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Fundamental principles to design an ethical payment system

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The ongoing digitalisation of payments is an immense challenge for society and raises several ethical issues. Although digital payment instruments have been around for some time, beyond the analysis of some specific cases and related ethical issues, a comprehensive approach is still absent from the literature. Starting from the claim that access to a payment system is a basic human right, we lay the foundations for a framework of fundamental ethical principles we find essential in designing and operating a morally sound and resilient payment system. Two main principles will be proposed: financial inclusion and fair treatment of users. Each principle has three dimensions: financial inclusion embraces physical, intellectual and economic accessibility to the payment system, fair treatment of users means protection against illegal and/or illegitimate surveillance, trustworthiness and fair distribution of costs. Relying on these principles we discuss their significance in the payment system with special focus on the transition from a cash-dominant payment system to a fully digital one.

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Introduction

Payment systems play a pivotal role in society because money is the communication medium of economy (Luhmann, 1974).[1] Each member of society needs to have access to money in order to share the opportunity to meet his or her needs and to take part in economic and social life.

The recent trends in payment methods can be characterised by the evolvement into a system in which electronic payments are rapidly replacing paper-based ones (Angel and McCabe, 2015, Business Insider Intelligence, 2019). The ongoing digitalisation of payment instruments breaks the dominance of traditional financial institutions and brings a new, unprecedented proliferation of companies involved in the processing of financial and credit transactions. At the heart of this transition is the transformation of money from a physical, tangible fiat money to an intangible sequence of signals in the digital space. The user of the new money needs new skills, new knowledge and new devices in order to own and pay with it. Replacing paper-based payments with electronic payments also imposes a challenge for society. The new system of digitalised money needs new legal regulations, technical standards, reliability and security in the constantly and rapidly changing digital space. The societal costs of such a transition are huge, the complex technological digital infrastructure has to be established, and access for everyone and everywhere should be provided. The operational costs of a pure digital payment system seem to be lower compared to a cash-based or mixed payment system. In addition, the cashless payment system is less resilient than a mixed or cash-based system, since technological risks, such as disruption of servers, damage to communication systems, failure of access devices, power supply problems, etc. cannot be eliminated (de Almeida et al. 2018).

Businesses and governments tend to prefer digital payments over cash, and those who are not able to use digital payment systems are excluded from everyday transactions. Therefore, using a particular payment tool is not a voluntary choice but a societal expectation. This is the reason why designing an ethical payment system has crucial importance.

Will the new payment ecosystem contribute to the well-being of all strata of society, or widen the gap between rich and poor, well-educated and untrained? How is it possible to provide equal opportunities for the vulnerable groups of society? Why is this necessary? Our investigation intends to answer these questions. We focus on the payment system, because the basic function of money is to facilitate exchange, i.e. transfer and get purchasing power, buy products, contribute to financing public goods via taxes, etc. In modern societies, participating in the payment system is needed to live a decent and responsible human life.

Based on a thorough literature review, we have identified several gaps in the existing literature. Although digital payment instruments have been around for some time, beyond the analysis of some specific cases and related ethical issues, a comprehensive approach is still absent from the literature. In addition, previous literature has mainly focused on ethical topics like the general monetary system, financial inclusion, and loan assessment. However, the specific design of payment systems has received limited attention. In the paper, we address these gaps by applying a comprehensive approach, and lay the foundation for a coherent framework of relevant ethical principles that we regard as the necessary "ingredients" in building a morally sound and resilient payment system.

Our paper has two objectives. To guide our investigation and structure our argumentation, we formulated some propositions for each objective. Our first objective is to demonstrate that ethical principles are essential to the design and implementation of a fair and equitable payment system. Two propositions are offered in relation to this objective.

Proposition 1 *In the transition to digital finance, access is not merely a technical matter but a societal challenge that requires assessment through an ethical lens.*

Proposition 2 *A transition to fully digital payment systems, when guided by ethical principles, has the potential to reduce social and economic inequalities.*

The second objective is to establish a set of fundamental ethical principles that should guide the design and operation of digital payment systems, ensuring that they are morally sound and resilient. Based on the second objective, we have formulated three additional propositions as follows.

Proposition 3 *The concept of basic human rights should form the cornerstone of an ethical framework for payment systems.*

Proposition 4 *Addressing financial inclusion in digital payment systems will significantly increase their usability and adoption by diverse populations.*

Proposition 5 *The digitalisation of financial services must be guided by an adequate consumer protection framework to mitigate the misuse of the system.*

In developing and supporting our propositions, we drew on the literature by analysing and synthesizing relevant ideas and perspectives, as well as on our own conceptual framework, which we propose to guide the design of ethical payment systems.

The paper is structured as follows. The next section provides the basic considerations regarding the methodology. The ethical framework applied is justice in the sense of Rawls (1999, 2001). The following section clarifies some relevant concepts we rely on in our work. Then, we review the related literature. First, we look at the payment system from a historical perspective and present some distinct ethical approaches. Second, we identify the sources of literature which we can integrate and build on in deriving the ethical principles of the payment system. We close the literature review by highlighting the possibilities to apply ethics to payment system. In the next section we present arguments to support the claim that access to the payment system qualifies as a fundamental human right. In the following section we introduce a framework of fundamental ethical principles which we find essential in developing and operating a morally sound and sustainable payment system. All in all, we propose two basic principles with six dimensions and discuss their significance in the payment system with special focus on the transition from a cash-dominant payment system to a completely digital one. It is followed by a discussion on the propositions and relevant policy recommendations of our research. Finally, we offer some concluding remarks and point to future research directions.

Methodology

We look at the payment system as a subsystem of the financial domain deeply embedded in society. Our intention is to uncover the fundamental traits of the payment system, focusing on its objectives (Checkland, 2000). Only with thorough observation and continuous theorization, is it possible to trace the changing financial domain of society and evaluate the proliferation of FinTech solutions. This approach will provide an in-depth view of main ethical issues in connection with the use of money as a medium of exchange and it will lead to new insights on how to address the problems originating from the full potential of digitalisation of payment methods.

This is a conceptual paper. We think that the quest for fundamental ethical principles must find its starting point in some axioms. Ethics in connection with the use of new technologies is about how to establish and shape future systems, so it is a prescriptive ethics that can be accessed only by finding some general propositions as a starting point. In our case the anchor point of

our ethical inquiry is justice in the sense of Rawls. We agree with Rawls that in order to live in a just society, every member needs an equal right to the possible greatest liberties. This is the ideal situation, a guiding principle that cannot be realised, but should be targeted. In order to achieve this situation in society, and to mitigate the growing inequalities due to the transition into a new digital world we have to apply the difference principle, where the equal distribution of liberties and economic goods should prefer the least advantaged members of society (Rawls, 1999, 2001). We are convinced that other important principles such as fairness, respect for person and financial sustainability can be derived from the notion of justice. The reference point of our inquiry is society as we emphasize the long-term well-being of the whole society.

Although we follow a theoretical path of research, this approach opens the assessment of real-life problems, e.g. the responses of the financial industry to poverty (Davis, 2014). We strongly believe that business ethics should give some landmarks to future design of payment systems for a socially just and fair society (Miller, 2008).

The steps of our inquiry are as follows.

1. In the first part we make a literature review and outline some distinct historical concepts that influence present innovations in payment systems. Analysing them we will find some ethical issues that result from the interconnections between society and financial system. Furthermore, we intend to identify the literature sources that deal with ethical problems in the payment system.
2. In the second part we set out the main ethical principles of payment system design. We investigate the system from the perspective of the whole society emphasizing the user's position. In a fair society, each member should have access to a payment system without sacrificing his or her privacy and endangering the value of his purchasing power represented by money. This principle influences the technological design and the juridical or technological limitations to utilize the whole scale of possibilities provided by the digitalisation of financial systems.

The concept of a payment system and digital payments

A payment system is used to settle financial transactions through the transfer of monetary value. Relying on the definition given by the Bank of England: "Payment systems are a set of common rules and procedures that support the transfer of funds between people, businesses and financial institutions."[2]

Digital payments refer to the transactions that are carried out through digital or online modes where no physical exchange of money is being involved. A digital (or equivalently an electronic) payment is the transfer of money or digital currency from one account to another using digital tools such as a mobile phone, computer, or a credit, debit or prepaid card. In fact, all non-cash payments belong to this category.

For digital payments to take place, normally the payer and payee both must have a bank account,[3] an online banking method, a device from which they can make payment, and a medium of transmission, meaning that either they should have signed up to a payment provider or an intermediary such as a bank or a service provider (Khaitan and Joshi, 2024).

Payment instruments are of key importance in operating a payment system. According to the definition given by the European Central Bank, a digital payment instrument is "a personalised device (or a set of devices), software and/or set of procedures agreed between the end user and the payment service provider to request the execution of an electronic transfer of value." (ECB, 2021). Examples include payment cards, credit transfers, direct debits, e-checks, mobile payment apps, mobile wallets and digital currencies.

Among digital currencies, the evolvement of cryptocurrencies with the inception of bitcoin[4] (Nakamoto, 2008) has brought a big innovation in the payment systems. The reason was that it has proposed a distributed monetary system, and as a decentralised payment system, it has challenged the central authority that controlled money supply (Chuen, 2015). It has promised to provide a cheap form of payment system and a possibility to reach unbanked and underbanked people (Nian and Chuen, 2015). Cryptocurrencies in their purest form are peer-to-peer versions of digital cash using cryptographic protocols to prevent double-spending. They allow online payment to be sent directly from one party to another without a need for an intermediary such as a financial institution. This system was designed to eliminate third party trust, therefore there is no need for a legal entity behind it, except an open-source software. Cryptocurrency payment systems rely on blockchain technology which provides a publicly accessible record of all transactions ever processed, allowing anyone involved in the system to verify the validity of a transaction. It is remarkable that the carbon footprint of cryptocurrencies is immense, consuming more energy annually than some countries, raising concerns about environmental sustainability.

Although Bitcoin was designed as an alternative payment method, it has not met expectations. Instead of becoming a tool for everyday transactions, its primary use remains speculative. High volatility, slow transaction speeds, and scalability issues make it impractical for widespread adoption as a payment solution (Bugár and Somogyvári, 2020).

Meta's proposed special cryptocurrency, the Libra/Diem stablecoin project pushed central banks to accelerate their efforts on developing digitalised fiat currencies, i.e. Central Bank Digital Currencies (CBDCs).[5] Governments saw Libra/Diem as a potential threat to financial stability and monetary sovereignty, prompting stronger regulatory scrutiny. This highlighted ethical concerns about whether private corporations should influence global financial systems. Ultimately, Libra/Diem's failure reinforced the importance of transparent, state-regulated digital payment systems that prioritize public interest over corporate dominance.

CBDC is a liability of a nation's central bank. Two types of CBDC can be distinguished. Wholesale CBDCs are designed for use by financial institutions such as commercial banks and central banks, primarily for interbank settlements and cross-border transactions. In contrast, retail CBDCs are intended for everyday use by the general public, providing a digital alternative to cash that is directly backed by the central bank (Kosse and Mattei, 2023).

There is a pioneering CBDC. D-Cash issued by the Eastern Caribbean Central Bank (ECCB), designed to enhance financial inclusion by providing a secure and low-cost digital payment system. It allows unbanked and underbanked individuals to access digital financial services without requiring a traditional bank account. Unlike cryptocurrencies, D-Cash is backed by the central bank, ensuring monetary stability, transparency, and consumer protection (Kosse and Mattei, 2023).

There are three main differences between cryptocurrencies and CBDCs. First, cryptocurrencies are private-sector issued and decentralised (meaning that there is no need for a financial intermediary), central bank digital currencies are centralised as they are issued by the central bank of the relevant country. As such, they are in fact digitalised fiat currencies. Second, cryptocurrencies use a public ledger to record and verify transactions; CBDCs are designed to rely on a centralised ledger. Third, cryptocurrencies (excluding stablecoins) are much more volatile than CBDSs.

Literature review

Historical ethical approaches to payment system. Some forms of money may have intrinsic value, as gold or silver mints, but digitalised money loses all physical nature, so money is becoming a purely abstract concept. Ethics within economics explores the fundamental principles guiding moral assessments within society. It seeks to differentiate between ideal and undesirable societal models while analysing the necessary systems to construct a societal framework aligned with individual standards of acceptability. The ethical dimension of money emerges from the benefits or harms provided by the money system to individuals and to the whole society. Money is the facilitator of exchange, and it can be stated that exchange is "one of the purest and most primitive forms of human socialization" (Simmel, 2011, p. 247). In modern societies, where money is an independent structure, the use of money and distribution of money among the members of society is deeply intertwined with the existing social order. This is manifested, among other things, in wealth concentration and income inequality, in defining access to education, health care, and other opportunities, and in influencing politics and media coverage.

Money as a tool to increase the wealth of society. With respect to the main perceptions of money, there is a remarkable approach proposed by Fichte in the nineteenth century, called "economic romanticism", or "monetary nationalism" (Gray, 2003). We eliminate the historical circumstances and focus on the main thesis of the "Closed Commercial State" written in 1800 (Fichte, 2012). According to Fichte, money has to facilitate exchange. He claims that it is a pure signal, without any intrinsic value and it can fulfil this requirement only if everybody accepts it. Therefore, the "rational" state has to introduce and manage the money. This leads to an obligation of the state to preserve the value of money because, according to Fichte, the wealth of citizens is a basic right.

This concept is important for an ethical approach, because it emphasizes the ethical purpose of money and the commitment of the state to use the payment system for the benefit of citizens (Scharding, 2019).

Money as an expression of moral values. Some recent approaches intend to design cryptocurrencies advancing moral aspirations. In contrast to Fichte, instead of a central authority, they build on the latest and continuously developing technology of decentralized digital payments in highlighting the possibility to develop money possessing both ethical and monetary values. Gladden (2015) introduced the futuristic concept of "autonomous ethically guided cryptocurrencies" which utilize artificial intelligence (AI software) to make self-supporting decisions based on predetermined ethical principles in the process of financial transactions. In case of violating any of the conditions the initial owner assigned to her/his virtual coins, the AI software would refuse the transaction.

Kleineberg and Helbing (2016) envisioned a multidimensional financial system in which one dimension of "qualified money" is an appropriately designed cryptocurrency, the so-called "social Bitcoin". The idea is built on that online social networks of the future Internet might challenge the information monopoly of service providers like big IT companies and even some governments in routing information. Individuals performing searching and navigation tasks by utilising their social connections can fulfil socially beneficial duties and in exchange might earn social Bitcoin. It represents socio-digital capital, and can be exchanged to other currencies. The possibility of being able to "mine" this kind of cryptocurrency would work as an incentive for individuals to be active in several networks, and, in order to increase their expected payoffs, even to be engaged in less active ones. Such a design of information routing might guarantee digital diversity.

According to Kleineberg and Helbing (2016), the social Bitcoin would play a significant role in the decentralized architecture for information and communication technology forming "digital democracy". In addition, information would be managed in a bottom-up way via social networks of individuals. This system was expected to provide diversity among digital services and a freedom from central monopoly. Furthermore, it might offer a solution for the transparency and privacy concerns of the future payment systems.

The above-mentioned concepts remain largely unrealised in the current crypto market, where most tokens and coins are speculative assets or outright scams.

The fast development of AI technology we experienced recently calls for "socially responsible and morally sound" implementation (Radanliev et al. 2024b). AI-driven FinTech solutions must adhere to strict ethical guidelines to ensure fairness, transparency, and data protection, particularly in fraud detection, credit scoring, and transaction monitoring. The deployment of privacy-preserving technologies such as homomorphic encryption and differential privacy is essential to balance financial security with consumer rights, preventing discrimination and undue surveillance in digital transactions. (Radanliev et al. 2024b).

Money as a medium of free choice. Mises, as the founder of the monetary theory in the Austrian school of economics, denies in his work "The Theory of Money and Credit", the role of money as a medium of payment. Money is the tool to perform the "liquidation of liabilities" (von Mises, 1981, p. 41) and the commercial partners choose the form of this liquidation, ergo they choose the type of money. Every transaction, where sale and purchase seem to be independent, can be traced back to an original form in which the buyer and the seller (or the lender and the debtor) make a direct transaction with the chosen payment instrument. Therefore, payment cannot be regarded as an independent legal act. (von Mises, 1981, p. 41).

Mises and the Austrian school strongly oppose every state intervention. Only the economic agents know which is the best money form fitting the particular transaction. The only role of the state is to accept it. Every further intervention causes disturbance, of which the most disruptive is inflation, allowing "an alliance of politicians and bankers to enrich themselves at the expense of all other strata of society" (Hülsmann, 2008, p. 239).

Mises' work can be seen as the ideological foundation of cyber-libertarianism. They deny the state, because it is considered as the symbol of tyranny. According to their view, each government is "bad" because of the inevitable concentration of power. This leads to abuses of the monetary system by central banks and the Fed (Golumbia, 2016). Cryptocurrency callers rely on various conspiracy theories (Rothbard, 2002) claiming that the Fed is a private bank run by the Rotschilds and other London banking families that take money away from people and give it to the elite (Mullins, 1992, pp. 62–63). Their solution to this problem is the pure market mechanism and the unconditional trust in Nakamoto's blockchain technology (Nakamoto, 2008). Decentralized, blockchain-based cryptocurrencies ensure an inflation free currency and lock out every possible manipulation caused by the established financial authorities. Cryptocurrencies are the forerunners in the recent digital money landscape started with the appealing idea of bitcoin. The short history of bitcoin proved that without a general guarantee of acceptance, it cannot completely supplant current monetary systems (Lebow, 2022). Therefore, it

is, and with high probability, it will remain a speculative asset in future (Yermak, 2015).

Ethical assessment of modern payment systems. We seem to live in a transition from a cash-based to a cashless society. The main drivers of this transition are banks and financial institutions and the government facilitating the use of digital instruments instead of cash. Digital payment systems have a huge advantage in comparison with a cash-based system: low transaction costs due to cost reduction in handling physical money (Prior and Argandoña, 2009),[6] simplifying payment procedures and reducing security concerns (Kamran and Uusitalo, 2019). On the other hand, it allows for greater state control in the economy and everyday life (Gnan and Masciandaro, 2018).

Payment system as organizing force of society. The new technology forces scholars to reconsider money's role within a digitalized landscape. In grappling with this emerging paradigm, it becomes crucial to acknowledge Cowton's (2002) assertion that finance cannot exist devoid of ethical considerations; it "should not be and cannot be the ethics-free zone." Cowton articulates the dual dimensions of finance – systemic and personal/professional –, which demand ethical contemplation.

Peneder (2022) accentuates money as a social institution intertwined with technological evolution. This view harmonizes with Winner's (1977) proposition that technology moulds our social framework, significantly impacting economic and societal structures such as industry, bureaucracy, and education. Consequently, the societal role of payment systems necessitates banks to embrace a wider social responsibility, serving diverse strata of society, not solely the affluent (Prior and Argandoña, 2009, Morrison and O'Brien, 2001).

However, banks and financial institutions often operate as conventional service providers, prioritizing lucrative clienteles while excluding less profitable segments, as highlighted by Speak (2000). Their inherent societal role, as inevitable intermediaries, should encompass the provision of services for all. Individuals from low-income backgrounds, the underprivileged or small businesses with limited literacy or digital skills face a disempowerment in comprehending financial information, contributing to their financial exclusion (Cartwright, 2011, Laureti, 2017). The EU's survey underscores the pervasive exclusion of perceived high-risk consumers from banking services, including electronic payment systems (EBA, 2015). Despite the seeming rationality from a bank's standpoint, this risk mitigation strategy ultimately results in the financial exclusion of individuals and companies, impeding their ability to engage in international monetary transactions or participate in electronic commerce (EBA, 2015).

The problem of financial exclusion. Financial exclusion refers to the situation where individuals or groups within society have limited or no access to essential financial services and products that are typically available to the broader population. The barriers to use the modern digitalized financial services are manifold: geographical exclusion via closing bank branches and ATMs, (Mohapatra, 2014, Alonso et al. 2022), lack of access, knowledge, positive attitudes, skills or support to use digital services (Anrijs et al. 2020). Unfortunately, the transition into a cashless economy is not a smooth transition; it will not provide easier and flexible management of money for all strata of society (O'Neill et al. 2017, Perry and Ferreira, 2018, Collins et al. 2009). The COVID-19 pandemic has emphasized the challenges in transitioning to a cashless economy, despite the acceleration of digital onboarding and the surge in FinTech adoption for payments. Studies, including those in Kenya, indicate that favourable regulatory measures spurred the dominance of mobile banking as the primary payment mode during the pandemic (Tut, 2023). However, the aftermath of COVID-19 poses risks to financial inclusion due to uneven access to digital tools. Limited access to technology might lead to exclusion as financial services rapidly shift online (Sahay et al. 2020).

Accessibility of new communication and information technologies becomes more and more essential in the digital future. Fostering inclusivity in digital innovations can overcome socio-economic barriers. By using universal and proactive design principles and working closely with affected communities, can create more inclusive and empowering experiences for everyone (Radanliev et al. 2024a).

The literature review highlights the importance of embedding ethical principles into the design of payment systems. This supports Proposition 1 and Proposition 2, which are articulated as follows.

Proposition 1 *In the transition to digital finance, access is not merely a technical matter but a societal challenge that requires assessment through an ethical lens.*

Proposition 2 *A transition to digital payment systems, when guided by ethical principles, has the potential to reduce social and economic inequalities.*

Possibilities to apply ethics to payment system. Existing literature on the ethics of payment systems primarily focuses on specific contexts: developed economies with advanced digitalized financial systems or the adoption of mobile banking in selected African countries (Hussain et al. 2019, Kabir et al. 2015, Lin and Nguyen, 2011). A notable niche within this body of work is the ethical analysis of cryptocurrencies, as explored by Dierksmeier and Seele (2018, 2020). Angel and McCabe (2015) argue that the ethical evaluation of payment systems is limited to assessing their use, rather than the systems themselves. Building on this principle, Bagus and Horra (2021) conclude that cryptocurrencies, as digital money, can serve both ethical and unethical purposes depending on their application.

However, these approaches predominantly focus on isolated contexts or individual use cases, neglecting a broader systemic perspective. Specifically, they fail to address the ethical responsibilities of rule-makers and system designers. Our research aims to fill this gap by emphasizing the need to assess not only the use of payment systems but their design and structure as well. A well-designed payment system inherently discourages unethical practices and ensures inclusivity by balancing the interests of all users. Furthermore, it must incorporate mechanisms to safeguard the purchasing power of users, especially in the short and medium term. For instance, cryptocurrencies, while innovative, often lack the economic foundations or regulatory mechanisms (e.g., central bank oversight) necessary to ensure stability, making them prone to high volatility (Peneder, 2022).

We argue that the ethical evaluation of payment systems should extend beyond individual use and consider systemic principles that promote accessibility and equitable use for all members of society, including vulnerable groups (Morawczynski et al. 2010, O'Neill et al. 2017). By addressing these broader concerns, we aim to establish a framework that bridges the gap between individual ethics and systemic responsibility, contributing a novel perspective to the discourse on payment system ethics. This framework of ethical principles consists of the essential building blocks for creating a morally sound and resilient payment system.

Participation in the payment system as a basic human right

The ongoing digitalisation of payments raises the problem of financial exclusion affecting vulnerable groups who for some

reason have no access to digital or semi-digital payment systems and financial services.

Article 25(1) of the Universal Declaration of Human Rights (UDHR) proclaimed by the United Nations General Assembly held in Paris on 10 December 1948 enshrined the notion that access to food, shelter, and medical care constitute basic human rights.

> *"Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, and housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control."* (United Nations, 1948, UDHR 25(1))

In modern societies where finance has permeated the whole economy, access to financial resources, i.e. financial inclusion seems to be a necessary condition for mitigating poverty. (Yunus, 2011, Pradeep, 2014). Yunus, the Nobel Peace Prize laureate in 2006 and the founder of Grameen Bank for facilitating micro-credit programs in Bangladesh, considered access to credit as a fundamental human right.

As Pradeep (2014) aptly expressed, "right to financial inclusion is a right against financial exclusion" (Pradeep, 2014, p. 5). Hudon (2009) and Bayulgen (2013) concluded that access to credit and financial inclusion can be regarded as moral rights because they primarily concern ethical demands.

The recently emerging international discourse underlines the essential role of "human rights lens" in building "a more sustainable and resilient financial system" with the aim of serving the society by integrating ethical values and norms more deeply in the financial system. Regarding financial inclusion, we can report on a positive tendency as "financial institutions are increasingly asserting that financial inclusion in and of itself is a human right" (Wachenfeld et al. 2016, p. 62).

As a further favourable case when a moral right received legal recognition, an EU law can be mentioned. In order to provide an easy access to a bank account for all EU citizens, the Directive 2014/92/EU ensures the right to open a basic payment account anywhere in the European Union and enforces an improvement in transparency of bank account fees (European Parliament and Council, 2014).

Access to a payment system can be regarded as a moral right in a fair society. As we have emphasized, this is a prerequisite to take part in social life. However, there is an urgent need to legitimize it as a human right. This claim can be proven by applying four assessment criteria proposed by Bayulgen (2013) in pointing to the possible approaches of criticisms in the right-to-credit controversy.

According to the *institutionalist criterion* there is a need for an institutional framework or a so-called "duty bearer" who takes the responsibility for fulfilment of the right. In a cash-based or centralized digital payment system, the monopoly of the state (central bank) is to issue (the national) currency, which secures the general public's access to money as a means of payment. Therefore, in this case, fulfilment of the right-to-payment is "automatically" guaranteed, and the role of the duty bearer can be allocated to the government.

Feasibility criterion ensures the right to be realizable from the part of the grantee, therefore the duty bearer must possess the full capacity and all the necessary resources to be able to take actions in order to facilitate and assure the realization. Independently of the fact, whether the payment system is cash-based or contains digital payment instruments, on behalf of the state, the government along with the national bank (as duty bearer) has to provide the proper infrastructure for running the payment system.

Justifiability criterion is related to legitimization of a relevant right. It requires the existence of a legal framework, which is capable to enforce the right and provide "remedy" in case of aggrievement. Access to the payment system, especially to digital payment instruments is an emerging right, and it eventually must be included in international or national laws because the remedy must come from jurisdiction. In most countries, the realization of this criterion is still a challenge for the future.

Universality criterion emphasizes that a right must be universally valid, namely applicable and acceptable to everyone. This excludes that the right has any negative consequences to anyone. It is obvious that each member of the society should have access to a payment system in order to take part in economic and social activities.

Building on the arguments presented above, we firmly believe that access to a payment system, when ensured by a central authority, should be recognized as a fundamental human right. This is clearly reflected in Proposition 3, which is formulated as follows. Proposition 3 *The concept of basic human rights should form the cornerstone of an ethical framework for payment systems.*

Among the Sustainable Development Goals (SDGs), the set of global development targets adopted in 2015 by the member countries of the United Nations, a call for a deep reform of the "outdated, dysfunctional and unfair international financial architecture" has been expressed. In addition, ethical concerns were clearly and strongly articulated as its current state has been described as "morally bankrupt" (United Nations, 2023, p. 4) with "structural barriers that predominantly serve wealthy countries and individuals" (United Nations, 2023, p. 57). A fundamental goal was to remedy the historical injustices that underpin the international financial system, to give the most vulnerable countries and people a fair chance for a better future.

Related to the payment system the importance of advancing financial inclusion has been emphasized. It can be facilitated with the new opportunities to reach unbanked by leveraging digital payments by building up interoperable payment networks and telecommunications infrastructure.

Ethical principles of payment system design. In this chapter, we present two ethical principles, which can be regarded as essential "ingredients" for building up a morally sound and resilient payment system. The three dimensions of the first principle, financial inclusion, are physical, intellectual and economic accessibility to the payment system. The second ethical principle is the fair treatment of users. The three dimensions of this latter principle are protection against illegal and/or illegitimate surveillance, trustworthiness and fair distribution of costs. Table 1 gives a summary of the above-mentioned principles, provides their description and lists the relevant challenges one has to face and comply with in practical implementations.

In the following discussion, we will clarify the significance of each principle and give response to relevant challenges with special focus on the transition from a cash-dominant payment system to a digital one.

Financial inclusion. If a person cannot access financial services, has no possibility to use any or all payment instruments, or cannot get credit, we speak about financial exclusion. This phenomenon is widespread in the world. There are deeply rooted cultural elements that impair the financial self-determination of whole groups. Children, young people, women, the elderly or people living with cognitive impairment may often not participate in financial processes, they are denied making buying decisions and to have and spend money in any form. Solving this problem would involve changing the attitude of whole societies.

Table 1 Fundamental ethical principles of payment system design.

Ethical principles	Description	Challenge
Financial inclusion	**Access to all payment instruments and connected financial services**	**How to include vulnerable groups in less-cash or cashless payments?**
• Physical accessibility	Availability of services (e.g. bank branches, ATMs, Internet, mobile broadband services) in close proximity	How to increase low internet penetration and broadband connectivity?
• Intellectual accessibility	Fitting the payment system to mental and cognitive skills of users	How to cope with low functional literacy and/or financial illiteracy?
• Economic accessibility	Setting affordable charges according to the financial situation of users	How to provide the complete range of services for people living in poverty?
Fair treatment of users	**Eliminating the misuse of asymmetric power relationships**	**How to provide just and equitable treatment to all members of society?**
• Protection against illegal and/or illegitimate surveillance	Excluding supervision, unauthorised use of data and control by any authorities and/or participants in the payment chain	How to prevent the misuse of Information Technology and invasion of privacy?
• Trustworthiness	Assuring confidence and reliability in the system	How to develop trust in different payment instruments?
• Fair distribution of costs	Eliminating dominant positions leading to asymmetric power relationships	How to support the least advantaged players in the payment chain?

In designing an ethical payment system, it is crucial to consider vulnerable groups, such as seniors and children, by ensuring they have accessible payment options and the necessary support to transition to digital methods, while still allowing alternatives like cash to prevent exclusion (Holden, 2024).

The first logical step is that everybody should have access to the payment system. This is the main criterion for a citizen to be able to participate in the economy. Today we assume a general availability of cash, and a substantial portion of the population is dependent on cash as exclusive payment method. The clearest demographic indicators of cash use are low income and higher age (Greenham and Travers-Smith, 2019). We can sense an explicit prevalence of cash usage in the countryside unlike urban regions. The size of a business is a further criterion, small businesses and businesses in remote regions with a lot of low-income households and bad financial infrastructure use primarily cash (Greenham and Travers-Smith, 2019).

In most countries cash as a basic payment instrument provides the widest access to present day payment systems. The continuous digitalisation and most of the future trends point to a cashless or less-cash economy (Rogoff, 2016), where the lack of possibilities for digital payment will exclude certain people from various economic opportunities. Ignoring this could have a detrimental impact on the financial health of vulnerable groups. In order to establish the main principles designing an ethically acceptable payment system, we focus on the barriers preventing the use of modern payment instruments. There are three main issues gaining importance in the digital world: physical, intellectual as well as economic accessibility.

Physical accessibility. The first step towards financial inclusion is having a bank account and a bank branch in available proximity. Even if someone is not familiar with digital payment methods, he or she can trust a bank employee who manages his or her account. The permanent attempt of financial institutions to cut costs and to decrease the personal contact with customers affects mostly the vulnerable groups, among others the elderly, the illiterate or functional illiterate.[7] In addition, bank branches play an important role in local communities and in providing credits to small businesses (Greenham and Travers-Smith, 2019).

The decline of bank branches and cash usage affects the number of ATMs as well. According to forecasts, the number of ATMs worldwide, which was approximately 3.24 million in 2019 is expected to decline in the future. This trend is driven by a decrease in the top five ATM markets, particularly in China, where fully digital payment methods are increasingly dominating (Business Insider Intelligence, 2019). The impact of this decrease on vulnerable groups in these markets is similar to the impact of closing bank branches.

The unavailability of POS terminals is a disadvantage for card and smartphone users and is a barrier to digital transition. There is an asymmetric power relation between the card companies and merchants (Angel-McCabe, 2015), i.e. the smaller the company, the larger the possibility of exploitation. The costs and the delays in connection with card processing can be very high for small businesses, especially for low value purchases.

The willingness to pay with bankcards changed due to the Covid measures introduced in most countries. The fear of the virus carried by coins or currency notes forced people and businesses to digital solutions. Even Germany, the 'country of cash' increased digital payment from 26 percent before Corona in 2017 to 40 percent during the lockdown in 2020 (DBB, 2021).

Transport to the next bank branch or to the next ATM can be a challenge for rural population. This is the case not only in developing countries, but also in rural communities in the developed world. Deprived households without a car in remote villages, where there is virtually no public transport, can easily be found even in Europe (Vitale Brovarone and Cotella, 2020). These groups affected not only by the lack of spatial, but also digital and intellectual accessibility are often excluded from financial services.

The future payment systems should find some new innovative business models to preserve the functions of the disappearing bank branches for vulnerable communities and groups. The loss of bank branch locations seems to be inevitable. There were some regulatory measures in India to force banks to preserve them (Demirguc-Kunt et al., 2018), but this is not the way of the future. The pressure on banks due to modern FinTech solutions is huge and has a negative effect on their profitability. Depending on the population density of unbanked regions, the settled bank branches can be substituted by new business models such as mobile banks or bundling basic functional banking combined with some other services as post, insurance, or lottery.

The access to the internet is vital to managing accounts, communicating with financial service providers, card issuers as well as paying online orders. The internet penetration is 72 percent in urban, 64 percent in rural regions globally. The worst situation is in Africa, where only 28 percent of the urban households and 6 percent of rural households have access to internet. In a predominantly cash-based system, this is apparently

not a disadvantage, but internet access and digital payment is a pivotal point to participate in the global or national e-commerce that means more possibilities for the businesses and lower prices for the customers. Even in developing countries, we can witness the increasing pressure of governments forcing the use of digital payment (Simatele and Mbedzi, 2021). The gender gap is the largest in Africa and in the Arabic states, where more males than females use the Internet (ITU, 2020). Fortunately, the Internet is not the exclusive communication channel for digital payments; the mobile phone network slowly takes over. Most of the world population, approximately 93 percent lives in regions with access to a mobile-broadband network. The mobile-phone ownership of women is similar to that of men in most countries (ITU, 2020). This works as a new prospective tool to ensure the financial inclusion of women in the developing world. M-Pesa, a mobile banking service provided by Safaricom in Kenya (Lashitew et al. 2020) can be given as one of the best examples that addressed the challenge of financial exclusion, and was offered as a solution for a significant rural, unbanked segment of the population. It enables cash deposits, withdrawals, transfers, and payments through a vast agent network, making banking more accessible, especially in rural areas. The system has significantly improved financial inclusion and economic resilience, allowing users to share financial risks and access emergency funds quickly. Women, in particular, have benefited, with many shifting to entrepreneurship, contributing to poverty reduction. Despite its success, challenges such as high transaction fees and market dominance by Safaricom remain barriers to further growth and competition (Holden, 2024). Unfortunately, due to physical and intellectual accessibility not every experiment with mobile money is a success for the African rural population (Serbeh et al. 2021).

Mobile devices and QR codes provide access to digital payment instruments that circumvent the payment system run by banks and financial institutions. This step, implemented by new technology firms and social network providers, revolutionized the Chinese payment system. The prevalence of cash disappeared in a decade, and now China is a country with digital payment ecosystem used by more than 1 billion people (Klein, 2020).

The increasing broadband 4 G coverage with mobile devices allows everyone access to new revolutionary payment and banking services. However, this possibility is only theoretical for some vulnerable groups because intellectual and economic factors prevent them to participate in the modern digital world.

Intellectual accessibility. The physical access to payment systems is only the first step to achieve financial inclusion. The second important factor is empowering people to use the various tools of the payment ecosystem. The easiest payment instrument is arguably cash. This is a tangible, physical tool, and many people find it easier to manage their finances with cash. The distribution of cash, tracking its increase or decrease is clearly visible for people with low functional literacy and/or financial illiteracy. That is why low-income households use mostly cash for budgeting (Gibbons et al. 2016). These people work mostly in low-paid jobs or they are unemployed. They often work in the shadow economy and are paid mostly in cash. Living in suburban or rural settlements and the physical unavailability of banking services enforces the use of cash. Therefore, they do not have to learn how to cope with digital payment systems. Demolishing the cash ecosystem would be detrimental for them (Clarke, 2018).

The lack of digital skills affects not only the above-mentioned groups. Older people or people with disabilities or mental disorders are often not able to use the digital ecosystem. They are afraid of technology, they fear to be scammed online. Furthermore, sometimes they do not even want to use call centres because they do not trust the unknown at the far end of the line (Gibbons et al. 2016).

Digital skills enable people to take part in the digital world, but do not solve the problem of financial illiteracy, a global problem even in the developed world. The standard measurement of financial literacy aims capabilities like calculating interest rate, understanding compound interest, inflation and risk diversification (Lusardi, 2019). Using a digital payment system involves even more skills, such as budgeting without tangible money, knowing the amount of virtual money, tracking the decrease after purchase, calculating the fees and comparing the conditions of different financial providers. When customers are not able to understand the products and payment methods using day-by-day, they cannot make well-informed decisions (Borg and Hooker, 2019). Even the users of banking apps with budgeting tools tend to make poor financial decisions (Finextra, 2018).

The long-term solution is to enhance the financial education of the population, which is a shared task for the government, education system and financial institutions. The short time solution is to abandon the complicated financial and legal language of banks, and to use everyday language and explanations for everybody. Simplifying the products, tailoring the services according to the needs of vulnerable people can facilitate financial inclusion. The innovative digital solutions in the future will include user-friendly paying apps with artificial intelligence and voice recognition (Bhattacharyya, 2017, Finextra, 2018).

Economic accessibility. The use of cash is the cheapest and easiest payment tool for households. It can be used everywhere, and it is accessible for everyone. The ongoing digitalisation and the plans to introduce digital central bank money anticipate the possibility of narrowing down cash usage. In order to enable everybody to use digital money, great attention must be paid to fees and costs.

Apart from such hard barriers as incomplete identity documents, administrative restrictions due to poor credit files, the primary barrier to having a bank account or a bankcard is the relatively high cost (Greenham and Travers-Smith, 2019). Affordability depends on the income of households. Low-income people with low account turnover are not among the most popular banking customers. Financial regulation can help forcing banks to provide free basic accounts. This is the case in the European Union (European Parliament and Council, 2014). The access to the digital world can be expensive compared to the income of the person. The only solution is to provide free access to basic key digital and mobile services and digital payments. This is based on societal solidarity where access to the digital world and to the payment system is a common good.

According to Rawls' difference principle (Rawls, 1999), the society has to prioritize the least favoured, in order to ensure the fair distribution. This means that in creating a fair society social and economic inequalities are to be structured so that they are to the greatest benefit of the least advantaged. Therefore, access to the payment system must be provided for everyone. This aligns with Proposition 4.

Proposition 4 *Addressing financial inclusion in digital payment systems will significantly increase their usability and adoption by diverse populations*.

Fair treatment of users

Protection against illegal and/or illegitimate surveillance. The flawless working payment system is inevitable to the smooth operation of business and society. Controlling the payment system means not only to control the speed and costs of transactions, but also to influence the monetary and fiscal policy. In a cash-based payment system, the control is indirect. Central banks

can increase or reduce the amount of money circulating in the economy, but they have only improper information about the exact volume of money or tangible money substitutes in circulation. The number and the volume of transactions in a given time-period can only be guessed. This impairs the ability of central banks to control and influence the monetary policy, to introduce an unconstrained interest rate that is to push interest rates into the negative domain (Rogoff, 2016).[8] Paper currency is the main obstacle to total financial control and surveillance of payment processes by central banks.

The anonymity of cash facilitates illegal money transactions, fraud, money laundering, settlements between criminals and payment in the shadow economy. This is a common argument against paper money (Rogoff, 2016, Shirley, 2019, Immordino and Russo, 2017). This reasoning has not been supported by the radical demonetization in India because it did not take a final blow to the black market and shadow economy and did not affect the black money holders too much (Shirley, 2019). Globally the criminals are at the forefront of digitalisation, they increasingly use digital channels, cryptocurrencies and the dark web (Best, 2018). Bitcoin and the underlying blockchain technology have the objective to ensure the anonymity of payments in the digital channels (Weber, 2014). This idea originally served the elimination of state and central bank intervention from the financial system, but it enabled large-scale global illegal transactions (Dierksmeier and Seele, 2018).

Digital money gives a unique possibility to gain information about each transaction, control the transactions, permit or inhibit the use of the payment system. Therefore, it can influence not only businesses but impair the whole economy as well. The Belgium based SWIFT system; the global provider of secure financial messaging services is the central nervous system of international trade. Suspending major banks of a country means that they cannot pay for imports or get any payment from abroad. This was the case with some Iranian banks after US sanctions of 2012 and 2018. This cut Iran off from the world and made the oil-export difficult. SWIFT claims to be neutral and "does not monitor or control the messages that users send through its system" (SWIFT, 2021). However, it was not able to resist the threat of the US administration, which warned it would be faced with penalties if sanctioned banks and institutions had access to the system (Lee, 2018). This seems to be a special case, but it reveals a general phenomenon: centralized, exclusive digital payment systems lead to concentration of power that can be easily misused.

US influence over SWIFT prompted China to develop CIPS as an emerging alternative for yuan-based transactions, particularly for countries aiming to reduce dependence on the US-led financial system. Its growth could play a major role in reshaping global finance and accelerating de-dollarization efforts.

The digital payment system is the source of previously impossible datasets. Nowadays this is a highly decentralized system where a complex net of stakeholders is working together to ensure transactions. The main categories of stakeholders are acquiring banks and processors, issuing banks, card networks, independent sales organizations (ISOs), merchant service providers (MSPs), and payment gateways. Each stakeholder gets a fee for the contribution and gets the necessary pieces of information of each transaction (Business Insider Intelligence, 2019). Most of the data are bundled, therefore anonymous, but there are some main players – such as banks, card issuers or specialized internet payment providers with a great deal of sensitive data about their clients.

Big Tech wants to launch financial services. Apple Card, Facebook's Libra, Tencent's WhatsApp, Google's attempt to build a digital wallet are important examples. McKinsey estimates that these companies will grab up to 40 percent of the financial market (Business Insider Intelligence, 2019). It is no wonder because datasets are nowadays source of valuable information.[9] When payment data can be linked to persons, purchases, internet searches, social media entries, then with the help of artificial intelligence the profile of each user is available. This enables mass customization: personalized offers for each potential customer, which go beyond the classic marketing offerings. Not only the buying decisions, but also preferences, emotions, habits, and political views can be easily influenced. This means that all dimensions of privacy are affected (Finn et al. 2013, North-Samardzic, 2020).

The generally accepted definition of privacy is "the interest that individuals have in sustaining 'personal space', free from interference by other people and organizations" (Clarke, 1997). It is worth noting that Article 12 of the Universal Declaration of Human Rights (United Nations, 1948) refers to privacy protection as a right that must be guaranteed by law.

The digitalisation of the payment system is an ongoing process. Full digitalisation means that the central bank issues digital money and distributes it through the commercial banks. The division of functions is similar to the current system in the developed world: Central Banks are responsible for the monetary policy, for production and distribution of money; they play a regulatory role and manage reserves. Commercial banks have direct contact with the customers. Independent financial providers run the payment and clearing systems. These processes are already largely electronic today. The only difference between fully digitized fiat money and the incumbent situation would seem to be the withdrawal of cash from the economy.

The range of surveillance expands from the total lack of control in the only cash payment system as well as in the blockchain-based cryptocurrency ecosystem where the transactions are anonymous, to the fully controlled central bank digital currency where each transaction is transparent for the state. The question arises, whether the payment system should prevent criminality or this is the task of other government organizations. The digital money that is fully transparent for the government allows a deep intervention in the personal life of the citizens and enables total power over the economy. This also includes the potential misuse of this power where the consequences of failed policy or bad governance affect everyone. In order to increase the resilience of the financial sector and the whole society, it must be necessary to build anonymity into the system. There are several methods to ensure it, from legal regulation to special IT solution. In a democratic society, all these are essential to preserve personal freedom.

The digitalisation of financial services must be guided by an adequate consumer protection framework. This means a set of laws, regulations and codes that enable fair transactions between financial service providers and their customers. Customer protection in financial services comprises six main areas: disclosure and transparency, business conduct, fair treatment of customers, data protection, and the requirement for accessible and effective dispute resolution mechanisms. In the last two decades, progress has been achieved in a number of countries in establishing a legal framework for national retail payment systems and some form of supervision of basic payment service providers (World Bank, 2021). Consumer confidence and trust are the key aspects that will enable widespread acceptance of cashless payment methods.

Trustworthiness. Trust has crucial importance in the economy as a whole. As Arrow (1970) pointed out, trust has a vital role in commercial transactions, emphasizing that the lack of it would increase transaction costs. Trust also represents one of the

principal values for society to guide ethically desirable behaviour. Therefore, trustworthiness is a key principle of developing a sustainable and resilient payment system.

Depending on whom the trust is placed in, we can differentiate personal, institutional and technological trust. The first one refers to the conventional meaning of trust from the origin, which is often labelled simply as trust or interpersonal trust (Rotter, 1967, Bornstein and Tomkins, 2015, Szumski, 2020).

Interpersonal trust is originally related to face-to-face interaction between individuals. In the context of payment systems, however, if we consider in-store (brick-and-mortar) sales, one of the parties (or both) participating in the transaction should not necessarily be a person but a business entity. Castaldo et al. (2010) considered trust "as an expectation that a subject distinguished by special characteristics (honesty, benevolence, competencies) will perform future actions aimed at producing positive results for the trustor in situations of consistent perceived risk and vulnerability" (Castaldo et al. 2010, p. 665). There is a prevalent view in the literature that familiarity between participants encourages trust because it reduces uncertainty (Bhattacherjee, 2002).

With the proliferation of financial transactions between strangers in modern times, there was an urgent need for trustworthy intermediaries such as banks, credit rating agencies and financial service providers. This resulted in that trust has taken the form of institutional trust as it has been placed in a central authority (Bornstein and Tomkins, 2015). In the context of payment systems, the acceptance of a state-issued currency rests upon trust placed in the current government of the relevant state. Furthermore, having a bank account and/or a credit card at a certain financial institution suggests that the owner puts trust in the particular bank. Eventually, one can draw the conclusion that he or she must confide in the whole payment ecosystem, namely in all "institutions" taking part in facilitating and processing payments.

Technological trust plays a crucial role in the adoption of digital payments. From users' perspective, the most important factor is trust in the service provider that has the required resources and capabilities to implement and run a secure system. In addition, some other factors can contribute to the users' trust in the technology, in particular those related to the personal assessment of certain features of the specific payment system. Mondego and Gide (2018) labelled those factors as perceived usefulness, perceived ease of use, perceived risk and performance expectancy. The above-mentioned factors can be originated from user experience. In fact, each successful transaction reinforces trust in the technology.

The conceptualization of cyber-trust (Etzioni, 2019), which can also be regarded as a kind of technological trust, is due to the advent of Internet and permeation of software-based applications. The emergence of bitcoin, the first cryptocurrency and the underlying blockchain technology has brought a "novel architecture for trust" (Werbach, 2018). Indeed, blockchain offers a fully distributed ledger and a possibility to verify transactions for all participants in the system without the need and any requirement for a central authority or anything else to be trusted. That explains why blockchain technology was characterized with the oxymoron of "trustless trust" (Werbach, 2019). In fact, the decentralized system of Bitcoin developed by Nakamoto (2008) is proposed to create trust through the power of consensus among participants. Therefore, it can be concluded as Werbach properly expresses it: "trust is not placed on any one actor in the system, but, rather, is placed in the system as a whole" (Werbach, 2019, p. 3). In a survey on the adaptation of new payment instruments, respondents did not prove to place trust in cryptocurrencies and the underlying blockchain technology (Szumski, 2020). Despite the fact that the system is promised to be safe, the user might not believe in it. Several examples demonstrate that crypto users often misplaced their trust. The crypto industry is rife with scams, from Ponzi schemes like OneCoin to exchange collapses like FTX, where billions of investor funds have been lost due to fraud, mismanagement, and lack of regulation.

Finally, it is worth mentioning that we can find some authors who highlight the importance of transparency in blockchain-enabled payment systems in contrast to conventional trust-based counterparts (Dierksmeier and Seele, 2020). It means that theoretically each user can check the whole blockchain containing all transactions. This requires a great deal of technological knowledge. Therefore, there is also a danger that a huge mass of simple users trusts a potentially faulty software.

Fair distribution of costs. The operation of the payment system implies costs for the relevant stakeholders such as the issuing authorities (i.e. central banks and governments), banks, interbank infrastructure providers (clearinghouses, ATM networks, etc.), retailers, cash-in-transit companies and consumers. Among the different payment instruments, only cash is available for all, non-cash payments are restricted for certain groups of the society. Therefore, the fair distribution of costs along the payment chain has core importance in eliminating such discrimination in order to create socially equitable payment facilities.

According to the terminology used by the European System of Central Banks (ESCB) there are social and private costs incurred by the different stakeholders in the payment system (Schmiedel et al. 2012). Social costs are the costs to society related to the use of resources in the provision of payment services. Private costs refer to the costs of the respective individual participants in the payment chain.

Private costs of each participant can be divided into internal and external costs. The former ones are the costs of resources used by the participant itself for carrying out transactions, for instance the amount spent on leased terminals or software. In rural villages where any branch of bank or ATM is not available in close distance, the travelling expenditures of reaching the relevant payment services should also be considered as internal costs. The external costs refer to payments to other participants in the payment system for the offered services. As the most important elements among those, fees and tariffs must be mentioned.

Relying on the definition given by ESCB, social costs can be calculated as the sum of internal costs for all participants involved in the payment system (Schmiedel et al. 2012).

Based on the concept of costs in payment systems described above, in a comprehensive study conducted by the European Central Bank with the participation of 13 EU countries, it has been shown that the social costs of providing retail payment services are substantial. Indeed, on average, they proved to be almost 1 percent of the GDP for the sample of participating countries. As to the breakdown of social costs by different stakeholders, banks and interbank infrastructure providers shown to possess the highest proportion (50 percent), closely followed by retailers (46 percent). The social costs of central banks and cash-in-transit companies were relatively low, as they accounted for 3 percent and 1 percent of the total amount of costs, on average, respectively. Due to the dominant role of cash as a payment instrument in the EU countries at the time of the survey, it is not surprising that the social cost of cash usage represented nearly half of the total social costs. Among the payment chain participants, retailers exhibited the highest private costs because they are exposed to the highest external costs to be paid to other participants (Schmiedel et al., 2012).

In fact, the taxpayer finances the costs of running the whole money system. Banks and retailers mostly incorporate their costs

into the price of products and services. Therefore, the present payment system seems to be financed by the overlapping groups of taxpayers, banking clients and retail customers. A further problem is that the distribution of costs is not transparent.

Participants (issuers, card networks, payment processors, payment gateways, merchant service providers, independent sales organisations) who run the payment chain have a dominant position, which leads to an asymmetric market power. This is most evident in the case of major card companies (Resendiz, 2021). They are free to dictate the terms and conditions, and smaller players have virtually no bargaining power.

The starting point to reach fair distribution of costs in the payment system is to accept that access to cash and digital payment instruments is a basic human right. That means that the society has to bear the costs. For the implementation, we may define payment system as a public good. According to Taylor, (2021) two types of public goods can be distinguished. The essential public goods such as basic infrastructure, defence, public health and primary education are necessary for minimally decent life for all members of society. That is why the supply of essential public goods is required by justice. The second type of public goods are the so-called optional public goods (museums, arts, theatres, cultural institutions) that are valued by people but they are not necessary for a fair society. In the second case the fair distribution of these optional public goods can be done on basis of proportionality requirement, i.e. their cost should be distributed based on the proportional benefits provided for different individuals.

The payment system dominated by cash complies with full accessibility by every member of the society, and in fact, is provided free of charge for the end-users. In a fully digitalised payment system, the access to digital payment instruments should be considered as an essential public good. In this case the access to basic services must be provided free of charge for everyone. It means that the costs are incurred by the taxpayer.

Staying with the current market-based situation, in a transition from cash-dominated to digitalized payment system, according to the difference principle of Rawls (1999), the least advantaged participants must be supported. In particular, for small retailers and customers in poverty the access to the system must be subsidized. In addition, it is also important to reinforce fair competition along the value chain and break the power of big corporations.

The argumentation above leads to Proposition 5, which is formulated as follows.

Proposition 5 *The digitalisation of financial services must be guided by an adequate consumer protection framework to mitigate the misuse of the system.*

Discussion

The findings and propositions outlined in this paper highlight the pressing need for ethical considerations in the design and implementation of digital payment systems. As payment systems evolve toward a cashless, fully digital model, the societal implications of this transition extend far beyond technological innovation. The transition to digital finance brings to the forefront critical ethical issues as Proposition 1 expresses by emphasising the importance of ethical lens.

While digital payment systems have the potential to streamline financial transactions and reduce operational costs, they also risk marginalizing individuals who lack the resources, skills, or infrastructure to participate. Vulnerable groups, including the elderly, those in rural areas, and economically disadvantaged populations, face significant hurdles in adapting to these systems. This challenge underscores the necessity of embedding equitable access as a cornerstone of the ethical framework for payment system. Proposition 2 posits that a thoughtfully guided transition to digital payment systems can reduce social and economic inequalities.

The set of ethical principles proposed in this study provides a robust framework for addressing these challenges. Proposition 3, which emphasizes the role of basic human rights, establishes a moral foundation for payment system design. Access to the payment system, as argued in the paper, is integral to living a dignified life in modern society. Recognizing this access as a fundamental right ensures that no individual is excluded from participating in economic and social life due to systemic barriers.

Propositions 4 and 5 further emphasize the need for financial inclusion and consumer protection. Addressing financial inclusion involves not only expanding access but also tailoring systems to meet the diverse needs of users. Consumer protection frameworks are equally critical in safeguarding users from exploitation, data breaches, and system failures, which could undermine trust in digital payment systems.

Policy recommendations. Financial inclusion means to empower people to have access not only to cash but to digital payment systems as well. This is only possible with measures addressing all three barriers (i.e. physical, intellectual and economic) and combining them in a policy that includes new regulation, state subsidies, and boosts innovation of digital services.

Regarding physical accessibility to payment system, low internet penetration and broadband connectivity must be increased. Intellectual accessibility calls for enhancing the financial education of the population, which can only be achieved in the long run. Educational programs aimed at improving digital literacy are vital to empowering users to engage confidently with digital finance. Without such measures, the gap between the digitally literate and those excluded from the financial ecosystem may widen, exacerbating existing inequalities. As a short-term solution, however, there is an urgent need for abandoning the complicated financial and legal language of banks, simplifying the products and tailoring the services according to the needs of vulnerable people. As to economic accessibility, the society has to prioritize the least favoured, in order to ensure the fair distribution – in this context access to the payment system – for everyone.

Concerning protection against illegal and/or illegitimate surveillance, it must be necessary to build anonymity into the system. Otherwise, it would not be possible to prevent the misuse of Information Technology and invasion of privacy.

It seems to be rather difficult (probably the most difficult of all) to overcome the challenge connected to trustworthiness of the payment system. The emergence of technological trust from personal trust went parallel with the evolution of payment instruments. In case of digital payments, from users' perspective the most important factor is trust in the service provider. This can be reinforced by some subjective factors originated from user experience.

In order to respond to the challenge related to fair distribution of costs, we arrived at the conclusion that in a fully digitalised payment system, the access to digital payment instruments should be considered as an essential public good, and access to basic services must be provided free of charge for everyone. In a current transition from cash-dominated to digitalized payment system, the least advantaged participants must be supported.

Conclusion and future research directions

In this study, we laid the foundations for a framework of fundamental ethical principles that seem to be essential in designing

and operating a morally sound and resilient payment system. The circumstances dictated by recent trends in the evolution of payment systems, namely the current transformation from a cash-dominant payment system to a fully digitalised one, calls for ethical considerations even more than before.

The starting point of our investigation was to take a "human right lens" by arguing that the access to payment system, including all payment instruments, must be legitimized as a fundamental human right. We arrived at the conclusion that this right must be guaranteed at both the national and the international level. Therefore, its formal declaration in international covenants as well as national legislations must be encouraged.

In order to establish the fundamental principles in designing an ethically acceptable payment system, first we focused on the barriers preventing the use of modern payment instruments. From those barriers, physical, intellectual as well as economic accessibility can be deducted. We referred to them as the three dimensions of financial inclusion. The three dimensions of fair treatment of users were labelled as protection against illegal and/or illegitimate surveillance, trustworthiness and fair distribution of costs.

As payment systems evolve, our ethical framework offers a compass for ensuring that digitization fosters inclusion rather than exclusion. By anchoring payment access in human rights and coupling it with principles of fairness and sustainability, societies can harness technological progress to build equitable economic ecosystems. Policymakers, technologists, and ethicists must collaborate to translate these principles into practice, ensuring no individual is left behind in the digital age. The journey toward morally sound payment systems is not merely technical — it is a testament to our collective commitment to justice.

However, we must face several challenges in the future. Cultural and economic heterogeneity complicates universal application; a one-size-fits-all approach may overlook local realities. Future research should explore contextual adaptations, such as tailoring privacy norms to regional data governance traditions. Additionally, legal scholarship must investigate pathways to enshrine payment access as a human right, drawing parallels to efforts recognizing internet access as a fundamental service.

The ethical framework proposed in this paper not only addresses current gaps in the literature but also calls for future research and policy development. Further research is needed to explore how emerging technologies such as AI-driven solutions can contribute to the implementation of these ethical principles.

Policymakers, businesses, and technologists must collaborate to ensure that ethical considerations are integrated into the digital payment ecosystem from the outset. Additionally, ongoing monitoring and assessment of these systems are essential to identify emerging challenges and adapt ethical guidelines accordingly.

The transition to digital payment systems represents a paradigm shift with profound societal implications. By prioritizing access, equality, and resilience, and grounding these systems in a robust ethical framework, we can ensure that the benefits of digital finance are shared equitably, fostering a more inclusive and sustainable economic future.

We strongly believe that further research in this field is essential and sincerely hope that our ideas will spark a meaningful dialogue.

Data availability

Data sharing is not applicable to this research as no data were generated or analysed.

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Notes

1 The authors sincerely appreciate the anonymous editor and reviewers for their valuable comments and constructive suggestions.

2 We adopted the definition appearing on the homepage https://www.bankofengland.co.uk/payment-and-settlement.

3 It should be noted here that there are semi-digital solutions such as M-Pesa, a mobile phone-based money transfer service when one of the parties does not even need a bank account. In this case the money is sent to a relevant person, and he/she can get it at an agent (Lashitew et. al. 2020).

4 Bitcoin is not only a payment instrument but also a payment system. Written in lower case, usually it refers to the currency unit, while starting with upper case, Bitcoin indicates the underlying payment system.

5 Bahamas' sand dollar was the first ever nationwide Central Bank Digital Currency (CBDC) in the world. It was rolled out to the Commonwealth of The Bahamas' public on 20 October 2020 (Bharathan 2020). Nowadays, China is the world leader in developing its CBDC, the so-called electronic yuan (e-CNY). According to a BIS survey, more than four-fifth of the world's central banks are engaged in CBDC pilots or activities (Boar and Wehrli 2021).

6 Due to asymmetries in the payment ecosystem, certain users may not benefit from the cost savings of digital currencies. Retailers often prefer to offer discounts for cash payments, as they perceive processing costs to be lower.

7 Functional illiteracy describes the inability to effectively use reading, writing, and numeracy skills in daily life, despite having basic literacy knowledge.

8 The ability of central banks to pay or charge interest on Central Bank Digital Currencies (CBDCs) has profound implications for monetary and fiscal policy, far beyond a brief mention. If CBDCs bear interest, they could become a direct tool for monetary policy, allowing central banks to influence spending and saving behavior more efficiently than traditional interest rate adjustments. In a low or negative interest rate environment, charging interest on CBDCs could incentivize consumption and investment, while paying interest could make them more attractive than commercial bank deposits, potentially reshaping the banking sector. On the fiscal side, governments could use CBDCs for targeted stimulus payments, universal basic income (UBI), or even tax collection, increasing policy effectiveness and financial inclusion.

9 There is a debate over whether consumers should share in the value of their transaction data centers on issues of ownership, privacy, fair compensation, and corporate control. Proponents argue that individuals generate this data and should have the right to own, control, and monetize it, especially as financial institutions and tech firms profit from selling it. They advocate for greater transparency, data dividends, and consumer empowerment through informed consent.

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