I started using the card, I feel scared because that was my first time using it. But after sometimes, I feel shopping was very easy. Also, I do not need to travel long distances to go to the shops."

The three recipients quoted above demonstrated that after their encounter with the system, they were very satisfied, each then going on to join the 40 others who commented on the platform's ease of use. Furthermore, 100 per cent of the PDM group nominated to receive an e-voucher—in this case, represented by the NFC card—in place of other assistance when they were asked to consider the next time a disaster strikes.

Unfortunately, due to a limitation of how data was collected, it is not possible to determine if the people having these positive experiences are in the unbanked category. If that were true, their fears and doubts concerning the solution tested might be related to their prior experiences being limited to the use of cash, whereas others who had used cards of one form or another might have felt otherwise. Presumably, the majority of the pilot's participants had no understanding of cryptocurrency, so it is conceivable that many fears and doubts may be associate to the newness of the technology. See section 8.11. 'Addressing research limitations' for more information regarding the limitations of this study.

7.5.1. USER INTERFACE

There are two elements of the Sempo platform to consider when interrogating the UI. The first is a browser-based dashboard with a public-facing Uniform Resource Locator (URL), the second is the Android app.

While each user group engaged with the Sempo UI, recipients primarily interacted with the platform by tapping their assigned NFC card and verifying purchases by glancing at the Sempo app

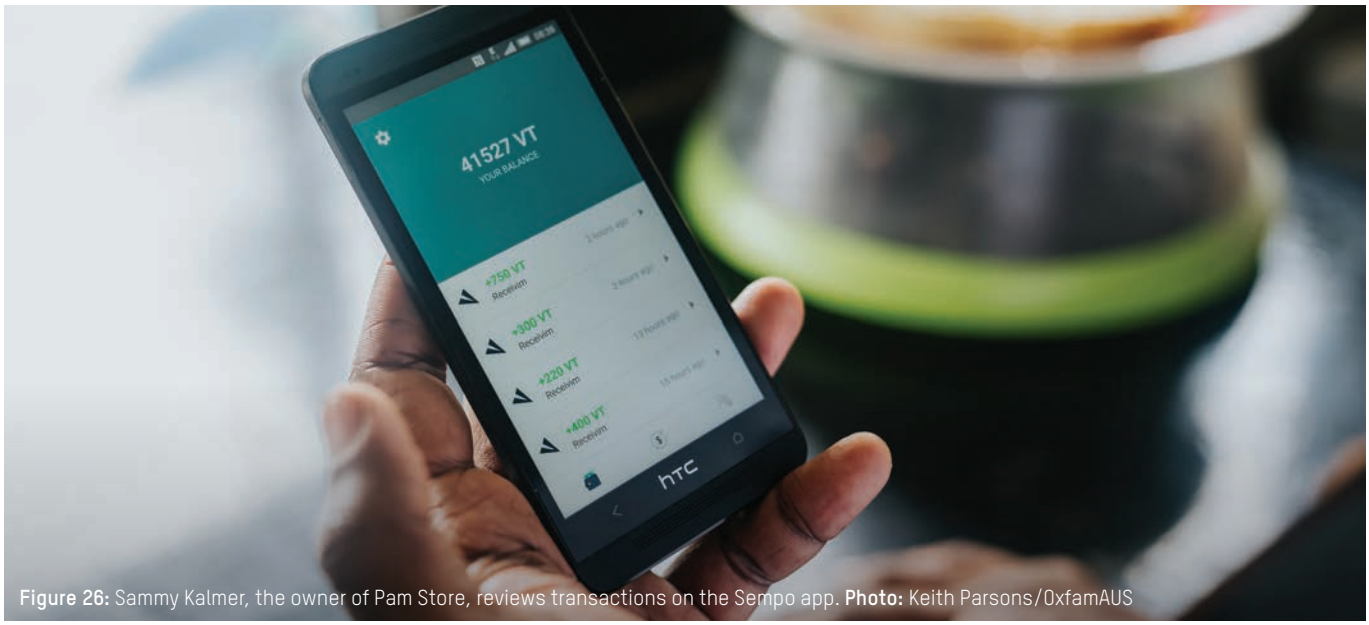

Figure 26: Sammy Kalmer, the owner of Pam Store, reviews transactions on the Sempo app. **Photo:** Keith Parsons/OxfamAUS

on devices held in the vendor's hands. As such, this section will evaluate the experience of the vendors and Oxfam staff.

Vendors were the primary user of the Sempo app, which was installed on an NFC-compatible device to facilitate in-person transactions between vendors and recipients. The app also provided vendors with a record of their transactions, see Figure 26, and the ability to cash-out their accumulated value into fiat currency, see Figure 27. The cash-out feature was referred to as a 'withdrawal' within the app UI.

The receiver of the CCV entered the amount owed in VUV on a three-by-four numeric keypad; the value was rendered above the keypad as if on a calculator, see Figure 27. The receiver of goods was asked to verify the amount before the transaction was confirmed with the press of a button, see Figure 30.

The same three-by-four numeric keypad was used for logging into the app by way of a personal identification number (PIN). Given the limited experience among vendors with smartphones, some struggled with this process. Ultimately, the inability to log in was not the result of the app UI, but rather to connectivity issues, or the vendor having created and subsequently forgotten their PIN.

Figure 27: Amount owed being entered in a transaction between and Melika Kaluat (Vendor) and Loid Albert (Super Vendor).
Photo: Keith Parsons/OxfamAUS

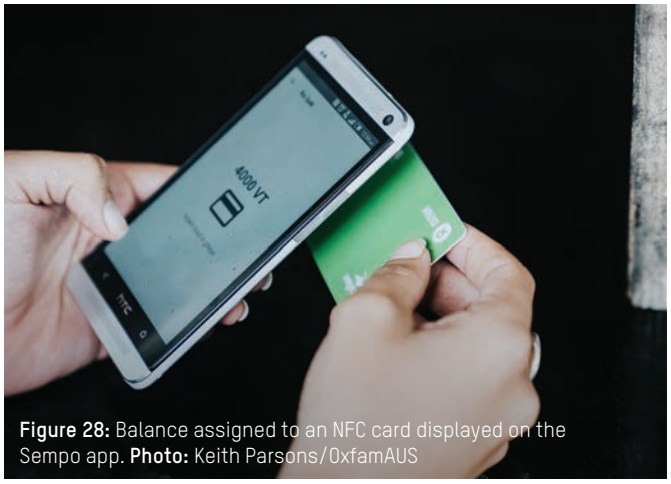

Figure 28: Balance assigned to an NFC card displayed on the Sempo app. **Photo:** Keith Parsons/OxfamAUS

The Sempo app was also used by vendors and Community Focal Points to check the balance held on a recipient's NFC card. The UI presented a distraction-free white background with the value rendered in VUV approximately centred on both axis, see Figure 28.

In contrast to the vendor experience seen in Figure 26, Oxfam staff typically saw all activity across the programme via the dashboard, see Figure 29. Much like the app, Sempo's dashboard UI was uncomplicated with all values displayed in VUV.

Confusion among Oxfam staff were limited to the language used to describe actions on the platform, especially when viewed in relation to the activity recorded on the Ethereum mainnet. No significant feedback was recorded in regards to the dashboard UI; see section 7.3.1. 'Platform Transparency' for user experience issues faced by Oxfam staff unrelated to the UI.

7.5.2. INTEGRATIONS

One of the key features of the Sempo platform is its tight integration with KoBoToolbox.[17] This open-source suite of tools is supported by the Harvard Humanitarian Initiative (HHI), Brigham and Women's Hospital, and Kweyo, among many humanitarian actors. It is popular among those collecting field data in challenging environments, such as a humanitarian crisis or in developing countries. The suite is composed of a form builder that informs the way data is collected and a data manager/visualiser.

Sempo's KoBoToolbox integration streamlined recipient onboarding by taking advantage of existing humanitarian processes. Since Oxfam staff in Vanuatu have used KoBoToolbox in past programmes, no additional training was required.

Figure 29: Oxfam Australia's view of the Sempo transfer page captured at 12:55pm on 10/05/2019.

17 More information on KoBoToolbox available at: https://www.kobotoolbox.org/

8. RECOMMENDATIONS

8.1. CONSIDER THE LOCATION IN PROJECT PLANNING

While connectivity and stable power were among the selection criteria for the UnBlocked Cash pilot and the system was designed to withstand some degree of service interruption, issues did present with intermittent connectivity in the second round. As such, additional consideration may have to be made to ensure a high-quality intervention.

Intervening parties may consider creating local networks by introducing their own hardware. This might include resilient mesh-networks or simple local area networks depending on the context. See section 6.7. 'DLT-based CVA durability in an urban context of Vanuatu' for a more detailed explanation of the connectivity issues faced during the UnBlocked Cash pilot.

8.2. CONSULT COMMUNITIES MORE BROADLY

8.2.1 CONSULT AT-RISK URBAN COMMUNITIES

Since the UnBlocked Cash pilot was not tested in a disaster or other adversely affected area, the needs of the pilot participants are anticipated to be quite different from a disaster-affected population—noting that building materials were the least-purchased items during the UnBlocked Cash pilot, see section 6.3. 'How value is spent' for a comparison of spending patterns between the Ambae volcano emergency response and the UnBlocked Cash pilot.

As such, more work should be done to understand the needs of at-risk communities to prepare a solution like that offered by Sempo for the unique conditions of a post-disaster scenario. This might include more extensive comparative studies of spending patterns from PDM surveys of disaster-affected communities or other anthropological activities.

It is important to note that Pango and Mele Maat were specifically selected for their low-risk status, as it is Oxfam's position that solutions should not be 'tested' on highly at-risk, vulnerable or actively disaster-affected communities. Oxfam believes that since Tropical Cyclone Pam heavily impacted both Pango and Mele Maat in 2015, these communities hold a recent living memory of a disaster and are, therefore, well-informed research participants.

8.3. UNIQUELY IDENTIFIABLE CARDS

Since all the NFC cards issued to both vendors and recipients were visually identical with the exception of a QR code, it was common to observe cards accidentally switched during a transaction. This was particularly problematic when vendor cards, used as identification (ID) for the system, were mistaken as recipient cards. The vendor cards could be accidentally picked up from a table, and neither party could immediately resolve the situation. According to Sempo, there was only one instance of a pair of families accidentally switching cards; however, at scale, this issue is likely to become more common.

Cards might be differentiated by role, with a different colour assigned to Super Vendors, Vendors, and Recipients. Each card might also include a noncritical piece of identifiable information such as name or initials and gender. Additionally, the cards might be emblazoned with an algorithmically generated pattern so that no two cards are alike.

8.4. MORE SUPER VENDORS FOR POST-DISASTER SCENARIOS

In a post-disaster scenario, Super Vendors could be used to help the local economy recover faster. Typically financial institutions take time to recover after an event, the length and extent to which depends on whether either or both their headquarters and branch network are effected (Hosono et al 2016, p.17). Beyond the time required to repair physical damage to banking infrastructure, lending capacity may be weakened for up to three years after an event (Ibid).

The traditional banking system, as well as conventional deployments of DLT-based assistance, rely on fragile information and communications technology (ICT). While these often bounce back quickly under the right conditions and with the right support, there is a period where interpersonal and organisation trust could allow a system like that tested in Vanuatu to operate before aid arrives in the county.

If Super Vendors have an agreement with Oxfam that a certain amount of funds will be made available within a specific time of the event, Oxfam could issue value to the recipient cards locally, and the Super Vendors could begin exchanging their inventory with community members on a 'side-channel'. Once ICTs recover, the transaction could sync with the Ethereum mainnet, and the Super Vendors could redeem the value from Oxfam or via a digital exchange depending on the state of the network. Alternatively, Oxfam could replenish the vendor stocks with goods through relief channels or invite local wholesalers to participate as vendors, thereby enabling smaller vendors to restock more often and without having to cash-out in order to do so. In the latter scenario, wholesalers could also perform the function of the Super Vendor.

In these scenarios, the recovery solution becomes more community-owned, as it is the Super Vendors that are providing liquidity during the ICT outage. There may also be other community-initiated resilience programmes like time-banks that allow participants to accrue value, which could be exchanged at an agreed rate for the tokenised value used during the emergency response. In the case of Oxfam, hours in the time-bank could be exchanged for the Sempo CCV and subsequently spent at participating vendors.

Figure 30: Vendor Sammy Kalmer confirms a transaction on the Sempo app. **Photo:** Keith Parsons/OxfamAUS

This solution presumes working mobile phones and some means by which to charge batteries.

8.4.1. ALTERNATIVES TO THE SUPER VENDOR

In addition to examining the Super Vendor model in different contexts, alternatives to the Super Vendor must also be explored. Depending on the design of the total system, it could be argued that the Super Vendor represents an additional and perhaps unnecessary step. Indeed the Super Vendor was not tested in Mele Maat in favour of traditional account-to-account bank transfers.

8.5. CASHING OUT VIA DIGITAL EXCHANGE

Cashing-out vendors in a timely and cost-effective manner was among the most significant challenges of the UnBlocked Cash pilot. This was due in large part to the limitations of existing FSPs on which Sempo and Oxfam relied. These FSPs imposed fees on both sender and receiver in addition to setting minimum transfer values, which were higher than what vendors required. These conditions lead to the Super Vendor model discussed in section 6.2. 'Hub-and-spoke funds flow'.

Regardless of the Super Vendor, the tested system still required that all vendors held a traditional bank account, and all major reimbursements were nevertheless made with the aid of financial incumbents. As a result of this, the UnBlocked Cash pilot did not disintermediate when compared to Oxfam's standard process. Since disintermediation represents potential time-efficiencies and cost-savings and is one of the three characteristics of DLTs as defined by this report, Oxfam considers it an important goal.

One approach to disintermediation is to encourage vendors to exchange their DAI for fiat currency through third-party exchanges such as Binance, Coinbase, or Kraken. This would serve to remove the reliance on incumbent financial institutions. In this scenario, there are more actors in the relief chain than Oxfam's standard process, i.e. Sempo and an exchange; however, there is no need for Oxfam to handle fiat currency after the CCVs are created.

Given the moratorium on the individual use of cryptocurrencies in Vanuatu, including the purchase and use of exchanges and subsequent unavailability and inaccessibility thereof, this solution is not currently possible. However, it is conceivable that if systems like that trialed during the UnBlocked Cash pilot demonstrated clear advantages at a low risk, then the situation in Vanuatu and elsewhere might change.

During the UnBlocked Cash pilot, Sempo was the only organisation on its whitelist that controlled which actors had access to the DAI and the sale thereof to a third party. Theoretically, any party capable of transferring funds into Vanuatu to cash-out vendors in compliance with KYC regulations could be on the list. Alternatively, vendors who have passed KYC checks could be added to the whitelist, which would allow the direct sale of DAI on any exchange while meeting Sempo's regulatory obligations.

The second approach to further disintermediate is to develop a proprietary DLT-based solution equivalent to that tested. Even in a perfect world, Sempo essentially replaces existing FSPs in the relief chain; it is, therefore, impossible to truly disintermediate unless actors are subtracted from the current solution.

An advantage of this which is unique to Oxfam is the ability for confederates to hold one another accountable without 'external' influence. This consensus mechanism works because each confederate has self-interests and is simultaneously obliged to cooperate. Additionally, a proprietary system could have significant benefits to Oxfam's internal operations, which might include but is not limited to intra-institutional transfers (IITs).

Currently, Sempo is a small start-up testing a development phase product. In contrast, Oxfam enjoys global reach, and considerable brand recognition—an endorsement from Oxfam is likely to carry weight in the sector.

Since DLTs can be made interoperable, especially if data is stored publicly, a proprietary solution does not necessarily limit 'hand over', which is an important function of humanitarian programmes.

8.6. THE USE OF STABLECOINS

More should be done to understand the benefits of using cryptoassets where a simple representation of value would suffice. As indicated in section 8.5. 'Cashing out via digital exchange', there are currently many legal restrictions on the direct use of cryptoassets, such the stablecoin DAI, in countries like Vanuatu. As a result, the inclusion of such assets increases complexity for questionable gains if the solutions described in the previous section are not possible.

In the case of the UnBlocked Cash pilot, Oxfam, as a trusted entity, could back its own token, which would provide all the same reporting efficiencies as the tested system without the complexity of the 'wrapping' and 'unwrapping' of DAI.

8.7. APP IMPROVEMENTS

8.7.1. SUPER VENDOR COMPATIBLE APP

A significant limitation affecting the Super Vendor is the inability to see the amount they are owed from performing cash-out services. Given the relative success of the Super Vendor model, Oxfam recommends that the Sempo app offer equivalent information to the dashboard without overwhelming the interface.

8.7.2. DONOR COMPATIBLE APP

Oxfam's work with DLTs has been relatively diverse. Among its experiments is the Smart Donations app described in section 3. 'Background & Context'. This experience creates an obvious opportunity to test the extent of the disintermediation promised by supporters of DLTs. If funds jumped from the donor directly to recipients or a single liquidity partner in-country—which might include Oxfam—the system would, by virtue of fewer bank transfers, become more cost-effective to maintain. A baseline study conducted by OxLabs suggests that the merchant fees incurred by Oxfam for low-value-high-volume donations from individual donors can incur high overheads when compared with high-value-low-volume donations from a back donor such as DFAT. As such, extending the functionality of the Sempo app to accept individual or back donor payments presents potentially dramatic cost savings. See section 8.9.1. 'Adding additional actors' for more context.

8.8. DIGITAL WALLETS

8.8.1. GOVERNANCE OF DIGITAL WALLETS IN A CORPORATE ENVIRONMENT

Value on Ethereum's distributed ledger is assigned to a public address, which anyone with the correct key can access. The combination of an address or a public key with a private key constitutes a digital 'wallet'.[18]

The underlying public-key cryptography, sometimes called asymmetric cryptography, is at the heart of the user experience of any tokenised exchange on a distributed ledger. This technology generates a pair of keys from a randomly generated string. One of the keys is public, which can be shared in the way a bank account number is disseminated. The other is private, which the owner keeps to themselves like a PIN used to withdraw funds from that bank account.

Contrary to popular belief, value cannot be 'lost' on a distributed ledger; since there are many copies of the ledger, there are also many copies of the record that a particular address holds a certain amount a value. However, one can lose access to value if the private key is lost. This makes the management of the keypair or wallet critical. The type of wallet dictates how the keys are managed and, more recognisably, how one interacts with the associated value. The table below provides a summary of the different wallet types and some of their properties.

Table 30: Wallet Solutions

TYPE	CATEGORY	EXAMPLE	SECURITY	SPEED	EASE
Mobile wallets	Software	Bitcoin Wallet, TrustWallet etc.	Medium	Medium	Medium
Desktop wallets	Software	Bitcoin Core, MyEtherWallet etc.	Medium	Medium	Low
Browser wallets	Software	MetaMask.	Medium	Medium	Low
Web/ Online wallets	Software	Coinbase, MyCrypto etc.	Low	Medium	Medium
Hardware wallets	Hardware	KeepKey, Ledger, Trezor etc.	High	Low	Low
Paper wallets	Physical	Representation of an address committed to paper.	Medium	Low	Low
Smart cards	Physical	As issued by Sempo; functionally equivalent to a 'paper wallet'.	Medium	High	High

Note: The assessment of security and usability, i.e. speed of use and ease of use, above is the author's opinion and not a statement of fact. Additionally, the usability assessment has been contextualised to the UnBlocked Cash pilot.

The question for Oxfam and other similar corporate environments is who governs the wallet and what processes need to be developed for safe and effective use thereof? Alternatively, does Oxfam need to govern the wallet at all? More work must be done to identify these questions and subsequently develop guidelines with respect to their answers.

8.8.2. DIGITAL WALLETS IN DEVELOPING CONTEXTS

In developing contexts where cryptoassets are untested or misunderstood, it remains unclear what jurisdiction local administrations have or should have over such assets and the digital wallets to which they are assigned. During the UnBlocked Cash pilot, the NFC cards behaved much like a 'custodial' paper wallet, which was used to retrieve rather than store value. This is in contrast to a 'non-custodial' wallet with which the holder is personally responsible for the assigned value. In this design, there is no risk of value being lost along with the card; however, the cardholder must trust the custodian.

This presents the second jurisdictional question: if the NFC card is just a right to access a wallet, which is centrally held alongside all others in the programme, who is legally responsible?

18 The digital 'wallet' serves as a gateway to interact with a DLT. A wallet is to a DLT what a browser (Chrome or Firefox etc.) is to the internet. The 'wallet' is the second-to-last mile in CVA, where the last mile is represented by the off-chain exchange of goods for non-fungible tokens or CCVs in the case of the UnBlocked Cash pilot.

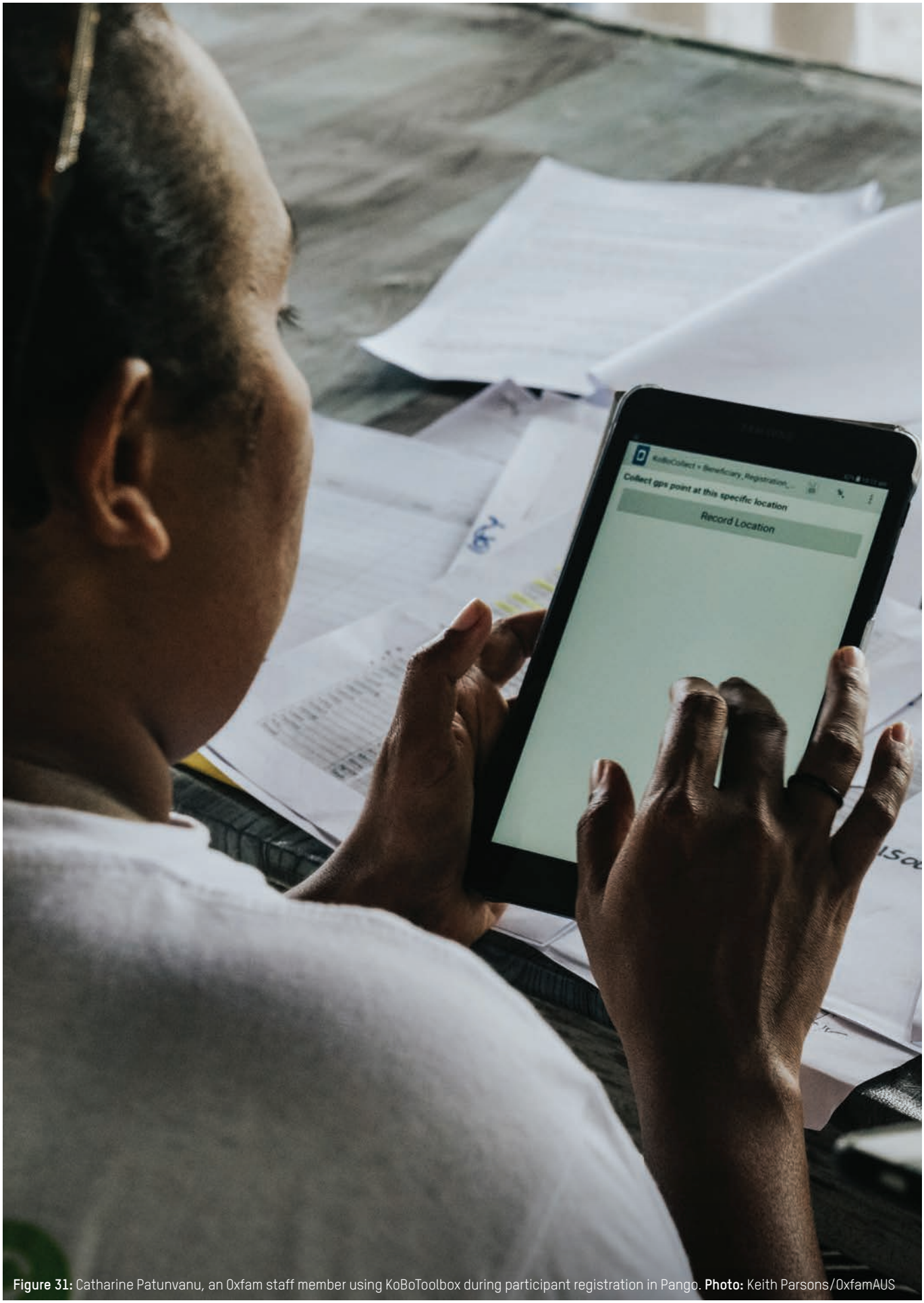

Figure 31: Catharine Patunvanu, an Oxfam staff member using KoBoToolbox during participant registration in Pango. **Photo:** Keith Parsons/OxfamAUS

8.9. SCALING-UP

Testing the pilot in different contexts and with more donors

With just 187 heads of households and 29 vendors participating in the UnBlocked Cash pilot, it remains unclear how the tested system is likely to respond at scale or in a different context, especially in an emergency response or recovery effort.

Without further testing at a larger scale, it is impossible to determine how the Sempo platform or the underlying DLT will cope. In 2017, Vitalik Buterin told TechCrunch "Bitcoin is processing a bit less than three transactions per second". Ethereum at the time was capable of five transactions per second, which Buterin points out is considerably less than the 12 rides a second Uber provides (Biggs 2017). This illustrates one of the many scaling issues DLT-based applications have to contend with.

8.9.1. ADDING ADDITIONAL ACTORS

A clear scale-up opportunity exists in the inclusion of donors to the DLT-based relief chain. This might include traditional government back donors like DFAT, corporate donors, or individual donors.

Donors could contribute cryptoassets directly or convert fiat currency at a digital exchange such as Binance, Coinbase, or Kraken into an asset like DAI. The asset could be forwarded directly to an NGO like Oxfam or committed to a specific type of intervention by way of a 'Smart Donation' feature. Such donations could also be triggered if donor-defined conditions are met as in the Smart Donation app briefly described in section 3. 'Background & Context'. For such functionality, the Sempo app would have to be redesigned to accommodate a donor front end as previously described in section 8.7.2. 'Donor compatible app'.

However, it is possible to add additional actors without modifications of this nature. By simply assigning a digital wallet to each actor in the relief chain, it is possible to test the business processes required to accommodate this new technology.

Alternatively, Oxfam might test the implications of using DLTs to track its IITs. If it is taken for granted that funds flow back and forth between Oxfam confederates constantly, it stands to reason that any two confederates in the network may in time reach equilibrium. One actor might owe another a payment of 100,000 dollars. Meanwhile, the other actor owes the first four payments of 25,000 dollars. In this scenario, both actors pay bank transfer fees for effectively 0 dollars transferred. If a DLT was employed to track these IITs, tokens could be sent back and forth at no cost. Then at agreed intervals, the two actors could settle any outstanding amount in a single transfer, hereby reducing direct costs and potentially increasing liquidity as the funds are not held hostage by intermediaries for 'processing'.

8.10. LIFETIME RESEARCH AND DEVELOPMENT COSTS

OxLabs has been working on testing DLT-based CVA, among other activities, since March 2018. While this small team only dedicates an incredibly small amount of their time to OxLabs, this length of time relative to the period of the UnBlocked Cash pilot and the small amount of value dispersed, represents a high operational overhead. Much of this time was exploratory, as only three months past between engaging Sempo and successfully delivering the pilot. Nevertheless, this exploratory period contributes to the research and development costs of the UnBlocked Cash pilot and any others to follow. Additionally, this study does not take into consideration the development costs incurred by Sempo; it is, therefore, impossible to say what it would cost to develop a platform equivalent to that tested. This section explores some of the elements that might contribute to the costs of future DLT-based CVAs.

8.10.1. STAFF TRAINING AND OPERATIONAL CONSIDERATIONS

During the UnBlocked Cash pilot, Oxfam observed a clear reduction in the time required to onboard participants when compared to traditional CVA solutions and between the first and second rounds of the pilot. This suggests both an inherently more efficient process facilitated by the Sempo platform and a possible learning effect, which is typical as staff become more familiar with the system.

Staff in Vanuatu reported that they did not have sufficient time to familiarise themselves with the Sempo dashboard. This suggests that not enough time was spent on staff training or that expectations were not properly set for the degree of time that would be dedicated to internal capacity building. Due to resource limitations, the staff did not log the time spent on many of their activities regarding the pilot, see section 8.11. 'Addressing research limitations' for more information. It is, therefore, impossible to report how much time each step took or how much staff time was dedicated to training. For future implementations and for a better understanding of the lifetime cost of implementing a system like that tested during the UnBlocked Cash pilot, it is essential that more rigorous records be kept of staff activities.

To directly address staff concerns regarding their lack of familiarity with elements of the platform, it is recommended that Oxfam or the service provider develop a clear training process as a component of staff onboarding.

8.10.2. CLARIFY BUSINESS MODELS

Presently, many of the service providers evaluated by Oxfam, including Sempo, are in a start-up or scale-up phase with evolving business models. Some like Sempo offer turnkey solutions for a fixed price, while others rely on volume-based pricing. At the scale of the UnBlocked Cash pilot, the service providers' business model or pricing structure has little impact; however, at scale, a volume-based system becomes highly uncompetitive compared to Oxfam's existing arrangements. It is, therefore, essential that Oxfam and others in the humanitarian sector set clear expectations for start-ups amidst evolving business models and offer insight into existing humanitarian operations and ways of working.

Furthermore, to establish the true cost of a full-scale implementation of a system like that tested during this pilot, the business models of both the service provider and the humanitarian organisations involved must be clearly defined.

8.11. ADDRESSING RESEARCH LIMITATIONS

8.11.1. ONSITE MONITORING DISCONNECTED FROM PDM

Many of the insights that inform the user experience dimension of this study were made during onsite monitoring. This is due to the potency of the responses of the 120 recipients who were asked to "... tell us a bit about your experience with the pilot".

While insightful, this data was collected without names; it is, therefore, impossible to connect the insights from this data set with others. For instance, are people who reported struggling with the Sempo platform also in the unbanked category and, therefore, unfamiliar with representations of value other than cash? It is recommended that future data collection asks one identifying question to ensure the data sets are interoperable.

8.11.2. MORE COMPREHENSIVE BASELINE STUDIES

To make robust comparisons of new and novel solutions with existing ones, it is imperative Oxfam collects baseline data with a one-to-one relationship to the tested system. Given the speed with which the UnBlocked Cash project was iterated upon, the baseline study conducted by Oxlabs for the time and cost dimensions of this research became largely irrelevant. As such, much of the information used for comparison is either anecdotal or extrapolated. It is for this reason that it is impossible to comment confidently on many aspects of the time and cost dimensions.

Direct costs, such as transfer fees, should be more comprehensively evaluated in relation to the context of future activities. In particular, transfers from back donors such as DFAT to Oxfam, and subsequent transfers from that pool of funds to country offices, should be tracked. This report relies on the measurement of bulk transfers from Oxfam's Australian bank accounts to those in Vanuatu as a proxy for the transfers described above. The most significant limitation of using monthly bulk transfers in place of a transfer made during an emergency response is Oxfam's internal processing time, which is slowed by policies enforced by finance departments in both Australia and Vanuatu. To arrive at an accurate rendering of the time required to transfer funds between the two countries, observations must be made during an emergency response or in a simulation thereof. Additionally, and more critically, staff time must be assigned to well-defined tasks within a programme so that operating costs can be confidently calculated.

8.12. ADDRESSING RISKS

8.12.1 SINGLE POINT OF FAILURE

The Sempo co-founder's privileged knowledge of the platform represents a vulnerability if this system is to scale beyond the parameters of the pilot. If the Sempo platform is to be implemented as a component of an emergency response, more qualified experts or additional staff training should be deployed to ensure platform issues can be addressed quickly and safely. See section 6.8. 'The indispensable expert' for more information.

8.12.2. PRIVACY BREACH DUE TO REAL-TIME MONITORING?

Real-time monitoring of transactions during the UnBlocked Cash pilot provided both greater transparency than traditional CVA solutions and faster response to participant needs. However, this raised issues of privacy, power, and potential risk of pseudonymous transaction records available in real-time or near real-time.

More work should be done to identify risks associated with this system and to understand the potential implications.

Figure 32: Pango, Vanuatu: Pango Community member Ruth Nalau registers for the Unblocked Cash Transfer Pilot. **Photo:** Keith Parsons/OxfamAUS

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