Between efficiency and *do no harm:* Blockchain-based innovation in cash and voucher assistance

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Abstract:

The focus of this study is the determination of the risk factors for beneficiaries that arise from the use of blockchain technology in the delivery of cash and voucher assistance (CVA), as part of a framework for the identification of *digital harm*. The study also aims to use the said framework to create actionable points for humanitarian organizations working on reducing risks to beneficiaries when implementing this type of program.

As the need for humanitarian assistance grows, trends such as cash and voucher assistance and digitalization emergence. CVA can lead to benefits such as cost efficiency, more timely and accurate meeting of beneficiaries' needs, operational flexibility, and empowerment of beneficiaries. When blockchain is used in CVA, further benefits such as higher transparency and accountability, less corruption, security, and programmability can be acquired. Nevertheless, the analysis of the risks that arise from this implementation must be conducted, addressing a gap in both literature and practice.

Through an extensive literature review and the investigation and comparison of three cases (the World Food Programme's Building Blocks, Oxfam's UnBlocked Cash, and Finn Church Aid's Kenya Feasibility Study), using an abductive research approach, this thesis has identified twelve risk factors, classified into five major categories, that make up the notion of *digital risk* to beneficiaries in blockchain-based CVA. This framework constitutes the study's theoretical contribution.

Furthermore, a list of seven measures was suggested to help humanitarian organizations in reducing digital harm to beneficiaries in the context in question. Those measures are considered the thesis's managerial contribution.

Keywords: Humanitarian supply chain, cash and voucher assistance, blockchain, digital harm

ACRONYMS

CALP	The Cash Learning Partnership
CVA	Cash and Voucher Assistance
DLT	Distributed Ledger Technology
FCA	Finn Church Aid
HSC	Humanitarian Supply Chain
ICRC	International Committee of International Red Cross
IFRC	International Federation of the Red Cross
WFP	World Food Programme

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1 INTRODUCTION

1.1 Context and research problem

In 2021, an estimated 235 million people were in need of humanitarian assistance and protection (Global Humanitarian Overview, 2022) – a number that is expected to reach 339 million people in 2023 (The Guardian, 2022). As demand for humanitarian aid increases, so does the need for the humanitarian sector to be able to respond better. In this context, especially as events that lead to supply chain disruptions become more common, trends such as digitalization and cash and voucher assistance (CVA) emerge in humanitarian logistics (Kovács & Falagara Sigala, 2021).

With the former, "combinations of information, computing, communication, and connectivity technologies" (Vial, 2019, p. 121) are used to promote substantial changes and improve organizations. With the latter, the traditional distribution of aid in the form of physical goods is replaced by the direct provision of money to beneficiaries, be it in the form of cash or vouchers (Heaslip, Kovács & Haavisto, 2018). These trends, furthermore, can be combined, enabling, for example, the use of digital payments – here defined as end-to-end digital transactions, or those in which both the medium of transfer used by payers and payees and the payment instrument are electronic (Burton, 2020).

These digital transactions have the potential to increase the speed of delivery and the number of beneficiaries that can be reached by CVA programs, at a lower cost (Burton, 2020). Beyond gains in efficiency and speed, which lead to cost savings, they can promote enhanced traceability and accountability, which, in their turn, increase transparency and security and reduce corruption and theft, and promote financial inclusion through access to financial services, among other benefits (Better than Cash Alliance, n.d.). They can also be safer for beneficiaries and humanitarian staff, as the risks of theft and looting that arise from carrying cash could be reduced (Burton, 2020). These benefits can contribute to mainstreaming a techno-optimistic narrative (Lee, 2020), which emphasizes the increased levels of efficiency that digital technologies such as blockchain, which will be the focal point of this study, can bring to the humanitarian sector.

Nevertheless, adopting innovative approaches in humanitarian operations, especially uncritically, can expose beneficiaries to new risks (Sandvik, Jacobsen & McDonald, 2017). Considering that the very reason for the existence of humanitarian supply chains

is the meeting of beneficiaries' needs (Thomas & Mizushima, 2005), these risks need to be further investigated, and strategies for their mitigation should be created. In doing so, the guiding principle of humanitarian action, *do no harm*, is updated to include the notion of *do no digital harm* (Burton, 2020).

1.2 Aim of the thesis

Risk factors do not exist in abstraction; they are deeply contextual and must be determined in a case-by-case analysis (Burton, 2020). Because of this, the primary aim of this research is to determine the risk factors for beneficiaries that arise from the use of blockchain technology for the delivery of cash and voucher assistance. The secondary aim is to create a theoretical framework that can be used by humanitarian organizations when deciding whether the potential benefits of that implementation are proportional to the emerging risks posed to beneficiaries.

The following research questions (RQ) are posed to achieve these aims:

> **RQ 1**: What are the main digital risks posed to beneficiaries when blockchain is used for the delivery of cash and voucher assistance?
>
> **RQ 2**: How can humanitarian organizations mitigate digital harm to beneficiaries when using blockchain technology for the delivery of cash and voucher assistance programs?

1.3 Methods

Not only is the topic of the compatibility between the use of blockchain and humanitarian principles still underexplored in the literature, but most pilots that make use of that technology in the humanitarian sector do not have much information published about their implementations or results achieved (Coppi & Fast, 2019). Two cases stand out as exceptions: the World Food Programme's Building Blocks, and Oxfam's UnBlocked Cash. As that first program is so far the largest of its kind, it has attracted non-negligible media attention and has been covered in technology-focused publications. The second, while not often mentioned in the media, has published official reports after the project's conclusion.

Both of these implementations will be investigated in this study, in which a multiple-case analysis will be undertaken. The third case is that of Finn Church Aid's 2019 Kenya Feasibility Study. Beyond two short articles on the websites of the organizations

responsible for the program (Finn Church Aid and Solita Oy), there was no publicly available information before this thesis – thus making the exploration and reporting of that case particularly valuable for academic research.

In this study, abductive research methods are used. Secondary data sources from the World Food Programme and Oxfam cases (Cases A and B, respectively), are considered during the first phase of the research alongside the relevant literature. From that, a theoretical framework of digital harm to beneficiaries is developed. That framework is then applied to Finn Church Aid's case (Case C), using primary and secondary data sources, and fine-tuned so that concrete suggestions can be created to help humanitarian organizations in mitigating the risks identified.

1.4 Delimitations

The three cases investigated in this study refer to projects developed by humanitarian organizations in which blockchain technology is used for delivering cash and voucher assistance. Case A – the World Food Programme's Building Blocks – was launched in 2017 in Pakistan and is currently active in Bangladesh and Jordan, serving, respectively, Rohingya and Syrian refugees (WFP, 2021). The sources used in this study are focused on the implementation in the Syrian refugee camps in Jordan, particularly Azraq and Za'atari. Oxfam's UnBlocked Cash (Case B), was a pilot implemented in Vanuatu in 2019, in which 187 households were selected as beneficiaries (Rust, 2019). Finally, the Feasibility Study of Case C was conducted in November and December of 2019, and included fieldwork in Lokichar, Kakuma, and Kalobeyei, in Kenya, with a focus on refugee and internally displaced people.

In the present research, the focus is on the beneficiaries' perspective, as they are considered relevant actors in the humanitarian supply chain. This leads to two important delimitations. The first is that risk is not the same as an adoption barrier. Although issues such as the complexity of establishment and environmental sustainability (Coppi, 2020), or lack of technical standardization affect the implementation of blockchain solutions (Sahebi, Masoomi & Ghorbani, 2020), they are not a source of direct risk to beneficiaries and therefore, do not belong in the scope of this thesis. The second is that the use of blockchain technology in CVA programs can also pose risks to humanitarian organizations – notably causing a loss of legitimacy when projects implemented fail or, worse, harm to those they should be serving (Sandvik *et al.*, 2017). Nevertheless, as

stated before, since the central perspective of this research is that of beneficiaries, risks to organizations will not be discussed either.

1.5 Thesis outline

In this Chapter 1, a brief overview of the context of the present study is given, and its aims and research questions are stated. The methods used to achieve those aims and provide answers to the research questions are presented, as well as the delimitations of the cases under analysis. Chapter 2 follows with a descriptive and thematic literature review, divided into three parts: cash and voucher assistance, digital harm, and blockchain technology's use in CVA programs. In Chapter 3, the methodological aspect of the thesis is explored, including the research approach, the framework for the case study design, and its execution. In Chapter 4, the results of the empirical study are presented, and in Chapter 5, these findings are analyzed and compared to existing literature; based on them, guidelines are suggested for humanitarian organizations seeking to reduce the digital harms to beneficiaries that arise from the implementation of blockchain-based solutions in CVA programs. Finally, Chapter 6 concludes with a summary of the study and its theoretical and managerial contributions. An overall evaluation of the study is made, with future research recommendations being provided.

2 DIGITALIZING CASH AND VOUCHER ASSISTANCE WITH BLOCKCHAIN TECHNOLOGY

In this Chapter, a descriptive and thematic literature review is presented, with a focus on three main points: cash and voucher assistance, digital harm, and the use of blockchain in CVA programs. That technology is considered an example of digitalization in the humanitarian supply chain (Baharmand, Saeed, Comes & Lauras, 2021b). Figure 1 shows how blockchain-based CVA, the focus area of this thesis, is situated at the intersection of two emerging fields in HSC.

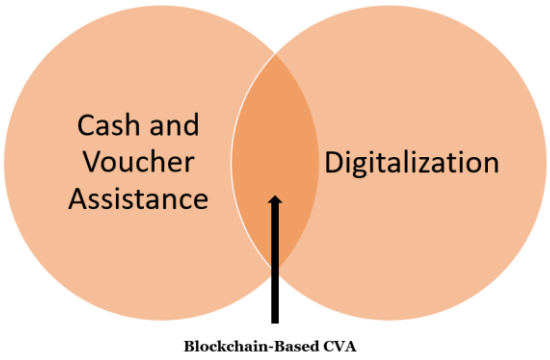

Figure 1 Thesis focus area

The literature on cash and voucher assistance covers the aspects of the definition of CVA, its modalities, factors that influence its implementation, the benefits observed, and the overall impact caused on humanitarian supply chains. The concept of digital harm is then introduced as a basis for the analysis of the use of blockchain for the delivery of cash and voucher assistance programs. After that, a short description of the technical aspects of blockchain is provided, with the way the technology can be used in cash and voucher assistance programs being explained. The potential benefits and digital risks brought by blockchain are summarized based on the ledger's key characteristics of immutability, distribution, and decentralization. With that background established, tentative answers to the two research questions posed in this thesis can start to be formed, being structured in a framework of *do no digital harm*, thus addressing a critical gap in both literature and practice.

2.1 Cash and voucher assistance

Humanitarian supply chains (HSCs) are defined as

> The process of planning, implementing, and controlling the efficient, cost-effective flow and storage of goods and materials, as well as related information, from point of origin to point of consumption for the purpose of meeting the end beneficiary's requirements. (Thomas & Mizushima, 2005, p. 60)

While this definition emphasizes the distribution of physical goods, in-kind assistance is by no means the only option available in humanitarian assistance. Another option, which has become increasingly popular since 2016 (Maghsoudi, Harpring, Piotrowicz & Heaslip, 2021), is providing beneficiaries with cash and vouchers. In this case, a voucher is defined as "a paper, token or electronic card that can be exchanged for a set quantity or value of goods, denomination either as a cash value or as predetermined commodities or services" (Heaslip, Haavisto & Kovács, 2015, p. 62).

A widely accepted definition of Cash and Voucher Assistance (CVA) is that brought by the Cash Learning Partnership. According to it, CVA "refers to all programs where cash transfers or vouchers for goods or services are directly provided to recipients" (CALP Network, n.d.). In the literature, this type of programming has also been referred to as Cash Based Assistance (CBA), Cash Transfer Programming (CTP), and Cash Based Intervention (CBI) (Maghsoudi *et al.*, 2021). In this thesis, following the CALP definition, only the term Cash and Voucher Assistance (CVA) will be used.

Although not a new phenomenon – as cash has been part of HO's toolkit at least since 1998, with IFRC's response to Hurricane Mitch in Central America (Kovács, Matopoulos & Hayes, 2010) – the use of CVA has become more prevalent since 2016, with the Grand Bargain recommending the increased use and coordination of cash-based programming (Heaslip *et al.*, 2018). The Covid-19 pandemic has also contributed to an increase in the use of CVA in both humanitarian and government social assistance (Lawson-McDowall, McCormack & Tholstrup, 2021). Figure 2 shows the increase in global funding for CVA since 2016, which went from U$ 2.8 billion in that year to U$ 6.7 billion in 2021. The numbers represent total programming costs, not the transfer value, and do not include government-led social protection systems. While the numbers for 2022 are not yet available, they are predicted to continue growing due to the large multi-purpose cash response in Ukraine (Rieger, 2022).

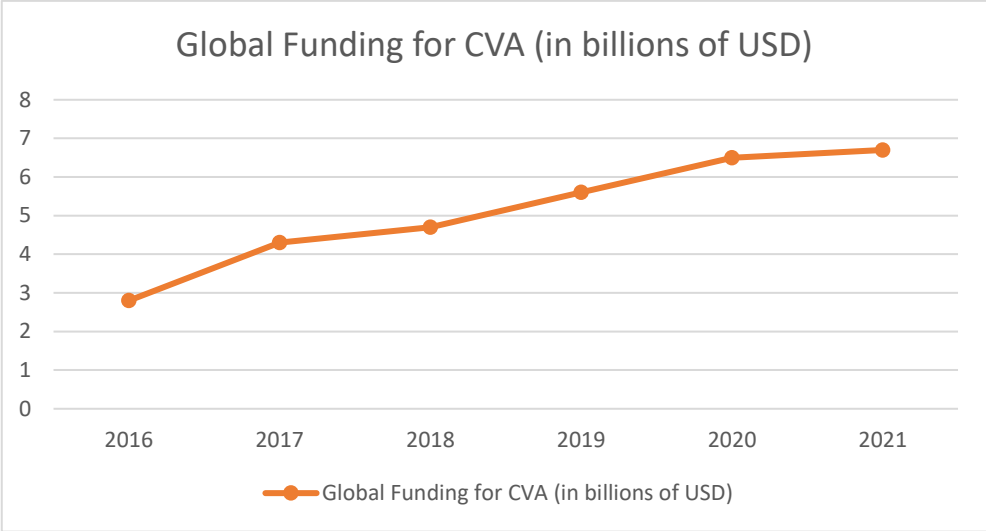

Figure 2 Global funding for CVA programs – total programming costs in US$ (adapted from Rieger, 2022)

According to Heaslip *et al.* (2018), cash transfers can be either unconditional or conditional. In the first case, beneficiaries can use the assistance as they wish; in the latter, specific requirements are set by the humanitarian organization, such as resources having to be directed to a certain finality. CVA includes a wide range of delivery mechanisms, such as debit and smart cards, mobile money transfers, and direct cash, with each mechanism bringing its own specific requirements and challenges (Maghsoudi *et al.*, 2021).

As explained by Maghsoudi *et al.* (2021), the choice to deliver assistance in one or more of these ways depends on a myriad of factors, which can be external or internal to the actors of a given HSC. External factors include the type of disaster (i.e. whether it is sudden or slow-onset, and natural or man-made, following Van Wassenhove's 2006 classification) and its phase, as well as aspects related to the local infrastructure (such as whether the banking system is operational), and political and economic situation. Within the political aspect are issues such as political support, and the economic aspect involves matters such as local inflation and unemployment rates. Internal factors, in their turn, can be divided into supply-side and demand-side (Maghsoudi *et al.*, 2021). Supply-side factors include aspects such as whether local markets are functional and accessible to beneficiaries (Heaslip *et al.*, 2018), while demand-side factors bring considerations such as beneficiary preferences, and the level of familiarity and access recipients may have with different payment instruments (Burton, 2020).

The analysis of such factors, as well as the definition of the delivery mechanisms or modalities, is part of the CVA Project Cycle. In its basic form, that cycle is made up of three main phases: preparedness, analysis and program design, and implementation (Shrestha & Smart, 2022). Each of them can be further divided into subcategories, as shown in Figure 3.

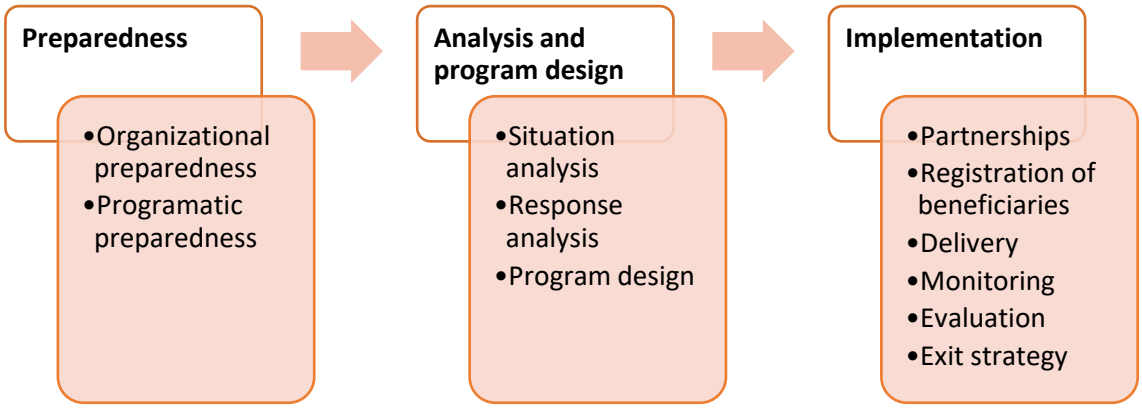

Figure 3 CVA Project Cycle (adapted from Shrestha & Smart, 2022)

During the preparedness phase, the focus lies on ensuring that both the responsible organization and its partners have the internal capabilities for implementing a CVA program, including human and financial resources. The evaluation of the general level of programmatic preparedness is also done in that first phase through pre-disaster assessments. In the analysis and program design phase, the question of whether CVA would be an appropriate response for a specific given context is explored. Four critical aspects are mapped during that step: needs and capacities of the local population, the local market's functionality and accessibility, potential service providers to partner with, and the potential contextual, programmatic, and institutional risks that must be addressed. (Shrestha & Smart, 2022)

This study is centered in an activity that takes place in the third phase of CVA Project Cycle, namely, the actual delivery of cash and voucher assistance to beneficiaries. Other activities in the implementation phase include contracting service providers, registering eligible CVA beneficiaries, monitoring outputs and results, and evaluating how program

is faring regarding relevance, effectiveness, efficiency, impact, and sustainability. (Shrestha & Smart, 2022)

2.1.1 Benefits of cash and voucher assistance

For humanitarian organizations, one of the most compelling reasons for the use of cash and voucher assistance is cost efficiency, especially given the reduced need for traditional logistical activities, such as transportation or warehousing (Heaslip *et al.*, 2018). These activities account for a high proportion of the cost of a program, with the 2006 assertion that "disaster relief is about 80% logistics" (Van Wassenhove, 2006, p. 475) being often cited (Maghsoudi *et al.*, 2021).

Heaslip *et al.* (2018) emphasize that another critical benefit of CVA is that it can lead to recipients having their needs met more quickly and accurately. That becomes possible since beneficiaries can choose from the start what goods and services to purchase, enabling a pull strategy in the HSC. That strategy contrasts with the more traditional push strategy, in which a humanitarian organization "pushes" items until it has enough information to determine what is needed in a particular situation.

Cash and voucher assistance programs can provide greater operational flexibility for humanitarian organizations, as well as enable increased speed in the distribution of aid and in the number of people that can receive it – especially when digital technologies are used (Burton, 2020). CVA can also bring benefits to the communities where the programs are implemented, as the increased demand for goods and services can stimulate the local economy (Heaslip *et al.*, 2015), which contributes to improving the coexistence with host communities (Burton, 2020).

Finally, allowing beneficiaries to make their own choices can be empowering and dignifying (Heaslip *et al.*, 2015). The increased participation of beneficiaries brought by CVA (Maghsoudi *et al.*, 2021), furthermore, can lead to changes in the power dynamics between them, humanitarian agencies, and other stakeholders within the humanitarian sector, such as governments and donors (Burton, 2020). These changes support a new view of aid recipients, who go from a passive role in the HSC to an active one (Kovács *et al.*, 2010), and contribute to a more socially sustainable system (Kovács & Spens, 2011).

2.1.2 Changes in the Humanitarian Supply Chain

A final point regarding CVA programs is that they lead to the participation of new actors, such as financial institutions and mobile phone companies, creating diagonal or cross-

sector partnerships, as explained by Heaslip *et al.* (2018). As a result, the very structure of humanitarian supply chains is modified. A way to visualize this change is through the different flows that make up the HSC: material (regarding physical goods), informational, and financial (Van Wassenhove, 2006). In Figure 4, the basic structure of a traditional HSC is represented. In it, humanitarian organizations use the financial resources received from donors to purchase the goods that will be distributed to beneficiaries. The figure's orange arrows represent material flows, while the green arrows symbolize the financial ones.

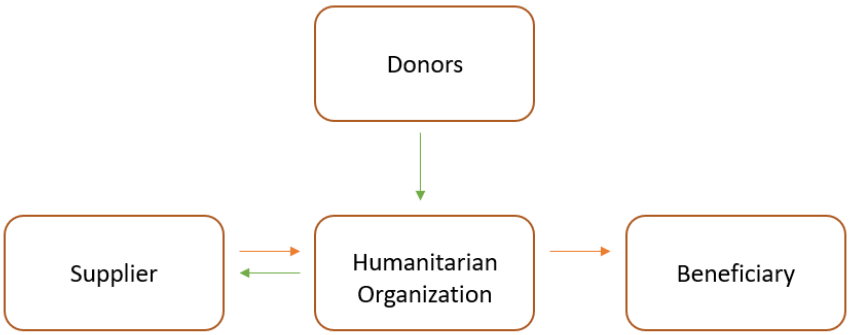

Figure 4 Traditional humanitarian supply chain (adapted from Heaslip *et al.*, 2015)

In Figure 5, the structural change brought by the implementation of a CVA program is shown. Humanitarian organizations no longer acquire goods from suppliers; instead, the cash and voucher assistance provided to beneficiaries allows them to directly purchase the goods and services they require. The orange and green arrows have the same meaning as those in Figure 3.

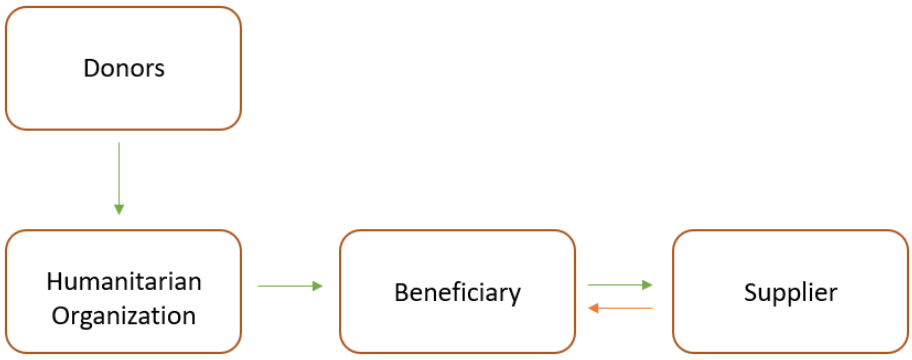

Figure 5 CVA supply chain (adapted from Heaslip *et al.*, 2015)

The models above are simplified and do not include all the actors in the humanitarian supply chain. As explained by Heaslip *et al.* (2018), the distribution of goods from humanitarian organizations to beneficiaries shown in Figure 3, for example, is usually done by third-party logistics service providers, local NGOs, and local authorities. Financial flows, in both Figures 3 and 4, are normally intermediated by financial institutions such as banks and payment service providers.

Crucially, technological innovations can lead to further changes in the cash and voucher assistance supply chain. The way this happens will be explained in the following sections, and its impacts on beneficiaries will be investigated. Before that, however, the notion of *digital harm* must be presented.

2.2 Digital harm

According to the United Nations Office for the Coordination of Humanitarian Affairs (2022), humanitarian action should be guided by the principles of humanity, neutrality, impartiality, and independence, which are based in the Fundamental Principles of the International Red Cross and Red Crescent Movement of 1965. Under the principle of humanity, the purpose of humanitarian action is to address human suffering wherever it is found, protecting the life and health of human beings. Neutrality prescribes that humanitarian actors should not take sides, while impartiality means that need ought to be the basis for providing assistance – any other factor, such as the beneficiaries' beliefs, nationality, or race, should not be taken into account. Finally, independence states that humanitarian action should be autonomous, independent from any political, economic, or military objectives. These principles, when combined, lead to the duty to *do no harm*. By that imperative,

> those involved in humanitarian responses must take steps to avoid or minimize any adverse effects of their intervention, in particular the risk of exposing people to increased danger or abuse of their rights. (Sandvik *et al.*, 2017, p. 323).

Because of this, a critical evaluation of the risks that can potentially arise from an intervention must be conducted. As argued by Sandvik *et al.* (2017), this evaluation is especially needed when new technologies are used in the humanitarian context, involving vulnerable populations and unstable environments, in which risks are exacerbated. In these situations, the supposed exceptionality of emergency can be exploited to legitimate the use of untested innovations. Once the logic that "something must be done" is deployed, even non-consented interventions can be deemed justifiable,

with as protection and safety considerations are "weighed against assumptions of immediate health benefits or knowledge to be gained" (Sandvik *et al.,* 2017, p. 328).

The consideration of the digital dimension of *do no harm* includes aspects such as data management and the overall way humanitarian organizations and their partners interact with beneficiaries in "the digital space" (Burton, 2020, p. 48). This dimension is related to the concept of data responsibility, which can be defined as

> a set of principles, processes and tools that support the safe, ethical and effective management of data in humanitarian response. This includes data privacy, protection, and security, as well as other practical measures to mitigate risk and prevent harm. (Burton, 2020, p. 57)

While there is no definition for digital harm, risk factors can be listed, and frameworks can be created to highlight these risks relate to the potential benefits that a given implementation can bring. The primary aim of this study, therefore, as stated in Chapter 1, is to identify what these risks would be when blockchain is used for the delivery of cash and voucher assistance.

Every technology brings with it benefits and risks, and blockchain is no exception (Lee, 2020). As noted by Sandvik *et al.* (2014), techno-optimistic narratives, which are based on the belief in the power of technology to promote positive change, tend to be widespread. In the case of the use of blockchain in CVA programs, that optimism can be seen especially in the emphasis on efficiency gains that is given by both media and practitioners (Lee, 2020). While that narrative might not be as explicit in academic publications, in which a degree of techno-skepticism can be observed (Lee, 2020), there is still a significant gap that needs to be addressed. A considerable part of the literature tries to transpose the benefits and challenges found in blockchain implementations from the commercial sector to humanitarian supply chains (Baharmand, Maghsoudi & Coppi,, 2021a), failing to examine the aspects in which these sectors differ, notably with regard to humanitarian principles. These principles might be violated by the uncritical implementation of new tools in the humanitarian sector (Sandvik *et al.*, 2014), exposing vulnerable communities to risk (Baharmand *et al.*, 2021b).

The principle of humanity, for example, might be violated if people are put at risk or their access to aid becomes compromised because of the misuse of their data. Furthermore, as technologies are never neutral, they may be used in ways to escalate conflicts, violating the principle of neutrality. Finally, if factors such as access to mobile phones or literacy become requirements for accessing aid, the impartiality that should guide humanitarian aid is lost, as people in need might not be reached. (Sandvik *et al.,* 2014).

2.3 Blockchain technology for cash and voucher assistance

The first application of blockchain – even though the word *blockchain* itself is not mentioned in that text – dates back to Satoshi Nakamoto's 2008 whitepaper. That system, which formed the Bitcoin cryptocurrency network, was designed to replace central trust with cryptographic proof to solve the double-spending problem. In it, parties can make peer-to-peer transactions, meaning that no intermediaries or trusted third parties are need. (Nakamoto, 2008).

Third parties can be bypassed in the system because transactions are compiled in blocks and broadcasted to the entire network. Each new block is added to the network in a linear, sequential order, being cryptographically linked to the previous block – creating then a chain of blocks. Furthermore, each additional block has to be validated by every computer that runs that blockchain. That makes changing past transactions impossible, ensuring that the ledger is immutable and tamper-proof, and as data is visible to all participant nodes, the system is completely transparent. (Coppi & Fast, 2019).

Blockchain can be defined as a type of Distributed Ledger Technology (Baharmand *et al.*, 2021b): it is a consensus-based, distributed, immutable and append-only electronic ledger, in which information is automatically updated and made visible to all participants of the network (Rodríguez-Espíndola, Chowdhury, Beltagui & Albores, 2020). It promises "a more transparent, accountable, efficient and secure way of exchanging decentralized stores of information that are independently updated, automatically replicated and immutable" (Coppi & Fast, 2019, viii), with the power to "reshape information, communication and financing at the deepest level" (Coppi, 2018).

Blockchains can be public or private. In the first case, as explained by Coppi and Fast (2019), they are open to all users to view transactions; in the latter, only an approved set of users can do so. Another way to classify them is into permissionless and permissioned, depending on whether users need previous authorization to add transactions to the network. A blockchain can also be run by a consortium of organizations and agencies, which can have different roles as nodes; as an example, all nodes could have permission to view transactions, but only a restricted number could be able to validate new transactions in the system (Hunt, Narayanan & Zhuan, 2022). Humanitarian organizations tend to prefer private and permissioned blockchains (Seyedsayamdost & Vanderwal, 2020; Madianou, 2019).

The current research on blockchain is situated in the context of both its growing adoption on the field (Madianou, 2019) and scholarly interest in the role of digital technologies in humanitarian supply chains (Marić, Galera-Zarco & Opazo-Basáez, 2021). A number of potential use cases has been highlighted in the literature: tracking donor financing (ICRC, 2020), distribution and tracking of aid (Zwitter & Boisse-Despiaux, 2018) and relief items (Baharmand *et al.*, 2021a); ID management (Zwitter & Boisse-Despiaux, 2018); facilitation of collaboration between actors during disaster relief (Dubey *et al.,* 2020), including between emergency responders and business organizations in order to directly share resources (L'Hermitte & Nair, 2021). They can involve both back-end processes and end-user experiences, although the former seems to be more relevant for humanitarian supply chains (Coppi & Fast, 2019). Blockchain can allow, furthermore, the automation of logistical processes with smart contracts, leading to cost reduction (Zwitter & Boisse-Despiaux, 2018). Conditions could be programmed, for example, into "qualified money", such as what types of goods or services it can be used to buy, or by who (Zwitter & Boisse-Despiaux, 2018), or to initiatives that are empowering to women and girls (Thylin & Duarte, 2019).

In this work, the focus will be in the use of the technology in cash and voucher assistance, with three key characteristics of blockchain being explored: immutability, distribution, and decentralization. Emphasis is given to how each of them can lead to benefits in the supply chain of cash and voucher assistance, as well as which potential risks they can pose to beneficiaries.

2.3.1 Immutability

In a blockchain, all transactions are recorded and they cannot be deleted or modified; information can only ever be added to the system (Rodríguez-Espíndola *et al.,* 2020). As data cannot be altered or removed after it has been registered, the information recorded becomes tamper-proof. This immutability is considered one of the most distinctive and transformative features of blockchain (Seyedsayamdost & Vanderwal, 2020), assuming that the data registered in the system is correct in the first place – in what is known as the "garbage in, garbage out" problem (Thylin & Duarte, 2019).

In humanitarian supply chains, lack of transparency is regarded as a major issue (Baharmand *et al.*, 2021a). A sequential, tamper-proof, and append-only record could provide not only a trail for relief items, but for other transactions, such as financial flows, improving traceability in the HSC. Such transparency, and subsequent accountability,

could reduce the possibility of corruption or misallocation of funds (Zwitter & Boisse-Despiaux, 2018). It is important to note, however, that private blockchains do not guarantee the same immutability as public ones. As such, blockchains controlled by a reduced number of entities might not be able to ensure greater traceability, given that these entities would be able to modify transactions if they so choose.

The same immutability that can be used to hold actors accountable, however, means that inaccurate or incorrect data cannot be rectified and will remain in the system (Zwitter & Boisse-Despiaux, 2018). This could lead to grave consequences for displaced people (Madianou, 2019). Immutability also raises legal questions, as the implications of blockchain for data protection are not yet fully known. As an example, under the European General Data Protection Regulation, subjects have the right to have their personal data rectified and erased, which stands in clear contradiction with an immutable system (ICRC, 2020). It must be noted that it is not given that the GDPR will be applicable to a given program, but that the uncertainty generated by the absence of a clear regulatory framework can be regarded as a source of risk in itself (Coppi & Fast, 2019).

Workarounds, such as off-chain solutions with logical deletion, exist. In that case, the organization does not register personal information on the blockchain, especially if they are public (ICRC, 2020); rather, off-chain databases designed in ways that are compliant with the relevant data protection regulation can be cryptographically linked to the blockchain (Thylin & Duarte, 2019). If the data subject then requests the deletion of his or her personal data, it can be removed from the off-chain database alongside the decryption key associated with it. The information will still be on the blockchain, but without the key, it will remain encrypted and impossible to access (ICRC, 2020). This approach for not storing personal data on the blockchain is often the one chosen by humanitarian organizations (Coppi & Fast, 2019).

Such workarounds are not, however, entirely satisfactory, especially considering the present limitations of data protection in humanitarian operations (ICRC, 2020). The use of consent as a basis for data collection and processing in those settings, for example, can be considered problematic given the power asymmetry between organizations and beneficiaries (Thylin & Duarte, 2019), and how the latter might not understand what that consent would entail (Lee, 2020). Finally, opting out cannot be said to be a real option when the refusal to consent leads to a vulnerable person not receiving the aid he or she needs (Madianou, 2019; Burton, 2020).

A final point to note is that it can also be argued that the immutability of blockchain can pose a risk to beneficiaries not only from a data protection perspective, but also considering their dignity. As Howson notes, beneficiaries are required to give up sensitive personal information, such as biometrics, to an immutable archive, in order to access basic and temporary benefits (Howson, 2020). Although proportionally and fairness may seem like abstract notions, it is important to emphasize that the goals of humanitarian assistance go beyond saving lives and alleviating suffering, as it is also intended to maintain human dignity (Urquhart, Girling, Nelson-Pollard & Mason, 2022).

2.3.2 Distribution

As explained by Rodríguez-Espíndola *et al.* (2020), in a blockchain, all participants of the network have an identical copy of the entire ledger. Whenever a new transaction is added to the system, the copies are automatically updated in all nodes, ensuring that participants always have access to the data in full. Because of that, blockchain is deemed as a highly transparent system, allowing for each transaction to be monitored.

In humanitarian supply chains, information-sharing and visibility is often limited (Baharmand *et al.*, 2021a), with the shortage of critical information being a frequent challenge for humanitarian operations when attempting to allocate resources efficiently (Baharmand *et al.*, 2021b). As blockchain enables network participants to see new transactions in real-time (Thylin & Duarte, 2019), it can help to build swift trust and enable cooperation (Dubey *et al.*, 2020). The improved information sharing between participating organizations, by their turn, could result in better decision-making (Rodríguez-Espíndola *et al.*, 2020) and more resilient humanitarian supply chains (Dubey *et al.*, 2020).

Furthermore, as copies of the entire database are stored in the computers participating in the network, even if one or more of these participants become compromised, the system will still continue to run without changes to the data stored (Coppi & Fast, 2019). Because of this, blockchain is considered to have a high degree of security, meeting all three key principles of data securiy (i.e. confidentiality, integrity, and availability) (ICRC, 2020). That security could contribute to an overall reduction of cyber risks (Zwitter & Boisse-Despiaux, 2018), a relevant point since humanitarian organizations are increasingly becoming targets of digital attacks (Burton, 2020).

It is important to note, however, that the increased transparency brought by that system tends to be limited to organizations and does not reach individuals – who may not be

aware that a blockchain-based system is being used (Coppi & Fast, 2019). That is particularly relevant when private platforms are used – which is often the case in humanitarian implementations. If the ways in which the system works are not made public, accountability beyond that to donors might not exist, with the technology being a "black box" (Lee, 2020).

Furthermore, humanitarian organizations tend to collect too much data (Sandvik *et al.*, 2014), and in a transparent system, that data is shared with actors such as host governments and commercial partners. Beneficiaries are often not informed about other parties that could have access to their data, and how they would use it (Madianou, 2019), raising issues about consent. Not only that, but once data is shared, humanitarian organizations have no way to control how it will be used (Burton, 2020), especially if clear policies and legal frameworks are not in place (Madianou, 2019).

That data might be used for purposes unrelated to the provision of humanitarian assistance, which it was originally collected for. From a commercial perspective, the data could be used for profiling potential customers and targeting ads (Burton, 2020). Even more severely, especially when States are involved, humanitarian data can lead to harms such as involuntary repatriation of refugees and further persecution (Lee, 2020). That was the case with biometric data collected by the UNHCR from Rohingya refugees, which was shared with the government of Myanmar – the very State responsible for the persecution of that minority (Rahman, 2021). Finally, critical literature points out that the level of transparency and control afforded by blockchain could lead to a form of "surveillance philanthropy" (Howson, 2020, p. 3). In it, the interests and visions of donors would be prioritized over the needs of beneficiaries and organizations' abilities to respond to changes in the environment they operate (Howson, 2020).

Those misuses of humanitarian data are especially critical when highly sensitive personal information is used in the system. Although it might not be possible to say with certainty whether a particular piece of information will be sensitive in a given context (Sandvik *et al.*, 2014), biometric data will likely always be considered as such due to its inherent connection with individuals. Biometrics can be defined as "a technology for measuring, analyzing, and processing a person's physiological characteristics, such as fingerprints, iris, facial patterns, voice, hand geometry, and DNA" (Madianou, 2019, p. 583). It can be used for both identification – when a one-to-many comparison is made, with a record being compared to a larger database – and verification processes – when the authentication is one-to-one, with a record being checked against a specific entry in the

database. In the context of blockchain-based programs, biometrics tend to be used for such purposes (Madianou, 2019), despite the fact that the collection and use of biometric data can lead to risks "even in the absence of ill intentions or negligence" (Sandvik *et al.*, 2017, p. 340).

Because of this, humanitarian organizations are advised to conduct a Data Protection Impact Assessment, which can help to map the privacy risks that arise from the deployment of a blockchain-based system and indicate avenues for mitigating them (ICRC, 2020). If there are less intrusive means, from a data protection perspective, that can achieve the goals of a program while presenting fewer risks to beneficiaries, those should be implemented instead. As Sandvik *et al.* (2014) note, however, privacy and efficiency exist in tension. Resources are needed in order to mitigate risks to beneficiaries: staff needs to be trained in data collection, security, and sharing, and investments in technology and infrastructure in the organization might be required. In situations of emergency, nevertheless, these resources might not be available.

2.3.3 Decentralization

Decentralization, by its turn, is related to mechanisms of consensus and validation, which require that network participants agree on each new transaction added to the system (ICRC, 2020). As this process of validation is required, the chances of a single organization or malicious party adding data to the system are very low, especially in public blockchains with a high number of validating nodes (Coppi & Fast, 2019).

As transactions are automatically verified by this consensus mechanism and participating nodes have real-time access to data, there is no need for a controlling central intermediary (Rodríguez-Espíndola *et al.,* 2020). Because of this, when implemented in CVA programs, blockchain can reduce the resources spent by intermediaries on administrative processes, with funds being directed to activities that can impact beneficiaries (Baharmand *et al.*, 2021b). Bypassing traditional banking institutions, for example, could lead to savings in service fees, as well as reducing the time required for the distribution of aid (Thylin & Duarte, 2019).

Nevertheless, two critical points must be considered regarding this potential disintermediation. As noted by Seyedsayamdost and Vanderwal, although the role of some third parties, such as financial institutions, can be reduced, the participation of others, especially those with technical expertise, becomes more prominent. As such, "decentralization and democratization of decision-making are not a given when using

blockchain technology" (2020, p. 956). Furthermore, as humanitarian organizations tend to outsource the technical aspect of a project development to these new actors (Baharmand et al, 2021b), they may not develop a sufficient internal understanding of the technology, which is considered highly complex (Lee, 2020). This knowledge gap can create the perception of risk within the organization (Coppi & Fast, 2019) and, as the humanitarian staff itself does not understand and trust the system they are working with, it becomes harder for them to create risk mitigation and protection strategies.

The second critical point is that disintermediation tends to lead to a detrimental reduction in the role of downstream actors. As noted by Coppi (2020), when blockchain is used to transfer funds directly to beneficiaries, bypassing local financial institutions, those native businesses are not activated, taxes are not collected, and that community may become more dependent of foreign aid and institutions. This can, furthermore, lead to local governments and central backs reacting negatively to humanitarian organizations and donors (Martin *et al.*, 2022).

As mentioned in the previous section, the current disintermediation that was supposed to arise from the implementation of blockchain is more of a replacement of traditional actors with new, more technically-oriented ones. These new actors entering the HSC, such as technology companies and financial service providers, benefit from the legitimacy (Jutel, 2022) and operational license given by humanitarian organizations (Sandvik *et al.*, 2017). Nevertheless, they are not bound by their principles of action, legal frameworks and mandates (McDonald, 2021), and can alter the power dynamics in the humanitarian supply in ways that may endanger beneficiaries (Coppi & Fast, 2019).

That point is especially sensitive as new actors might have different motivations for wanting to participate in humanitarian operations. They may range from a legitimate attempt of corporate social responsibility to a mere commercial desire to reach new markets, and it is unclear how certain humanitarian organizations can ever be of a potential partner's motivation. The vulnerability of beneficiaries, however, and the fact that they can become easy targets to companies and be led to accept terms that go against their own interests, makes public-private partnerships a source of risk that needs to be considered. (Sandvik *et al.,* 2014)

2.4 Theoretical framework

A theoretical framework is designed to explain the "key factors, constructs or variables" of a study and how they related to each other (Miles & Huberman, 1994, p. 18). After this

research has identified both the potential benefits and risks to beneficiaries that may arise from the use of blockchain for delivery in CVA programs, its theoretical framework can be presented. This framework is regarded as necessary due to its specificity to the humanitarian context. As Baharmand *et al.* (2021b) note, the adoption of an existing framework from the commercial sector could lead to violations of humanitarian principles, as it would not have been designed with those principles in mind in the first place.

Lewin's Force Field analysis is "a method of analyzing causal relations and of building scientific constructs" (Lewin, 1943, p. 294). In it, the forces that influence a situation, either driving or restraining it, are mapped and represented in opposition (Fisher, 2010). Although more widely used in the area of organization development (Thomas, 1985), it was chosen for this study due to its ability to convey the dynamic nature of the balancing act that is choosing whether or not to implement blockchain technology in the case under discussion. Furthermore, it shows that the factors are part of a larger system (Thomas, 1985), which must be considered as a totality, not as mere components to be individually dealt with.

In Figure 6, potential benefits are represented as enabling forces, while the possible risks are constraining forces. The relative strength of each enabling or constraining force is not shown, as it will depend on the specific context of a given CVA program.

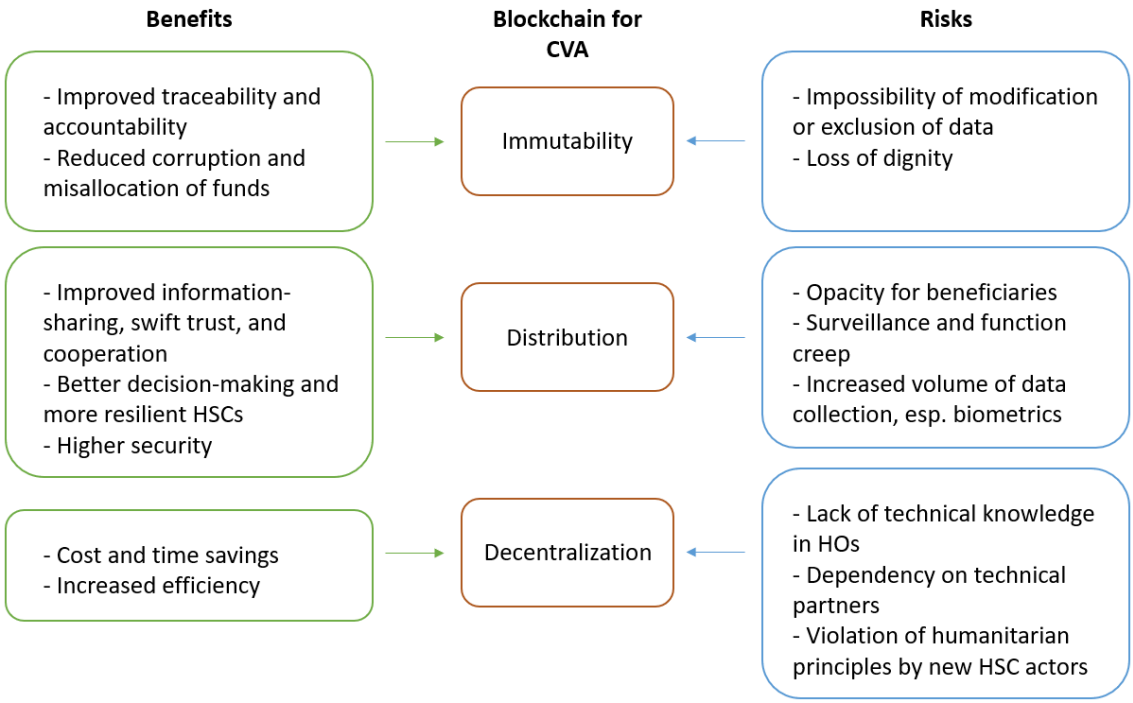

Figure 6 Thesis theoretical framework as a force field diagram

3 RESEARCH METHODS

In this chapter, aspects related to the methodology of the present study are discussed. It begins by explaining the philosophy underlining the research and why it is suitable for achieving the study's stated aims. After that, the choices that inform the design of this research are presented, including the abductive approach and qualitative methods. The sampling strategies and data sources are then considered, with the process of data collection and analysis being explained for both primary and secondary sources. Finally, the techniques used for evaluating the quality of this study are specified.

3.1 Research philosophy

In logistics studies, three main research paradigms can be identified: positivism, scientific realism, and interpretivism (Kovács & Spens, 2007). Attempts in building theory – defined as "any coherent description or explanation of observed or experienced phenomena" (Gioia & Pitre, 1990, p. 587) – require from a researcher the appropriate understanding of one's chosen paradigm, as the assumptions it brings will influence that process of creation. The positivist approach, for instance, with its belief in objectivity and universality claims, has been criticized for not being conducive to the development of new theories; when combined with deductive methods, it can often lead only to the modification of existing frameworks (Gioia & Pitre, 1990). The interpretivism paradigm, in its turn – in which the relationship between researcher and phenomenon under investigation is emphasized and the existence of absolute truths is rejected – is better suited for the building of theories focused on descriptions and explanations, but not on predictions (Kovács & Spens, 2007).

In this thesis, the underlying research paradigm chosen is that of scientific realism, which stands as a "middle ground" between the two above-mentioned approaches. Under that approach, according to Kovács and Spens (2007), it is believed that, despite the fact that there is an objective nature to the world, the ways to perceive, create knowledge about, and interpret it are context-dependent. Scientific realism, furthermore, is compatible with abductive research methods, which are used in this study, as will be explained in the following section.

3.2 Research design

In the abductive research process, empirical observations are the starting point, even if the researcher takes advantage of pre-existing theoretical knowledge – as that knowledge should be used to find the spot in which the reality observed does not match the previous

theories. As the goal in the abductive approach is the development of theory, the suggestion of new hypotheses and propositions is made in the second step of the research process. Those, in their turn, are applied to further empirical research in order to test the conclusions reached. (Kovács & Spens, 2005)

Theory-building is one of the main purposes of this work, thus making the abductive approach suitable for the study. Furthermore, as the framework about the risks of using blockchain technology in the delivery of CVA programs is built, moving back and forth between the theoretical and empirical realms contributes to its accurate representation of the reality investigated.

In this thesis, the first step of the process is the analysis of two cases (the World Food Programme's Building Blocks and Oxfam's UnBlocked Cash; respectively, Cases A and B), which are compared to the techno-optimistic literature already known by the researcher. A new element is introduced to the analysis – the consideration of risks to beneficiaries – and a theoretical framework is suggested. After that, the framework is tested on the case study about Finn Church Aid (Case C). Finally, the conclusions drawn from the application of the framework to FCA's case are compared to those reached in the analysis of the two previously mentioned projects, and concrete guidelines are suggested to humanitarian organizations. The process is shown in Figure 7.

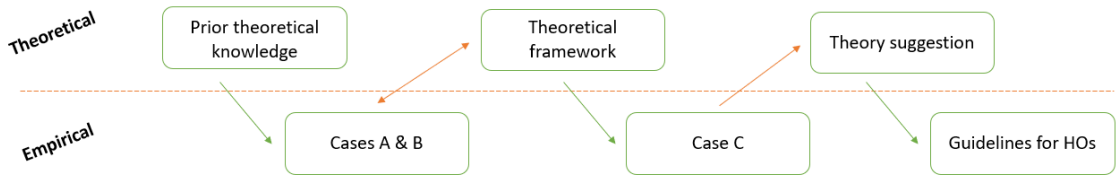

Figure 7 The study's abductive research process (based on Kovács & Spens, 2005).

This thesis also uses qualitative research methods, which allow for in-depth and detailed analysis (Patton, 2002), especially when case studies are used to "explain, explore or describe a topic of interest" (Vega, 2018, p. 180). Through that combination, insight can be gained into little-known phenomena (Vega, 2018). Patton identifies seven types of knowledge that can be generated through qualitative inquiry. Of those, two are particularly relevant to the aim of this thesis: the identification of unanticipated consequences and side effects, and the discovery of patterns across cases (Patton, 2002).

3.3 Sampling strategy

As qualitative studies are often done with small sample sizes, sampling strategies must be selected purposefully in order to promote an in-depth understanding of the phenomenon under observation (Patton, 2002). Because of that, purposeful sampling will be used in this study, with a focus on the selection of information-rich cases. Nevertheless, still according to Patton (2002), before further sampling strategies can be selected, the units of analysis to be studied must be defined. As they are not mutually exclusive, being therefore possible for a study to contain multiple units of analysis, this thesis will focus on two units. In Table 1, these units are presented alongside the sampling strategies used for them.

Case	Unit of analysis	Sampling strategy
A, B, C	Documents	Emergent theory sampling: in the first stage of the abductive research process, the documents are selected according to the concepts that are being developed, When compared, the similarities and differences between them can help to sharpen the analysis.
C	Individuals familiar with FCA's Feasibility Study	Key informant sampling: the selected individuals can provide insight into the project, given their first-hand experience with it, or deep knowledge about it.
		Snowball sampling: the first interviews will be conducted with people that are already known to have participated in the project; those interviewees will then be asked to nominate other project participants, who will be invited to participate in the study. The process will be repeated until no more participants can be found.

Table 1 The study's units of analysis and sampling strategies

3.4 Data collection

Yin (2015) describes three conditions for the use of case studies: the main research questions have to do with how and why, no control of behavioral events is required, and the focus of the research lies on contemporary events. All three of these conditions are

fulfilled in the present research, especially as case studies can utilize multiple sources, including interviews and written documents, to triangulate data, enabling an even deeper understanding of the subject being investigated.

A multiple case study is conducted in this thesis. Cases A and B – respectively, the World Food Programme's current Building Blocks project, and the Oxfam's UnBlocked Cash pilot that took place in Vanuatu in 2019 – are considered, as explained above, in the first phase of the abductive research process. After a thereotical framework is developed, Case C, which refers to Finn Church Aid's Feasibility Study conducted in Kenya in 2019, is investigated. The first two cases were chosen for two major reasons: they are deemed representative and have been widely documented. Publicly available information about Case C, by its turn, was scant; nevertheless, the author had personal knowledge of and access to the organization responsible for it.

According to Yin (2015), multiple case studies can offer more compelling and robust evidence. It is expected that all three cases selected will show variation in their design choices and implementations, but that these variations and their consequences to beneficiaries can be justified in light of the theoretical framework developed in this study – thus following a logic of theoretical replication (Yin, 2015).

Three main types of data can be used as sources for qualitative research: interviews, direct observations, and written communications (Patton, 2002). In this study, two of them will be used, with semi-structured interviews being the study's primary data source, while the secondary sources are written documents.

According to Roulston (2010), interviews, which can be of several types, such as journalistic, motivational, and diagnostic, have question-answer sequences as the basic units of interaction. These questions can be closed or open. In the first case, the answers generated are either negative or affirmative; in the second, participants have more freedom to elaborate answers using their own words – with the latter type of answers being generally preferred on qualitative research, as they allow for more information to be provided by respondents.

As explained by Patton, with interviews, the researcher can "enter into the other person's perspective" (2002, p. 341), thus enabling access to information that could not be obtained by mere observation, such as a person's previous behavior, or his or her intentions, motivations, and feelings. Three main approaches can be used to collect

qualitative data through interviews: the informal conversation interview (also known as unstructured interviewing), the general interview guide, and the standardized open-ended interview. The second approach was chosen for this study. With a semi-structured interview, conducted with the help of an interview guide, predetermined questions allow the interaction to remain focused on the key aspects, while, at the same time, providing enough flexibility to pursue interesting points that emerge from the conversation with the participants (Patton, 2002).

The use of documents, by its turn, can serve multiple purposes in research, from bringing background and contextual information to observing how a program or organization has changed over time (Bowen, 2009). In this study, two purposes are emphasized. The first is identifying new questions or relevant points to be added to the study. As previously explained, this thesis has chosen to use the abductive research approach, so the analysis of the documents from Cases A and B is done parallel to the Literature Review. The second purpose is to allow for triangulation. By showing that findings are consistent across different types of sources, such as documents and interviews, and highlighint the patterns that arise from them, the study's credibility can be enhanced (Patton, 2002).

3.4.1 Primary data sources

The primary data is refers to semi-structured interviews with people familiar with the above-mentioned Feasibility Study. Interviwees 2 and 3 have worked in it from the beginning, while Interviewees 1 and 4 became acquainted with it at a later stage. The questions were inspired by the literature review conducted in Chapter 2, especially by The Handbook on Data Protection in Humanitarian Action (Kuner & Marelli, 2020), as well as Oxfam's Unlocking Digital Cash and Voucher Assistance: A Guide to Digital Options (Kayastha *et al.*, 2022). The complete list of interview questions is found in Appendix 1.

The interviews took place between November 2nd and 15th, involving four respondents. Three of these interviews (with Interviewees 1, 2 and 4), were conducted online, via Teams; the other was done in person (Interviewee 3). In Table 2, the Respondent Codes, as well as the organizations they represent, are listed. The interview dates and the duration of each are also informed.

Respondent Code	Organization	Interview date	Duration

1	Finn Church Aid	November 2nd, 2022	01:06:32
2	Solita Oy	November 8th, 2022	01:00:45
3	Finn Church Aid (formerly)	November 10th, 2022	00:44:34
4	Finn Church Aid (associated to)	November 15th, 2022	00:53:23

Table 2 Primary data sources

3.4.2 Secondary data sources

The secondary data, in its turn, encompasses written documents. These documents can be in several forms, including organizational reports and case studies – the main types used in this study. As a process, the use of written documents for research includes multiple steps, as the appropriate and relevant documents must be found, selected, and appraised, until the data contained in them can be synthesized (Bowen, 2009). In total, 11 such documents were analyzed in this study. Of those, four were official reports created by the organizations implementing the programs; four others were non-academic case studies by experts; and three were pages on the websites of the responsible organizations, in which their respective cases were presented. The documents are listed in Table 3.

Case	Document Code	Description
A	A1	Fieldwork comments from the Azraq refugee camp (Cheesman, 2022)

	A2	UN Women Jordan Case Study (2021)
	A3	GovLab Case Study (2018)
	A4	MIT Technology Review article (Juskalian, 2018)
	A5	Building Blocks project page (WFP Innovation Accelerator, n.d.)
	A6	WFP Innovation Accelerator's 2020 Year in Review report
B	B1	Rust's Oxfam Research Report (2019)
	B2	Hallwright & Carnaby Case Study (2019)
C	C1	Article published by FCA about the program on the organization's website (2019)
	C2	Article published by Solita about the program on the organization's website (2019)
	C3	Final document of the Feasibility Study (2020)

Table 3 Secondary data sources

It is important to note that the Feasibility Study in Case C is considered a confidential document. Because of that, it was agreed with Finn Church Aid that it could be used as a source to inform the research design and could be referenced during the interviews, but direct quotes or references would not be allowed.

3.5 Data analysis

Through the process of data analysis, the data collected can be transformed into findings (Patton, 2002). In the present work, as a multiple case study is conducted, this process of analysis is centered in trying to find recurring themes and patterns among cases A, B, and C.

3.5.1 Interviews

The primary data, which was collected via in-depth, semi-structured interviews with key informants, was analyzed using Spiggle's (1994) qualitative data manipulation operations. The first of these is categorization, by which units of data are classified. These units can be of any length, as long as they contain meaning. Before the interviews were conducted, four a priori categories were identified: background, program structure, benefits, and risks. As advised by Miles & Huberman (1994), these codes were derived from this study's research questions and the theoretical framework proposed. As the

interviews were conducted, transcribed, and color-coded, new themes emerged. These emerging themes were background, context, regulation, design, transparency, accessibility, privacy, coordination, security, implementation, partners, speed, biometrics, beneficiary response, and power dynamics.

The emerging themes were further analyzed in order to identify potential patterns in the data. In this operation, which Spiggle (1994) defines as abstraction, the categories previously identified are revised and grouped into classes of a higher conceptual level. In this study, the classes identified were program structure (which included the previous categories of background and context), benefits (including transparency, accessibility, privacy, coordination, security, and speed), implementation (with design, regulation, and partners as subcategories), and risks (which considered the subcategories of biometrics, beneficiary response, and power dynamics). At the same time that these classes were being structured, the operation of comparison was being undertaken, as analyzing the similarities and differences between the subcategories that were being classified helped to ensure that they were included in the correct class.

The operations of integration and iteration, by which, respectively, the relationships between the classes are highlighted to facilitate theory-building, and data collection and analysis are considered in parallel (Spiggle, 1994), were used throughout the entire case study. Finally, refutation was done as part of the process of iteration, as the emerging findings were intentionally scrutinized during their development, to make them more consistent and robust.

3.5.2 Documents

Document analysis is a "systematic procedure for reviewing or evaluating documents — both printed and electronic" (Bowen, 2009, p. 27). It includes skimming, reading, and interpreting the materials selected in an iterative process (Bowen, 2009). In this thesis, the 11 documents selected were subjected to both content and thematic analysis. In the first phase of the abductive research process, content analysis was used in the documents referring to Cases A and B, with broad categories related to the research questions being identified. After the development of the theoretical framework depicted in Figure 5, the documents from those cases were re-read, and thematic analysis was performed. The factors listed in the theoretical framework were used as predefined codes for the documents for all cases, and the relevant arguments and quotes were selected based on them.

3.5.3 Ethical considerations

The four people interviewed for this study were properly informed of its purpose and scope, and have agreed on their own accord to participate on it. Before the interview, they gave consent for the collection and processing of their personal data, being informed of how the data was going to be used, which types of data could be made public, and for how long data would be kept. Their consent was also given for the video and audio recording of the interviews.

3.5.4 Quality of the study

Finally, to ensure its quality, this study will be evaluated according to the five dimensions of trustworthiness developed by Wallendorf and Belk (1989): credibility, transferability, dependability, confirmability, and integrity. Credibility refers to whether the reality studied was represented adequately, while transferability asks whether the study's hypotheses and findings can be applied in other contexts. Dependability, in its turn, considers whether results would be replicated if the study was conducted again with similar subjects and contexts. Confirmability seeks to show that a study's findings derive not from the researcher's preferences or interests, but from the subjects and the field. Finally, integrity aims to demonstrate that these findings were not misleading due to informants' misinformation or deception. In Table 3, the techniques used in this study are explained.

Dimension	Technique
Credibility	Prolonged engagement and persistent observation are used as the author has been working with blockchain technology since 2017, so before the beginning of this study, the context and the phenomenon were already understood. Triangulation is also used, as this study makes use of different sources and methods, including interviews, media articles, and organizational reports.
Transferability	The study involved the analysis of three different cases, which were led by different, independent organizations, and took place in diverse contexts. Despite that, the core findings are shared by all, which could suggest their transferability to further implementations of blockchain in CVA programs.

Dependability	As the author has been following the cases analyzed for a number of years, revisiting them in order to refine their understanding, dependability is ensured with observation over time.
Confirmability	Confirmability was ensured with the careful documentation of the research process, including recording the interviews conducted and transcribing them.
Integrity	The people interviewed for the study have all worked with matters related to Finn Church Aid's Feasibility Study and are members of reputable organizations. Interviewee 1 was still working at FCA and suggested the names of Interviewees 2 and 4 as trusted partners. Interviewee 2, by his turn, nominated Interviewee 3. The same Interview Guide was used for all of them, and their responses were consistent. At the beginning of the interviews, respondents were informed about how their data would be used and how they would not be identified in the study or any published material. Finally, the interviews had an average of one hour in duration, which allowed them to feel at ease to develop their arguments and responses.

Table 4 Quality of the study

4 *DOING NO DIGITAL HARM* IN BLOCKCHAIN-BASED CVA

In this fourth chapter, the findings from Cases A, B, and C (respectively, the World Food Programme's Building Blocks, Oxfam's UnBlocked Cash, and Finn Church Aid's Feasibility Study), are presented. The first section of the chapter is focused on establishing the background of the programs under investigation. After that, each section is dedicated to one of the major themes that emerged from the data collected, namely efficiency, transparency, privacy, biometrics, and disintermediation.

4.1 Case descriptions

In this section, a brief description of each of the three cases investigated is given. Each description includes information about the implementing organization, the location and target population of each program, as well as its process of aid distribution and the basic structure of their supply chains, following the model proposed by Heaslip *et al.* (2015).

4.1.1 Case A: the World Food Programme's Building Blocks

The largest blockchain-based cash distribution system in the humanitarian sector is the World Food Programme's Building Blocks (Document A6), using a private, permissioned system (Thylin & Duarte, 2019). Launched in 2017 in the Sindh province in Pakistan (Seyedsayamdost & Vanderwal, 2020), it is currently active in Bangladesh and Jordan, where it serves, respectively, Rohingya and Syrian refugees (Document A5). As of the end of 2021, the program had served over 1,000,000 refugees and processed USD 309 million in cash transfers (Document A5).

In the first wide implementation of the program, in the Azraq refugee camp in Jordan, a system for cash and voucher assistance already existed, and parts of it were modified to incorporate blockchain technology (Document A3). Previously, bank accounts were created for each beneficiary, who would be provided with debit cards or e-vouchers to be used in authorized local shops. In the stores, beneficiaries would be identified with optical biometric authentication or one-time passwords sent to their mobile devices (Seyedsayamdost & Vanderwal, 2020), and vendors would receive the payment from the bank. After blockchain was incorporated into the system, the bank accounts were replaced with e-wallets; this shift from bank accounts to e-wallets did not change how beneficiaries received assistance (Document A3). The new process of aid distribution can be summarized as follows (Awan & Nunhuck, 2020):

1. Virtual wallets are created for beneficiaries, based on their biometric information from the UNHCR refugee database; the WFP sends the funds to these e-wallets.

2. Beneficiaries have their irises scanned to verify their identity when purchasing goods at shops registered with the Building Blocks program.

3. After consulting the transactions recorded on the blockchain, the WFP reimburses the due amount to the retailers. That reimbursement is made via traditional financial institutions.

The Building Blocks supply chain is represented in Figure 8. Green arrows represent financial flows, while blue and orange represent, respectively, informational and material ones.

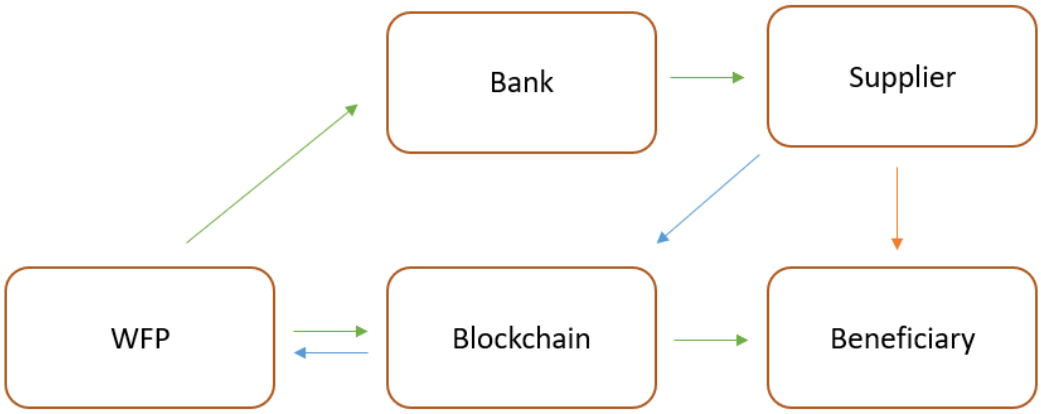

Figure 8 The Building Blocks supply chain

In 2019, the WFP established a partnership with UN Gender to expand the Building Blocks to a cash-for-work program for Syrian refugee women in two camps in Jordan, Azraq and Za'atari (Document A1). This implementation works in a similar manner to that described above, in which the beneficiaries can use their biometrics to purchase goods at the participating shops. It has, nevertheless, an additional feature, which is the possibility of withdrawing cash from the market (Document A2). Between June 2019 and April 2020, 467 women participated in the pilot version of that program (Document A2). According to Coppi and Fast (2019), the new system is safer, removing the need for women and UN staff to physically carry cash on predetermined distribution dates, as well as being more transparent. It is also meant to be more empowering for women, as it would allow them to manage their own accounts.

4.1.2 Case B: Oxfam's UnBlocked Cash

Another case using blockchain for cash transfers is Oxfam's UnBlocked Cash Project, which was implemented in Port Vila, Republic of Vanuatu in 2019, in partnership with company ConsenSys and startup Sempo (Document B1). UnBlocked Cash is not the only Oxfam initiative implementing blockchain technology. The organization has developed concepts or pilots on at least five other occasions, with uses ranging from fundraising to the tracking and certification of products such as rice and strawberries (Document B2).

The blockchain pilot was built upon an existing cash transfer project (Document B2). In it, beneficiaries received physical cards with near-field communication (NFC) chips, which were preloaded with DAI stablecoins, and vendors were provided with smartphones (Document B2). The card system was designed as such in response to the low internet connectivity on the island (Document B1). In the pilot, aid was delivered in the following manner (Document B1):

1. Oxfam Australia purchased DAI stablecoins in the amount equivalent to the one that would be distributed to beneficiaries. Nevertheless, as the use of cryptocurrencies was not allowed by the government of Vanuatu, the DAI were "wrapped" in a Crypto Collaterised Voucher (CCV) – meaning that they were sent to an escrow smart contract.

2. The CVVs were assigned to beneficiaries, and the NFC cards were loaded with a value equivalent, at the date of the beginning of the program, to 49,24 AUD.

3. The NFC cards were distributed to beneficiaries, who could then redeem goods or services from the partner vendors. To complete the purchases, vendors would scan the QR codes printed on the cards.

4. Vendors exchanged the CVV tokens received from beneficiaries for cash, receiving the money either by direct bank transfer from Oxfam or by cashing out at designated Super Vendors – larger partner vendors, who would later be reimbursed by the humanitarian organization.

These financial, material and informational flows are represented, respectively, by the green, orange and blue lines in Figure 9.

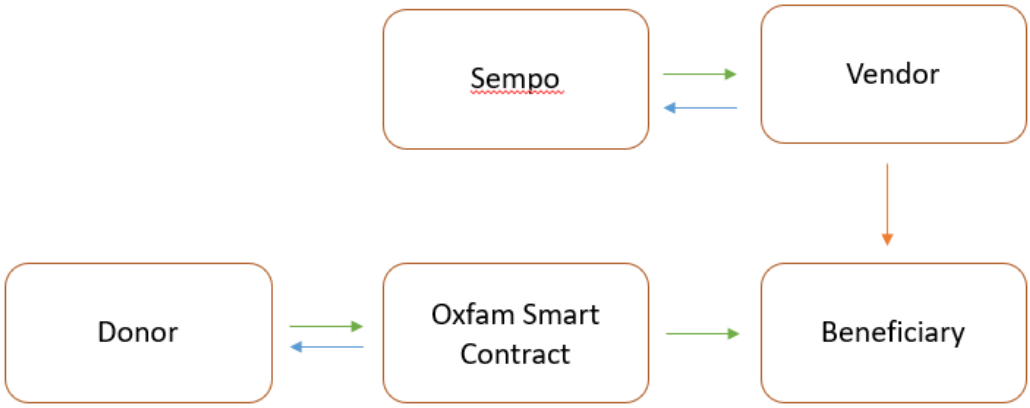

Figure 9 **The UnBlocked Cash supply chain (based on Document B1, p. 23)**

4.1.3 Case C: Finn Church Aid's Feasibility Study

Case C refers to the Feasibility Study conducted by Finn Church Aid and Solita in 2019 in Kenya. The project was designed to test how blockchain could be used to distribute cash-based assistance, with emphasis on the aspects of efficiency and donation tracking (Document C2). The idea was to create an end-to-end digital system, which would start with individuals making donations through an app or website (Interviewee 3). Virtual wallets would be created for each beneficiary, who could go to verified retailers and buy the products of their choice using either biometrics or a card as a means of identification. As each transaction made by beneficiaries was monitored, donors would be able to receive information on how the assistance was used (Document C1). In Figure 10, the proposed flow of money, information, and goods is represented, respectively, by the colors green, blue, and orange.

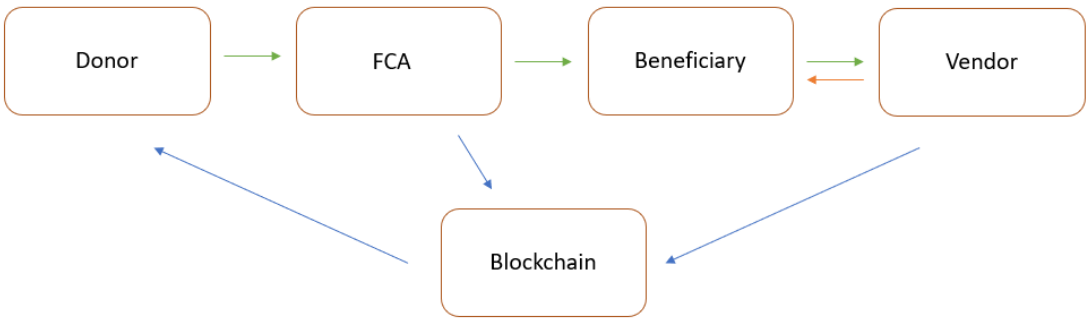

Figure 10 The Finn Church Aid-Solita supply chain

Despite the intention to create an end-to-end digital system, the team in charge of the project decided to start by testing only on the last-mile part of the relief chain in the Kenya Feasibility Study. According to Interviewee 3:

> Our vision at the end of the day, that was that "OK, like, let's do like, baby steps". You know like, we know that at the end of the day, what we want to have is like fully, digitalized kind of a delivery system. But we also understood that, OK, there's going to be a lot, plenty of hurdles over here, so let's just sort of like, and it's going to be also costing a bit so, let's just, like, let's put some of it into blockchain. (Interviewee 3)

As explained by Interviewee 3, the Feasibility Study followed a small proof-of-concept between the FCA Head Office and the Myanmar Office, in which FCA and Solita tested whether it would be possible to deliver funds using blockchain. That experiment was considered successful, thus creating the need for understanding how it could be turned into an actual humanitarian program. According to Interviewee 2, several countries were considered for the implementation, including Myanmar and South Sudan. Ultimately, it was decided that Kenya would be a suitable location, due to reasons such as the popularity of digital payments like M-Pesa in the country, as well as a more stable political situation and easier access to the places where the Feasibility Study would be conducted. More specifically, the feasibility study took place in the cities of Lodwar and Lokichar, as well as the Kakuma refugee camp and Kalobeyei settlement (Document C2).

4.2 Achieving efficiency through cost and time savings

As previously noted, the aspect of efficiency is highly emphasized in the techno-optimistic discourse on the use of blockchain in cash and voucher assistance. In the reporting of the cases investigated in this study – both those coming from the humanitarian organizations themselves and those reported in the media –, that emphasis was confirmed.

In Case A, the new mode of back-end data processing has led to substantial cost savings for the WFP, with a reported 98% monthly reduction in bank-related fees (Document A3). By the end of 2021, that amounted to up to USD 2.4 million in savings in bank fees, with 14 million transactions made using the blockchain system (Document A5). According to the Programme, the system makes cash transfers "faster, cheaper and more secure" while "increasing transparency and accountability" (Document A6, p. 22).

In Case B, 187 households participated in the trial, as well as 29 twenty shops, in two different communities in Vanuatu, with a total of 11,896.91 Australian Dollars being

distributed to beneficiaries (Document B1). The project's time savings related to operational activities were considered significant, while cost savings were deemed modest (Document B1). Notably, the time required to onboard an aid recipient was reduced from over an hour per individual to an average of 3.6 minutes. Overall, the quality of the solution was reported as "extremely high" (Document B1, p. 4).

The interviews conducted in this study have shown that the Feasibility Study of Case C was undertaken due to a general desire for improvement and efficiency in the humanitarian sector rather than the existence of a specific problem to be solved. According to Interviewee 1:

> We wanted to test improved ways to deliver our humanitarian cash assistance. (...) I cannot say with certainty that we faced any issues, particularly not FCA on its own. I believe the humanitarian community has been sort of identifying obstacles that somehow could all, or most, be resolved by using blockchain technology. (Interviewee 1)

In Cases A and B, the term "efficiency" was not used with particular precision in the documents analyzed. Nevertheless, the reports suggest that efficiency includes aspects such as speed and cost – which were echoed by the interviewees in Case C. Reflecting on the motivations for Finn Church to use the technology, Interviewee 2 stated that:

> There was a promise that FCA had recognized and had thought about, this promise of using blockchain to make things faster. So, in this sense, faster is more efficient, delivering, instead of using lots of different middlemen in the process, and then that's slowing down the process of delivering aid. So that was one promise, then another one was being more efficient in the sense that more economic value is delivered to the recipient in the end, and not so much on these different players in between. (Interviewee 2)

Interviewee 4, however, has noted that other systems, such as mobile payments, can likely be as efficient as blockchain. As such, cost and time savings would not be enough, by themselves, to justify the use of that technology:

> These other money transfer systems, because nowadays other money transfer systems are also so fast. I send money to [home country], like, and it goes so fast, within, you know, an hour or less, and the cost is also so little. So, it makes sense that blockchain is used to avoid the banking, but then I don't know if it can compete with these other money transfer systems nowadays we see in the market. (Interviewee 4)

Regarding efficiency, Interviewee 3 shared the views of Interviewees 1 and 2 and emphasized the aspect of speed and time savings. For him, blockchain could enable humanitarian organizations to respond faster to disasters, especially when there are limitations on the affected country's banking system.

4.3 Transparency as accountability to donors

When addressing the aspect of transparency, all the documents and interviews analyzed referred to it as a major benefit not only in the abstract but with the specific purpose of increasing donors' trust in a program.

In Case A, the WFP has a record of every transaction that happens at each participating shop, which is reported as a way to increase accountability to donors (Document A2), to whom transactions can be made visible. In Case B, each transaction is recorded in the Ethereum mainnet, which is a public blockchain, theoretically accessible to anyone interested in the information (Document B1). In addition to that, Sempo, Oxfam's technology partner, developed a dashboard for the program, which allowed real-time monitoring of transactions and facilitated compliance with donor requirements such as Know Your Customer (KYC) and Anti-Money Laundering (AML) (Document B1).

Similarly, transparency was a benefit often emphasized by the respondents interviewed in Case C. Interviewee 3 has explained that one of the main reasons for FCA's interest in testing blockchain was to see how it much more transparent it could make a cash and voucher program:

> Another thing was that there was a question of, like, "how do you actually, like, how transparent can you actually make these?" (...) One of the things that the humanitarian field always gets criticized about – even if in actual terms it's actually super transparent compared to many other fields of work – but anyway, that's sort of a deal, the thing that you need to be dealing with. So, I was thinking, like, is it possible that we would actually like put, start pushing the money, instead of using the, like, traditional banking routes, and actually put it simply to blockchain? (Interviewee 3)

Interviewee 2 has also spoken about how transparency was one of the main drivers for conducting the Feasibility Study:

> And then one more was around the idea of transparency, so this kind of way of delivering maybe could provide means of following better what money goes where and how is it used, and how much of it goes where, so it could in this sense enable better control of how much the person donates gets delivered in the end, and so in this, better control of what happens in the process. So those were kind of the initial hypotheses of benefits that inspired them to move forward. (Interviewee 2)

For FCA, the transparency that could be brought with the implementation of blockchain was intended to work on multiple levels, including that of being able to prove to donors that beneficiaries were not misusing the aid received. Interviewee 1 has explained that:

> A lot of people, or donors, let's say, are sort of skeptical about what the people do with the money. And there is skepticism about if people are just spending the money on things that they shouldn't be, or what it's not meant to be spent for. (...) Because of the traceability of the blockchain nature, it is easy to track and see where the money is spent, and by this, I don't mean that we are just watching and knowing who is doing what, but it is the way to visualize that the money is spent in shops, where they're like, grocery shops (...). But at bottom line is that this transparency is

> definitely useful for sort of unveiling this sort of preconceived notions that people misuse the cash when they're given it or the possibility to buy what they want. (Interviewee 1)

Nevertheless, Interviewee 4 has argued that blockchain is not the only system that can provide such a level of transparency to donors. According to him, if donors trust FCA and there are no other parties involved in adding data to the system, there are less costly and easier ways to show how the resources received are being used:

> If you have a, in a centralized system, everything, all data, like, to whom you provided the money, or who bought what from the marketplace, if you have it in a centralized system of FCA, that could be also used to show the donor. I mean, that's no difference between having a blockchain and a centralized system. There is no difference there, in my opinion. (Interviewee 4)

Similarly to the aspect of efficiency previously mentioned, Interviewees 1, 2, and 3 share a more optimistic view, while Interviewee 4 reiterated the possibility of using systems other than blockchain to achieve the same goal.

4.3.1 Opacity for beneficiaries

Although general transparency and accountability to donors are reported as advantages by the documents analyzed in all cases, the aspect of transparency for beneficiaries is rarely addressed in these materials. In Case A, the documents present somewhat contradictory information regarding the level of transparency provided to beneficiaries. On the one hand, the official Jordan Case Study reports that all 114 respondents of its December 2019 midline assessment "confirmed that they are regularly informed when entitlements are added to their balances by UN Women Staff" (Document A2, p. 8). Document A1 reports that, in the Azraq Camp, the participating women interviewed by Cheesman have complained about how they did not have access to detailed information about their earnings:

> "We never know what each salary payment is for, we might think it's for this month and it might be for the previous one," Aya, one of the senior seamstresses, said. Her colleague Fatima added, "We wish there was clear information somewhere telling us how much we received based on how many days of work, and when we received it, and how much we withdrew and if there's anything left." (Document A1)

In that implementation, still according to Document A1, while the supermarket receipts contained the amount that had been withdrawn and the remaining balance of the account, they did not include key aspects for beneficiaries, such as payment dates, and what the payments were for. Because of that, women participating in the program would collect the receipts and create their own systems to document how many hours they had worked and what they estimated that their payments should be:

> Women kept the receipts safely in their bras during the workday and brought them out when discussing or contesting salary issues with GEN or the supermarket cashiers. Many times, women workers took receipts out to show me, the thin paper folded to prevent the ink from rubbing off. The information on the receipts was printed in Roman script and English numerals. Almost none of the refugee women workers spoke English, but accounting practices were usually collective, relying on those who could best interpret the information. (...) Rather than empowering refugee workers with a new accounting tool, GEN's implementation of blockchain introduced new challenges for their financial management. Refugee workers incorporated receipts into their arsenal of socio-technical resources where the blockchain ledger was nowhere to be seen. (Document A1)

In Case B, beneficiaries only had access to the NFC card, but it was not possible for participants to check their balances as they had no access to the Sempo information dashboard (Document B1). Although it would still be possible for them to try to find the relevant transactions in the public Ethereum network, that was likely not a realistic option, given the high degree of technical knowledge required for it.

From the interviews conducted for Case C, it was not possible to determine whether beneficiaries would have access to the information stored on the blockchain. As the project was not implemented, the respondents could not say with certainty how it would have worked. Nevertheless, Interviewee 1 expressed surprise when told that other cases do not make account information visible to beneficiaries:

> There has to be a tracking, and that's exactly what the best thing that blockchain has is that it's a transparent, transparent tracker of any sort of actions that take place. So, I find it hard to believe that it was an issue that, you know, it wasn't able to be verifiable. So, I suppose that if you request it from the teller, from the person that has the reader, you should be able to. (Interviewee 1)

A potential reason for that lack of transparency is the general notion by humanitarian organizations that beneficiaries would not be able to understand the information even if it was made available to them. According to Document A1, in Case A:

> But no one explained the blockchain to these women workers: as a concept, GEN staff treated blockchain on a "need to know basis," deeming the technical complexity inappropriate because of workers' mixed literacy and numeracy skills and technical capacities. (...) When their eyes were scanned by the supermarket cashier using an EyePay machine (...), the biometric check authenticated the transaction by triggering a cryptographic private key — which the women did not know they had. Refugee women workers made new data points whenever they completed a transaction, but the ledger was not made visible to them. The only transaction records they were able to access were the paper receipts provided by supermarket cashiers. (Document A1)

In Case B, the project has acknowledged that "not everyone served by the Sempo platform has access or the literacy to comprehend the information stored on the network" (Document B1, p. 13), and the same idea was echoed in Case C. When asked about how much beneficiaries needed to know about the program, Interviewee 1 replied:

> You just have to explain the concepts and the mechanisms. So just that and understand why they're getting the assistance. But beyond that, I don't think it is necessary to have a deep understanding of the technology in itself. But they do have to understand, you know, how much money they have, how they can use it, when they can use it and where, and for how long they will be getting that. So,

> these are the things that are sort of essential for the communities to understand. But the technology at hand? Not really. (Interviewee 1)

While Interviewee 2 did not go into detail about this, the fact that many beneficiaries were illiterate was mentioned. According to him, FCA has even experimented with using symbols instead of numbers as pin codes in order to allow for more beneficiary participation. In that context, it is thus unlikely that participants would be informed about the use of blockchain in the system. Interviewees 3 and 4 did not discuss the matter.

4.4 A privacy-enhancing or surveillance-enabling technology?

With regard to privacy, all cases considered have highlighted how blockchain technology can be used to enhance beneficiary privacy. The exact manner in which that is done, however, varies depending on the project.

In Case A, the use of blockchain is argued to lead to better protection of beneficiary data, especially as it reduces third-party involvement (Document A2). The WFP only has access to an anonymized, hashed version of the beneficiaries' personal information, which is used to validate transactions at the participating retailers; the database containing personal data is managed by the UNHCR (Coppi & Fast, 2019). The payment history is registered on the Ethereum blockchain, which is considered a quicker and more efficient way to identify issues with payments and balances and resolve them (Document A2).

In Case B, on the other hand, Oxfam has access to beneficiary data, but it has chosen to not register it on the blockchain (Document B2), nor the details of transactions beyond the general category of purchases (Baharmand *et al.*, 2021b). Reducing the amount of personal beneficiary data available to third parties could thus increase privacy.

Blockchain's privacy-enhancing potential was brought up by interviewees in Case C. According to Interviewee 1:

> Another appealing aspect of blockchain technology is the ability that blockchain has, not only because it's transparent and traceable, but because you're able to share information and you select what information you want to share. It's not, it's unlike when you know you get stopped in the streets and you show your ID that says your name, your age, where you were born, and a lot of other information that perhaps might be sensitive. This is a way for people to sort of protect their information and their identity. (Interviewee 1)

Nevertheless, the interviewees have also acknowledged that beneficiary privacy could become a point of concern if the transparency of blockchain were to be misused as a surveillance tool. For Interviewee 3:

> It is so easy to actually follow it up, like where it's going. Like, you could, theoretically speaking, let's say you have, you have FCA head office over here, you have your country office here. Here you have, say, let's say that you operate fully on crypto. So then what you have is like the merchants in the field. And then you have the people who have the wallet, practically the beneficiaries, and they go with that, like, you can follow up real time what they're buying from the store, and I think that that will... There will actually be a pretty big issue like, like you need to be anonymizing, doing those sort of protection issues. (Interviewee 3)

Interviewee 1, while recognizing this potential risk, has highlighted that the precise extent of the availability of information depends on each particular implementation and the design choices informing it:

> It's a bit controversial because of course there are some grey areas there as to how much do we really need to know. (...) There are donors or, I don't know, agencies that may not purposely want to sort of go that deep into the transparency aspect, and not sort of provide too much information just as a means to just sort of provide help without there being, some kind of fishbowl for the beneficiaries that receive it. (Interviewee 1)

Interviewee 2 explained that the consideration of privacy risks and surveillance was part of FCA's risk assessment during the Feasibility Study. Interviewee 4, in his turn, expanded on a point made by Interviewee 1, which was how the level of transparency in the system can be chosen by humanitarian organizations and donors.

4.5 Designing CVA with and without biometrics

Within all major themes analyzed, the use of biometrics for identifying beneficiaries was the aspect with the most variation between the cases under investigation – and, as will be explained in Chapter 5, the one that diverges most from the relevant literature.

In Case A, biometrics are the main way used by beneficiaries to receive aid (Document A3). Because of that, neither an active internet connection nor smartphones are required from beneficiaries, which can be argued to make the program more inclusive. Beyond inclusion, in the implementation by UN Women, a baseline survey with beneficiaries has reported that they feel safer with the biometric process (Document A2).

Interestingly, the WFP had been using biometrics for payments in Jordan refugee camps since 2016 (Document A2). The identity of beneficiaries was verified through iris scanning, and after the confirmation that the beneficiary's account had enough funds, purchases were authorized at partner shops (Document 2). The basic structure in that implementation was very similar to the one later used in the Building Blocks program; in fact, the only difference between them is that in the first case, the account balance was checked with the Jordan Ahli Bank and the payments were made via the Middle East Payment Services, instead of using blockchain technology (WFP, 2016).

In Case B, they are not used at all, and no biometric information was collected from beneficiaries (Document B2). As NFC cards were distributed to them, neither an active internet connection nor smartphones were required (Document B1).

Finally, in Case C, biometrics were pointed out as the method of access most likely to be chosen if FCA decided to implement the plan discussed in the Feasibility Study (Interviewee 3), with interviewees highlighting several advantages of the use of biometrics. The first, along the same lines as Case A, is that they could be a way to make programs more inclusive, making it possible for humanitarian organizations to reach, for instance, undocumented people. According to Interviewee 1:

> Another one is we often work with people who are on the move, people who have been suddenly displaced, and we work with people who are undocumented, and it is in these situations where using biometric means of payment for the cash that we provide could bypass a huge obstacle, huge obstacle that in occasions when people do not have any ID, they might not even be included in any assistance, so they are vulnerable in every single way because they're not in any system. They have other difficulties opening a bank account or getting, I don't know, like, a phone connection or doing any sort of transactions when they're undocumented. (Interviewee 1)

The interviewees have also argued that biometrics can be safer for beneficiaries. Interviewee 3 has explained that:

> But say, if we were, like, if we were planning to work on like, based on biometric. So, say that you have a grocery store over here, you have your beneficiary over here, and in the middle you have a hostile checkpoint. Then your person can actually just, because he or she has biometrics, like, you don't need to have any kind of a card, any kind of cash, like, anything that sort of gives up the fact that, OK, that you are carrying something of value on you, so... (Interviewee 3)

That safety is also extended to cases in which humanitarian organizations have to cooperate with others in order to provide aid to beneficiaries. In those, blockchain could enable cooperation without having to expose personal data. Interviewee 1 argued that:

> That's the difficulty where I was getting at, blockchain could help resolve, because in this, because, you know, usually people, or many NGOs, they store their data on databases. So you would sort of, today, let's say somebody has to share, so they would just hide several columns and just leave the names or just leave the phone numbers, or any sort of what we call single identifier. (...) Having a platform like blockchain, where we could cross-check information without really exposing any extra information in order to sort of, and maximize our resources and not duplicate, would be to sort of have a shared platform. (Interviewee 1)

Nevertheless, respondents have also acknowledged that the use of biometrics brings a degree of risk. For the interviewees, risk factors arose mostly from exceptional situations, i.e. they do not consider biometrics a source of major systemic risk. The risk most often cited was the possibility of the technology not working for certain groups of people. According to Interviewee 1:

> Perhaps people who are disabled or who are not, sometimes the, if we're doing, let's say fingerprints and there's people that, because they work with their hands or for whatever reason,

> there could be some sort of exceptions where the technology may not sort of function. (Interviewee 1)

A similar situation was verified by Interviewee 2 during the fieldwork of the Feasibility Study. He recalled that:

> When we were there with a community of elderly people, they have many experiences of these devices not working. So this, the biometric device is not working, when you go and you should now get your, you're entitled to go and collect the money, but you cannot because they're not working, and they were really frustrated about them. And then, it was also interesting that they have explanations why they thought that they weren't working. So, people were saying that they had worked for all the life in manual labor, so their fingerprints are worn out. So that's why the devices cannot recognize anything, because they're kind of blank. (Interviewee 2)

Another potential risk identified by respondents in Case C was that of family conflicts arising from a change in power dynamics. Such a change in power dynamics, interestingly, were the same ones considered positive in Case A when women were the registered beneficiaries, and thus the ones in control of the aid received (Document A2). According to Interviewee 1:

> So, for example, if the man is the dominating head of household and then we want to have a gender balance and different, other humanitarian principles applied, and we choose to deliver to women alone. Then in that case, it could possibly, potentially create some tensions there. But again, I don't think this is... But I think yeah, it is a bit related specifically to blockchain because many cases when, you know the family, receives the money, we have one main person as the recipient, as the head of the household. But then they can still sort of distribute some of the responsibility of the shopping or the, whatever the amount. There's not so much of a "only I can get the cash with the finger". So, basically, maybe it could, yeah, maybe it could just put additional pressure in family dynamics. (Interviewee 1)

Interviewee 2 has added another example to the issue of family dynamics, citing cases of mobile payment systems in which funds were misused because the only literate family members were children or young people. Interviewees 3 and 4 did not go into detail about this point.

4.6 Disintermediation from traditional financial actors

In Case A, the intermediaries used before the implementation of blockchain in the program, the banks, are not removed from the supply chain. Nevertheless, the transactions in which they participate are processed in bulk in the new system (Seyedsayamdost & Vanderwal, 2020) when the WFP sends the financial amount owed to the participating shops (Thylin & Duarte, 2019). Still, the vision for Building Blocks is that it would eventually become a "neutral" platform, owned by the participating humanitarian organizations, in which payments could be coordinated without relying on traditional financial institutions (Martin *et al.,* 2022, p. 19).

These intermediaries are also present in Case B. As Vanuatu's Reserve Bank crypto prohibition had outlawed the use of crypto wallets and currencies in the country (Jutel, 2021), vendors were still required to have bank accounts to receive reimbursements from Oxfam. In one of the project's research reports, it was concluded that the pilot "did not disintermediate when compared to Oxfam's standard process" (Document B1, p. 46). The report has also suggested that vendors could be encouraged to exchange the DAI stablecoin received for fiat currencies through third-party exchanges instead of cashing out with banks to reduce the use of traditional financial institutions (Document B1).

In Case C, the fact that these institutions would still likely be needed in the program was recognized. According to Interviewee 3, that point was considered by FCA:

> It is fast if you operate on crypto. It's super fast. So you can sort of bypass all that thing. You have the total ownership of the thing, you need don't need to be relying on the banks. (...) The worry that we had at FCA was that, OK, you put it into blockchain, but then at some stage you actually still need to be putting it into the regular banking system because we're not operating on crypto. So, it's sort of, at the end of the day, if you don't go full crypto, I think you're not going to be able to make it at the end of the day in a way that it will make, like, really make sense. (Interviewee 3)

Regarding disintermediation, the statements from Interviewee 1 were not clear. On the one hand, she argued that blockchain could help to include unbanked beneficiaries, suggesting that traditional financial institutions could be bypassed, at least to a certain extent. On the other hand, a functioning banking system was considered an important factor when determining whether a given context would be suitable for the implementation of a blockchain-based CVA program.

Interviewee 2 did not discuss the matter, while Interviewee 4 had an opinion similar to that of Interviewee 3, emphasizing how blockchain should allow for a reduction of the participation of traditional financial institutions in the humanitarian supply chain.

4.7 Summary of case findings

The findings from the data collected from Cases A, B, and C are summarized in Table 5. The aspects included in the table are the status and location of each project, as well as what has been reported by documents and interviewees about the projects' efficiency, transparency, privacy, use of biometrics and level of disintermediation achieved.

	Case A	Case B	Case C
Current status	Active (Document A5)	Inactive; pilot concluded in 2019 (Document B1)	Inactive; Feasibility Study concluded in 2019 (Document C2)

Location	Piloted in Pakistan; currently active in Jordan and Bangladesh (Document A5)	Piloted in the Republic of Vanuatu (Document B1)	Not implemented; Feasibility Study took place in Kenya (Document C2)
Efficiency	Time and cost savings were reported (Document A6)	Time savings were reported, while cost savings were only "modest" (Document B1)	Reported as a key goal behind the Feasibility Study (Interviewees 1, 2 and 3), although alternative systems were suggested to achieve it (Interviewee 4)
Transparency	Emphasized for donors (Document A2), but restricted for beneficiaries (Document A1)	Emphasized for donors, but restricted for beneficiaries (Document B1)	Emphasized for donors and reported as a key goal (Interviewees 1, 2 and 3), although alternative systems were suggested to achieve it (Interviewee 4); likely restricted for beneficiaries
Privacy	Reported as privacy-enhancing (Document A2); no mention found to risk of surveillance	Reported as privacy-enhancing (Document B2); no mention found to risk of surveillance	Reported as a key reason for the Feasibility Study (Interviewees 1 and 4); risk of surveillance was reported as considered by interviewees (Interviewees 2 and 3)
Biometrics	Used as the main way for beneficiaries to	Not used (Documents B1 and B2)	Likely would be used (Interviewees 2 and 3)

	receive aid (Document A3)		
Disintermediation	Partially achieved as payments through the banking system were made in bulk to vendors, but not to individual beneficiaries (Seyedsayamdost & Vanderwal, 2020)	Partially achieved as payments through the banking system were made in bulk to vendors, but not to individual beneficiaries (Document B1)	Not enough data available to reach a conclusion

Table 5 Summary of case findings

4.8 Updated theoretical framework

In Chapter 2, Figure 5 displayed the theoretical framework developed for this study after the analysis of Cases A and B and the review of the relevant academic literature – which constituted the first two steps of the abductive research method used. Following the analysis of both interview transcripts and documents from Case C, that framework was updated, and its new version can be found in Figure 11. The main considerations regarding the update are as follows:

- With the exception of *better decision-making and more resilient humanitarian supply chains*, which were factors only found in the literature, all previously mentioned benefits were confirmed by documents and interviews. The point regarding *improved traceability and accountability* was modified to reflect how that benefit is accrued by donors, but not by beneficiaries.

- As previously mentioned, neither documents nor interviewees have detailed the risks that the implementation of blockchain technology for the delivery of CVA programs can pose to beneficiaries. Still, the factors *impossibility of modification or exclusion of data, opacity for beneficiaries, lack of technical knowledge in humanitarian organizations, surveillance and function creep,* and *dependency on technical partners* were confirmed. Most risks, such as *loss of dignity, increased volume of data collection,* and *violation of humanitarian principles by new HSC actors* were only present in the literature on the subject.

Nevertheless, as these risks might still prove to be significant, they continue to be part of the study's theoretical framework.

- Two core characteristics (*digital technology* and *biometrics*), as well as their respective benefits and risks, were added. The benefits brought by the use of a digital technology are the same as those that result from decentralization, albeit from different reasons. Regarding the main risks from that characteristic, both *exclusion of already vulnerable groups* and *technology malfunction* were factors mentioned only in the interviews conducted. Finally, although it is recognized that *biometrics* are not necessary for the implementation of blockchain in CVA programs, that characteristic is viewed in such a different manner by the literature and the practitioners from humanitarian organizations that it was considered that it should be addressed in its own.

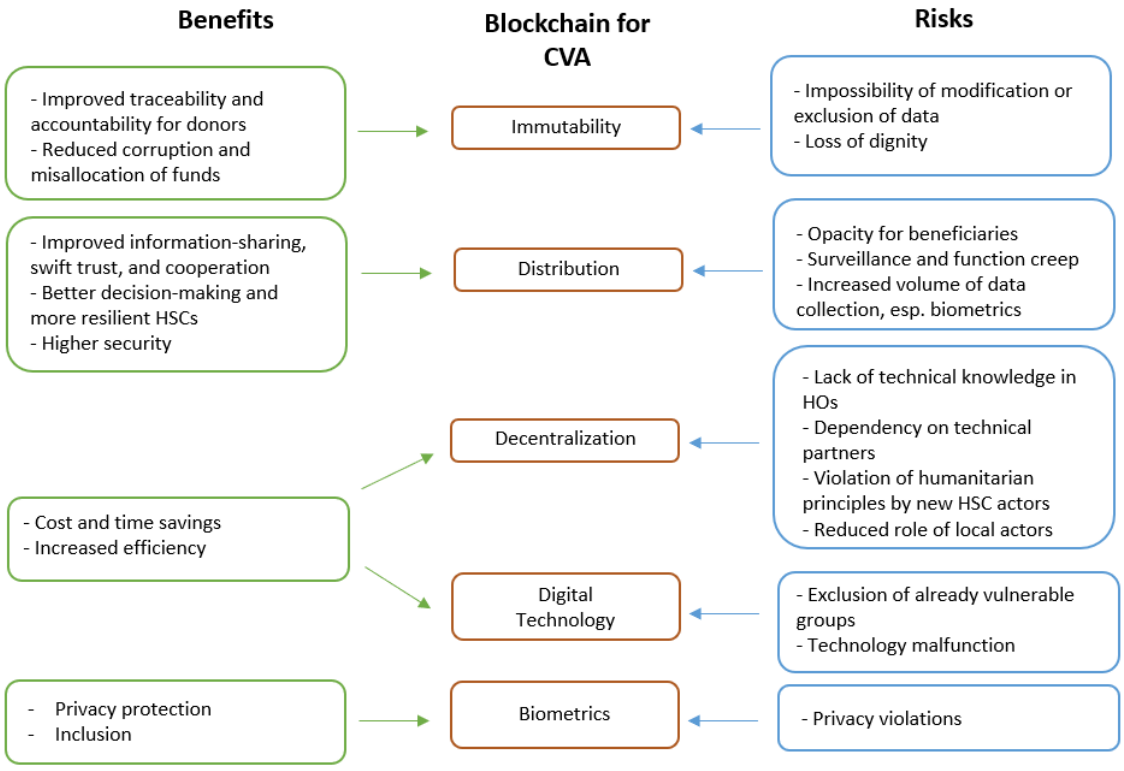

Figure 11 Updated theoretical framework of this study

5 DISCUSSION

In this Chapter 5, the findings of the analysis of Cases A, B, and C, and described in Chapter 4 are discussed using the literature reviewed in Chapter 2. The discussion is based on the five key points shown in the updated theoretical framework of Figure 11, namely immutability, distribution, decentralization, digital technology, and biometrics. Following that, a set of seven measures is suggested for humanitarian organizations working with blockchain-based CVA programs in order to minimize the potential digital risks posed to beneficiaries.

5.1 Risks arising from immutability

The first risk related to the immutability of data registered on the blockchain is that of the impossibility of modification or exclusion of data, even in when such data is inaccurate or incorrect, as explained by Zwitter and Boisse-Despiaux (2018). Although the literature raises it as a key point of concern, especially as this immutability can be seen as a conflict between blockchain-based systems and data protection regulations such as the European GDPR (ICRC, 2020), the three cases analyzed seem to have been able to avoid major issues in this regard. As previously explained, neither Case A nor Case B register beneficiary personal data on chain, and while it is not possible to say if the same would occur in Case C, the respondents interviewed in this study seemed at least aware of the fact that such registration should be avoided. The notion that implementations that do not register identifiable personal information on the blockchain could avoid data protection issues was confirmed by Interviewee 4:

> It really depends how the system is designed. Like, if you cannot, if you are not identifying the person with their identity, like, and somehow if you do not really show it to the donor, or if you do not... If you maintain the privacy, in simple word, then I do not really see any problem on that. (Interviewee 4)

It is clear, therefore, how much the design choices made by the humanitarian organization implementing the program matter, as emphasized by Coppi and Fast (2019). Immutability can be dangerous to beneficiaries if their data is registered on the blockchain; however, that is not necessary for the functioning of a CVA program. The use of workarounds such as off-chain solutions with logical deletion, explained in Chapter 2, should suffice from a data protection perspective (ICRC, 2020; Thylin & Duarte, 2019).

Less clear, however, is the matter of the risk of loss of dignity, as reported by Howson (2020). Cash and voucher assistance is seen as empowering to beneficiaries (Heaslip *et al.*, 2018), and the general tone of the documents analyzed echoes that. In Document A2,

for instance, the UN Women implementation is described as giving participants more control over their finances; the project has also included seminars on financial literacy. Still, no direct mention of dignity, especially when considering the proportionality of using an immutable system to provide temporary benefits, is made by either the documents investigated or the respondents interviewed. The lack of mention is perhaps due to the abstract nature of the concept, which may be considered to lie within the domain of ethics, not operations. It must be noted, however, that this does not mean that the matter is not relevant and should not be considered by a humanitarian organization implementing a blockchain-based CVA program (Lee, 2020).

5.2 Risks arising from distribution

As explained in Chapter 2 and reiterated by all cases examined, transparency is regarded as a key benefit of blockchain technology that arises from its distributed nature, especially as the humanitarian sector suffers from a lack of it (Baharmand *et al.*, 2021a). Although Coppi and Fast (2019) argue that transparency should not be regarded only as a benefit brought by blockchain technology, but as a precondition for its implementation in CVA programs, in practice, such transparency is seldom extended to beneficiaries.

The fact that neither Case A nor Case B have mechanisms that enable beneficiaries to visualize their own data or transaction histories, exemplifies this. Although Case C was not implemented, the fact that no respondent could explain how the program would enable that, and one of the interviewees was in fact surprised to hear that it was something that had to be intentionally implemented by the organization seem to suggest that such a feature might not have been planned for by FCA and Solita. The risk related to the opacity of the system to beneficiaries is, therefore, visible.

The second risk related to distribution is that of surveillance and function creep, as it enables humanitarian organizations to easily share sensitive data with other actors. Once that data is shared, it is no longer under the control of the organization and could be misused (Burton, 2020), putting beneficiaries at risk (Lee, 2020). As previously mentioned, beneficiary personal information is not registered on the blockchain in Cases A and B, which greatly reduces this possibility of misuse. Nevertheless, in both cases, transaction histories are still registered. Because of that, if a person were to be identified – for instance, by combining data from different sources – it would be theoretically possible to trace back his or her entire transaction history, which Seyedsayamdost and Vanderwal (2020) consider a potential risk. In Case C, although respondents generally

reported seeing blockchain as a privacy-enhancing technology, they seemed aware that surveillance was a potential risk, and that it should be considered when designing a program.

The possibility of surveillance can be worsened by humanitarian organizations' tendency to collect too much data, as explained by Sandvik *et al.* (2014). Nevertheless, in the cases analyzed in this study, it was not clear whether additional data was collected from beneficiaries once blockchain-based systems were deployed, as the projects were reported to have been built on top of existing CVA programs. In Case A, in which biometrics are used, the previous system already used that type of data (Document A2). In Case B, no biometric information was used in the previous program, and that remained so after blockchain was introduced (Document B1). It is not possible to say what type of data would be collected in Case C if the program was implemented.

The aspect of distribution shows, yet again, how the levels and types of risks posed to beneficiaries depend on program design. Transparency to beneficiaries is not a given, but it could be implemented. Surveillance is a possibility, but it can be minimized if less data is collected and strict controls over who can access it are implemented. The matter of design choices is then reiterated as key, as with the considerations regarding immutability made above.

5.3 Risks arising from decentralization

In this study, the aspect of decentralization was the one in relation to which the highest number of potential risks were identified. These risks are interrelated: the disintermediation enabled by decentralization exposes the lack of technical knowledge in humanitarian organizations, which can lead to a dependency on technical partners; these new actors in the supply chain, in their turn, may violate humanitarian principles. At the same time, these same actors replace local players, reducing their role.

Although no data was found in the documents analyzed in Case A about this matter, it was reported in Case B that internal stakeholders had a "large knowledge gap related to the technology"; as a result, the project team had to spend "significant time educating internal stakeholders about the basics of the technology, including clarifying that Oxfam was not in any way going to be using, buying or selling cryptocurrencies" (Document B2, p. 3-4). This is in line with the consideration found in the literature that humanitarian organizations may lack the technical understanding of the complexity of blockchain technology (Lee, 2020), outsourcing it to third parties (Baharmand *et al.*, 2021b). In Case

B, the startup Sempo was responsible for the technical parts of the Oxfam program; in Case C, the company Solita developed the technology for Finn Church Aid's Feasibility Study. In the latter, Interviewee 1 acknowledged how that can lead to a dependency on the partner, stating that:

> Clearly, if we're working with a secondary sort of like, a partner, it also, I mean, you know there are things that are going beyond our control. Like, if we were implementing and they for whatever reason, bankruptcy, whatever, they sort of are unable to continue, to finish the project, then, of course, there's a risk because we are not a technological sort of agency that can resolve that without their assistance, so... Then clearly that would also become an issue, to work with a high-level sort of technology that we, the primary implementers, are not able to sort of operate without external assistance. It makes it, puts us in a dependency sort of position with them. (Interviewee 1)

Authors such as Jutel (2022), Sandvik et al. (2017), and McDonald (2021) argue how problematic a dependency can be on partners that benefit from the humanitarian operational license but are not bound by its rules. Commenting on Case B, Jutel states that the project "operates alongside the most dubious elements of crypto and against government attempts to regulate in the public interest" (2022, p. 2), in reference to the participation of the controversial company Consensys. While not specifically relating to Case A, the World Food Programme has been criticized for establishing a partnership with the company Palantir Technologies, which has been involved in scandals with the US Central Intelligence Agency, Immigration and Customs Enforcement, as well as Cambridge Analytica (Burton, 2020; Madianou, 2019). As most documents analyzed in this study, however, in all cases, were authored by humanitarian organizations and their partners, no mentions of this potential risk of violations of humanitarian principles by new HSC actors were found in them. The same was true for the interviews conducted with respondents associated with Case C.

Another risk explored was the fact that, as new, technology-oriented partners emerge, the role of downstream actors can be reduced (Coppi, 2020). In the literature review, the efficiency gains that arise from blockchain's decentralization and disintermediation are considered alongside the potential risks of bypassing the traditional banking system and reducing the role of local actors (Baharmand *et al.*, 2021b; Thylin & Duarte, 2019; Coppi & Fast, 2019). Mentions of potential downsides, however, were scant in the documents analyzed and interviews conducted. In Case A only, the organization responsible for the project has acknowledged that local financial sectors could be negatively affected using blockchain (Document A3).

Nevertheless, it must be noted that, although the cases analyzed have achieved some degree of decentralization, there are currently no cases in which the system is fully digital

end-to-end (Coppi & Fast, 2019), or that do not require some level of interaction with traditional financial institutions (Martin *et al.,* 2022). In order to bypass these institutions, cryptocurrencies would have to be used by donors, when transferring funds to humanitarian organizations, by beneficiaries, when receiving aid, and in all processes that happen between those two ends.

5.4 Risks arising from the use of biometrics

The most striking differences found in this study between the academic literature and the cases investigated are those related to the use of biometrics. In a clear divergence, the former is highly critical of its use (Madianou, 2019; Sandvik *et al.*, 2014; Sandvik *et al.*, 2017), while biometrics are mostly seen as beneficial in the latter. In both Cases A and C, as noted in Chapter 4, biometrics were regarded as a means of inclusion (Document A3; Interviewee 1), and as safer for beneficiaries (Document A2; Interviewees 1 and 3).

In the literature, the fact that biometrics constitute sensitive personal data that can be misused in emphasized (Sandvik *et al.*, 2017). Madianou (2019) argues that biometric identification is particularly dangerous as it tends to be outsourced to private partners – thus including even more actors in the supply chain that are not bound by humanitarian principles. That can be seen in Case A. While Building Blocks is linked to the UNHCR's biometric identity system (Thylin & Duarte, 2019), the entity responsible for the technology part of that system is the private company IrisGuard; the iris scans of 2.7 million Syrian refugees are reported to be held by it (Martin *et al,* 2022).

Biometrics were not used in Case B (Documents B1 and B2), and although it would likely be used in Case C (Interviewees 2 and 3), respondents in the latter have only identified exceptional risks in implementing that method for identification and verification. Interviewees 1 and 2 noted the possibility of technology malfunction, and changes in family dynamics. The former will be will be commented on next section, which deals with the matter of risks that arise from the use of digital technologies.

With regard to the latter, Cases A and C have diverging accounts of the effects of choosing women as the beneficiaries of the assistance. While Case A has considered that it brings positive changes in family dynamics (Document A2), Interviewee 1 has noted that it could be a source of tension in households. The literature on cash and voucher assistance and gender, nevertheless, points out that there is no straightforward answer to the question of whether women are empowered when they are responsible for collecting

benefits. An evaluation of a cash program in Raqqa, Syria, for example, has shown how the results can vary greatly: in some households, women reported greater decision-making power, while in others, tensions were heightened, especially with in-laws (Blackwell *et al.*, 2019).

5.5 Risks arising from the use of digital technologies

Technology malfunction was one of the two risks identified by respondents in Case C regarding the use of biometrics. As Sandvik *et al.* (2014) note, however, due to the instability of the environments in which humanitarian operations take place, the risk of technology failure is higher. Advanced technologies are seldom designed for that specific type of context, so even if a vulnerability is exceptional and not systemic, it should be carefully considered.

The second risk was that of exclusion of already vulnerable groups, such as elderly people or manual laborers, whose fingerprints are often not recognized by biometric scanners (Interviewees 1 and 2). In the literature review, it is noted that, although such a risk is not specific to the blockchain, it must be considered because the analysis of a technology's implementation cannot be done without consideration of the social context in which it occurs (Lee, 2020). Digital payments, and by extension, systems that make use of blockchain wallets, are less accessible than cash since they must be directly linked to the beneficiary's identity, opening the possibility of exclusion and discrimination (Martin & Taylor, 2021). This exclusion can lead to a digital divide (Baharmand et al., 2021b).

5.6 Guidelines for Humanitarian Organizations

The onus of proving that the implementation of a given technology will not cause harm belongs to the humanitarian organization conducting it (Sandvik *et al.*, 2017), and while it is not possible to completely eliminate the possibility of *digital harm*, the risk factors that constitute it can be mitigated (Burton, 2020). Because of this, the following seven measures are suggested to humanitarian organizations working with the use of blockchain for the delivery of cash and voucher assistance. Each measure is directly related to the risks identified in this study, as shown in Figure 12. A more detailed description of each measure is presented in the sections following it.

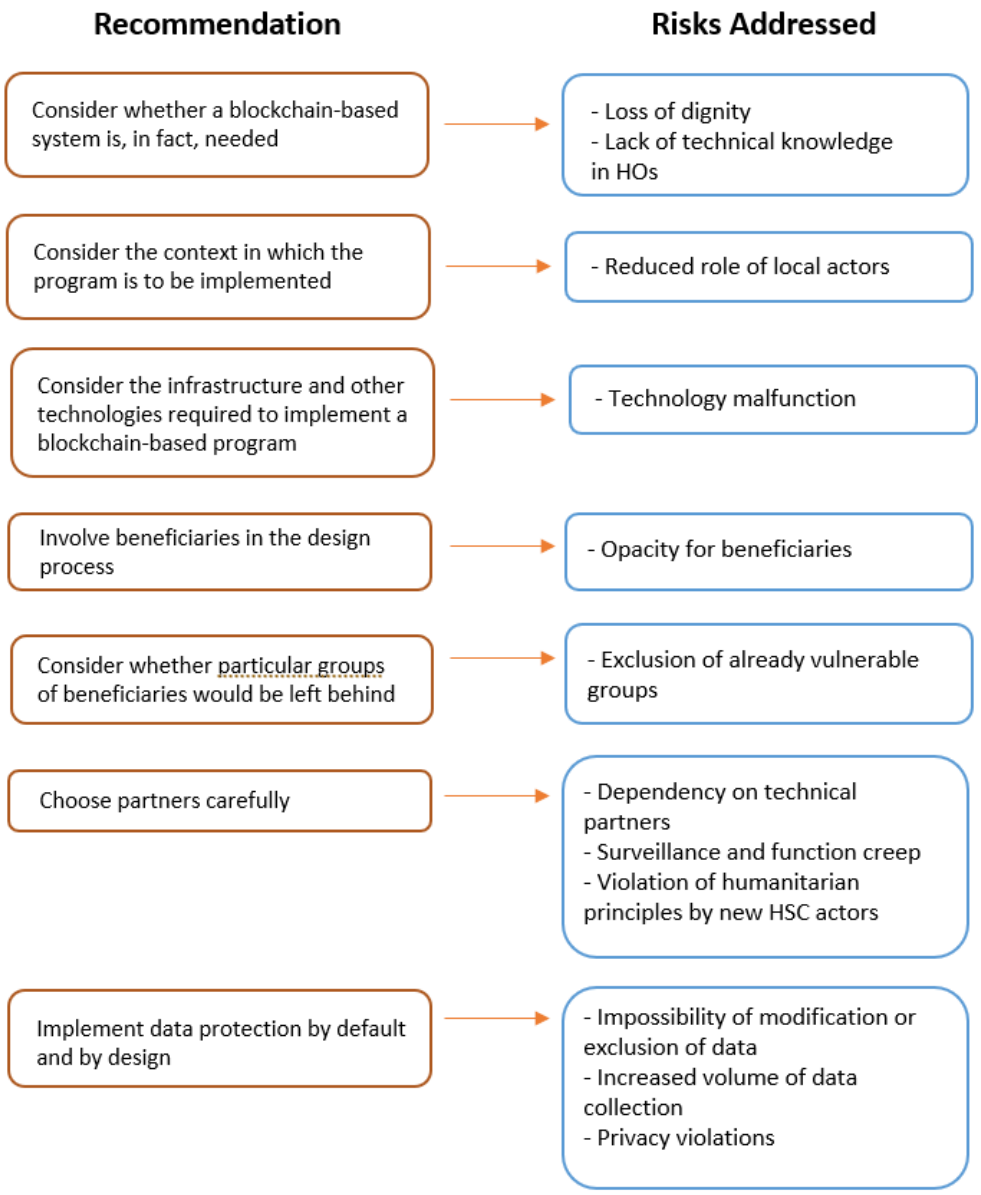

Figure 12 Summary of recommendations and the risks addressed by them

5.6.1 Consider whether a blockchain-based system is, in fact, needed

Blockchains should not be seens as a "universal governance principle capable of solving all manner of social issues" (Jutel, 2022, p. 3), or as applicable to every given situation. In order for distributed systems to be used in ways that can provide the most benefits, certain conditions should be present, including: (a) a set of transactions that must be recorded and (b) involve multiple parties that (c) have to collaborate while (d) there is no trusted central authority or third party in the system (ICRC, 2020). In cases where all the parties involved trust each other, for example, there is no need for blockchain to be implemented, and the use of a traditional database would be easier and cheaper to

implement, more efficient and safer for beneficiaries. Both Cases A and B analyzed in this study have been criticized for not meeting all of these criteria.

Although the Building Blocks program started in the public Ethereum network, it became a private and permissioned implementation due to high fees and slow transactions; in the private version, WFP controlled all the nodes in the network (Document A4). Later, UN Women joined the network and started to run as an independent node (Thylin & Duarte, 2019). Nevertheless, as UN Women is a trusted partner, the benefits that blockchain could bring to the program are not clear. This criticism was confirmed by Houman Haddad, the creator of the Building Blocks program, who has stated that "of course, we could do all of what we're doing today without using blockchain" (Document A4). Still, Robert Opp, an executive at WFP, has defended the program by explaining that it is just the beginning of a process of experimentation with blockchain technology:

> If our endpoint was to do exactly what we're doing right now on 100,000 Syrian refugees on a digital voucher system in Jordan, then doing it with a database may well be cheaper. But this is not the end point for us. This is a beginning point. (Stanley, 2018)

In Case B, the fact that the system used was private and controlled by only one partner (Sempo, the software company), was acknowledged as a single point of failure (Baharmand et al, 2021b). When commenting on the case, Jutel argued that private systems that do not require mining or consensus algorithms, are "the epitome of a database masquerading as a blockchain" (Jutel, 2022, p. 3). For him, given the project's "highly-intermediated" blockchain (...)" (Jutel, 2022, p.7), "it is not self-evident what virtues blockchain might have over mobile telephony payment systems (...) which can operate under existing financial regulations and communications infrastructure" (Jutel, 2021, p. 7).

In Case C, the concern of whether blockchain would be the most adequate technology for the project was only voiced by Interviewee 4. According to him:

> In general, if there is only one entity, only one, then the whole concept of blockchain is gone, to be honest. Like, blockchain is about, you know, multiple entities and then the trust is shared, or trust is rebuilt in the network. But if there is only one entity who can change or write the blockchain data whenever they want? That is almost like a centralized system. So, in that sense, you know, it's only in a marketing way... You can say that that you are using blockchain and it's a great thing, but deep down you are doing basically a centralized system, so... In my view, yeah, that's... I don't know, I do not really see much benefit in a situation like this. (...) In that sense, the real value of blockchain is almost gone. (Interviewee 4)

The implementation of a blockchain solution should be based on concrete evidence and weighed against alternatives that make use of different systems (Coppi & Fast, 2019). If a humanitarian organization fails to do so, a complex and expensive system might be put

in place where a simpler database could work. When a blockchain-based system is deployed unnecessarily, beneficiaries might be required to provide sensitive data about themselves, such as biometrics, to an immutable register, in order to access temporary aid, which this study has argued could lead to a loss of dignity. Furthermore, the unnecessary deployment of such a system means that the humanitarian organization will likely have to implement a technical solution over which it lacks the expertise, making it dependent on third-party actors.

5.6.2 Consider the context in which the program is to be implemented

The implementation of any technology is influenced by the social context in which it takes place (Lee, 2020), and the specificities of each context should be considered by humanitarian organizations (Zwitter & Boisse-Despiaux, 2018). This aspect was not often discussed in Cases A and B – likely because contextual considerations are made during the design phase, and the secondary data sources reviewed tended to focus on what occurred after the program had been implemented. Nevertheless, interviewees from Case C have emphasized the idea that the use of blockchain may be more suitable to certain environments than others. Interviewee 1 has stated that:

> Because not only because it's a highly technological – or because it's highly technological? – it will or will not work in a given context. There are many different factors and variables that would make this an appropriate sort of means of, as a humanitarian assistance distribution. (Interviewee 1)

Context, in this case, refers to multiple aspects, including the country of implementation. As explained by Interviewee 2, Kenya was deemed as a suitable place for the Feasibility Study conducted in Case C due to various factors, including the country's political stability and the population's habit of using mobile payment systems. Conditions such as these will not be present in all countries, as explained by Interviewee 1:

> Of course, it was decided that it was a feasible context on which to test, at least to pilot the program, so it was in Kenya, given, you know, the context where people have the necessary tools, they also have highly working markets, and also many displaced people or refugees. So, in this case, it was a good, sort of it met all the requirements for it to be fertile for piloting a project. That would sort of limit the number of obstacles. Because, I mean, if we try that in Syria, I can tell you that, you know, day two and it wouldn't probably be very feasible. (Interviewee 1)

The analysis of the legislative landscape of the country in question is also part of a contextual assessment. Case B, for example, has been criticized by Jutel as a "blithe disregard of the [Vanuatu's] Reserve Bank's policy" and an attempt to bypass the host country's legal framework (2022, p. 6). Interviewee 1 has confirmed, in Case C, the need to gain approval from local governments before implementing a program, stating that:

> You always need to have permission for running a sort of a program, especially when there is cash or some technologies that might be, you know, in some in some regions, it might be controversial, like in Colombia, there was, it was not allowed to take any biometrical data. That was a governmental guideline. We could not do that. So in this case it wouldn't work. So anyway, in this way you are understanding what the context is and what the challenges might be. (Interviewee 1)

As explained by Interviewee 2, In order to ensure that the Finnish team had a good understanding of the Kenya context for the Feasibility Study of Case C, weekly meetings with FCA's Kenyan team were held for at least two months prior to a visit to the country in question. Once there, the project's Lead Designer and Ethnographer, alongside a local guide, met with community leaders and ran focus groups with beneficiaries in order to understand the particular opportunities and challenges present.

A humanitarian organization should make similar investigations regarding the context where a program is to be implemented. That can be done as part of the analysis and program design phase of the CVA Project Cycle, in which the appropriateness of a potential response is measured against its surroundings (Shrestha & Smart, 2022). In it, beyond the above-mentioned considerations, it can also investigate how the program would affect local actors – i.e. whether their participation in the humanitarian supply chain would be reduced in a detrimental way, as was defined as a potential risk in this study.

5.6.3 Consider the infrastructure and other technologies required to implement a blockchain-based program

Context also refers to being aware of other technologies that might be needed in order for the system to work. As pointed out by Sahebi, Masoomi, and Ghorani (2020), integrating blockchain with other systems requires time and resources, as well as high energy consumption. Oftentimes, other technologies need to be implemented in order for a blockchain-based program to work, such as the devices to scan beneficiaries' biometrics in Case A (Awan & Nunhuck, 2020), or the smartphones capable of reading NFC cards in Case B (Document B2). Rodríguez-Espíndola *et al.* (2020) go even further, showing how the combination of blockchain with other advanced technologies such as artificial intelligence and 3D printing can be used to improve operations in humanitarian supply chains. That point was emphasized in Case C by Interviewee 4:

> Often it happens that blockchain is used not alone, really. Many times you use these IoT systems, and then of course, in some cases you use some machine learning and AI related stuff, and then together they give you the solution. It's not just one thing. It's not just blockchain. Blockchain is just a database that ensures transparency and trust, nothing else. But then you'll need the IoT devices from where you get the data, and then those data will be stored. (…) That's why I'm telling this, that, you know, don't, never, you know, jump to the solution of blockchain at the very beginning. You really need to understand the context, you really need to understand the current

> situation. You also need to understand the investments because this is a whole new system. (Interviewee 4)

After the required infrastructure and accompanying technologies are identified and their availability is confirmed, beneficiaries and other partners have to be trained on how to use the system. In the case of retailers, for example, Interviewee 1 has explained that:

> (...) because of course, they have to have the right terminal or the right equipment to read the biometrics or whatnot. So we would do a training course for them, we would troubleshoot anything. We would sort of, you know, spend a good time for them to be able to receive the payments and to feel comfortable as to how this system works. (Interviewee 1)

A similar need for training was reported in Cases A (Document A2) and B (Document B2), and humanitarian organizations looking to implement blockchain-based systems should be aware of the fact that it will likely represent a steep learning curve for most, if not all, stakeholders involved in the project.

5.6.4 Involve beneficiaries in the design process

The power imbalance between humanitarian organizations and beneficiaries can be exacerbated when the latter are not included in the design of a program (Coppi & Fast, 2019), which may revert CVA's and blockchain's general empowering potential discussed in Chapter 2. Even worse, implementations that do not take into account the beneficiary perspective could lead to vulnerable people and economies, particularly in the context of refugee camps (Madianou, 2019), becoming "testing grounds for technologies" (Jutel, 2022, p. 2). Cases in which digital innovation contributes to the reproduction of existing power asymmetries are referred to as technocolonialism (Madianou, 2021). As summarized by Coppi and Fast:

> The adoption of DLT therefore tends to reflect the needs and perspectives of those using the technology rather than the needs of those affected by it. This mirrors a frequent critique of the use of new technologies in the sector – that they are more often a technology in search of a problem than a solution to a perceived problem. (Coppi & Fast, 2019, p. 15)

In order to avoid this, beneficiaries should be involved in the design process, with their preferences being taken into account – both in terms of what they would and would *not* be comfortable using. Document A1 brings an example of this, highlighting how some of the women participating in Case A had health concerns associated with biometric scanning devices:

> Women workers expressed a range of fears and perceptions about the bodily effects of regular iris scanning: from "We will go blind from the amount of eye scans we do," to "I fear for my eyes and my health," to "It's all the time for the salary and the food and every time we want to buy bread too. My eyes burn after I scan them, it's too much." Some people worried about the effects of iris scans on pregnant women, or on reproductive organs more generally. (Document A1)

Beneficiaries' concerns should not be underestimated, and the possibility to opt out of the collection and processing of personal data should be given to them, without their receiving of aid being affected (Burton, 2020). Any system that intends to help people and reduce potential harm should involve the beneficiaries it is meant to serve and take into account their preferences and limitations. If, for instance, a digital payment scheme cannot be used, the humanitarian organization responsible should be able to offer alternatives, including in-kind assistance or cash (Burton, 2020). Interviewee 3 has shared some of his experience with these considerations:

> There are, often times, people may prefer like having cash over card, but then there's also often times situations where you have, say, the local culture isn't accustomed to using cash. So I remember like, for example in South Sudan, we did, or our team did, I wasn't there, but our team did a cash intervention and then they followed up a couple of weeks later. Unfortunately, there was this one lady there that just like, dug a hole. Like, on the floor of her hut and just hid the money over there because she didn't really, like sort of like, know what she was supposed to be doing with this stuff, and she was waiting for her husband to come back so that they could sort of make a decision on what to do with this. (Interviewee 3)

Involving beneficiaries in the design process is encouraged by Coppi and Fast (2019), and can lead to positive results. Sheppard *et al.* (2013), for example, have argued that involving local populations can contribute to preparedness and response in natural disasters, making humanitarian supply chains more effective, while Kovács *et al.* (2010) have shown how community involvement in the reconstruction phase can lead to more transparency and cost efficiency, as well as positive effects to the local economy. A humanitarian organization that encourages beneficiary participation can, furthermore, address ethical concerns and risks that cannot otherwise be resolved, such as loss of dignity.

5.6.5 Consider whether particular groups of beneficiaries would be left behind

Even when the required infrastructure exists for the functioning of a blockchain-based system, such as electricity, smartphones, and internet access are required, access to it is not always a given, especially for segments of the population that are already marginalized. Women and girls, for instance, tend to have less access to smartphones – as well as less access to identification documents and financial systems (Thylin & Duarte, 2019). Their vulnerability could be further increased because of these restrictions in access (Seyedsayamdost & Vanderwal, 2020), in direct violation of the humanitarian principle of impartiality, according to which these people's needs should be prioritized (Baharmand *et al.*, 2021b).

All three cases analyzed in this study have taken these considerations into account and can be seen as examples of best practices. In Case A, the implementation done by UN Women in Jordan has explicitly attempted to address women's generally lower level of digital literacy and access to technology (Document A2). In Case B, Oxfam emphasized the inclusion of a particularly vulnerable group of beneficiaries, which included "single mothers, widows, people with a disability, and LGBTIQ+ members", in the UnBlocked Cash program, considering that they would be at a higher risk of marginalization after a natural disaster (Document B1, p. 21). Finally, in Case C, Interviewee 1 has pointed out the need to identify:

> Who would benefit? Would there be some kind of group that wouldn't? Perhaps the elderly who do not do well with technology, or the illiterate or whatnot. So this is, you know, standard procedures when you implement anything basically. So we would cover the obstacles that we may face, and then we can seek thereafter to find ways to mitigate it. So we create a risk matrix and then we sort of assess how likely is it and if it is, how harmful is it? So maybe there's little chance that it happens, but if it does happen, then it's a big problem. (Interviewee 1)

The involvement of beneficiaries in the design project, which was suggested in the previous section, can facilitate the identification by organizations of how different groups of participants would respond to a program, as well as how each of them would be affected by particular risks (Burton, 2020).

5.6.6 Choose partners carefully

As explained in Chapters 2, 4 and in the first part of this Chapter 5, humanitarian organizations that lack the technical knowledge required for the implementation of blockchain-based solutions are at risk of dependency on partners who are not obligated to follow humanitarian rules and principles. Because of that, organizations should seek to establish partnerships with reputable and trustworthy partners.

Another key point is that humanitarian organizations should be aware of the extent to which personal data from beneficiaries is shared with partners, as it could enable surveillance and other types of misuse. That point was emphasized by Interviewee 1 in Case C, who explained that:

> It depends on a lot of things, factors, when throughout the planning and the agreement. For example, if this company is going to be our partner to do all the blockchain projects, perhaps in that case we are partners and therefore they're part of the project and then... But if they're like, an outside contractor company that we sort of hire them for the service alone, we may have other plans, we may protect or we may not disclose, or give the information, but again that varies. Also, each organization has their own sort of policies on data protection, so it might be that you cannot share it with an external partner. So, in that case, you might be forced. So there are different ways, I think, to go about it, depending on existing policies and context such as hiring a company. (Interviewee 1)

As previously mentioned, both the organizations responsible for Cases A and B were criticized for their choice of technical partners – the World Food Programme due to its partnership with Palantir Technologies, and Oxfam for the participation of Consensys in the Vanuatu pilot. That type of criticism can potentially be reduced by humanitarian organizations that impose stricter ethical requirements for partnerships.

5.6.7 Implement data protection by default and by design

In the academic literature reviewed, privacy and data protection are key points of concern, as the protection of beneficiaries' personal data should be seen as "an essential part of protecting their life, integrity and dignity" (Burton, 2020, p. 61). Because of that, humanitarian organizations must have in place strong data protection principles and practices – which, in the case of blockchain, is not a straightforward matter, as the technology's compatibility with data protection regulations such as the European GDPR is still disputed (Martin *et al.*, 2022).

A key way for humanitarian organizations to embed privacy considerations in a program is by implementing data protection by default and by design. That means that privacy risks should be anticipated and mitigated, and the most privacy-preserving alternative should be set as the default option (ICRC, 2020). Organizations can also include a critical assessment of the need to use biometrics in the system, as that constitutes sensitive personal data, as previously explained.

6 CONCLUSION

The present study was conducted with two major aims: determining the risk factors for beneficiaries that arise from the use of blockchain technology for the delivery of cash and voucher assistance, and creating a theoretical framework that can be used by humanitarian organizations when deciding whether the potential benefits of that implementation are proportional to the emerging risks posed to beneficiaries. To achieve them, two research questions were posed:

> **RQ 1**: What are the main digital risks posed to beneficiaries when blockchain is used for the delivery of cash and voucher assistance?
>
> **RQ 2**: How can humanitarian organizations mitigate digital harm to beneficiaries when using blockchain technology for the delivery of cash and voucher assistance programs?

Regarding the first question, this study has identified a mismatch between academia and practitioners over the potential risks that can arise from blockchain-based CVA programs. For the former, risks are considered as systemic and include more abstract and ethical notions such as loss of dignity and violation of humanitarian principles. For the latter, however, risks arise in exceptional situations, such as in cases of technology malfunction.

In total, 12 risks to beneficiaries were identified in this thesis, being divided into five major categories in the revised theoretical framework (shown in Figure 11) proposed at the end of the abductive research process (described in Figure 7). Such a theoretical framework presents tentative elements for the definition of *digital harm* when applied to the use of blockchain in cash and voucher assistance programs. The risks and categories they are classified into are reproduced in Table 6. The Table also informs whether each risk was identified based on the literature review conducted, data collected from case studies, or both.

Category	Risk	Source
Immutability	Impossibility of modification or exclusion of data	Both literature and case studies
	Loss of dignity	Literature

Distribution	Opacity for beneficiaries	Both literature and case studies
	Surveillance and function creep	Both literature and case studies
	Increased volume of data collection, especially biometrics	Literature
Decentralization	Lack of technical knowledge in humanitarian organizations	Both literature and case studies
	Dependency on technical partners	Both literature and case studies
	Violation of humanitarian principles by new actors in the humanitarian supply chain	Literature
	Reduced role of local actors	Both literature and case studies
Digitalization	Exclusion of already vulnerable groups	Case studies
	Technology malfunction	Case studies
Biometrics	Privacy violations	Both literature and case studies

Table 6 Answer to the first research question: risks identified, categories and sources

Interestingly, the analysis of Cases A, B, and C, has shown how the humanitarian organizations responsible for these programs – respectively, the World Food Program, Oxfam, and Finn Church Aid –, have taken measures to mitigate many of the risks identified. These measures are in line with the answers found to this study's second research question. In this thesis, seven such measures are suggested for humanitarian organizations to reduce the digital harm to beneficiaries that can be posed by blockchain-based CVA. The measures were described in Chapter 5 and summarized in Figure 12, which also shows which specific risks each measure is meant to address. In brief, the measures suggested were:

1. Considered whether a blockchain-based system is, in fact, needed;
2. Consider the context in which the program is to be implemented;
3. Consider the infrastructure and other technologies required to implement a blockchain-based program;
4. Involve beneficiaries in the design process;

5. Consider whether particular groups of beneficiaries would be left behind;
6. Choose partners carefully;
7. Implement data protection by default and by design.

6.1 Contributions

As currently there is no framework for the identification and mitigation of digital harm to beneficiaries in the context of the application of blockchain technology to cash and voucher assistance programs, the present study addresses a gap in both theory and practice.

A theoretical contribution is made with the answer to the study's first research question, in which twelve risk factors of digital harm to beneficiaries in that context are analyzed and classified, with a framework of factors being proposed.

The answer to the second question provides a managerial contribution by compiling a list of seven actionable measures for humanitarian organizations trying to reduce the potential digital harm to beneficiaries that can be posed by the use of blockchain in CVA programs.

6.2 Limitations and avenues of future research

The process of collection of primary data had clear limitations, notably the small sample size. The reduced number of interviewees was explained by the fact that most of the people associated with the Feasibility Study, from the Finn Church Aid side, are no longer working at that organization. In the case of Solita, there were only two people involved in the project. Another limitation was the lack of respondents from Kenya, who could have potentially provided more insight into that country's context. All interviewees in this study were Finland-based.

Limitations were also present in the collection of secondary data, as the availability of materials varied among the cases. Case A had been extensively covered in both media and research, while the main documents available in Case B were two final project reports. In Case C, the only public information found were two mentions on Finn Church Aid's and Solita's websites; access to the Feasibility Study was granted to the author, but it was agreed that that document should remain confidential.

The risks identified and considered in this study are not part of an exhaustive list; as time passes, new risks will continue to emerge, and it is simply not possible to predict them

all (Burton, 2020). As such, the consideration of new risks as blockchain technology continues to evolve, as well as how humanitarian organizations should react to these changes, presents one possible avenue of future research.

Another possibility is to investigate how digitalization affects the role of beneficiaries in humanitarian supply chains, and what the limits of technological experimentation on vulnerable populations should be. Technology should not be the focus of humanitarian action; instead, beneficiaries and their needs should be at the center of the discussion. As summarized by Burton:

> Expecting people in crisis situations to absorb new risk or trust unfamiliar systems is a big ask and must not be undertaken unless it is in their best interest and with their agreement. (Burton, 2020)

Finally, as demonstrated in this study, many risks posed by technology to beneficiaries can be mitigated through careful design. Because of that, the role of service design in the last mile of humanitarian supply chains is also an interesting additional avenue for future research.

7 REFERENCES

Awan, F., & Nunhuck, S. (2020). Governing Blocks: Building Interagency Consensus to Coordinate Humanitarian Aid. *Journal of Science Policy & Governance, 16*(02). https://doi.org/10.38126/jspg160201

Baharmand, H., Maghsoudi, A., & Coppi, G. (2021a). Exploring the application of blockchain to humanitarian supply chains: Insights from Humanitarian Supply Blockchain pilot project. *International Journal of Operations & Production Management*, 41(9), 1522-1543. https://doi.org/10.1108/IJOPM-12-2020-0884

Baharmand, H., Saeed, N., Comes, T., & Lauras, M. (2021b). Developing a framework for designing humanitarian blockchain projects. *Computers in Industry, 131*, 103487. https://doi.org/10.1016/j.compind.2021.103487

Better than Cash Alliance (n.d.). *How to define digital payments?* Available from: https://www.betterthancash.org/define-digital-payments. Accessed on 21 August 2022.

Blackwell, A., Casey, J., Habeeb, R., Annan, J., & Falb, K. (2019). Women's status and qualitative perceptions of a cash assistance programme in Raqqa Governorate, Syria. *Gender and development, 27*(2), 253-271. https://doi.org/10.1080/13552074.2019.1624047

Burton, J. (2020). “Doing no harm” in the digital age: What the digitalization of cash means for humanitarian action. *International Review of the Red Cross, 102*(913), 43-73. https://doi.org/10.1017/S1816383120000491

CALP Network (n.d.). *Glossary of Terms*. Available from: https://www.calpnetwork.org/resources/glossary-of-terms/. Accessed on 30 August 2022.

Cheesman, M. (2022). *Blockchain for Refugees*. Available from: https://points.datasociety.net/blockchain-for-refugees-a46b41594eee. Accessed on 22 November 2022.

Coppi, G. (2020). Introduction to distributed ledger technologies for social, development, and humanitarian impact. In: Cappiello, B. & Carullo, G. (Eds) *Blockchain, Law and Governance*, Springer, pp. 231-241. https://doi.org/10.1007/978-3-030-52722-8_17

Coppi, G., & Fast, L. (2019). *Blockchain and distributed ledger technologies in the humanitarian sector*, HPG Commissioned Report, Overseas Development Institute (ODI), London.

Dubey, R., Gunasekaran, A., Bryde, D. J., Dwivedi, Y. K., & Papadopoulos, T. (2020). Blockchain technology for enhancing swift-trust, collaboration and resilience within a humanitarian supply chain setting. International Journal of Production Research, 58(11), 3381-3398. https://doi.org/10.1080/00207543.2020.1722860

Finn Church Aid (2021). *Blockchain can increase the transparency and efficiency of cash-based assistance.* Available from: https://www.kirkonulkomaanapu.fi/en/latest-news/articles/blockchain-can-increase-the-transparency-and-efficiency-of-cash-based-assistance/. Accessed on 30 August 2022.

Global Humanitarian Overview (2022). *Global Humanitarian Overview 2022*. Available from: https://gho.unocha.org/. Accessed on 30 August 2022.

Hallwright, J. & Carnaby, E. (2019). Complexities of Implementation: Oxfam Australia's Experience in Piloting Blockchain. *Frontiers in blockchain, 2*(10). https://doi.org/10.3389/fbloc.2019.00010

Heaslip, G., Haavisto, I. and Kovács, G. (2015). Cash as a form of relief. In: Zobel, C., Altay, N. and Haselkorn, M. (Eds) *Advances in Managing Humanitarian Operations*, International Series in Operations Research & Management Science, Springer, Cham, pp. 59-78. https://doi.org/10.1007/978-3-319-24418-1_4

Heaslip, G., Kovács, G., & Haavisto, I. (2018). Cash-based response in relief: the impact for humanitarian logistics. Journal of Humanitarian Logistics and Supply Chain Management, 8(1), 87–106. https://doi.org/10.1108/JHLSCM-08-2017-0043

Howson, P. (2021). Crypto-giving and surveillance philanthropy: Exploring the trade-offs in blockchain innovation for nonprofits. Nonprofit Management and Leadership, 31(4), 805-820. https://doi.org/10.1002/nml.21452

Hunt, K., Narayanan, A. & Zhuang, J. (2022). Blockchain in humanitarian operations management: A review of research and practice. *Socio-economic Planning Sciences, 80*, 101175. https://doi.org/10.1016/j.seps.2021.101175

ICRC (2020). *Handbook on data protection in humanitarian action*, 2nd edition. Geneva: ICRC.

Juskalian, Russ (2018). *Inside the Jordan refugee camp that runs on blockchain.* Available from: https://www.technologyreview.com/2018/04/12/143410/inside-the-jordan-refugee-camp-that-runs-on-blockchain/. Accessed on 10 October 2022.

Jutel, O. (2021). Blockchain imperialism in the Pacific. *Big Data & Society*, *8*(1), https://doi.org/10.1177/205395172098524

Jutel, O. (2022). Blockchain humanitarianism and crypto-colonialism. *Patterns (New York, N.Y.), 3*(1), 100422. https://doi.org/10.1016/j.patter.2021.100422

Kovács, G., & Falagara Sigala, I. (2021). Lessons learned from humanitarian logistics to manage supply chain disruptions. *Journal of Supply Chain Management, 57*(1), 41-49. https://doi.org/10.1111/jscm.12253

Kovács, G., Matopoulos, A. & Hayes, O. (2010). A community-based approach to supply chain design. *International Journal of Logistics*, *13*(5), 411-422. https://doi.org/10.1080/13675567.2010.511609

Kovács, G., & Spens, K. M. (2005). Abductive reasoning in logistics research. *International Journal of Physical Distribution & Logistics Management*. *35*(2), 132-144. https://doi.org/10.1108/09600030510590318

Kovács, G. & Spens, K. M. (2007). Logistics theory building. Available from: https://philpapers.org/rec/KOVLTB. Accessed on 04 November 2022.

Kovács, G. & Spens, K. M. (2011). Trends and developments in humanitarian logistics - a gap analysis. *International Journal of Physical Distribution & Logistics Management, 41*(1), 32-45. https://doi.org/10.1108/09600031111101411

Kuner, C. & Marelli, M. (2020). *Handbook on Data Protection in Humanitarian Action*. 2nd edition.

L'Hermitte, C. & Nair, N. C. (2021). A blockchain-enabled framework for sharing logistics resources during emergency operations. *Disasters, 45*(3), 527-554. https://doi.org/10.1111/disa.12436

Lawson-McDowall, J., McCormack, R. & Tholstrup, S. (2021). The use of cash assistance in the Covid-19 humanitarian response: Accelerating trends and missed opportunities. *Disasters, 45*(1), S216-S239. https://doi.org/10.1111/disa.12524

Lewin, K. (1943). Defining the 'field at a given time.' *Psychological Review, 50*(3), 292–310. https://doi.org/10.1037/h0062738

Madianou, M. (2019). The Biometric Assemblage: Surveillance, Experimentation, Profit, and the Measuring of Refugee Bodies. *Television & New Media, 20*(6), 581–599. https://doi.org/10.1177/1527476419857682

Madianou, M. (2021). Technocolonialism: Digital innovation and data practices in the humanitarian response to refugee crises. In: *Routledge Handbook of Humanitarian Communication* (pp. 185-202). Routledge. https://doi.org/10.1177/2056305119863146

Maghsoudi, A., Harpring, R., Piotrowicz, W. D., & Heaslip, G. (2021). Cash and Voucher Assistance along Humanitarian Supply Chains: A Literature Review and Directions for Future Research. *Disasters*. https://doi.org/10.1111/disa.12520

Marić, J., Galera-Zarco, C. & Opazo-Basáez, M. (2021). The emergent role of digital technologies in the context of humanitarian supply chains: a systematic literature review. *Annals of Operations Research*. https://doi.org/10.1007/s10479-021-04079-z

Martin, A., Sharma, G., Peter de Souza, S., Taylor, L., van Eerd, B., McDonald, S. M., Marelli, M., Cheesman, M., Scheel, S. & Dijstelbloem, H. (2022). Digitisation and Sovereignty in Humanitarian Space: Technologies, Territories and Tensions. *Geopolitics, ahead-of-print*, 1-36. https://doi.org/10.1080/14650045.2022.2047468

Martin, A., & Taylor, L. (2021). Exclusion and inclusion in identification: Regulation, displacement and data justice. *Information Technology for Development*, 27(1), 50-66. https://doi.org/10.1080/02681102.2020.1811943

McDonald, S. (2021). *A humanitarian duty to integrity*. Available from: https://blogs.icrc.org/law-and-policy/2021/04/08/humanitarian-duty-to-integrity/. Accessed on 02 June 2022.

Miles, M. B. & Huberman, A. M. (1994). *Qualitative Data Analysis: An Expanded Sourcebook*. 2. ed. Thousand Oaks: Sage.

Nakamoto, S. (2008) *Bitcoin: A Peer-to-Peer Electronic Cash System*. Available from: https://bitcoin.org/bitcoin.pdf. Accessed on 12 October 2022.

Patton. M. Q. (2002). *Qualitative Research & Evaluation Methods*. 3rd ed. Thousand Oaks, CA: Sage Publications.

Rahman, Z. (2021). The UN's refugee data shame. Available from: https://www.thenewhumanitarian.org/opinion/2021/6/21/rohingya-data-protection-and-UN-betrayal. Accessed on 12 December 2022.

Rieger, N. (2022). *Tracking cash and voucher assistance.* Available from: https://devinit.org/resources/tracking-cash-voucher-assistance/. Accessed on 3 October 2022.

Rodríguez-Espíndola, O., Chowdhury, S., Beltagui, A., & Albores, P. (2020). The potential of emergent disruptive technologies for humanitarian supply chains: the integration of blockchain, Artificial Intelligence and 3D printing. *International Journal of Production Research*, 58(15), 4610-4630. https://doi.org/10.1080/00207543.2020.1761565

Roulston, K. (2010). *Reflective interviewing: A guide to theory & practice.* Sage.

Rust, Björn (2019). *Unblocked Cash: Piloting Accelerated Cash Transfer Delivery in Vanuatu.* Available from: https://policy-practice.oxfam.org/resources/unblocked-cash-piloting-accelerated-cash-transfer-delivery-in-vanuatu-620926. Accessed on 16 November 2022.

Sahebi, I. G., Masoomi, B. & Ghorbani, S. (2020). Expert oriented approach for analyzing the blockchain adoption barriers in humanitarian supply chain. *Technology in Society, 63*, 101427. https://doi.org/10.1016/j.techsoc.2020.101427

Sandvik, K. B., Gabrielsen Jumbert, M., Karlsrud, J., & Kaufmann, M. (2014). Humanitarian technology: A critical research agenda. *International review of the Red Cross (2005), 96*(893), 219-242. https://doi.org/10.1017/S1816383114000344

Sandvik, K. B., Jacobsen, K., & McDonald, S. (2017). Do no harm: A taxonomy of the challenges of humanitarian experimentation. *International Review of the Red Cross*, 99(904), 319-344. https://doi.org/10.1017/S181638311700042X

Seyedsayamdost, E. & Vanderwal, P. (2020) From Good Governance to Governance for Good: Blockchain for Social Impact. *Journal of International Development, 32:* 943– 960. https://doi.org/10.1002/jid.3485.

Sheppard, A., Tatham, P., Fisher, R., & Gapp, R. (2013). Humanitarian logistics: Enhancing the engagement of local populations. *Journal of Humanitarian Logistics and Supply Chain Management, 3*(1), 22-36. https://doi.org/10.1108/20426741311328493

Shrestha, S. & Smart, K. (2022). *Delivering better together*. Available from: https://www.calpnetwork.org/wp-content/uploads/2022/09/Delivering-Better-Together.pdf. Accessed on 24 January 2023.

Solita (n.d.). *How blockchain can increase trust and transparency in humanitarian aid.* Available from: https://www.solita.fi/en/customers/how-blockchain-can-increase-trust-and-transparency-in-humanitarian-aid/. Accessed on 30 August 2022.

Spiggle S. (1994) Analysis and interpretation of qualitative data in consumer research. *Journal of Consumer Research, 21* (3), 491-503. https://doi.org/10.1086/209413

Stanley, A. (2018). *U.N. Official Defends Refugee Voucher Program, Even Though It Doesn't Require Blockchain*. Available from: https://www.forbes.com/sites/astanley/2018/06/09/u-n-official-defends-refugee-voucher-program-even-though-it-doesnt-require-blockchain/?sh=3abafa21f66a. Accessed on 11 October 2022.

The Guardian (2022). *One in 23 people will require humanitarian relief in 2023, UN warns*. Available from: https://www.theguardian.com/global-development/2022/dec/01/one-in-23-people-will-require-humanitarian-relief-in-2023-un-warns. Accessed on 02 December 2022.

Thylin, T., & Duarte, M. F. N. (2019). Leveraging blockchain technology in humanitarian settings–opportunities and risks for women and girls. *Gender & Development, 27*(2), 317-336. https://doi.org/10.1080/13552074.2019.1627778

Thomas, A. and Mizushima, M. (2005). Logistics training: necessity or luxury? *Forced Migration Review*, 22, 60-1.

Thomas, J. (1985). Force field analysis: A new way to evaluate your strategy. *Long Range Planning, 18*(6), 54-59. https://doi.org/10.1016/0024-6301(85)90064-0

UNOCHA (2022). *What are Humanitarian Principles?* Available from: https://www.unocha.org/sites/unocha/files/OOM_Humanitarian%20Principles_Eng.pdf. Accessed on 13 December 2022.

Urquhart, A., Girling, F., Nelson-Pollard, S. & Mason, E. (2022). Global Humanitarian Assistance Report 2022. Available from: https://devinit.org/resources/global-humanitarian-assistance-report-2022/#downloads. Accessed on 12 October 2022.

Van Wassenhove, L. (2006). Blackett memorial lecture humanitarian aid logistics: Supply chain management in high gear. *The Journal of the Operational Research Society, 57*(5), 475-489. https://doi.org/10.1057/palgrave.jors.2602125

Vega, D. (2018). Conducting in-depth case studies in humanitarian logistics: The case of MSF. In *The Palgrave Handbook of Humanitarian Logistics and Supply Chain Management* (pp. 179-202). Palgrave Macmillan, London. https://doi.org/10.1057/978-1-137-59099-2_6

Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems, 28*(2), 118–144. https://doi.org/10.1016/j.jsis.2019.01.003

WFP (2016). *WFP Introduces Iris Scan Technology To Provide Food Assistance To Syrian Refugees In Zaatari.* Available from: https://www.wfp.org/news/wfp-introduces-innovative-iris-scan-technology-provide-food-assistance-syrian-refu. Accessed on 13 December 2022.

WFP (2021). *2021: A year of impact and growth*. Available from: https://docs.wfp.org/api/documents/66a13f43813843a4ad8d558aaf6afba3/download/. Access on 05 August 2022.

WFP Innovation Accelerator (n.d.). *Building Blocks*. Available from: https://innovation.wfp.org/project/building-blocks. Accessed on 14 December 2022.

WFP Innovation Accelerator (2021). *2020 Year in Review*. Available from: https://innovation.wfp.org/year-in-review-2020/docs/WFP_InnovationAccelerator_AnnualReport2020.pdf. Accessed on 05 August 2022.

Yin, R. K. (2014). *Case study research: Design and methods* (Fifth edition.). Los Angeles: SAGE.

Zambrano, R; Young, A. & Verhulst, S. (2018). *Connecting Refugees to Aid through Blockchain-Enabled ID Management: World Food Programme's Building*

Blocks. GovLab. Available from: https://blockchan.ge/blockchange-resource-provision.pdf. Accessed on 09 October 2022.

Zwitter, A., & Boisse-Despiaux, M. (2018). Blockchain for humanitarian action and development aid. *Journal of International Humanitarian Action*, *3*(1), 1-7. https://doi.org/10.1186/s41018-018-0044-5

APPENDIX 1 INTERVIEW QUESTIONS

Topic	Questions
Background	Can you tell me about this program and your role in it?
Problem	What specific problem is blockchain meant to address? Why was blockchain technology chosen to address this specific problem? - Are there other tools that could be used for addressing this issue? How does the program work?
Technical aspects	What kind of data is stored in the blockchain? - Does it include the personal data of beneficiaries? - Which organizations or actors have permission to input data into the system? - Which organizations or actors have permission to view the data? Which type of blockchain is used? - Why was this structure chosen?
Pros and cons	What advantages would blockchain bring? What potential risks would it bring? - What measures were put in place to mitigate these risks? What has FCA done to identify possible risks to beneficiaries? - How are these risks supposed to be mitigated? - Do you also consider risks posed by partners? Was there any special consideration given to privacy and data protection? What were the requirements for people to participate? IDs, mobile phones, literacy, bank account…

	What were the main challenges in using blockchain technology in the program? Did the personnel working on the project have the necessary skills?
Results	Has the program achieved its goals with the use of blockchain technology? - Which expectations were fulfilled? - Which expectations were not fulfilled? Have there been any unanticipated consequences? How have the beneficiaries reacted to the program? Is there anything you would like to add?